WSX-R01 – Risk and return

Response to Ofwat's PR24 draft determination

Wessex Water
YTL GROUP

FOR YOU. FOR LIFE.

Representation reference: WSX-R01

Representation title: Risk and return

CONTENTS

1. Executive summary

Our plan for 2025-30 proposes a step change in investment and, as a result, performance levels. We, and our long-standing shareholder, want to support the government's growth and environmental agenda and are committed to delivering this investment for the benefit of our customers. In this context, it is crucial to ensure that the overall risk and return package at PR24 allows companies the capacity to finance a large-scale investment programme to deliver for customers and the environment in the long-term.

1.1. Our track record

At Wessex Water, we have a track-record of attracting and retaining long-term investment, underpinned by a committed and responsible investor in the form of YTL, which sees itself as a custodian of the company and our assets. At PR24, to ensure we can maintain this position (to the benefit of our current and future customers, and to ensure Ofwat's financing and consumer duties are met) it is essential that determinations are set whereby, *for an efficient company:*

- **The expected return for debt and equity investors is commensurate with the risks they face**, which in turn requires that the:
    - WACC is set so that it accurately reflects debt and equity investors' risk; and
    - Determinations as a whole result in a symmetrical balance of risk for equity investors, so they expect to earn the allowed cost of equity (in line with the fair bet principle).
- **An investment grade credit rating is secured**, such that the company can raise debt finance on reasonable terms.

1.2. The Draft Determination

The draft determination includes a number of mechanisms which seek to recalibrate the risk and return package. This includes addressing some risks at source, as well as a revised view of the returns necessary to compensate investors fairly for the unmitigated risks.

Having carefully considered the overall risk and return package proposed in the draft determination, it is our view that the draft determination puts our ability to retain and attract investment at risk. Given the size and scale of the investment programme, the downward risk skew created by PCs, PCDs, and other mechanisms, the draft determination has not achieved the right alignment of risk and return, and so a final determination that maintains this position would not meet Ofwat's consumer and financing duties. This is because:

- **The circumstances under which PR24 is being determined are materially different from previous price controls**. The scale of investment at PR24 will be far greater than the recent past (and focused on more innovative projects), both to address historical underinvestment and meet challenging forward-looking statutory and regulatory targets. This means Ofwat's previous approach to setting the WACC (which may have been broadly appropriate in a different context) is increasingly likely to be inaccurate and undercompensate investors for the increased risks they face.
- **Equity investors face an imbalanced risk package at PR24, with returns skewed to the downside.** Outturn evidence demonstrates that PR19 was also skewed to the downside (including for firms identified by Ofwat as being efficient), and the source of this has not been addressed (i.e. removed or offset); and the PR24 methodology and draft determinations introduce additional sources of downwards skew.

- **We encourage Ofwat to adopt a more holistic approach to setting the cost of equity, to ensure consistency with other price control parameters and support the economic growth objective.** The current approach to setting the cost of equity solely relies on the standard CAPM. However, the limitations of the CAPM are being increasingly recognised,[1] specifically that a narrow application of it fails to recognise interconnections between equity returns, investment, productivity, and growth (which is especially critical at this time, in the broader context of poor economic performance for the UK overall).
- **At a detailed level, there are issues in the proposed approach to setting the WACC using the CAPM**. These also contribute to it being below the level required to compensate debt and equity investors for the risks they face.
- **The financeability assessment unduly focuses on debt credit-metrics**, without properly considering whether the assumptions that underpin it are coherent.

We encourage a thorough review of the risk and return package at final determination. In the absence of change in the final determination, the financeability of water companies, and therefore the critical investment required at PR24 (and thereafter) will be at risk, further perpetuating the cycle of underinvestment in the water sector.

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1.3. Our updated view of the appropriate cost of capital

The financial modelling, and data tables included in our response use Ofwat's view of the cost of capital as an input. However, as set out above, we have concerns with Ofwat's view, and the approach to setting this. We therefore provide an alternative view which we believe more appropriately compensates investors for the level of risk at PR24. Table 1 sets out our updated view of the appropriate WACC in our response to the Draft Determinations.

This view is based on our spot estimate, which is within the range set out in KPMG reports at our proposed 60% notional gearing.

It reflects an approach that is conceptually consistent with the CMAs rationale in the PR19 redeterminations. On RFR, considering yields on ILGs and AAA corporate bonds. On TMR, the analysis provides a stable estimate, updating analysis to reflect new DMS data that was not available at the time.

It starts with the CMAs approach to beta. Updating to reflect the inclusion of Pennon as a pure play competitor, then reflecting the potential increases in systematic risk by considering other estimates at the upper end of the range. Given that the potential impact of significant investment on systematic risk was recognised in the DD and has previously been recognised by other regulators we have selected a point estimate at the top end of the range.

When comparing the CAPM results to other cross checks (based on historic data), it suggests that it is underestimating systematic risk for the water sector. Therefore, as in the DD, to maintain investability we are applying an aiming up adjustment.

On the cost of debt we are recognising the likely issuances throughout the rest of this price control period, and applying an adjustment to the cost of new debt reflecting recent issuances.

[1] 'Exploring Multi-factor Models as a cross-check on allowed returns at PR24: Report prepared for Water UK.' KPMG (November 2022).

Table 1: Summary of updated WACC parameters (Nominal)

Parameter	Ofwat Draft Determinations	Wessex Updated View
Cost of equity	6.9%	8.4%
Cost of debt	4.9%	5.5%
WACC	5.8%	6.7%

2. Changing circumstances at PR24 materially increases risk

2.1. Our plan

In our business plan, we highlighted that systematic risk is higher at PR24 than at previous price controls and that it is essential the allowed cost of equity reflects this, to ensure we can continue to attract and retain long-term equity investment to the benefit of our customers.

Our plan highlighted three key drivers of increased risk to equity investors:

- the size and nature of the capital programme over PR24[2];
- longer payback periods[3]; and
- an asymmetric downwards skew in equity returns[4].

We supported the above points with a range of evidence. In relation to the size and nature of the capital programme, this included: (a) a report by KPMG on the cost of equity (which contained estimates of a beta uplift for the capital programme, including by placing some weight on the National Grid beta); (b) a beta recomposition analysis, whereby we calculated a weighted average of a pure-play water beta and a construction company beta; and (c) direct volatility modelling, where we estimated how our overall cost risk would vary, due to having a higher mix of enhancement spend at PR24.

There is broad consensus across the water companies that equity risk is increased at PR24 for the above reasons. Specifically, several of the WaSCs submitted that systematic risk is increased due to the size and complexity of the capital programme.[5] Similarly, all WaSCs considered that risk is asymmetrically skewed to the downside for equity.

We present further evidence of the impact of capital investment on systematic risk in sections 2.2 and 2.3.

2.2. The draft determination

The DDs do not explicitly adjust the allowed cost of equity to account for the above matters.

Focusing on the issue of whether the scale and nature of the capital programme might increase systematic risk, meaning beta should be set to reflect this, Ofwat recognises that 'in principle' risk may be increased for this reason, stating: *"a mix of more complex and uncertain activities for PR24 could potentially increase systematic risk"*[6]; and that it does not discount *"the possibility that the PR24 capex programme may increase systematic risk."*[7] However, the DDs do not to make an adjustment for this. Rather, they set out three main reasons for not applying an adjustment.

Firstly, Ofwat is not convinced that the theoretical reasons for why the scale / nature of the capital programme might increase systematic risk apply (or apply to the same extent as other sectors) to the water sector in practice. Ofwat

2 'WSX31 – Risk and return.' Wessex Water (October 2023); pages 7-8.
3 'WSX31 – Risk and return.' Wessex Water (October 2023); pages 9-11.
4 'WSX31 – Risk and return.' Wessex Water (October 2023); page 7.
5 This includes new investment activity including reaching technically achievable limits on nutrient removal.
6 'PR24 Draft determinations: Aligning risk and return: Allowed return appendix.' Ofwat (August 2024); page 41.
7 'PR24 Draft determinations: Aligning risk and return: Allowed return appendix.' Ofwat (August 2024); page 47.

highlighted that one theoretical rationale (higher operational leverage – i.e. a higher proportion of fixed costs, relative to variable costs) was considered at PR19 and in the subsequent CMA redeterminations.[8] Ofwat's position on operational leverage at PR19 was that water companies had limited exposure to demand risk (inherently, but also because of the way in which the regulatory regime operated). Ofwat also suggested cost-risk may reduce with operational leverage, because it means a 'smaller' proportion of total costs is at risk.[9] Ofwat was therefore not convinced of the 'in principle' basis to uplift beta for operational leverage (for small companies) at PR19.[10] However, we note that Ofwat's / the CMA's reasoning for not adjusting beta (for small companies) due to higher operational leverage at PR19 appeared to *primarily* be due to concerns regarding the empirical methods and evidence for doing so, rather than the theory.

Secondly, Ofwat is not convinced that the empirical evidence submitted by companies to date is sufficiently robust or compelling to support or identify a reliable beta adjustment. Ofwat's main concern appears to be that company (or company advisor) proposed methods for quantifying an increase in beta relied on placing some weight on non-water pure play comparators. Ofwat considers this problematic, because some of the difference between the (higher) betas of those comparators and the water sector may be due to factors other than the size / complexity of capital programme. For example, Ofwat states such an approach is: *"liable to introduce beta risk from completely unrelated sources."*[11] Ofwat also considered our direct volatility modelling to be insufficiently granular to robustly identify an increase in systematic risk arising from a higher mix of more complex projects, stating: "*we considered the use of enhancement spending* [for volatility analysis] *as a proxy for such* [more complex] *activities as too simplistic."*[12]

Thirdly, Ofwat is concerned that, were it to make a 'forward-looking' adjustment to beta at PR24 to reflect the increased scale or complexity of the capital programme, precedent would require it to do the opposite at times when the capital programme was shrinking / becoming less complex, to retain symmetry for customers and investors. Ofwat explains an adjustment at PR24 *"would require a framework for future decision making to ensure that adjustments for capex intensity/complexity could be symmetric (i.e. downwards as well as upwards),"*[13] and moreover, that this change may require a consultation process.

2.3. Our response

We recognise that there is validity in all three of the reasons identified by Ofwat (as summarised above) for not making a forward-looking adjustment to beta at PR24. However, in each case, this is a 'matter of degree' and so, in our view, this remains a critical issue to consider further at Final Determinations. In the following subsections, we summarise our position in response to each of Ofwat's three reasons.

2.3.1. The basis for the need for an uplift

In relation to the basis for a need for an uplift to beta in the first instance, it is necessary to both: (i) identify and establish the underlying theory of relevance; (ii) appraise the extent to which existing evidence / research establishes that this arises in the real world; and then (iii) consider its applicability to the water sector (including by taking into account the regulatory framework).

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8 'PR24 Draft determinations: Aligning risk and return: Allowed return appendix.' Ofwat (August 2024); page 41.
9 'PR19 final determinations: Allowed return on capital appendix.' Ofwat; page 97.
10 Ofwat and the CMA also had concerns about the ability to accurately estimate a beta uplift relating to this at PR19 and the subsequent redeterminations.
11 'PR24 Draft determinations: Aligning risk and return: Allowed return appendix.' Ofwat (August 2024); page 40.
12 'PR24 Draft determinations: Aligning risk and return: Allowed return appendix.' Ofwat (August 2024); page 41.
13 'PR24 Draft determinations: Aligning risk and return: Allowed return appendix.' Ofwat (August 2024); page 47.

We consider there are two main theories that may be consistent with a need for an uplift:

- First, an increase in capex may indicate a change in the mix of activities undertaken by water companies. Namely, it is often associated with a shift towards increased construction and heavy maintenance activity.
  - The mix of activities companies undertake is one determinant of their overall exposure to systematic risk.
  - Some activities inherently expose companies to economy-wide shocks and uncertainty to a greater degree than others.
  - Consequently, companies engaging more extensively in relatively riskier activities – such as construction – face a higher level of systematic risk overall.
- Second, operating leverage is typically associated with an increase in systematic risk. There are two dimensions to this. Firstly, an increase in the ratio of fixed costs to variable costs increases the volatility of firm profits (cash flows) to demand (volume). Secondly, the "thinner" a companies' profits are, the smaller the buffer it has to withstand shocks.

2.3.2. Limitations of existing empirical evidence to quantify a beta uplift

We agree with Ofwat that there are limitations with the evidence submitted by companies to date on the adjustment to beta required to reflect an increase / change in the capital programme. However, this is a matter of degree, and it is important to recognise that no analysis is perfect.

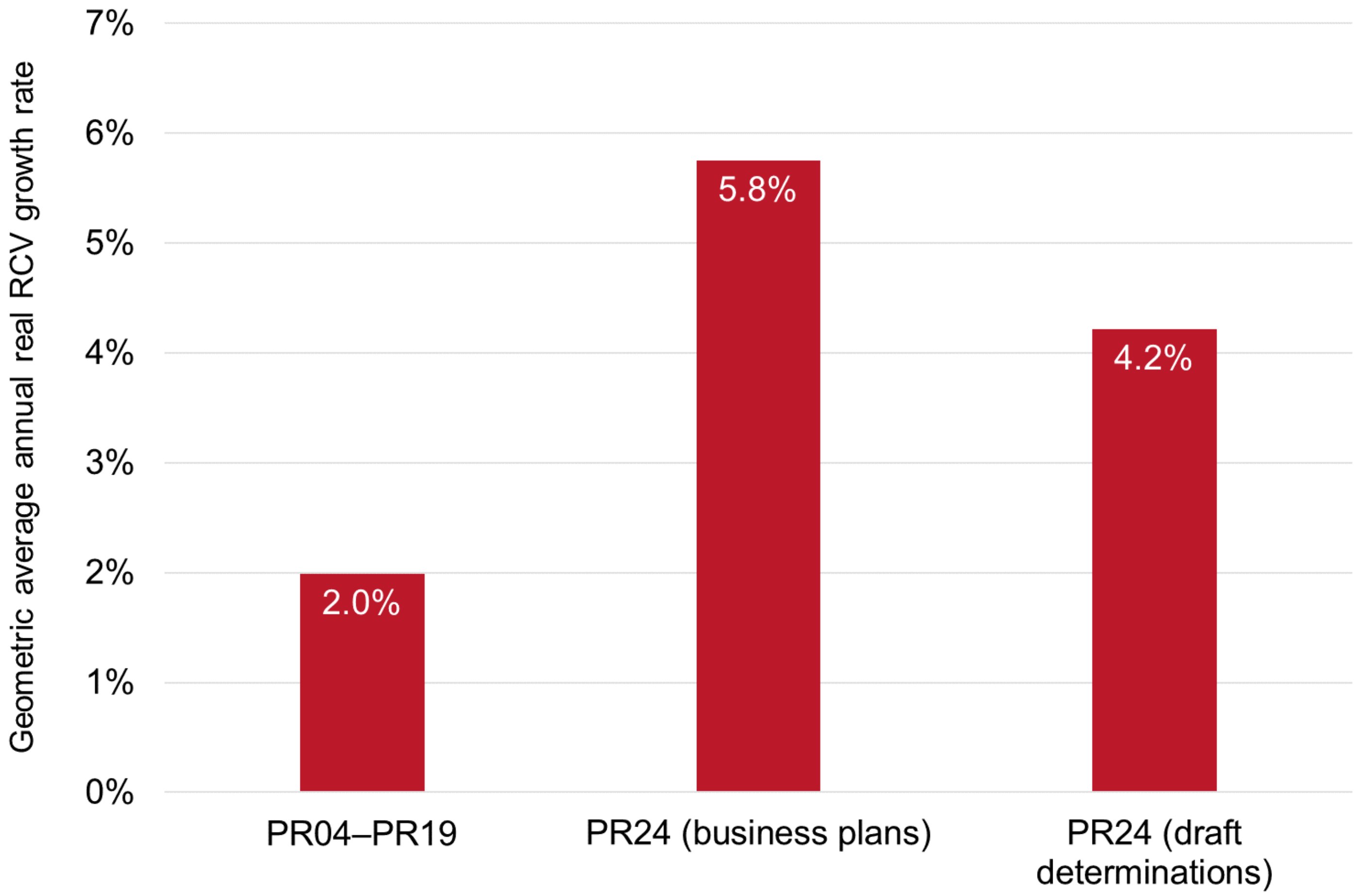
In relation to comparator-based approaches (such as the use of the National Grid beta, or the beta recomposition method) we agree that a downside of this is that it may incorporate a degree of systematic risk other than arising from higher capital intensity / greater construction activity. That said, the recomposition method, which draws specifically on firms engaged in infrastructure construction and only applies the identified beta to the proportion of our spend that relates to: *"capex that is novel, or at an unprecedented scale"* would seem to suffer from this limitation to a lesser degree (than reliance on National Grid, say). Moreover, as by definition one cannot observe a beta that reflects only the specific scale / type of capex being undertaken by water companies at PR24, we consider that comparator methods do have some merit and that to attach no weight to this approach appears extreme.

In relation to direct volatility modelling, we similarly agree that the more aggregated the approach, the less precisely it will reflect the specific change in mix of projects at PR24. However, whilst a more granular approach may be possible, intuitively it would reveal a similar conclusion (i.e. if you re-weight the industry's existing mix of totex towards a cost mix with higher variability due to systematic risk, overall cost-related systematic risk will be shown to increase).

Recognising the limitations raised by Ofwat, as part of our representations we commissioned Economic Insight to develop additional empirical evidence on the potential size of beta adjustment to reflect the scale and complexity of the capital programme. Economic Insight's report is enclosed as an annex to this report. In summary terms, they present an econometric analysis of a panel dataset of FTSE listed companies, whereby they regress betas against drivers of systematic risk. A measure of asset growth is used to isolate the impact of differences in capital investment, whilst controlling for other factors. This addresses the limitation that comparator methods may be 'polluted' by factors other than capital intensity, meaning that the implied beta uplift is overstated.

The analysis calculates that from 2005-06, the industry had an average annual rate of real asset growth of 2.0%. Annual real asset growth set out in Business Plans is 5.8% across PR24 and Ofwat's Draft Determinations imply a growth rate of 4.2%. Combining these data points implies that the planned annual asset growth will be 2.2%–3.8% higher than the 'business as usual' scenario. This is illustrated in Figure 1 below.

Figure 1: Historical RCV growth (2005-06 to 2023-24) and planned RCV growth at PR24



Source: Economic Insight

Economic Insight's model implies an increase in beta of 0.0087 for every 1% increase in annual asset growth. This indicates an uplift of 0.019–0.033 across the industry for forward-looking risk. This compares to a proposed uplift of top end of the beta range of 0.022, based on the inclusion of National Grid and consideration of forward-looking risk.

We hope this additional evidence will be useful to Ofwat. However, we would again highlight that no evidence is perfect and ask that the suite of new *and* existing evidence be balanced carefully and 'in the round' at the Final Determinations.

2.3.3. Precedent for making a forwards-looking adjustment to beta

We recognise and understand Ofwat's concern that, should it apply an uplift to beta at PR24 to reflect a change in the scale / complexity of the capital programme, it might set a precedent, whereby a method is required, going forward, to ensure adjustments are considered (both upwards and downwards) at future price controls.

However, it does not *necessarily* follow that such as precedent is set by making said adjustment at the PR24 Final Determinations. Rather, this primarily depends on whether (and the extent to which) the change in scale / complexity of the capital programme at PR24 is an unusual / a one-off event (say, to address previous underinvestment / underfunding, or to meet material changes in statutory requirements etc), or is within the bounds of reoccurring investment cycles.

In practice, whilst we consider the evidence *does* show PR24 to be atypical, the reality is that the change in the capital programme also contains elements that will be due to ‘reoccurring / within cycle’ issues. Following from this, we do think there is a valid concern that, whilst one might rationalise that the beta uplift at PR24 may not set a precedent, there would nonetheless be risk of overstating the size of that adjustment, *if it were made over the entirety of the (short-term) ramp up in capital spend at PR24.* Therefore, any method used should take this into account. We highlight that the new analysis from Economic Insight alongside our representation includes an approach doing so (i.e. it is intended to avoid this overstatement).

We do not consider that Ofwat would need to issue a specific consultation, were it to include a forward-looking adjustment to beta at its Final Determinations. Ofwat’s DDs contain a range of method-related changes to the regulatory framework that are more material than this and which have not been subject to separate consultation.

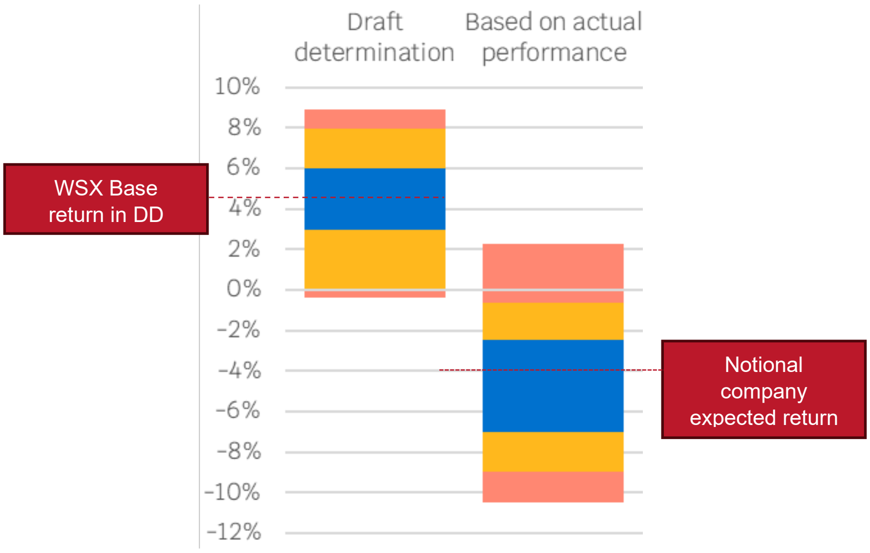
3. The balance of risk in the draft determination

The Final Methodology stated that it had set "*the overall balance of risk to be broadly symmetric at -4.85% to +4.80%*"[14]. The DDs rightly recognised the downside risks highlighted by companies and therefore considered mitigations to recalibrate the risk and return package, which mean it now considers "*equity investors in an efficient company have a reasonable prospect of earning the base allowed return under the notional company structure*"[15]. We welcome Ofwat's appreciation of the risks facing water companies and its proposals to mitigate the risk at source to support companies in delivering the critical increase in investment at PR24.

However, as detailed in our response to the RoRE analysis in representation WSX-R02, contrary to Ofwat's assessment and despite its proposed mitigations, the notional company faces asymmetrical and downward-skewed risk at PR24 at -10.52% to +2.30%. This is demonstrated in the table and accompanying figure below.

Table 2: DD Notional Company RoRE range (additive)

	P10	P50	P90
Totex	-4.9%	-1.9%	1.0%
Mex & ODI	-3.7%	-1.7%	0.1%
Financing	-1.9%	-0.3%	1.2%
Revenue	-0.1%	0.0%	0.0%
RoRE (additive)	-10.5%	-4.0%	2.0%



This is because, although one might expect investment in the water sector to be low risk in general, the regulatory settlement at subsequent price controls have implied higher levels of risk relative to the past. In particular, (i) Ofwat's PR19 determinations implied negatively skewed returns for equity investors; and (ii) Ofwat's PR24 draft determination further increases the extent of downside skew for equity investors. Below, we detail the evidence on each of the above.

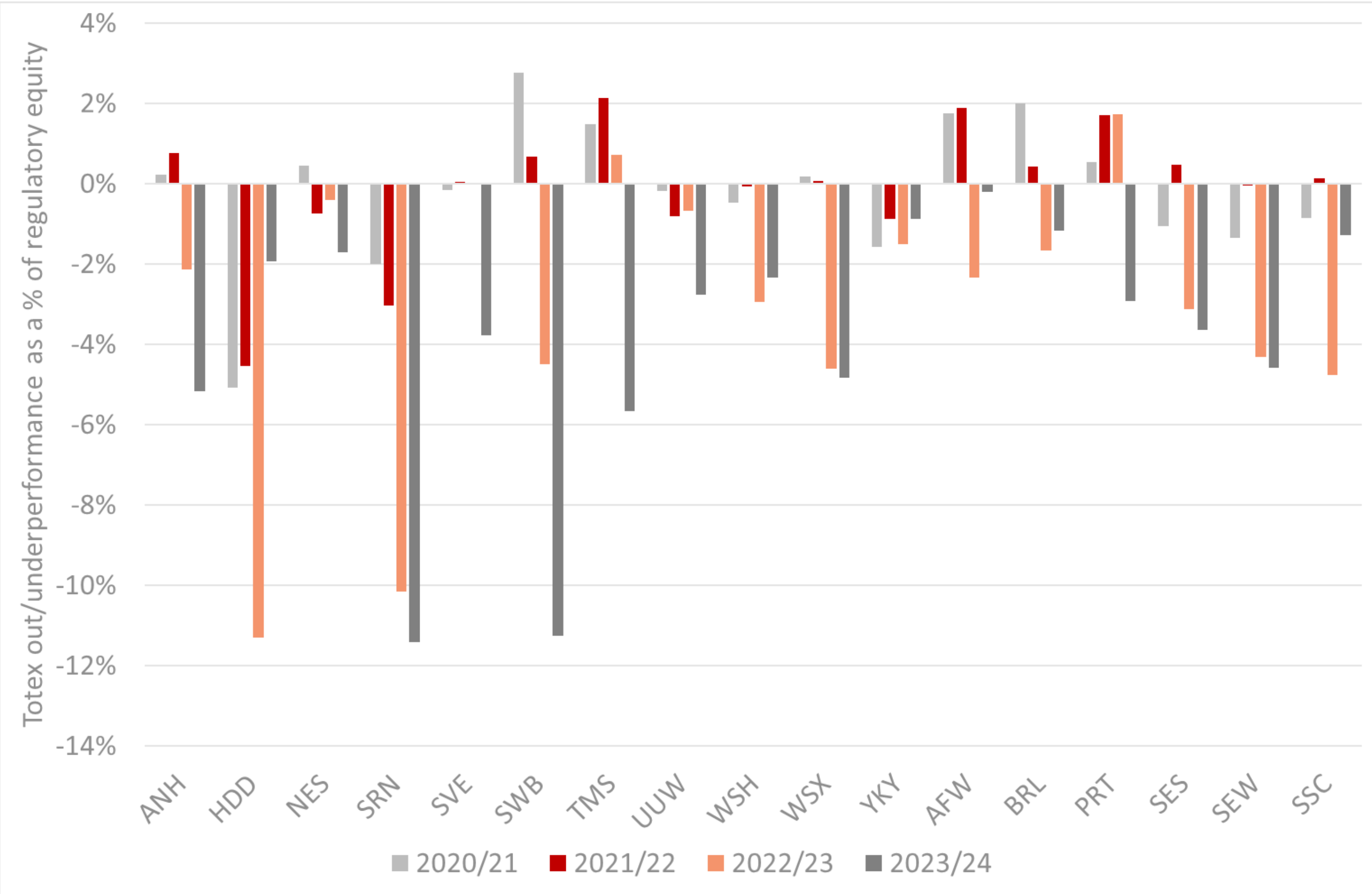
[14] 'Creating tomorrow, together: Our final methodology for PR24 – Appendix 10: Aligning risk and return.' Ofwat (December 2022), page 10.
[15] 'PR24 Draft Determinations: Aligning risk and return.' Ofwat (11 July, 2024), page 1.

3.1. The balance of risk in Ofwat's PR19 determinations

This is evident from the extent of overspend on allowed costs and underperformance on outcomes across the industry. This is the case despite the fact four companies – Anglian, Bristol, Northumbrian, and Yorkshire – received a 4.2% increase in allowed costs (on average) following the CMA redetermination.[16]

Figure 2 below shows totex out / underperformance for each company in each year of AMP7, expressed as a percentage of notional regulatory equity. There is a clear negative skew in the data, with companies overspending relative to their allowances. On average, companies underperformed by -1.81% as a percentage of notional regulatory equity, with 47 out of 68 observations reporting underperformance. This has been particularly pronounced in the most recent two years (2022/23 and 2023/24). For example, Southern has underperformed on totex by -6.65% on average across the four years of AMP7, and Hafren Dyfrdwy has averaged -5.71% across AMP7 so far. Only two companies, Affinity and Portsmouth, have outperformed across the four years, averaging 0.27% and 0.28% respectively.

Figure 2: Wholesale totex out / underperformance as a percentage of notional regulatory equity

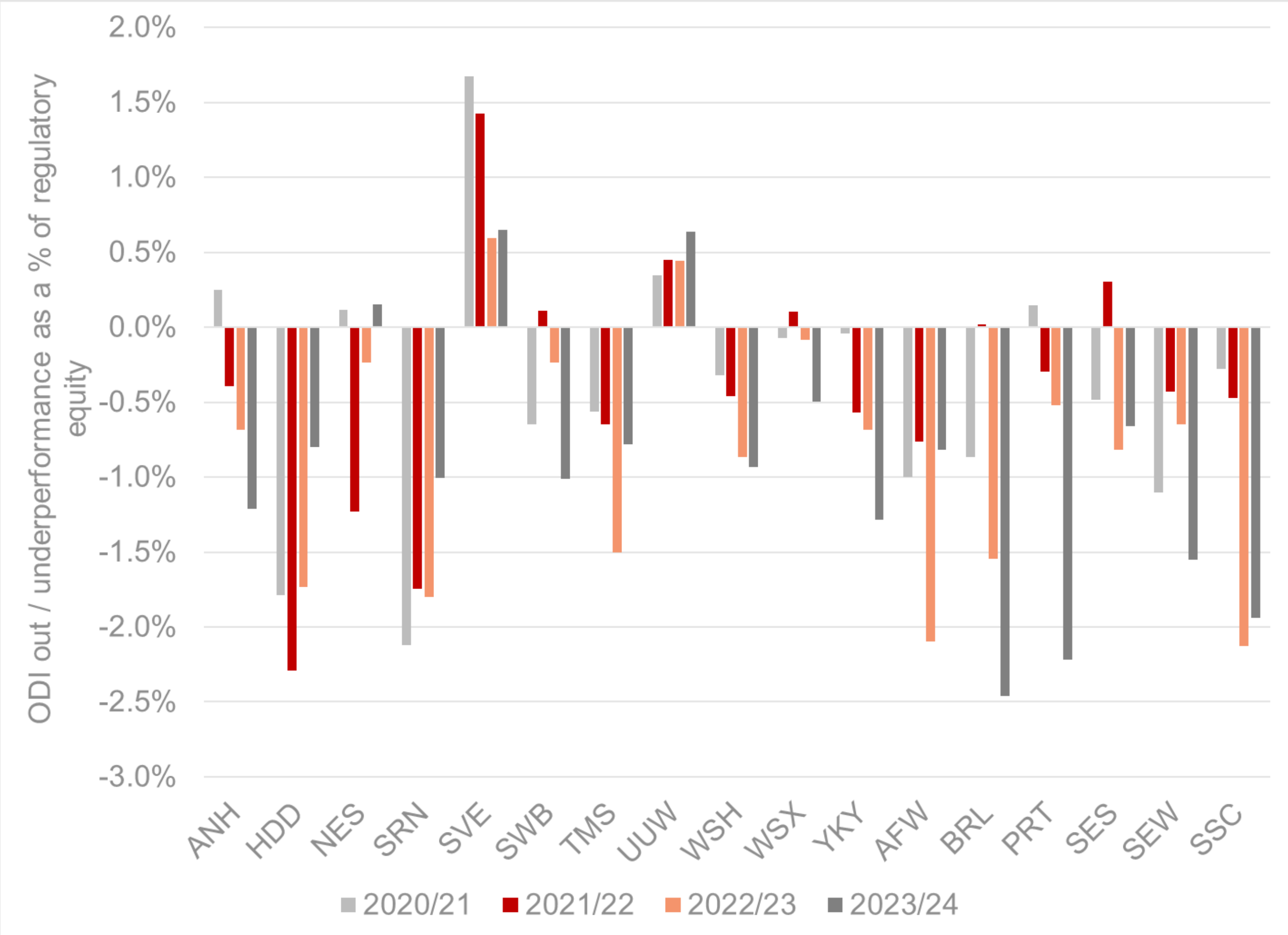


Source: APR data tables; 1F.10.

[16] 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations – Final report' CMA (March 2021); Table 6-12.

The picture is similar on ODIs, with companies having largely incurred net penalties across AMP7. Figure 3 shows ODI out / underperformance payments as a percentage of notional regulatory equity.[17] On average, companies underperformed by -0.65% across the four years of AMP7, with 52 out of 68 observations reporting underperformance. The only companies that break this trend are Severn Trent and United Utilities, outperforming by 1.08% and 0.47% on average respectively. However, we note that Wessex has also performed highly relative to other companies.

Figure 3: ODI out / underperformance



Source: APR data tables; 1F.11.

As a result, equity returns in the industry have been below the base (allowed) returns set by Ofwat and the CMA, as shown in Table 3 below.

[17] This data relates to in-period and notional out / underperformance payments relating to the reporting period.

Table 3: Average Industry RoRE

Return on Regulatory Equity (RoRE)	2020/21	2021/22	2022/23	2023/24	AMP7 to-date
Base RoRE	4.05%	4.08%	4.10%	4.13%	4.09%
RoRE (actual return - notional regulatory equity)	2.25%	3.91%	3.62%	1.75%	2.74%
RoRE (actual return - actual regulatory equity)	2.46%	4.25%	3.62%	1.26%	2.32%

Notes : Average industry returns are based on a simple average to give each company an equal weighting.
Source: APR data tables; 1F.17.

A part of this underperformance may be explained through higher energy prices and the impact of Covid-19, which Ofwat expects to be non-recurring events that it has mitigated, e.g. through an industry-wide CAC as well as an RPE and true-up mechanism on energy prices (which, as we note in our representations on costs we do not consider properly address this risk). However, other key sources of this downside risk at PR19, which continue into PR24 under Ofwat's DD, include the following.

- base costs allowances are being expected to stretch further and further;
- assessment of enhancement costs does not appropriately balance need and efficiency; and
- the ongoing efficiency (frontier shift) expected to be delivered is disconnected from evidence.

Below, we set out the evidence on each of the above.

3.1.1. Base costs

As detailed in our representation WSX-C01, we have a material concern that the approach to assessing base costs is contributing to a cycle of underfunding leading to underinvestment over subsequent price controls, such that the health of assets and the ability of water companies to deliver resilient water and wastewater services to customers is now at risk.

This is evident from the apparent disconnect between the urgent need for the water sector to invest in its assets, as highlighted by multiple sources such as the National Infrastructure Commission (NIC) and House of Lords[18,19], and the allowed base costs. Specifically, Ofwat's base costs allowances for the industry as a whole are only 3% higher (in real terms) than companies' expenditure over the last 5 years[20], and are 1% lower for Wessex than recent actual expenditure.

At the same time, the DDs expect companies to further stretch the base costs allowances to deliver:

- <u>Increased levels of performance</u>. As an example, there is an expectation that companies can deliver zero serious pollution incidents within base costs, which is especially striking because it is a new common

[18] 'The Second National Infrastructure Assessment.' National Infrastructure Commission (October 2023); page 110.
[19] 'The affluent and the effluent: cleaning up failures in water and sewage regulation.' House of Lords (March 2023).
[20] 2018/19 to 2022-23

performance commitment introduced at PR24.[21] In the last two years, there have been 47 and 44 serious pollution incidents across the 10 WaSCs, with only two companies achieving zero from current expenditure in each year.

- Compliance with changing regulation. As an example, Ofwat highlights that "*base expenditure for IED compliance is covered by base allowances*."[22] However, this does not recognise that the changing regulation / changing interpretation of regulation implies that "compliance" with regulation is not static, and may require additional activities that will not be reflected in historical base costs.

In summary, current expectations of companies' performance and the extent to which they can be delivered through base costs are flexible, and are not based on robust analysis to identify: (a) the efficient level of performance; and (b) the costs required to provide this level of performance.

3.1.2. Enhancement costs

As detailed in our representation WSX-C02, the current approach makes it more likely that necessary (efficient) costs will be disallowed, rather than unnecessary (inefficient) costs being allowed.

For PR24, around 73% of allowed enhancement costs are based on top-down benchmarking models.[23] In principle, we are supportive of the use of cost benchmarking where it can be shown to produce reliable estimates of efficient costs, and where the results are interpreted alongside other relevant information. However, in a number of areas, we are concerned that the econometric modelling is not sufficiently robust to reliably set efficient cost allowances. This is because many of the largest PR24 enhancement programmes (and therefore the costs related to the schemes) are unique by design. For these areas, the simplistic nature of the unit costs models or econometric benchmarking models cannot capture all the drivers of the variation in efficient costs that exist for these programmes, and do not reflect the complexities of delivering these schemes. This means that the models used have low explanatory power and, based on Ofwat's reported statistics, can result in a wide range of predicted costs for a reasonable degree of confidence[24]. Using these models to set not only programme-level but also scheme-level costs (for the purposes of PCD penalties) creates a major risk that companies will be underfunded for their efficient cost of scheme-level and programme-level delivery.

The issue of measurement error is further exaggerated because companies' enhancement costs are often based on forecast costs, the validity of which can be heavily reliant on different companies' ability / experience of forecasting costs.

For the remaining 27% of allowed enhancement costs that are based on shallow or deep dives, the DD assessments do not always appear to be grounded in engineering rationale.

In particular, the deep-dives result in disallowance of: (a) 20-30% enhancement costs on the basis of removing schemes which they considered should be funded through base expenditure allowances; and (b) 10-20%

[21] We note that PR19 included a PCL on "pollution incidents" which is similar to the "total pollution incidents" PCL at PR24.
[22] 'PR24 Draft Determinations: Expenditure allowances.' Ofwat (11 July, 2024), page 87.
[23] Calculated as the proportion of allowed enhancement costs that are recorded as 'Modelled' or 'Modelled/deep/shallow dive' (which includes enhancement costs categories where top-down benchmarking was combined with deep or shallow dives of outliers) in 'PR24 Draft Determinations: Expenditure allowances.' Ofwat (11 July, 2024), table 13.
[24] For example, for Ofwat's p-removal model, the difference between Ofwat's modelled allowance and the upper bound of its 95% confidence interval (for all parameters) is around £0.5 million (an average for PR1 and PR2 models). Given that this is a *scheme-level* estimate, this creates a material uncertainty range for the predicted costs at programme level, for a phosphorous removal programme of our size.

enhancement costs on the basis of removing schemes which it considers have been previously funded.[25] However, this approach is not in line with an outcomes-focussed totex regime where companies are inherently incentivised to deliver expected service levels in the most efficient manner possible. This is because:

- Firstly, Ofwat has retrospectively changed the trade-offs that companies considered at the time of making their expenditure decisions (see WSX-C04 for more details). Specifically, had companies known that Ofwat might penalise them for reprioritising away from an enhancement scheme at the next price control (and, therefore, that they face a harsher trade-off on that enhancement scheme), companies may have made a different decision in previous price controls.

- Secondly, Ofwat has considered the wrong counterfactual by not recognising that: (a) delivering one enhancement scheme would imply that the company would not have been able to deliver another; and (b) doing so would have been less efficient for the company and, therefore, would have led to worse outcomes for customers overall.

- Thirdly, the scale of the adjustment is arbitrary and not based on robust evidence, which means Ofwat's approach is not able to identify efficient costs.

3.1.3. Ongoing efficiency (frontier shift)

Ofwat's decision to apply a frontier shift challenge of 1.0% (albeit lower than the 1.1% it applied at PR19) is inconsistent with the UK's persistent (near zero) productivity performance since 2008 (and other wider evidence detailed in Economic Insight's frontier shift report).[26]

3.2. Changes to the balance of risk at PR24

In its DD, Ofwat highlights that it has recalibrated the risk-return balance following feedback from companies about the downside risk facing investors. While we welcome Ofwat's attempt to mitigate the risk in specific areas *relative to Ofwat's Final Methodology*, on the whole the DD materially increases the extent of downside skew for equity investors *relative to PR19*. This is because:

- PCDs further exaggerate the extent of downside totex risk;

- risk on ODIs and MeX has increased as a result of stretching PCLs and increased rates; and

- introduction of additional mechanisms at PR24 (including new untested mechanisms at DDs) undermine the promise of a "stable and predictable" regulatory regime.

Below, we walk through each of the key categories of risk and explain why the risk at PR24 is higher relative to PR19.

3.2.1. PCDs

On **totex**, we welcome that Ofwat has attempted to mitigate the downside skew through the following:

- RPEs and true-ups on more categories of input costs;
- lower cost sharing rate for enhancement and bioresources;

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25 'PR24 Draft Determinations: Expenditure allowances.' Ofwat (11 July, 2024), page 9.
26 'Productivity and frontier shift at PR24.' Economic Insight (April 2023).

- aggregate sharing mechanism on costs; and
- discussions on uncertainty mechanisms.[27]

However, these mechanisms do not fully address the higher systematic risk at PR24, as detailed in section 2.

In addition, as detailed in our representation WSX-O02, the introduction of PCDs creates a material downside risk for investors. This should be evident from the fact that, if Ofwat considers that totex risk at PR19 was symmetrical (which we do not agree with), then PCDs must have necessarily increased the downside risk at PR24. This is because:

- (a) PCDs introduce unbalanced risk for delayed delivery. Ofwat's claim that time-incentive payments are broadly balanced requires that delivery profiles are set correctly so that companies have a P50 likelihood of delivering 80% of outputs on time in each year. However, Ofwat has not set its PCD profiles correctly for the majority of PCDs subject to this time-incentive penalty. This means that companies would be expected to incur more in the way of underperformance payments than overperformance payments *ex-ante* under the proposed framework.

- (b) Ofwat ignores the fact that its own PCD framework is likely to lead to significant non-delivery penalties even where the majority of expenditure has already been incurred. This is particularly so given the considerable evidence that large infrastructure projects (of the kind that the water sector is embarking on at PR24) bear a high likelihood of delayed delivery and cost overruns.[28] This creates a major risk that companies will pay penalties for PCD outputs that they have already spent the majority of allowances on, due to factors outside of their control.

- (c) PCDs undermine companies' flexibility regarding approach to delivering outcomes and, therefore, benefit from allocative efficiency. This is the result of the fact that, despite Ofwat's intention that PCDs be outcome-focussed, more than a third of our PCDs are outputs based, which undermines our ability to deliver outcomes that customers care about more efficiently.

We have corrected Ofwat's RoRE analysis to present a more accurate PCD risk range for the framework that Ofwat propose. This is set out in WSX-O02. It shows that we face a downside risk of between -6.35% and -1.08% of regulatory equity from the introduction of PCDs, if Ofwat does not address the issues that we identify there.

3.2.2. Risk on ODIs and MeX

In relation to **ODIs** and **MeX**, while Ofwat has attempted to mitigate some of the downside risk by setting PCLs at median level (as opposed to UQ level as at PR19) and including MeX within the aggregate sharing mechanism, in actual practice the downside risk is still high because of the other changes including:

- New and stretching PCLs. Ofwat has introduced multiple new performance commitments at PR24 (such as BR-MeX, serious pollution incidents, etc.). Moreover, contrary to Ofwat's statement, in practice median PCLs have only been used for 2 of 19 common PCs.

[27] We welcome Ofwat's consideration of uncertainty mechanisms at PR24. However, in WSX-M07, we propose an alternative design which we believe would better address the key areas of uncertainty at PR24.
[28] Please see: Delays in the Construction Industry: Our 2022 Survey Results and How They Compare to 2016 (cornerstoneprojects.co.uk)

- Increased ODI rates. Ofwat's change in methodology at DD has implied that our ODI rates have changed significantly across most of our PCs. For instance, our ODI rate for sewer collapses has increased by 293%.

- Changes in ODI rates relative to PR19. The average increase from PR19 is over 500%. This requires companies to reconsider priorities (for instance if they chose to focus on a PCL over another) and, therefore, creates increased risks for outcomes that take time to deliver.

- Untested methodology for the experience measures (C-MeX, D-MeX, and BR-Mex). The uncertainty around the methodology as well as the expected performance creates additional risk.

3.2.3. Introduction of additional mechanisms at PR24 (including new untested mechanisms at DDs)

Ofwat has introduced new (untested) mechanisms at DD which further increase the downside risk:

- Changes to PCD. Ofwat has proposed changes to PCD at DD by: (a) changing the design to, most notably, including a reward for timely delivery alongside a penalty for delayed delivery (although, as noted above, these are not balanced); and (b) introduced PCDs for activities typically covered within base costs (e.g. mains renewals), which effectively ring-fences part of the base cost allowances. In our case, this is a particular issue because we have not been provided additional allowances, like other companies, to deliver mains renewals (which, as we set out in WSX-C20 we disagree with).

- Gearing mechanisms. Ofwat has proposed three options (for consultation) on incentive mechanisms intended to encourage companies to reduce / maintain gearing below 70%. (This is in addition to reducing notional gearing to 55%, and adopting an approach to financeability that serves to restrict dividends / inject equity where gearing is above 57.5%.) In the absence of robust (if any) evidence on efficient capital structures in the water industry, this not only takes away from companies' ability to operate in the manner that they deem appropriate, but risks incentivising inefficient capital structures, and further increase risk for investors.

- Delayed Delivery Cashflow Mechanism (DDCM). The DDCM proposes to claw-back a proportion (50%) of revenue associated with unspent wholesale allowances at the end of years 2 and 3 if companies have underspent their cumulative enhancement allowances (since the start of AMP8) by more than 50% by year 2, and 65% by year 3. This mechanism, alongside the PCD and in-period ODI penalties/rewards, adds further complexity to the regulatory framework and, therefore, risk for investors.

- DPC reward and penalty. For example, this includes a new cumulative penalty for timeliness and quality of DPC submissions. Although we note there is a potential for reward at delivery.

In addition to the additional risk that the individual mechanisms introduced (in and off themselves), the continuous evolution of the regulatory framework is inconsistent with the fact that Ofwat is asking equity investors to 'wait longer' to recover investments (eg extending assets lives / slowing down levers) and is asking them to take their return through RCV growth. This means that equity investors will now increasingly need to price in the fact that Ofwat will continue to make changes between controls, overlapping with their investment recovery timeline.

Stable regulation is one of the guiding principles of economic regulation in the UK: "*Economic regulation plays a significant role in establishing the terms under which investment is made. Efficient investment is an important part of promoting the long-term interests of consumers. It is important that the regulatory frameworks avoid adding undue uncertainty to the business environment. To a large extent this is achieved by building a stable and transparent regulatory environment with a long track record of consistent regulatory decision making. A history of rational regulatory decisions, which can be objectively justified, creates an expectation that a narrow set of outcomes will follow a given set of circumstances. This in turn will help both investors and consumers to predict regulatory* *decisions. On the other hand,* ***piecemeal, ad hoc or unanticipated changes in policy or regulatory responsibilities are likely to erode investor confidence and increase the cost of capital***." [emphasis added] [29]

Therefore, these changes have severe consequences for investors' perception of risk, and therefore the kind of investor the water industry is able to attract, because it undermines the promise of a "stable and predictable regulatory regime". That is, Ofwat's approach is failing to create the environment required to attract the investment required at PR24, and is instead adding to the risk.

[29] 'Principles for Economic Regulation.' BIS (April 2011), page 8.

4. Setting the cost of equity

A holistic approach to setting the cost of equity is required to ensure that returns in the water sector allow companies to deliver critical investment.

As Ofwat noted in its DD, the water sector needs to deliver a large-scale investment programme at PR24 for customers and the environment.[30] More broadly, as the new Chancellor also recognised,[31] investment in critical infrastructure is crucial to drive the UK economy out of the low productivity-low growth cycle it has been stuck in for some 15 years. It is therefore essential, both to water customers and the UK economy, that the water industry can attract investors to finance this large-scale investment.

We welcome Ofwat's revision to its early view of the returns intended to compensate investors more fairly. However, we are extremely concerned regarding our ability to attract equity at this allowed rate of return, which are lower than our investors can achieve through their investments in other infrastructure industries (including energy in the UK).[32]

It appears that Ofwat's approach to setting equity returns, which is solely based on the CAPM, has turned into a largely technical exercise and has become decoupled from the overarching objective of ensuring that equity returns are able to finance critical investment for a credibly characterised notional firm in a real-world setting.

4.1. The water sector requires a boost in investment to drive productivity

Going into PR24, the water sector needs significant investment to ensure that companies can continue to provide resilient services to customers and take care of the environment. For instance:

- In its review, the House of Lords found that "*Pressures on the sewage network have increased substantially over time due to a combination of population growth, property development and climate change. Levels of investment have not risen to match these demands. The result is a network unable to cope, and which relies on releasing polluted water into the environment. Nor has investment kept pace with the demands of future water supply needs, leaving us lacking appropriate plans and infrastructure to deal with future demand, and the loss of billions of litres of water to leakage every day*."[33]
- Likewise, in its latest National Infrastructure Assessment, the National Infrastructure Commission (NIC) noted that in the water sector "*Assets often are not resilient to current climate risks. This is partly due to a historic failure to anticipate risks and understand the underlying health of assets*."[34]

More broadly, the UK is in need of a significant boost to productivity and growth.[35]

It is well-established in economic literature that, at a country level, investment is a key determinant of productivity growth, which in turn, drives economic growth in the long-run. However, public and private investment in the UK has lagged behind other comparable economies. For instance, in one of her first policy statements, the new

[30] 'PR24 Draft Determinations: Aligning risk and return.' Ofwat (11 July, 2024), page 1.
[31] Please see: https://www.gov.uk/government/news/chancellor-unveils-a-new-era-for-economic-growth.
[32] 'RIIO-3 Sector Specific Methodology Decision – Finance Annex.' Ofgem (18 July, 2024), Table 13.

[33] 'The affluent and the effluent: cleaning up failures in water and sewage regulation.' House of Lords (March 2023); page 3.
[34] 'The Second National Infrastructure Assessment.' National Infrastructure Commission (October 2023); page 110.
[35] 'What is holding back UK productivity? Lessons from decades of measurement.' Mason, G., O'Mahony, M., & Riley, R. (2018).

Chancellor sited evidence suggested that, since 2010Q2, UK business investment averaged at 9.9% of GDP (compared to the G7 average of 12.6% in this period). If UK business investment as a share of GDP were at the G7 average since 2010Q2, business investment levels would have been £57.1bn higher on average, per year.[36] Similarly, for public investment, the OBR found that, on an internationally comparable basis, the UK consistently ranked between 23rd and 27th out of 30 OECD countries in terms of government investment as a share of GDP in the decade to 2017.[37]

Therefore, ensuring this investment is delivered is critical, and should be the regulator's key priority going into PR24. Failing to do so could reinforce negative feedback loops of underinvestment, and therefore, low productivity growth going forward.

4.2. The ability of companies to deliver investment turns on the returns that Ofwat allows

The nature of investment required to drive productivity gains, e.g. infrastructure; technology; etc., can be inherently risky. As detailed in section 2, nature and scope of investment required at PR24 is also inherently risky.

In competitive markets, firms are incentivised to make these risky investments to drive productivity improvements, because they stand to gain from this through higher profits. In turn, investors in these firms are incentivised to finance these risky investments, because they stand to gain from them through higher equity returns. The riskier the investment, i.e. the more tenuous / untested the link between the scale of the investment and the scope for productivity gains, the higher the equity returns expected by investors.

In regulated sectors, such as the water industry, there is a less direct link between the nature of investment, the expected productivity gains from it and the equity returns that investors can make, because the latter is set by regulators. This implies that investors are not inherently incentivised to finance riskier investments but instead need to be incentivised to do so by regulators. As above, the riskier the investment, the higher the equity returns expected by investors, and therefore the higher the allowed returns need to be.

Following from the above, in order to ensure that the critical investment required is delivered, it is necessary for Ofwat to recognise the link between the nature of investment it wants to encourage and the return it needs to allow investors.

4.3. The nature of investment of investment required

Ofwat's current approach to setting returns is not fit-for-purpose for setting equity returns for the nature of investment now required in the water sector. This is because:

Firstly, Ofwat's approach to setting equity returns is decoupled from its decisions in other parts of the determination. As an example, as detailed in section 3.1.1 above, over subsequent price controls Ofwat has set increasing levels of stretch (e.g. stretching levels of performance and higher frontier shift) without consideration of whether the equity return provides: (i) sufficient incentive to attract the investments needed to achieve those targets; and / or (ii) sufficient compensation for meeting the targets ex-post.

Secondly, Ofwat relies almost exclusively on ex-ante evidence which reflects investor historical expectations, and therefore 'bakes in' investors' pessimism regarding returns, making high-risk investments even less likely. This

[36] Please see: https://www.gov.uk/government/news/chancellor-unveils-a-new-era-for-economic-growth.
[37] Please see: https://obr.uk/box/international-comparisons-of-government-investment/.

makes low productivity growth a self-fulfilling prophecy if it means that companies cannot attract the equity required to invest sufficiently to drive productivity growth.

In fact, Ofwat has attached weight to the more recent past, in which investors' expectations have been depressed, relative to the long-term (meaning, under its WACC estimates, Ofwat's ex-ante TMR is below its ex-post TMR estimate). This is inconsistent with other areas of the price control which are inherently optimistic about UK productivity (e.g. frontier shift).

Thirdly, (and related to the above), Ofwat has also relied on short-term evidence on systematic risk. As explained in section 2, this does not reflect the nature of investment that it seeks to encourage. Additionally, this approach of relying on relatively short-term evidence which imply that equity returns at each price control can change substantially as a result of relatively short-term market movements might not be conducive to attracting and retaining investors willing to support the sector over the long term.

More generally, although it is a well-established approach to setting equity returns for regulated sectors in the UK, CAPM has well-known limitations which must be kept in mind in considering the results of the model.[38] Put simply, while no model is perfect and other approaches also have their limitations, these limitations must be recognised in considering the results of any model.

Looking beyond the CAPM, Ofwat's allowed cost of equity appears low relative to top-down evidence and cross checks. This suggests that returns are not on par with returns from other infrastructure investments in other countries, which investors in the UK water sector would also view as potential options.

For example, Ofwat's nominal return on equity is only about 80-90 basis points above the yield that an investor would earn on investment-grade bonds; and the draft determination cost of equity is below the return that Ofwat would have arrived at if had simply adjusted the CMA's PR19 figure for changes in interest rates.

[38] 'Exploring Multi-factor Models as a cross-check on allowed returns at PR24: Report prepared for Water UK.' KPMG (November 2022).

5. Limitations in setting the WACC using the CAPM

In addition to the need to pursue a more holistic approach to setting the cost of equity, there are also other issues in Ofwat's approach to setting the allowed return using the CAPM. In the rest of this section, we deal with three issues: (i) specific technical issues with Ofwat's choice of notional gearing; (ii) Ofwat's construction of the appropriate range; and (iii) how it has selected a point estimate within that range.

5.1. Notional Gearing

Consistent with our Business plan, we remain of the view that retaining a notional gearing of 60% is the most appropriate level for this parameter, and encourage Ofwat to re-consider its proposed reduction to 55%.

Ofwat's decision to reduce the level of notional gearing to 60% rests on the assumption that an efficient water company would (i) be able to attract more equity to finance the investment required at PR24; and (ii) naturally aim to finance more of its capital structure through equity at PR24 than at PR19. However, Ofwat has failed to consider that these assumptions may not actually hold in practice. It has only asserted that these things are true without verifying that it is the case. In particular:

- It risks underestimating the cost of capital, which would undermine the ability of companies to raise equity finance at PR24. In practice, a reduction in gearing from 60% to 55% would, all else equal, require an increase in the cost of capital (as equity is more expensive than debt). Ofwat does not reflect this in its WACC estimate, and therefore does not maintain an internally consistent view of the notional firm.

- It risks presenting a misleading financeability assessment, which will not be achievable in practice. Incorrectly assuming that a company can simply raise a certain amount of equity over the coming AMP will result in the financeability assessment being rendered meaningless if this is not the case and will give a misleading picture of financeability because it is not reflective of the efficient firm. While a firm may be financeable based on notional assumptions, if these are not achievable, they may result in a company having to make trade-offs in other areas of their expenditure to create the additional headroom to maintain credit ratings. In practice, this may be achieved through reducing expenditure on asset maintenance, which takes time to deteriorate and result in reduced performance.

We have commissioned Economic Insight to investigate this topic. In its report, Economic Insight has undertaken preliminary econometric analysis which indicates that: (a) identifying the appropriate level of gearing for the water sector is possible; and (b) preliminary results point towards a 60% gearing or higher.[39] As a result, Ofwat's assumption may give a misleading impression that the notional firm is financeable.

5.2. Setting the appropriate range

When setting the appropriate range for each parameter in the cost of equity, it is important to do so in a balanced way, such that the lower end of the range reflects a plausible low-end estimate of the parameter and that the upper end of the range reflects a plausible high-end estimate of the parameter. It is important therefore to take a balanced view on the methodologies used to calculate both ends of the range, so as not to make decisions that unnecessarily bias one end of the range. A bias at one end of the range will ultimately filter into a bias in the final point estimate.

[39] 'Optimal level of notional gearing in water – A report for Wessex Water.' Economic Insight (August 2024).

For example, if there are two plausible assumptions in a calculation, one leading to a lower estimate of the parameter and another leading to a higher one, a balanced approach would use the assumption producing a lower estimate for the lower bound and the assumption producing a higher estimate for the upper bound.

In the rest of this section, we set out the issues we have identified in relation to Ofwat's chosen ranges for specific parameters, dealing with each parameter in turn.

5.2.1. **Beta**

In its Draft Determinations, Ofwat has largely maintained its position from its final methodology, choosing a range for beta based on two- and five-year rolling averages of five- and ten-year betas. These are calculated using daily data, placing equal weight on Severn Trent and United Utilities. However, Ofwat has not accounted for increased forward looking risk at PR24. As set out in Section 3.1, we consider this to be a significant shortcoming of Ofwat's approach which will bias its range for beta downwards and risks underestimating of the cost of equity.

Ofwat even acknowledges that "*a mix of more complex and uncertain activities for PR24 could potentially increase systematic risk*".[40] Not attempting to quantify this in any way represents a potentially serious deficiency in its method that could undermine its desire to see companies raise additional equity over the course of AMP8. Even if Ofwat is uncertain about the extent of this effect, to ensure that the range is balanced it is necessary account for it at a minimum in the upper end of the range for the parameter. A point estimate can then be selected based on the evidence that has been presented on the existence and magnitude of such an effect.

One method of accounting for this effect would be to use comparators as a means of quantifying the effect on beta. However, this method is limited by the appropriateness of the available comparators.

- KPMG accounted for this effect through its inclusion of National Grid in the portfolio of water companies used to calculate the upper end of its range for beta. This was because National Grid's historical RCV growth better reflects the challenges facing the water sector at PR24, and because the regulatory frameworks are similar between the two sectors.
- In its Sector Specific Methodology Decision (SSMD), Ofgem has also taken steps to reflect changes in the risk profile at RIIO-3 relative to RIIO-2 and to ensure that it is capturing the risk of the sector on a forward-looking basis as accurately as possible. To do this, it has broadened its view of the appropriate comparators for the energy sector in its, including European utility companies as comparators to better reflect the risk in the gas network as National Grid is the only energy comparator.

Another way to account for this risk is quantifying it directly. As set out in Section 3.1, Economic Insight has undertaken econometric analysis to quantify the uplift to Wessex's beta that would be required by the scale of the capital programme. The approach taken regresses pure-play water company betas against a variable reflecting the extent of capital expenditure, as well as controlling for other factors that could influence systematic risk. This has two main advantages, which are intended to address the legitimate concerns raised by Ofwat:

- Firstly, it addresses the limitation that comparator methods may be 'polluted' by factors other than capital intensity, meaning that the implied beta uplift is overstated.
- Secondly, it is consistent with the retention of the CAPM, because it starts from CAPM consistent betas and identifies an ex-post adjustment (i.e. it allows one to set aside the wider debate regarding the validity of the CAPM).

[40] Ofwat (July 2024) '';

This analysis finds a statistically significant relationship between asset growth and beta at the 1% level, which implies an uplift to unlevered beta of 0.019–0.033.

Additionally, in producing its range, Ofwat has relied on shorter-term estimates of beta, placing weight on 5-year estimates. Given that Ofwat is looking to incentivise long-term investment in the sector, we suggest that its approach avoid placing weight on short-term estimates that are more likely to change at successive price controls as this may disincentivise investors with a longer-term outlook.

The first step is the estimation of the "BAU beta", which reflects the fundamental business risk for water stocks. Starting with a beta for SVT/UUW that is not significantly impacted by transient events. Replicating the CMA's PR19 approach yields an unlevered beta range of 0.28 to 0.30. This range is further supported by the beta reweighting method informed by the CAA's H7 methodology.

This beta is then adjusted to include the impact of PNN at the upper end of the range based on the difference between 2-year betas based on SVT/UUW/PNN and SVT/UUW. This increases the range to 0.28 to 0.33.

We then need to reflect the increase in forward looking risk, as set out in the KPMG report. This increases the top end of the range by 0.021, consistent with the analysis outlined above. This gives a total beta range of 0.25 to 0.35.

Given the scale of our capital programme, we have then placed more weight on the top end, and proposing a spot estimate of 0.33.

5.2.2. Risk-free rate

In its Draft Determinations, Ofwat has based its estimate of the risk-free rate using the March 2024 average yield of 20-year RPI gilts, a shift from its Final Methodology position which placed equal weight on 10- and 20-year gilts. We consider this approach to be unbalanced, leading to a downward bias in this parameter estimate.

Ofwat's decision to base its estimate solely on index-linked gilts departs from the CMA's approach in its PR19 redeterminations. The CMA's interpretation of the CAPM was in line with Brennan's (1971) framework. Under this approach, where borrowing and lending rates are different, the market equivalent risk-free rate should be reflected by a weighted average across all individual investors. The CMA reflected this by taking the midpoint between two estimates, one based on AAA non-gilt bonds and the other index-linked gilts. Given that Ofwat's approach only reflects the lower end of this range, it will likely systematically underestimate the true risk-free rate.

Ofwat justifies its decision to base its estimate on index-linked gilts by pointing to further complications that would have to be dealt with under the Brennan framework. These complications include consideration of borrowing and lending restrictions, as well as how to average the participant-specific risk-free lending and borrowing rates which it states "*are likely to be more numerous than the two rates featured in the CMA's analysis*".[41] While this may well be the case, it is noted as a limitation by the CMA who consider that using a simple average to be a simplified but reasonable assumption.[42] The question is whether the omission of the entire upper end of the range is likely to bias the estimate more than imperfectly accounting for the numerous types of market participants.

Ofwat also note that its comparison of AAA-rated bonds with nominal gilt rates indicates that the inclusion of this evidence would not make a meaningful difference. We do not see this as a good reason not to favour the more theoretically robust framework. Additionally, we note that Ofwat only uses 1-month average compared with the

41 Ofwat (July 2024) 'PR24 Draft Determinations: Aligning risk and return: Allowed return appendix; page 17.

42 CMA (2019) 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations – Final Report'; para 9.263.

CMA's preferred 6-month average. This was to ensure the use of up-to-date data while avoiding the issues of short-term market volatility.

Ofwat has also decided not to account for a convenience yield adjustment in its estimate of the risk-free rate. This is justified based on its finding that the spread between AAA non-gilts and the nominal gilts was relatively small and must also contain liquidity and default premia. However, again its uses only a 1-month average, which may be too short a time frame. Additionally, Ofwat show that the spread between these two instruments narrowed considerably in late 2023 and early 2024.

In any case, we acknowledge that there is a tension when applying an upward adjustment for a convenience while simultaneously accounting for a higher risk-free borrowing rate using the Brennan framework. Given that AAA-rated bonds may also contain risk premia, adjusting for a convenience yield but not these factors could introduce an upward bias in the estimate of the risk-free rate. The CMA also accounted for these dynamics in its PR19 redeterminations.[43] Therefore, if Ofwat were to account for the risk-free borrowing rate in its estimate, it would be acceptable to omit an adjustment for the convenience yield.

Acknowledging these points in the upper end of the estimate would result in a range of 1.55% to 2.22% we have the mid-point of this range, 1.89%, as our spot estimate.

5.2.3. Total market return

In its Draft Determinations, Ofwat has decided on a range for the total market return of 6.29%–6.87%. This estimate is based on both historical ex-ante and ex-post estimation methods. However, in its recently published SSMD, Ofgem has calculated its range for the total market return to be 6.5%–7.0%. This is a substantial difference between the two ranges for the same parameter, both published in the same month. Especially, given that UK regulators have tended to assume that the TMR is a more stable component of the cost of equity, as is highlighted by UKRN.[44] We see little justification for one regulated sector to have its returns set based on a higher estimate of the total market return than another.

On the upper end of the range, the main driver of the difference between these two ranges is Ofgem's decision to choose a single point estimate for the top end of the range, instead of taking the midpoint of a range of estimates. Ofgem does not see the value of using a range to define the top of another range. The ex-post ranges between the two regulators are relatively comparable (6.81%–6.93% for Ofwat compared to 6.81%–6.97% for Ofgem).

On the lower end of the range, the difference is largely driven by Ofgem's decision to base its ex-ante estimate on only a DMS decompositional approach. Ofgem cites that it is "cautious about the value of making judgements in relation to the amount of previous 'luck' that will apply in the future".[45] This has a significant impact on the point estimate of the lower end of the range, which is 6.5% for Ofgem, compared with 6.29% for Ofwat.

We would urge Ofwat to consider the potential for adjustments to its approach in light of the discrepancy between its estimate and Ofgem's.

Additionally, as set out in section 4, the weight placed on historical ex-ante evidence risks 'baking in' investors' pessimism regarding returns, making them less willing to invest in higher risk investments and making low

[43] CMA (2019) 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations – Final Report'; page 789-790.
[44] UKRN (March 2023) 'UKRN guidance for regulators on the methodology for setting the cost of capital'; page 16.
[45] Ofgem (July 2024) 'Decision – RIIO-3 Sector Specific Methodology Decision – Finance Annex; page 76.

productivity a self-fulfilling prophecy. As a result, we would recommend placing less weight on historical ex-ante approaches in the context of PR24.

In light of this we are proposing a range of 6.74% to 6.93% with a mid-point spot estimate of 6.84%.

5.3. Where in the range to select a point estimate

In its Draft Determinations, Ofwat has selected a point estimate for the cost of equity above the midpoint of the range (4.80% compared with the midpoint of 4.53%). It justifies this based on: (i) valuations of listed water companies sitting below their long-term averages; and (ii) the large scale of the capital programme at PR24, though does not consider that this requires explicit adjustments to parameters for capital intensity.

Within its analysis, Ofwat stated that it does "*not consider notional financeability considerations to be a direct constraint on the allowed return on equity as the financeability assessment is primarily a test of the cashflow headroom in our determinations*". It also considered there to be "*no material unaddressed asymmetry in the PR24 Risk & Return package*", and that there is no asymmetry in CAPM inputs that would imply a cost of equity above the midpoint.[46] We do not agree with this assessment.

Firstly, as set out in the previous section, we consider it to be imperative that the risk arising from the scale and scope of the capital programme is reflected in the estimate of beta. Evidence on the relationship between beta and capital expenditure suggests an uplift to unlevered beta of 0.019–0.033. Additionally, we consider the ranges for parameters such as the risk-free rate and TMR to be skewed downwards. However, even if these biases were corrected for, as set out in the previous section, it would still be necessary to select a point estimate higher than the midpoint to adjust for inherent uncertainty and potential measurement error in the parameter estimates. The financeability assessment hinges on the assumption that raising equity is viable over the course of AMP8, though does not verify that this is the case. Given the increased level of risk relating to the scale and scope of the capital programme, this suggests that aiming up would be prudent given that measurement error has the potential to be higher in this context. This is particularly important given that the risk of underestimating the WACC is more harmful than overestimating the WACC, especially in the context of companies requiring significant equity injections over the course of AMP8.

Comparing the results from CAPM to other asset pricing models also suggests that it is currently under estimating the systematic risk of the water sector, based on past data. The differential between q-factor- and CAPM-derived CoE is 0.71 – 1.54% as of June 2024.

Therefore, we are proposing an aiming up adjustment on the cost of equity of 45bps. This reflects a 15bps adjustment for parameter uncertainty, and half of the bottom end of the differential between CAPM and q-factor models. This reflects a cautious approach, and may still under-estimate the true level systematic risk facing the sector.

Secondly, as set out in section 3.1, evidence from PR19 shows that returns were negatively skewed for equity investors. Given that PR24 will see further challenge on costs, further increases in performance targets, and the introduction of downside-only PCDs, this is likely to result in even greater downside skew than was present at PR19. If Ofwat does not deal with these issues 'at source' through adjustments to its costs and outcomes framework, this will need to be compensated through a higher point estimate on the cost of equity.

Overall, these factors indicate that it will be important to select a point estimate towards the upper end of the range, even after adjusting the parameter ranges as set out in the previous section.

[46] Ofwat (July 2024) 'PR24 Draft Determinations: Aligning risk and return: Allowed return appendix; page 72-73

5.4. Cost of Debt

Beyond the cost of equity there are also key points relating to the cost of debt that need to be considered. Alongside this representation we submit KPMG cost of debt report.

5.4.1. Cost of embedded debt

As set out in the KPMG report, one should consider all current debt instruments, including the impact of wrapping fees and swaps. It should also take account of the expected issuances out to the end of this price control period rather than basing it on notional gearing.

We do not agree with the weight applied to the actual-notional methodology. This approach does not only adjust the company's portfolio, but also the timing of its issuances. Its inclusion also offers limited incentive properties as companies cannot change their past decisions.

Finally, given that actual cost of debt can be observed, we see little merit in the application of cross checks simulating ex-post past issuances.

Therefore, we are proposing a cost of embedded of 2.89% (CPIH real) should be used in the final determinations.

5.4.2. Cost of New debt

As set out in the KPMG report, even with the removal of the benchmark index adjustment, the allowed cost of new debt is not sufficient to ensure the allowance is reasonable and achievable for the notional company.

We would expect for this to be corrected, and a new benchmark index adjustment included when considering more recent issuances.

Therefore, we are proposing a cost of new debt of 4.02% (CPIH real) should be used in the final determinations.

5.4.3. Additional borrowing costs

As set out in the DD and in the KPMG report there are additional debt costs that are efficiently incurred. These include issuance fees, cost to carry and basis risk.

The KPMG report suggests that these could be up to 29bps. For the DD we are proposing to retain the 35bps adjustment we included in our initial submission, but note that this could be a conservative estimate.

5.5. Retail Margin

We do not see evidence to continue to make a retail margin adjustment. The calculation set out in the DD include c£900m trade creditors at an industry level. These will, in reality, represent intra company creditor balances of wholesale charges and therefore should be excluded. When also aligning the financing rate for working capital to the cost of new debt, this results in no adjustment.

6. Our updated view of the appropriate WACC

We note that for our Draft Determination representations, we use Ofwat's WACC as an input for the financial model. However, again we present an alternative view of the WACC that we view as more appropriate in light of the considerations set out in the previous sections in this chapter.

Table 1 below sets out our updated view of the appropriate WACC in our response to the Draft Determinations. We compare with the figures from Ofwat's Draft Determination view to provide clarity as to where our view remains substantively different to Ofwat's on each individual parameter.

Table 4: Summary of updated WACC parameters (Real CPIH)

Parameter	Ofwat Draft Determinations	Wessex Updated View
Notional gearing	55%	60%
TMR	6.58%	6.84%
RFR	1.43%	1.89%
Beta	0.28	0.33
Aiming up	0.22%	0.45%
Cost of equity	4.80%	6.30%
Cost of embedded debt	2.46%	2.89%
Cost of new debt	3.36%	4.02%
Ratio of embedded to new debt	74%	74%
Additional debt costs	0.15%	0.25%
Overall Cost of Debt	2.84%	3.43%
Appointee WACC	3.72%	4.58%
Retail Margin adjustment	0.06%	0.00%
Wholesale WACC	3.66%	4.58%

7. Financeability assessment

Ofwat's financeability assessment unduly focusses on debt credit metrics and lacks coherence. As set out in our Business plan and in WSX-R05, assessing notional financeability, and indeed "investability" means considering both whether we can (on a hypothetically efficient basis):

- **(i) Earn a reasonable return.** This includes ensuring that: (i) the overall return (the WACC) is set at the appropriate level; and (ii) the 'expected' equity return is equal to the allowed cost of equity.
- **(ii) Raise finance on reasonable terms.** This involves ensuring that the notional firm is able to meet the target investment grade rating for debt finance.

In evaluating both of the above, it is important that notional gearing is in-line with the efficient level, and that assumptions regarding the notional firm are supported by robust evidence and are internally consistent.

However, Ofwat's financeability assessment focuses entirely on debt metrics, whereby Ofwat assesses a number of financial ratios based on the cash-flows it projects, under its Draft Determinations. Therefore, the reliability of that assessment (and the extent to which it can be used to draw inferences as to whether the notional company is financeable) fundamentally rests on the reliability of the inputs (i.e. cash flows) into it.

In practice, the cash flows are predicated on various assumptions Ofwat makes about the notional company that lack robustness or coherence. For example:

- In its assessment, Ofwat suggests that "*in any period where gearing would still be above the threshold, we have assumed sufficient new equity to return gearing to the notional level of 55%*" [emphasis added].[47] However, it is our assessment this equity would not be forthcoming at Ofwat's proposed return on equity.
- Cost of debt is again too low, as set out in the KPMG report.
- Ofwat's RoRE risk range is based on assumptions which makes it symmetrical but there is no reason to believe that it actually will be.

Furthermore, as highlighted in the business plan, there are still tensions between what Ofwat assumes about the overall target investment grade; notional gearing; and the allowed cost of debt. Specifically:

- Ofwat states that water companies should target an investment grade of BBB+/Baa1 for the notional firm. However, Moody's rating guidance for UK water companies presents a gearing range of 65%-72% for the Baa1 investment grade[48] (as does Fitch's). Ofwat's notional gearing assumption of 55% is, therefore, inconsistent with its target credit rating.
- At PR24, Ofwat has decreased its assumed notional gearing (reduced from 60% to 55%) and decreased its cost of equity (from 4.19% to 4.80%, CPIH real), although equity risk is increased relative to PR19.[49] [50] Ofwat's assumed notional gearing is, therefore, also inconsistent with its proposed cost of equity.

[47] 'PR24 Draft Determination: Aligning Risk and Return – Appendix 1.' Ofwat (11 July 2024); page 52.
[48] 'Regulated water utilities – UK: Regulator's proposals undermine the stability and predictability of the regime.' Moody's (May 2018).
[49] 'PR19 final determinations – Allowed return on capital technical appendix.' Ofwat (December 2019); Table 1.1.
[50] 'PR24 Draft Determination: Aligning Risk and Return.' Ofwat (11 July 2024); Table 1.

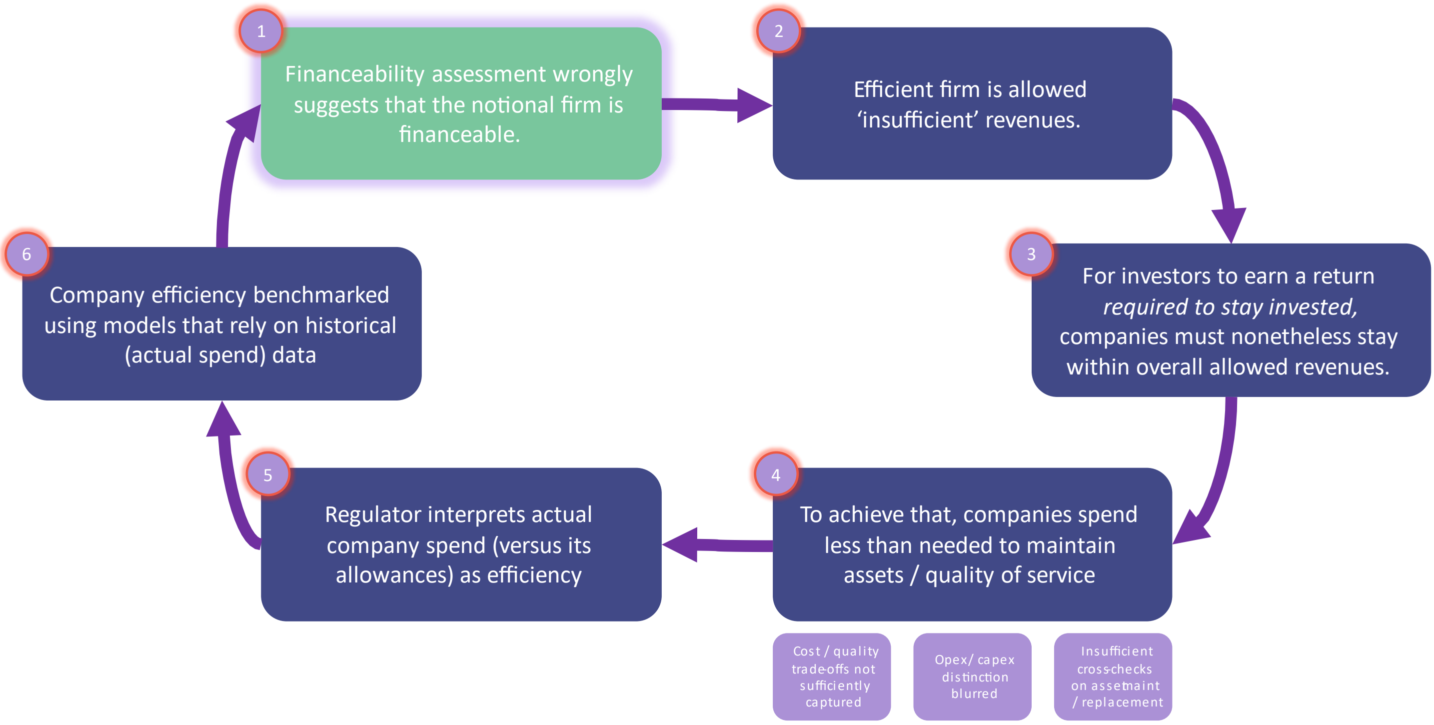
More broadly, Ofwat assumes that investors are indifferent between capital growth and dividends over time. However, this assumption requires investors with a reasonably long-term horizon, but Ofwat's approach of continuously changing the regulatory model (including the period over which investors can earn their returns) means that the water industry may not be able to attract / retain such investors.

8. The cycle of underinvestment

Under the Draft Determinations, Ofwat is simultaneously assuming material increases in investment, including large equity inflows (as is clear from a reduction in the notional gearing level from 60% at PR19 to 55% at PR24), without which its financeability assessment would not deliver investment grade credit ratings for debt), whilst also assuming an equity return reflective of historical risks (and where changes to the regulatory framework at PR24 have themselves increased equity risk). Moreover, Ofwat's projected company equity returns (and cash flows) under its determinations are artificially inflated, because it is further assuming companies can achieve outcomes and cost targets well beyond those supported by the evidence.

Ofwat is thus perpetuating the cycle of underinvestment that has characterised the sector, and the wider UK economy, over recent decades. It therefore risks setting an unbalanced risk-package, in which overall revenue allowances are 'too low', wherein: (a) *within* the water sector, companies are incentivised to increase cash, either by making 'cuts' to their investment programmes, or by raising debt – just so that investors can earn the allowed return set by Ofwat; and (b) *beyond* the water sector, the continuation of underinvestment in critical UK infrastructure holds back growth.

Figure 4: Cycle of underinvestment



Annex 1 – KPMG Report on Estimating the Cost of Equity for PR24

Private and confidential
Water Services Regulation Authority
Centre City Tower
7 Hill Street
Birmingham
B5 4UA

28 August 2024

Dear Director

Report on Estimating the Cost of Equity for PR24

We attach a copy of the above confidential report dated August 2024 ("Final Report") prepared by KPMG LLP ("KPMG"). The Final Report was solely prepared for Wessex Water Services Limited, Northumbrian Water Limited, South East Water Limited, Thames Water Utilities Limited, Anglian Water Services Limited, Southern Water Services Limited, Yorkshire Water Services Limited, Affinity Water Limited, and South Staffordshire Water Plc (together, "the Companies").

KPMG has agreed that we may disclose the attached Final Report to you, on the basis set out in this letter, to enable you to verify that a report has been commissioned by us and issued by KPMG in connection with the estimation of required cost of equity for the PR24 price control, and to facilitate the discharge by you of your regulatory functions subject to the remaining paragraphs of this letter to which your attention is drawn. KPMG has also agreed that you may publish the Final Report (in full only) on your website pages.

KPMG's work was designed to meet our agreed requirements and the engagement activities were determined by our needs at the time. The Final Report should not be regarded as suitable to be used or relied on by any party other than us for any purpose or in any context.

In consenting to the disclosure of the Final Report to you, KPMG does not assume any responsibility to you in respect of its work for us or for the Final Report. To the fullest extent permitted by law, KPMG accepts no liability in respect of any such matters to you. If you rely on the Final Report or any part of any of them, you do so at your own risk.

Yours faithfully

Wessex Water Services Limited

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Wessex Water Services Limited registered office
Registered in England No 2366648

Estimating the Cost of Equity for PR24

August 2024

Contents

1. Important notice

This Report has been prepared by KPMG LLP ('KPMG', 'we' or 'our') for Wessex Water Services Limited, Northumbrian Water Limited, South East Water Limited, Thames Water Utilities Limited, Anglian Water Services Limited, Southern Water Services Limited, Yorkshire Water Services Limited, Affinity Water Limited and South Staffordshire Water Plc ('group of companies') on the basis of an engagement contract dated 23 May 2024 between the group of companies and KPMG (the "Engagement Contract").

The group of companies commissioned this work to assist in their considerations regarding the Water Services Regulation Authority (Ofwat)'s PR24 Draft Determination (DD) on the cost of equity. Ofwat published the DD on 11th July 2024.

The agreed scope of work is included in section 3.2 of this Report. The group of companies should note that our findings do not constitute recommendations as to whether or not the group of companies should proceed with any particular course of action.

This Report is for the benefit of the group of companies only. It has not been designed to be of benefit to anyone except the group of companies. In preparing this Report we have not taken into account the interests, needs or circumstances of anyone apart from the group of companies, even though we may have been aware that others might read this Report. We have prepared this Report for the benefit of the group of companies alone.

This Report is not suitable to be relied on by any party wishing to acquire rights against KPMG (other than the group of companies) for any purpose or in any context. Any party other than the group of companies that obtains access to this Report or a copy and chooses to rely on this Report (or any part of it) does so at its own risk. To the fullest extent permitted by law, KPMG does not assume any responsibility or liability in respect of our work or this Report to any party other than the group of companies.

In particular, and without limiting the general statement above, since we have prepared this Report for the benefit of the group of companies alone, this Report has not been prepared for the benefit of any other person or organisation who might have an interest in the matters discussed in this Report, including for example other water companies or regulatory bodies.

Without prejudice to any rights that group of companies may have, subject to and in accordance with the terms of engagement agreed between group of companies and KPMG, no person is permitted to copy, reproduce, or disclose the whole or any part of this Report unless required to do so by law or by a competent regulatory authority.

Information in this Report is based upon on financial information platforms, financial datasets, and publicly available sources and reflects prevailing conditions as of the date of the Report, all of which are accordingly subject to change. Although we endeavour to provide accurate and timely information, there can be no guarantee that such information is accurate as of the date it is received or that it will continue to be accurate in the future. Information sources and source limitations are set out in the Report. We have satisfied ourselves, where possible, that the information presented in this Report is consistent with the information sources used, but we have not sought to establish the reliability or accuracy of the information sources by reference to other evidence. We relied upon and assumed without independent verification, the accuracy and completeness of information available from these sources. KPMG does not accept any responsibility for the underlying data used in this Report.

Where our Report makes reference to 'KPMG analysis' this indicates only that we have (where specified) undertaken certain analytical activities on the underlying data to arrive at the information presented. We do not accept responsibility for the underlying data.

You should be aware that KPMG, including members of the engagement team, delivers other advisory services to individual companies who are within the group of companies.

KPMG has not made any decisions for or assumed any responsibility in respect of what the group of companies, or any individual company within the group of companies, decides, or has decided to, include in its response(s).

The findings expressed in this Report are (subject to the foregoing) those of KPMG and do not necessarily align with those of the group of companies.

This engagement is not an assurance engagement conducted in accordance with any generally accepted assurance standards and consequently no assurance opinion is expressed.

2. Executive summary

On July 11th, 2024, Ofwat published the Draft Determination (DD) for the PR24 price control which covers the period from April 2025 to March 2030.

PR24 poses significant new challenges for the sector, with unprecedented levels of mandated investment, increasing delivery and performance risk, higher borrowing costs than experienced over the past decade and strong competition for investor capital across infrastructure asset classes. These factors underscore the importance of the PR24 cost of equity (CoE) as a mechanism to attract and retain equity capital within the sector.

The DD CoE has increased by 66bps relative to the Final Methodology (FM). Approximately half of this movement is driven by methodological changes to the TMR and an aiming up adjustment to support investability, given the market perception of higher risk for the sector[1].

Market commentary from rating agencies and equity analysts has highlighted a mismatch between risk and return based on the PR24 DD. While the DD includes a higher CoE and new regulatory mechanisms designed to mitigate risk, it also introduces a significant challenge on Totex, more demanding operational performance targets and stronger incentive rates.

At the same time, water companies based on the DD will have a lower CoE compared to the provisional CoE for RIIO-3. The lower CoE estimate for water juxtaposes with the market perception of risk for this sector. Barclays for example notes that "*Ofwat sees water as a lower-risk asset than other regulated assets. We do not see evidence of this, nor do investors*"[2]. An additional consideration for the relative attractiveness of equity investment in the sector continues to be the proximity to the return available on debt, which carries significantly lower risk.

These factors, if not addressed, could deter equity investors from the water sector. In this context, it is important to consider the appropriate principles for setting an evidence-based, balanced and risk-reflective allowance for the CoE to attract and retain equity investment in the sector in a highly competitive environment.

2.1. Risk-free rate

The starting point for the risk-free rate is 1m trailing average of 20Y RPI index-linked gilt (ILG) yields.

The risk-free rate for the CAPM is likely to lie above the ILG yield because (1) investors cannot borrow at the ILG yield; and (2) ILGs benefit from the convenience yield (CY).

In relation to (1):

The standard CAPM assumes that investors can borrow and save at the same risk-free rate. However, in the real world, the risk-free borrowing rate (r_b) is higher than the risk-free saving rate (r_s). In this case, the risk-free rate for the CAPM lies between the two rates as per Brennan (1971).

The CMA viewed its PR19 FD as an application of Brennan (1971). In particular, the CMA used the ILG yield as an estimate for r_s and the AAA corporate bond yield as an estimate for r_b.

Ofwat has not recognised (1) in the DD although this was the key rationale for the CMA's PR19 FD.

In relation to (2):

CY is explored across two steps.

First, assume as a simple benchmark that investors can borrow and save at the same risk-free rate.

ILGs like other government bonds provide additional benefits to investors (such as their superior collateral value vs other safe assets) which push their yield below the risk-free rate. The difference is CY. In consequence, CY(ILG) must be added to the ILG yield to obtain the risk-free rate.

[1] The remainder of the upwards change relates to movements in market data.
[2] Barclays (2024), Breaking the water cycle – no longer, so positive, p.64.

Second, now consider the more realistic case that investors' r_b exceeds their r_s. Specifically, r_s is equal to the common risk-free rate in the previous world but r_b increases. In this case:

- r_s remains ILG yield *plus* CY(ILG)
- r_b now becomes ILG yield *plus* CY(ILG) *plus* borrowing costs

This estimate for r_s more directly takes account of CY than the CMA's estimate. The CMA's estimate for r_b is the best possible estimate that exists but is conservative. The CMA's estimate of r_b can be expressed as ILG yield *plus* difference in yield between AAA bonds and ILGs (AAA-ILG difference).

Quantification of CY(ILG) and AAA-ILG difference:

The lower bound adjustment required to ILGs is based on CY(ILG) and the upper bound adjustment is based on the AAA-ILG difference.

The AAA-ILG difference is estimated directly based on the difference in yield between RPI AAA bonds and ILGs. This produces an estimate of 67bps.

2Y CY(ILG) is based on (1) estimate of CY for 2Y nominal gilts (NGs) in academic literature; and (2) analysis aiming to estimate the equivalent 2Y CY(ILG) from the academic literature estimate of 2Y CY(NG). The result is a range of 2-29bps. The midpoint of 15.5bps is selected as the point estimate. This recognises that the drivers of CY apply similarly to NG/ILGs but NGs may be more liquid.

Ofwat challenged in the DD whether estimates of CY at shorter tenors could hold at longer tenors. The empirical and qualitative evidence suggests this is reasonable. Further, the cross-check for CY(ILG) based on >10Y RPI AAA bonds implies a significantly higher value than 15.5bps.

Range and point estimate for the risk-free rate:

A range of 0-67bps is adopted for the adjustment required to ILGs. The upper bound position of 67bps is based on the AAA-ILG difference. The lower bound position of 0bps assumes no CY(ILG) is required, but this is not used to inform the point estimate for the adjustment to ILGs.

The point estimate of 41bps is below the midpoint of 15.5bps (point estimate for CY(ILG)) and 67bps.

The 1m trailing average of 20Y ILG yields over June 2024 is 1.21%. This implies a range for the risk-free rate of 1.21%-1.88% with a point estimate of 1.62% in RPI terms.

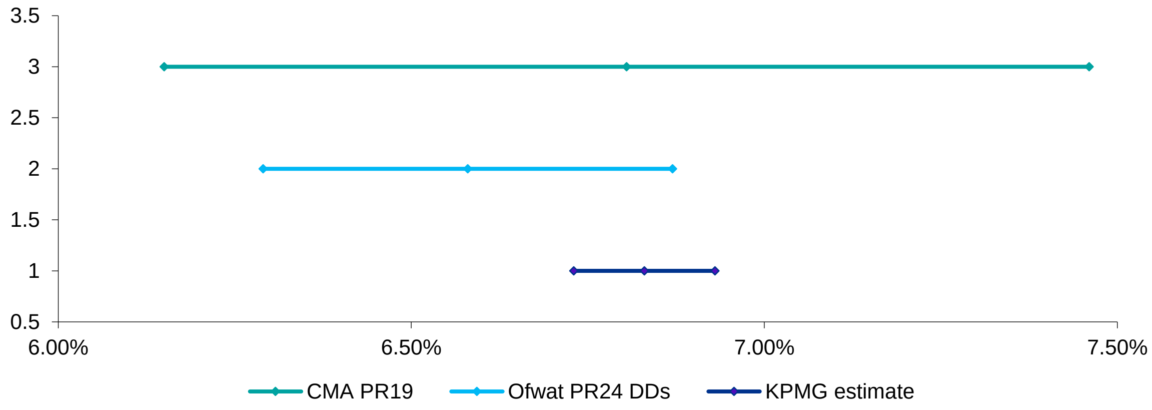
Adopting Ofwat's RPI-CPIH wedge of 0.34% results in an overall range for the risk-free rate of 1.55%-2.22% with a point estimate of 1.96% in CPIH terms.

2.2. TMR

The TMR range in this Report is based on historical ex post and ex ante approaches. The historical ex post estimate informs the upper end of the range (6.93%) and the ex ante estimate the lower end of range (6.75%). The resulting midpoint of 6.84% closely aligns with the CMA's PR19 estimate of 6.81%[3], reflecting the standard regulatory assumption that the TMR is relatively stable, and estimates developed in quick succession should be consistent. By contrast, the PR24 DD estimate is 23bps lower than the CMA's.

[3] CMA (2021), PR19 Final Determination, Table 7.

Figure 1: The KPMG TMR Range compared to CMA PR19 and PR24 DDs



Source: KPMG analysis

The KPMG estimate is fully encompassed within the CMA's PR19 range. The significant narrowing of the range is driven primarily by (1) the use of new data from DMS 2024 for ex ante approaches, which was not available to the CMA and (2) the movement in market data since the CMA's final decision.

The difference between TMR estimates in this Report and PR24 DD is mainly attributable to the ex ante estimate. In this Report it is derived as the midpoint of the range based on (1) the DMS decompositional approach (6.82%) and (2) the Fama-French dividend discount model (6.68%). The use of these approaches aligns with the PR24 DD and the CMA's PR19 methodology, though analytical improvements have been made to enhance the robustness of the estimates, as summarised in the table below.

Table 1: Ex ante estimates

Approach	Analytical Improvements	Impact versus the DD
DMS Decompositional	The Report calculates the estimate directly in CPIH terms using the new date from DMS 2024. This is a more precise approach that eliminates the need for judgmental adjustments to account for the differences in the inflation measures used by DMS and Ofwat[4].	An increase of 24bps.
Fama-French DGM	This Report substitutes the Barclays Equity and Gilt Study (BEGS) data with the new data from DMS 2024. The BEGS data has widely recognised shortcomings and is not appropriate for use in a regulatory setting. DMS 2024 is a clearly superior dataset which now includes previously unavailable information.	An increase of 68bps.

Source: KPMG analysis

The historical ex post estimate is derived as the simple 1-year arithmetic average as (1) there is no statistically significant evidence of serial correlation and (2) both investor and capital budgeter perspectives are relevant which requires the estimation of a neutral TMR in the form of the long-run arithmetic average. The resulting estimate of 6.93% is slightly higher than the PR24 DD point estimate of 6.87%.

[4] The published Decompositional approach values in Table 12 of DMS 2024 are in CPI-real terms based on the DMS' own series, which uses COLI in earlier years. COLI is a lower quality data series that overstates real values. Regulators historically applied a downwards COLI-CED adjustment to account for the lower quality of the COLI series. Expressing returns directly in CPIH terms eliminates the need for this adjustment and also suggests that the 35bps DD adjustment is likely overstated by 25bps.

2.3. Beta

An overall unlevered beta range of 0.28 to 0.35 is adopted in this Report. This estimate is underpinned by the principles that (1) the purpose of beta assessment is to appropriately capture the systematic risks expected by investors in the long-run, and (2) in a dynamic risk environment, betas based on historical data will not necessarily be the most appropriate guide to the assessment of forward-looking risk.

Treatment of distortive events

The impact of distortions from Covid-19 and the Russia-Ukraine war on estimates that inform the DD range is material.

Ofwat considers that Covid19 is an "*uninfluential factor*", however the table below indicates that this position is not consistent with the empirical data. The use of rolling averages in the DD amplifies the weight assigned to the data from this period and understates long-run systematic risk.

Table 2: Impact of distortions due to Covid19 and Russia-Ukraine war

Timeframe	Spot	1-year average	2-year average	5-year average
2-year	-0.02 (-7%)	-0.03 (-10%)	-0.04 (-16%)	-0.07 (-22%)
5-year	-0.06 (-19%)	-0.07 (-21%)	-0.08 (-23%)	-0.03 (-10%)
10-year[5]	0.01 (+3%)	0.03 (+10%)	0.02 (+7%)	-0.00 (-2%)

Source: KPMG analysis using Refinitiv Eikon and Refinitiv Datastream data.

The reduction in water company betas was driven by a decrease in the volatility ratio between SVT/UUW and FTSE All Share returns due to the flight-to-safety effect. This reflects the defensive nature of water company stocks whose returns fluctuate less than the overall market during periods of stress. The sustained increase of 2-year betas – which are now above 5-year and 10-year estimates – suggests that at a minimum there has been a reversal of these distortions ahead of AMP8.

Methods designed to address the impact of such distortive events indicate that unlevered beta estimates below 0.28, based on SVT/UUW data, would not be appropriate. By contrast, Ofwat has adopted 0.26 as the lower bound of the PR24 DD range.

Treatment of forward-looking risk

PR24 capital programmes continue to imply increasing risk exposure for companies even after accounting for new risk mitigations introduced in the PR24 DD. This increase is not yet reflected in beta estimates, which lag in capturing the impact on share prices and total returns due to their reliance on historical data.

Analysis of non-financial UK stocks within the FTSE 350 reveals a positive and statistically significant relationship between capital intensity and beta. The analysis of the risk exposure implied by the PR24 DD Totex using KPMG's stochastic risk model also finds that there is a material increase in Totex risk relative to PR19 after accounting for new risk mitigations. Consequently, beta estimates based on historical data for listed water companies are unlikely to fully account for forward-looking risks. Additional comparators and cross-checks are necessary to accurately capture and price these forward-looking systematic risks.

Selection of comparators

Additional data from PNN is both valuable and relevant for estimating the PR24 beta, as SVT and UUW represent only a subset of the industry whose betas embed historical outperformance that is not representative of the notional company. To account for the limitations inherent in the PNN data, PNN has been excluded from determining the lower bound of the beta range in this Report.

Incorporating NG at the higher end of the beta range could better capture the forward-looking risk exposure for the water sector because (1) the regulatory frameworks for the two sectors are relatively

[5] The observed increase in 10-year betas is likely driven by the relatively lower betas before the regime change at PR14 being assigned less weight relative to 2020. Refer to section 8 of the September 2023 report.

similar, (2) NG's historical RCV growth aligns more closely with the growth anticipated for water, and (3) empirical evidence indicates that the market is pricing higher risk for water relative to energy.

The estimate adopted in this Report and the basis of its derivation are set out in the table below.

Table 3: Overall unlevered beta range for PR24

		Lower bound	Upper bound
Business-as-usual (BAU) beta	Basis of estimation	• SVT/UUW betas estimated based on a replication of the CMA PR19 approach for mitigating the impact of distortive events[6]. • This is cross-checked against a re-weighting approach that assumes that a distortive event which is similar in impact to the pandemic and war, would affect 1, 2 or 3 out of 20 years[7].	• The upper bound adjusted to include the impact of PNN based on the difference between 2-year betas for SVT/UUW/PNN and SVT/UUW.
	Estimate	0.28	0.33
Forward-looking beta	Basis of estimation		• NG beta estimated based on a replication of the CMA PR19 approach for mitigating the impact of distortive events. • Cross-checked against evidence from: (1) the relationship between capital intensity and beta based on FTSE 350 excluding financials, and (2) translating the impact of the increasing capex intensity on RoRE range to equity beta.
	Estimate		0.35
Overall range		0.28	0.35

Source: KPMG analysis

The overall beta range of 0.28 to 0.35 adopted in this Report (1) substantially mitigates the impact of transient distortive factors and (2) takes into account – at the upper end of the range – the likely increase in systematic risk going forwards.

6 At PR19, the CMA limited the weight assigned to estimates affected by distortions (i.e. December 2020 cut-off) by setting a range that encompassed the upper end of the estimates (spot, 1-, 2- and 5-year averages of 2-, 5- and 10-year betas) to December 2020 and the full range of that to February 2020. This approach is replicated in this Report using daily beta estimates for the same estimation and averaging windows and based on cut-offs of February 2020 and June 2024.

7 This analysis differs from that included in the September 2023 report. That report effectively assumed that a distortive event would affect 2 years out of 20; this Report assumes that 1, 2, or 3 years would be affected. The September 2023 report also did not take into account data after the start of Russia-Ukraine war in February 2022. This Report calculates distorted betas as of mid-December 2023.

2.5. Notional gearing

The assumed reduction in notional gearing from 60% to 55% at PR24 is not supported by robust market evidence and corporate or regulatory finance principles. In consequence, this Report adopts notional gearing of 60%.

- Notional gearing of 55% sits materially below the average for the water sector. All else equal, this suggests that 55% gearing is below efficient market levels.
- A lower level of notional gearing has been assumed to support financial resilience. However, assuming a lower notional gearing cannot improve the notional company's overall financial position if business risk has increased – assuming lower gearing in practice reallocates risk from debt to equity. Where there is a marked increase in business risk on a forward-looking basis, the efficient market outcome would be a higher return to price in changes in risk (as reflected in the beta estimates in this Report).
- The DD assessment of issues affecting gearing during AMP7 omits relevant factors that exert upwards pressure on gearing, such as AMP7 operational performance across the sector. Observed gearing in the sector has not reduced from the beginning of AMP7.

2.6. Retail margin adjustment

The DD incorporates a 6bps deduction to the appointee WACC in the form of a retail margin adjustment (RMA) to prevent double counting of compensation for the systematic risk of the retail business, given the provision of a separate retail margin.

The calculation of the RMA is underpinned by several flawed assumptions.

First, it assumes that the risk of the retail business exceeds that of the wholesale business and that the retail margin adequately compensates for these additional risks. However, the validity of this assumption is not substantiated by the DD, which does not benchmark the retail margin against a holistic analysis of retail risks.

Second, the assumption that retail creditor balance is entirely comprised of trade creditors drives half of the DD adjustment but does not hold in practice as c.90% of the creditor balance is intercompany based on DD financial models.

Third, the adjustment relies on a working capital financing rate below the appointee cost of new debt. There is a high degree of variation in working capital rates among different companies, suggesting different derivation bases. Moreover, for integrated wholesale-retail businesses, financing for retail working capital is often indistinguishable from the overall debt portfolio. As such the use of the notional cost of new debt is appropriate.

Using the appropriate working capital balance and financing rate reduces the adjustment to less than 1bp. In consequence, this Report does not apply an RMA.

2.7. Cross-checks

The purpose of cross-checks is to increase the reliability and robustness of the CoE estimate derived based on the CAPM. Cross-checks are inherently subject to limitations and require careful and systematic selection to ensure effectiveness.

Criteria for evaluation of cross-checks

The primary criteria used to assess cross-checks in this Report are whether they are transparent, targeted, objective, and unbiased and consistent with established academic research. The assessment against these criteria indicates that multi-factor models (MFMs) and inference analysis represent balanced cross-checks, as they are targeted, unbiased, and grounded in academic research. In contrast, the DD's sole cross-check, MAR, is not targeted, heavily reliant on assumptions and can result in a wide range of outcomes.

The MAR cross-check did not receive systematic evaluation in the DD. In contrast, the MFM evidence has been evaluated based on stringent criteria that are inconsistent with its intended role as a cross-check rather than a primary model for estimation of returns. Applying different criteria and hurdles to different cross-checks risks introducing bias and omission of relevant evidence for cross-checking returns. To ensure a comprehensive and objective assessment, criteria should be applied consistently to all cross-checks.

Ofwat commentary on MFMs

The commentary from Ofwat's advisers does not provide sufficient and robust grounds for the exclusion of MFMs from the suite of cross-checks at PR24 FD. The evaluation has significant shortcomings, including mischaracterisations of the analysis, flawed statistical testing methods that deviate from established academic approaches, and the dismissal of robust statistical testing evidence included in the original MFM report.

Established statistical tests confirm the q-factor model's superior performance relative to the CAPM. Enhancements to the MFM analysis have increased the sample size and improved statistical test results, with two out of three additional factors now individually statistically significant.

Based on June 2024 cut-off, the q-factor model yields a CoE 0.71 – 2.21% higher than the CAPM.

Ofwat commentary on inference analysis

The evaluation of inference analysis by Ofwat's advisers has significant shortcomings and does not provide sufficient and robust grounds for its exclusion from the suite of cross-checks in the FD. These include mischaracterisation of the conceptual and analytical foundations of inference analysis, as well as flawed statistical testing methods.

Inference analysis is an asset pricing model that estimates the expected return on equity based on a relative pricing approach. This method derives asset returns based on the prices of other assets, specifically the cost of debt and the ratio of return on equity to the return on debt (i.e. elasticity).

Following the analytical approach developed by Campello, Chen, and Zhang (CCZ), inference analysis uses elasticity to estimate expected equity returns for water stocks. This estimate is then used as a cross-check for the regulatory CoE.

Inference analysis indicates that the CAPM-derived CoE based on the PR24 DD methodology as of June 2024 is c.153bps below the lower bound of the inferred CoE range.

Market-based cross-checks

The Report also considers market-based cross-checks typically used by regulators like Ofwat and Ofgem indicate that the expected market return has significantly increased by 115 – 282bps relative to equivalent figures in 2019. These approaches, although reliant on and sensitive to assumptions, can provide a directional signal on the evolution of expected market return.

2.8. Selection of a point estimate

This Report adopts a range of 15 – 75bps as the required adjustment to the midpoint of the CAPM-CoE range to address parameter uncertainty and to support investability in current market conditions.

- The lower bound represents the minimum required to avoid disincentivising high levels of investment projected for AMP8 and beyond in the context of parameter uncertainty, in line with the CMA's decision at PR19.
- The upper bound reflects (1) the *de minimis* adjustment required to address the underestimation of systematic risk in water stocks by the CAPM, as evidenced by multi-factor model analysis (70bps) and (2) other contemporaneous cross-checks.

Table : Implications of cross-check evidence for the selection of a point estimate

Approach	Implications of the cross-check evidence
Multi-factor models	The point estimate for the allowed CoE for PR24 should be 0.71 – 2.21% higher than the midpoint of the CAPM-derived CoE range to address the structural underestimation of systematic risk for water companies by the CAPM. MFM evidence is assigned the most weight in the calibration of the aiming up adjustment as the q-factor model has stronger explanatory power than the CAPM.
Inference analysis	The CAPM-derived CoE in this Report (midpoint, pre-aiming up) is at least 66bps lower than would be expected relative to the current market pricing of debt in the sector and the relationship between debt and equity pricing. As equity is riskier than debt, the expected return on equity needs to be substantively above the expected return on debt of the same company, as otherwise an investor is unlikely to be incentivised to invest in equity.
Market-based cross-checks	A range of market-based cross-checks, which consider contemporaneous market evidence, indicates that expected market return has significantly increased relative to PR19. This includes a DDM, equity analyst reports, survey evidence and infrastructure fund discount rates. When combined with midpoint CAPM parameters in this Report, the observed evolution of expected market return relative to 2019 suggests upward pressure on CAPM-derived CoE, ranging from 56 to 170bps.

Source: KPMG analysis

The Report adopts the midpoint of the implied aiming up range of 45bps but notes that it may be necessary to increase the point estimate to at least the upper end of the aiming up range to support investability.

This Report does not aim up to reflect asymmetric risk exposure. Where companies identify the presence of expected loss or negative skewness, they should apply an adjustment when selecting a point estimate from the CoE range implied by the analysis in this Report.

2.9. CoE estimate for PR24

The table below summarises the estimated range for the required CoE at PR24. This range reflects:

- An estimate of the market-based CoE based on a balanced evaluation of current market data, academic literature, and relevant regulatory precedent; and
- The uplift required to reflect cross-check evidence and attract and retain equity capital, given high levels of investment projected for AMP8 and beyond.

The CoE range below is presented pre and post aiming up. On a 60% gearing basis – i.e. reflecting the notional gearing assumption adopted in this Report – the CoE range is 5.16 – 6.11% pre aiming up, and 5.31 – 6.86% post aiming up.

The CoE estimate is also presented on a 55% notional gearing basis to enable like-for-like comparison with the DD estimate. This implies a CoE range of 4.82 – 5.73% pre aiming up and 4.97 – 6.48% post aiming up.

Table 4: PR24 CoE range based on parameter-level estimates, with aiming up included

Parameter (CPIH)	KPMG (Jun 2024) 55% gearing Lower bound	KPMG (Jun 2024) 55% gearing Upper bound	KPMG (Jun 2024) 60% gearing Lower bound	KPMG (Jun 2024) 60% gearing Upper bound
Notional gearing	55%	55%	60%	60%
TMR	6.75%	6.93%	6.75%	6.93%
RFR	1.55%	2.22%	1.55%	2.22%
Unlevered beta	0.28	0.35	0.28	0.35
Debt beta	0.10	0.10	0.10	0.10
Observed gearing	53.74%	43.72%	53.74%	43.72%
Asset beta	0.34	0.39	0.34	0.39
Notional equity beta	0.63	0.74	0.70	0.83
Coe before aiming up, appointee	4.82%	5.73%	5.16%	6.11%
Aiming up	0.15%	0.75%	0.15%	0.75%
CoE, appointee	4.97%	6.48%	5.31%	6.86%
RMA	0.00%	0.00%	0.00%	0.00%
CoE, wholesale	4.97%	6.48%	5.31%	6.86%

Source: KPMG analysis

The point estimate for CoE is 6.12% on a 60% notional gearing basis, incorporating aiming up of 45bps relative to the midpoint. The point estimate on a 55% notional gearing basis is 5.76% which compares to the DD estimate of 4.71% (updated for June 2024 cut-off).

Table 5: Point estimates of PR24 CoE

Parameter (CPIH)	KPMG (Jun 2024) 55% gearing	KPMG (Jun 2024) 60% gearing	Ofwat DD (Jun 2024) Point estimate
Notional gearing	55%	60%	55%
TMR	6.84%	6.84%	6.58%
RFR	1.96%	1.96%	1.55%
Unlevered beta	0.32	0.32	0.27
Debt beta	0.10	0.10	0.10
Observed gearing	48.73%	48.73%	52.91%
Asset beta	0.36	0.36	0.33
Notional equity beta	0.69	0.76	0.60
Coe before aiming up, appointee	5.31%	5.67%	4.57%
Aiming up	0.45%	0.45%	0.28%
CoE, appointee	5.76%	6.12%	4.85%
RMA	0.00%	0.00%	0.13%
CoE, wholesale	5.76%	6.12%	4.71%

Source: KPMG analysis

The CoE estimate derived in this Report is consistent with several principles implied by the CMA's determination of the allowed CoE at PR19, supporting consistency with the outcomes of previous price control whilst recognising the new challenges faced by the sector.

3. Context and scope

3.1. Context

On July 11th, 2024, Ofwat published the Draft Determination (DD) for the PR24 price control which covers the period from April 2025 to March 2030. Ofwat has set an allowed appointee cost of equity (CoE) of 4.80% CPIH-real, based on a March 2024 cut-off and 55% notional gearing. This represents a 66bps increase from the Final Methodology (FM), with approximately half of the movement driven by methodological changes to the TMR and an aiming up adjustment to support investment in the sector[8].

For the PR24 price control, two key themes will shape the context in which water companies must deliver their plans.

First, the upcoming price control will represent a material shift in the operating and financing environment for water companies, leading to a significant increase the risk borne by companies and their investors. AMP8 will see all water companies experience a step-change in risk exposure, driven by a significant ramp-up in capital programmes which are increasing in scale and complexity. Capital programmes also entail significant deliverability pressures, many of which are beyond the direct control of companies, coupled with challenging efficiency targets.

At the same time, the design of the regulatory framework for AMP8 will make PR24 the most challenging price control to date, with companies facing more stringent incentives, stricter ODIs and tougher targets. Moreover, the increased risk exposure that companies will bear is expected to be enduring, extending beyond AMP8, and impacting multiple future price controls.

Market commentators have highlighted a mismatch between risk and return based on the PR24 DD:

- Moody's notes that the risk of cost overruns, future underperformance and the risk of incurring penalties have increased and that "*the draft [determination] also increases the risk that sector returns may not be enough to attract the equity funding the companies need to support increasing investment*"[9].

- JPM suggests that "*in PR24, Ofwat must balance its conservative approach to setting returns with evidence of rising UK water sector risks* ***and the need to sustainably attract debt & equity capital to the sector***"[10] and that "*Ofwat recognises the financial challenges that the sector faces in AMP8 but believes balance sheets can be stabilised by raising equity and/or limiting dividends****. We are less optimistic and expect low equity investor appetite for UK water companies post the DDs***"[11].

Second, for the first time since privatisation water companies will need to attract significant amounts of new equity capital to finance critical investments and to be financeable throughout AMP8. The regulatory CoE needs to be sufficient to provide incentives for firms and their investors to meet investment requirements, as recognised by the CMA at PR19[12]. Attracting new equity will require investment appraisals to yield positive results and for the investment proposition to be sufficiently competitive relative to both other forms of capital investment and other equity investment opportunities. In other words, the cost of capital (and the price control as a whole) must represent an investable proposition.

In the PR24 DD, Ofwat notes that investor sentiment for the sector is currently low and acknowledges that it is important that "*determinations are seen to support investment and investor confidence at a time when all companies (whether good or poor performers) are expected to continue to raise record levels of debt and equity finance, while competing with other sectors and internationally for the*

8 The remainder of the upwards change relates to movements in market data.
9 Moody's (2024), Ofwat's draft determination increases sector risk, p.8.
10 J.P.Morgan (2024), What a Week for UK Water!, p.2.
11 Ibid., p.1.
12 CMA (2021), PR19 Final Determination, para. 9.1236.

allocation of that capital"[13]*.* At this stage, Ofwat has not carried an assessment of investability which would considers whether the water sector can successfully compete for investment in a highly competitive market based on the DD.

Ofgem meanwhile, in its recent Ofgem's Sector Specific Methodology Decision (SSMD), characterises the allowed return on equity as "*[the] return required to attract and retain sufficient equity capital"*[14]. The SSMD sets out initial commentary on the importance of assessing investability of the RIIO-3 price controls and how attractive the investment opportunity in energy networks is relative to other options.

The PR24 CoE estimate is lower than the equivalent figure in the SSMD[15] by 34 bps (based on 60% gearing), with the difference primarily driven by the TMR estimate and Ofgem's provisional[16] inclusion of European comparators, which significantly increases the upper end of the range. This is partially offset by Ofwat aiming up in the selection of the point estimate.

The lower CoE estimate for water juxtaposes with the market perception of risk for this sector.

- Barclays notes that "*Ofwat sees water as a lower-risk asset than other regulated assets. We do not see evidence of this, nor do investors*"[17].
- Moody's meanwhile notes that "*the lower cost of equity allowance for water companies* [relative to energy networks] *implies that the overall risk should be lower in the water sector. However, the water companies in England and Wales face heightened public and political attention, and tougher performance incentives may prevent them from achieving the allowed returns*"[18].

As a result, investors looking to deploy capital in regulated utilities may elect to pivot towards energy rather than water.

A key consideration for the relative attractiveness of equity investment in the sector continues to be the proximity to the return available on debt, which carries significantly lower risk. Market commentary from both debt and equity perspectives has highlighted the convergence between debt and equity pricing and its misalignment with market expectations:

- "*Based on the proposed parameters, the cost of equity allowance provides a slightly better buffer to the cost of new debt allowance than the early view estimate. However it still indicates* ***a rather low equity premium to attract new funding in a higher interest rate [environment]"***[19]**.**
- "[The] C*ost of equity allowed by Ofwat looks low vs. debt – currently debt returns are c.6.0% nominal. We would note that recent debt issuances from Severn Trent and Pennon were at 155bps (29 July) and 185bps (29 July) over risk-free. Risk-free is 4.3-4.5% leading to a return on debt of 5.875% in Severn Trent (14 years tenor) and 6.375% in Pennon (17 years). With a CPIH of c.2% this is a real cost of debt of c.4% real, only 80bps less than the proposed discount rate of equity.* ***We see this spread as too thin"***[20]*.*

The current debt-to-equity spread is unlikely to reflect the additional risks borne by equity holders, and all else equal could discourage equity investors from committing capital to the sector.

These factors, combined with the significant increase in market rates, would be expected to exert upwards pressure on allowed CoE relative to the CMA's estimate for PR19. In this context, it is important to consider the appropriate principles for setting an evidence-based, balanced and risk-reflective allowance for the CoE to attract and retain equity investment in the sector.

[13] Ofwat (2024), PR24 Draft Determination, Aligning risk and return – Allowed return appendix, p. 74.
[14] Ofgem (2024), RIIO-3 Sector Specific Methodology Decision – Finance Annex, para. 3.1.
[15] Ofgem (2024), RIIO-3 Sector Specific Methodology Decision – Finance Annex, Table 12, para. 3.227.
[16] Ofgem "*retain the flexibility to weight comparator data in the way that* [it] *think*[s] *is appropriate, and may not pick the midpoint of the range".*
[17] Barclays (2024), Breaking the water cycle – no longer, so positive, p.64.
[18] Moody's (2024), Ofwat's draft determination increases sector risk, p.8.
[19] Moody's (2024), Ofwat's draft determination increases sector risk, p.7.
[20] Barclays (2024), Breaking the water cycle – no longer so positive. P.61.

This Report therefore explores academic literature, relevant regulatory precedent, and market evidence to estimate returns required to attract and retain the required equity investment in the context of a significant increase in capital programmes and overall risk in the sector.

3.2. Scope and structure of the Report

KPMG has been engaged by a group of water companies to develop a risk-reflective estimate of the regulatory CoE for PR24. This estimate is based on relevant financial literature, regulatory principles, and the latest market data, and considers the implications of the evidence and estimates presented in the PR24 DD.

The Report derives the CoE estimate for PR24 based on following steps:

- First, it develops an estimated range for each CoE parameter using methodologies that are well-supported by financial literature, regulatory precedent, and current market evidence. It considers the implications of the evidence and estimates for each parameter provided in the DD. Where the Report identifies that the DD approach has been unbalanced or inconsistent with relevant and robust evidence, it includes commentary to shed light on the reasons behind these findings (sections 4, 5, 6).
- Second, it considers the appropriate assumptions for notional gearing (section 7) and the retail margin adjustment (section 8).
- Third, it considers the implications of the evidence from cross-checks that can increase the accuracy of the CoE assessment (section 9).
- Fourth, it sets out the framework for the selection of the point estimate of CoE (section 10) and comments on the appropriate risk-reflective point estimate for the allowed return on equity for PR24.
- Fifth, it analyses the technical findings and commentary from Ofwat and its advisors in relation to the muti-factor model (MFM) and inference analysis cross-check evidence submitted over the course of the PR24 price review process (section 11).

3.3. Authors

This Report has been written in conjunction with Professor Alan Gregory, a Director in Exefera limited, and Professor Alex Edmans, who are sub-contractors of KPMG LLP.

Professor Gregory is a Professor Emeritus in Corporate Finance at the University of Exeter. His research interests are in the general area of market-based empirical research, including the empirical estimation of cost of capital and the long-run performance of company acquisitions. From September 2001 to September 2009 he was a Reporting Panel Member of the UK Competition Commission (CC) where he was involved in a number of inquiries, including the merger investigation of two potential European takeover bids for the London Stock Exchange, and the groceries or “supermarkets” market investigation.

Professor Gregory was a member of the CC’s cost of capital panel from 2009 to 2017 and continues to provide advice to the Competition and Markets Authority (CMA). In addition to more than thirty papers in peer-reviewed academic journals, he has contributed to an OECD Roundtable publication on Excessive Prices and is the author of the Financial Times book ‘Strategic Valuation of Companies’.

Professor Edmans is Professor of Finance at London Business School (LBS). Professor Edmans' research interests are in corporate finance and behavioural finance. He is a Director of the American Finance Association and a Fellow of the Financial Management Association. From 2017-2022 he was Managing Editor of the Review of Finance, the leading academic finance journal in Europe. Professor Edmans has spoken at the World Economic Forum in Davos, testified in the UK Parliament, presented to the World Bank Board of Directors as part of the Distinguished Speaker Series, and given the TED talk What to Trust in a Post-Truth World and the TEDx talks The Pie-Growing Mindset and The Social Responsibility of Business. Alex was named Professor of the Year by Poets & Quants in 2021 and has won 25 teaching awards at Wharton and LBS.

Professor Edmans' book, Grow the Pie: How Great Companies Deliver Both Purpose and Profit, was featured in the Financial Times Best Business Books of 2020 and won the Financial Times award for Excellence in Sustainable Finance Education. He is a co-author of the 14th edition of Principles of Corporate Finance (with Brealey, Myers, and Allen). The UK government appointed him to conduct one study on the alleged misuse of share buybacks and a second one the link between executive pay and investment.

4. Risk-free rate

The risk-free rate in the CAPM represents the rate of return expected by investors for holding a risk-free asset, i.e. an asset with zero risk. This section is structured as follows:

1 It sets out Ofwat's approach to and estimate of the risk-free rate.

2 It evaluates Ofwat's starting point for the risk-free rate based on gilt yields.

3 It considers the impact of differing risk-free borrowing and saving rates.

4 It considers the impact of the convenience yield.

5 It considers whether an adjustment to gilt yields is required and different approaches for quantifying the adjustment.

6 It evaluates Ofwat's estimate of the RPI-CPIH wedge.

7 It sets out the overall estimate for the risk-free rate.

4.1. Ofwat's approach to and estimate of the risk-free rate

Ofwat set a point estimate for the risk-free rate in the PR24 DD of 1.43% CPIH-real. This point estimate is based on the approach set out in the table below.

Table 6: Ofwat's approach to risk-free rate

Component	Approach
Risk-free rate proxy	Yields on RPI index-linked gilts (ILGs)
Tenor	20Y
Cross-checks	Ofwat considers yields on 20Y ILGs, 20Y nominal gilts (NGs), 20Y SONIA swaps and the CMA PR19 AAA index, but observes only SONIA swaps point to a significantly different (lower) estimate. Ofwat does not rely on SONIA swaps as (1) swap rate is less intuitively interpreted than other risk-free rate proxies as an investment return; and (2) large negative swap spreads at 20Y tenor may be due to pension funds buying swaps to increase portfolio duration rather than to increase their weighting of risk-free assets
Averaging period	1m average of 20Y ILG yields using data over March 2024
Adjustments	No adjustments have been applied to 20Y ILG yields
RPI-CPIH wedge	0.34% based on the 20Y RPI-CPI wedge implied by inflation swaps and OBR forecasts. This wedge is applied to 20Y ILG yields to convert from an RPI to a CPIH basis

Source: KPMG analysis and PR24 DD

4.2. ILG yields as a starting point for the risk-free rate

Ofwat's starting point for the risk-free rate is the 1m average of 20Y ILG yields. Ofwat considers the use of 20Y ILG yields may be conservative as (1) 20Y ILGs are not truly risk-free; and (2) Ofwat has solely used 20Y ILGs instead of placing weight on 10Y and 20Y ILGs. On (1), investors generally perceive gilts as risk-free and this was reaffirmed by the CMA at PR19. On (2), the CMA at PR19 used 20Y ILGs as this matched the long asset lives in the sector which holds true at AMP8 based on Ofwat's DD average run-off rate (4% which implies 25Y remaining asset life). The use of a 1m average should be revisited at FD based on prevailing and expected market conditions at that time.

This section considers whether Ofwat's starting point for the risk-free rate is appropriate.

4.2.1. Risk-free rate proxy and tenor

Ofwat's starting point for the risk-free rate is the yield on 20Y ILGs. Ofwat identifies two reasons for why this may be a conservative starting point.

First, 20Y ILGs are not truly risk-free. They embed a degree of default, illiquidity and term risk which increase their yield above that of a truly risk-free asset, based on analysis from CEPA.

Second, Ofwat has solely used 20Y ILGs instead of placing equal weight on 10Y and 20Y ILGs which it considers is consistent with its PR19 FD. 20Y ILG yields are higher than an average of 10Y and 20Y ILG yields based on data over September 2022 and March 2024.

20Y ILGs are not truly risk-free

In the CAPM, an investor can invest their wealth in the market portfolio and the risk-free asset. In practice, no asset is entirely risk-free as is assumed in the CAPM. However, government bonds are investors' safest alternative to investing in the market portfolio and investors generally perceive these as risk-free. It follows that the real world equivalent of the CAPM risk-free asset is government bonds.

In consequence, to the extent that there is any small risk premium present in government bonds, this does not alter the investor choice of using government bonds like the CAPM risk-free asset. Accordingly, CEPA's points on a risk premium in government bonds are not relevant for the real world application of the CAPM as long as government bonds are the safest alternative to investing in the market portfolio. Notwithstanding this, CEPA's points are discussed below.

Default risk

CEPA suggests that UK government bonds are not completely immune to default risk because (1) the UK government does not have unlimited power to print money to cover GBP liabilities; (2) the UK government was downgraded in 2016 and 2017 to AA/Aa2 credit rating; and (3) 5Y UK credit default swaps imply a low default probability.

In theory, the UK government *does* have unlimited power to print money and there has not been a situation in the past which has called into question its power to do so. As such, it is expected that the UK government can always print money to honour its GBP liabilities and thus avoid default.

It may be possible that there is a small risk of default under extreme conditions, but this is not reflective of normal or plausible market conditions. Indeed, CEPA recognises that *"it is true that the UK government has effective recourse in the event of nearly any default…"*[21]. It appears appropriate to focus on plausible rather than non-plausible scenarios with remote likelihoods of occurring.

Importantly, the CMA at PR19 appeared to share the same view. The CMA acknowledged the UK government's credit rating downgrades, but still concluded that "*it appears clear to us* [the CMA] *that ILGs closely match part of our key requirement of the RFR, that the bonds are risk free"*[22].

This would imply that CEPA's point on default risk is not material and reaffirm that UK government bonds are an appropriate starting point for the risk-free rate.

Illiquidity risk

CEPA suggests there are plausible arguments for why government bonds may carry illiquidity risk.

The first reason outlined below shows why liquidity is not a relevant consideration in the CAPM. The last two reasons show that even if liquidity is assumed to be a relevant consideration, government bonds do not carry illiquidity risk.

First, in the CAPM investors choose stocks based only on their risk and return. As liquidity is not a factor in the investor's asset allocation decision, it is not a property of the CAPM risk-free asset.

Relatedly, Ofwat in the PR24 FM recognised estimates of the convenience yield (CY) for government bonds[23]. CY is driven by the additional benefits of government bonds beyond their risk/return trade-off i.e. beyond the properties of the CAPM risk-free asset. Liquidity is a driver of CY.

The presence of CY for government bonds means that they are more liquid than other safe assets. Put differently, they may be too liquid compared to the CAPM risk-free asset. Ofwat has implicitly agreed with this by recognising estimates of CY for government bonds.

Second, CEPA has not provided any specific arguments or evidence on illiquidity risk which means it is not possible to evaluate the reasonableness of its point.

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21 CEPA (2024), PR24 Cost of Equity, p. 50.
22 CMA (2021), PR19 Final Determination, para. 9.103.
23 Ofwat (2022), PR24 Final Methodology, Appendix 11 – Allowed return on capital, p. 93.

In any case, government bonds are widely considered to be the most liquid asset in the market. CEPA appears to agree with this, noting that *"gilts are likely to have higher liquidity than a comparable corporate bond"*[24]. Thus government bonds cannot be illiquid since all other assets are relatively less liquid. The implication is that government bonds cannot carry illiquidity risk.

Third, Ofwat agrees with CEPA's view of illiquidity risk but this appears to be inconsistent with its own position on CY and the view of its previous adviser. Ofwat's advisers at PR19 indicated that the bid-ask spreads on government bonds are the benchmark from which the liquidity of other assets should be measured[25]. It follows that government bonds cannot be illiquid if they represent the benchmark.

Term risk

CEPA suggests that longer-dated government bonds feature term risk. It cites two potential drivers for the term risk: (1) there is higher sensitivity to interest rate risk at longer tenors i.e. the market value of longer-dated bonds is more sensitive to changes in interest rates; and (2) this is compensation for investors who are locking up their funds for a longer horizon.

First, the CAPM assumes that investors hold the risk-free asset until its maturity. In this case, the risk-free asset is proxied by government bonds.

Government bonds provide a risk-free return over their maturity i.e. these are only risk-free when held to maturity, not when used for short-run trading. In consequence, term risk is only relevant for an investor if they sell the government bonds before maturity. This is not the case in the CAPM.

For example, interest rate risk is irrelevant for the investor as they would not be seeking to sell the government bond for its market value at any point in time. The investor has knowingly bought the (zero-coupon) bond purely for the risk-free cashflow they receive at maturity of the bond.

Second, the allowed return has been calibrated using long-dated government bonds because investors in the sector have long holding periods. This calibration assumes that investors invest in long-dated government bonds that match the duration of their long holding period.

CEPA's point around term risk implies that it would be appropriate to calibrate the return for investors with long holding periods using short-dated government bonds. This calibration, in contrast, assumes that investors continually reinvest in short-dated government bonds over their long holding period.

The latter is not convenient or efficient for investors. As a result, it is not relevant to compare the yield on longer- and shorter-dated government bonds.

Return on zero-beta asset in place of a risk-free rate

The discussion above indicates that 20Y ILGs can be used as the risk-free asset in the CAPM.

Ofwat may still consider that government bonds are not risk-free and therefore the risk-free rate cannot be identified. In this case, Ofwat should use the return on a zero-beta asset in place of the risk-free rate in the CAPM. Black (1972)[26] shows the CAPM holds with the zero-beta return. Ofwat in the PR24 FM acknowledged the possibility of using the zero-beta return in the CAPM[27].

The zero-beta asset bears no systematic risk whereas the risk-free asset bears no risk. Hence, the return on the zero-beta will be higher than the risk-free asset as the former bears idiosyncratic risk.

Di Tella et al. (2023) finds that in the US the real zero-beta return[28] is 7.6% higher than the real 1m Treasury bill return per year on average over 1973-2020[29]. It comments that *"the average level of the zero-beta rate may seem surprising. But it reflects a well-known fact, going back to Black et al. [1972], who pointed out, in the context of CAPM, that the expected return of an equity portfolio with zero covariance to the market was well in excess of Treasury bill yields"*.

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[24] CEPA (2024), PR24 Cost of Equity, p. 51.
[25] CMA (2021), PR19 Final Determination, para. 9.224.
[26] Black, F. (1972), 'Capital Market Equilibrium with Restricted Borrowing'.
[27] Ofwat (2022), PR24 Final Methodology, Appendix 11 – Allowed return on capital, p. 13 and 93.
[28] The zero-beta return is not tenor-specific because equities are assumed to have a flat term structure. The implication is that the zero-beta return can be used to set the allowed return at both short and long investment horizons.
[29] Di Tella, S., Hebert, B., Kurlat, P., and Wang, Q. (2023), 'The Zero-Beta Interest Rate'.

20Y ILGs have been used instead of an average of 10Y and 20Y ILGs

Ofwat at PR19 DD used the average yield on 10Y and 20Y ILGs as a starting point for the risk-free rate at an investment horizon of 15Y. At PR19 FD, it moved to directly use the yield on 15Y ILGs[30].

The CMA at PR19 ultimately decided to use 20Y rather than 15Y ILGs as adopted by Ofwat: *"…we note the very long-life assets and long-horizon investment decisions that are likely to be based on our cost of capital estimates. As a result, we suggest that a 20-year investment horizon would closely match the reality of decision-making within the sector and so use gilt and other market data at or close to 20-year maturities. We note this horizon is longer than the 15 years used by Ofwat"*[31].

Ofwat does not provide rationale for why it could in principle be appropriate to deviate from the CMA PR19 FD and revert to its PR19 DD position. Further, the sole use of 20Y ILGs is supported by:

- Ofwat in the PR24 DD has used a run-off (depreciation) rate of 4% on average for the sector[32]. This corresponds to an average remaining asset life of 25Y for AMP8. 20Y ILGs would broadly match the duration of cashflows implied by this average remaining asset life. Indeed, they can be seen as conservative as their maturity is only 20Y rather than 25Y.
- Ofwat requires companies to plan their capex over the next 25Y through its new Long Term Delivery Strategy framework for AMP8[33]. This suggests that 20Y ILGs should be used to broadly match the reality of decision-making that Ofwat requires for the sector.
- The risk-free rate and the cost of new debt in the allowed return both provide forward-looking expectations of rates. Ofwat has used the iBoxx non-financial A/BBB 10+ index as the benchmark index for the cost of new debt. This index has a tenor close to 20Y[34]. The risk-free rate should therefore be based on 20Y ILGs to maintain consistency across the allowed return.
- Ofgem in the RIIO-3 SSMD bases its estimate of the risk-free rate on 20Y ILGs. It comments that this is in line with RIIO-2 and consistent with UKRN guidance that the maturity of the risk-free rate proxy matches the investment horizon for the sector[35].
- CEPA considers the yields on 20Y ILGs are more stable than on 10Y ILGs[36]. Thus sole use of 20Y ILGs is preferable because investors in utilities target stable returns over a long time horizon.

Notwithstanding that conceptually it appears appropriate to rely only on 20Y ILGs, there are two points on Ofwat's empirical analysis that should be highlighted:

- Ofwat reports the difference in yield on 20Y ILGs and the average of 10Y and 20Y ILGs in RPI terms. This difference would be smaller in CPIH terms given the RPI-CPIH wedge for a 15Y bond would be higher than for a 20Y bond under Ofwat's DD approach. CEPA recognises the same[37].
- The difference in yield between 20Y ILGs and 15Y ILGs is smaller than that between 20Y ILGs and the average of 10Y and 20Y ILGs. The use of 15Y ILGs represents Ofwat's PR19 FD position. Further, the differences are significantly smaller over a long-term window e.g. 20Y.

4.2.2. Averaging period

Ofwat has used a 1m trailing average. It considers that this length of trailing average balances the benefits of (1) more recent data which may be more reflective of market conditions over AMP8; and (2) averaging over a longer historical period to protect against unusual daily volatility in yields.

30 This move was for two reasons: (1) depending on the shape of the yield curve between 10-20Y, the direct yield for 15Y may be different to an average of 10Y and 20Y; and (2) direct yields are generated using a more sophisticated line of best fit.
31 CMA (2020), PR19 Provisional Findings, para. 9.128.
32 Ofwat (2024), PR24 Draft Determination, Aligning risk and return appendix, p. 44.
33 Ofwat (2022), PR24 and beyond: Final guidance on long-term delivery strategies, p. 13.
34 The tenor of the iBoxx non-financials A/BBB 10+ index has been 19.8Y on average over the >26Y period from 01/01/1998 (date on which iBoxx begins) to 30/06/2024.
35 Ofgem (2024), RIIO-3 Sector Specific Methodology Decision – Finance Annex, paras. 3.37-3.38.
36 CEPA (2024), PR24 Cost of Equity, p. 49.
37 Ibid., p. 49, footnote 19.

Ofwat revisited whether the risk-free rate should be indexed but has ultimately decided to retain an ex-ante trailing average. This is because 20Y gilt yields have stayed broadly flat since the start of the year which makes the rationale for indexing less persuasive. It also noted that its PR24 FM assessment that the benefits of indexation do not clearly outweigh the costs, remains relevant.

Trailing average length

The choice of trailing average should reflect prevailing and expected market conditions.

Ofgem in the RIIO-3 SSMD has indexed the risk-free rate using a 1m trailing average in line with RIIO-2. However, Ofgem comments that *"…if we* [Ofgem] *were setting an RFR for the entire control period, there may have been a benefit from basing our estimate of the RFR on a longer-average of ILG yield data to avoid potentially 'locking in' short-term volatility for the whole length of the control"*[38].

CEPA also considers that *"…a slightly longer trailing average of 3-6 months would also be acceptable, as it could capture trends and provide more stability*"[39].

Ofgem's RIIO-3 SSMD and Ofwat's PR24 DD both used a data cut-off of March 2024. Based on this cut-off, the 3m and 6m trailing average of 20Y ILG rates were 10bps and 14bps higher than the 1m.

Based on a June 2024 cut-off, all three trailing averages imply broadly the same value. The 12m trailing average is also aligned with these which suggests that 20Y ILG rates have stabilised. Hence, the choice of trailing average length does not appear material based on the latest outturn rates.

However, forward rates for 20Y ILGs (and NGs) at present suggest the market expectation is for the spot rates on these instruments to increase over AMP8. Assuming Ofwat will not index the risk-free rate, it should retain a 1m trailing average if this market expectation holds at FD. The 1m trailing average would minimise the loss to investors if the market expectation was to materialise in practice as it would exclude lower rates from earlier months.

Ofwat should continue to monitor how spot and forward rates on 20Y ILGs evolve and consider what length of trailing average is merited at FD. Ofwat in the PR24 FM indicated that it would revisit the trailing average length, for example, if the 1m trailing average was unusually high or low due to temporary factors[40].

Indexation

Ofwat has decided against indexation which increases the importance of setting the ex-ante trailing average appropriately based on prevailing and expected market conditions.

4.3. Differing risk-free borrowing and saving rates

The risk-free rate for the CAPM is likely to lie above the ILG yield because (1) investors cannot borrow at the ILG yield; and (2) ILGs benefit from the convenience yield. Ofwat appears to conflate both into (2) but these are conceptually separate and necessary adjustments. The CMA's rationale for its PR19 FD was (1) whereas it did not directly account for (2). Taking (1) and (2) in combination implies the risk-free rate for the CAPM lies between the risk-free borrowing rate and the risk-free saving rate; the latter of which is proxied by the ILG yield *plus* convenience yield. The CMA's proxy for the risk-free borrowing rate was the AAA corporate borrowing rate. This rate is very close to but is not completely risk-free. However, it represents the lowest possible (and likely understated) cost at which investors can borrow in practice and is therefore the best estimate for the risk-free borrowing rate.

This section considers (1) how the adjustment for differing risk-free borrowing and saving rates is distinct to that for CY; (2) how the Brennan (1971) variant of the CAPM should be applied in practice to adjust for these; and (3) Ofwat's and CEPA's points on the analysis that quantified the adjustment for the former in the September 2023 CoE report.

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38 Ofgem (2024), RIIO-3 Sector Specific Methodology Decision – Finance Annex, para. 3.38.
39 CEPA (2024), PR24 Cost of Equity, p. 48.
40 Ofwat (2022), PR24 Final Methodology, Appendix 11 – Allowed return on capital, p. 17.

4.3.1. Conceptual distinction from CY

The September 2023 CoE report indicated that the appropriate risk-free rate for the CAPM is likely to lie above the ILG yield because (1) investors cannot borrow at the ILG yield; and (2) ILGs benefit from CY. Ofwat appears to conflate both into CY[41].

These are two conceptually separate and necessary adjustments. The first applies where the risk-free borrowing rate exceeds the risk-free saving rate. The second applies even where these are the same.

Investors cannot borrow at the ILG yield

The standard CAPM assumes that investors can borrow and save at the same risk-free rate. However, in the real world, the risk-free borrowing rate is higher than the risk-free saving rate. In this case, the appropriate risk-free rate for the CAPM lies between the two rates as shown by Brennan (1971)[42]. The intuition behind Brennan (1971) is explained in the September 2023 CoE report[43].

The CMA viewed its PR19 FD to base the risk-free rate on both ILGs and AAA corporate bonds as an application of Brennan (1971): "*We consider that our interpretation of the CAPM in a situation of different borrowing and lending rates…is in principle in line with Brennan's (1971) often quoted finding that the market equivalent RFR is a weighted average of the RFR of all individual investors*"[44]. In particular, the CMA used ILGs as a proxy for the risk-free saving rate and AAA corporate bonds as a proxy for the risk-free borrowing rate.

Brennan (1971) does not explore CY. Given the CMA's PR19 FD was primarily based on Brennan (1971), its decision cannot directly relate to CY[45].

ILGs benefit from CY

CY is explored across two steps.

a. Assume, as a simple benchmark, that investors can borrow and save at the same risk-free rate as in the standard CAPM.

The risk-free rate is used as a measure of an investor's time value of money: the required return for receiving a riskless payoff in the future instead of today[46].

Ofwat has used the ILG yield for this benchmark. However, government bonds provide additional benefits to investors such as the ease with which they can perform money-like roles. These benefits create additional investor demand for government bonds and push their return below that implied by the investor's time value alone. The difference is CY.

It is not only government bonds that bear CY; take physical cash as another example. Physical cash (notes and coins) and cash held in a bank account are both risk-free. However, physical cash earns no return whereas cash held in a bank account earns the deposit rate i.e. physical cash bears CY. This is because physical cash has a superior ability to perform money-like roles as it can be spent immediately. Rational investors are willing to pay for this convenience of physical cash.

It follows that for ILGs, CY(ILG) must be added to their return to obtain the risk-free rate.

b. Now consider the more realistic case that investors' risk-free borrowing rate exceeds their saving rate.

Specifically, the saving rate is equal to the common risk-free rate in the previous world but the borrowing rate increases.

41 Ofwat (2024), PR24 Draft Determination, Aligning risk and return – Allowed return appendix, p. 13.
42 Brennan, M. (1971), 'Capital Market Equilibrium with Divergent Borrowing and Lending Rates'.
43 KPMG (2023), Estimating the Cost of Equity for PR24, sections 6.5.1-6.5.2.
44 CMA (2021), PR19 Final Determination, para. 9.263.
45 Further, the CMA does not characterise its decision as directly for CY. For example, it comments *"what is also clear is that ILGs do not completely meet our* [the CMA] *requirement of the RFR as applied in the CAPM, that all market participants can borrow at the same rate"* in para. 9.104.
46 Van Binsbergen, J., Diamond, W., and Grotteria, M. (2022), 'Risk-free interest rates'.

The saving rate remains ILG yield *plus* CY(ILG). The borrowing rate now becomes ILG yield *plus* CY(ILG) *plus* borrowing costs. These borrowing costs relate to e.g. the transaction costs and collateral requirements associated with borrowing.

The CMA's estimate of the risk-free borrowing rate is discussed in section 4.3.2. The CMA's estimate of the risk-free saving rate is the ILG yield. However, a more complete estimate would be the ILG yield *plus* CY(ILG) as this explicitly takes into account the presence of CY.

Conclusion

It is not appropriate to conflate the adjustments for differing risk-free borrowing and saving rates and CY wholly into CY. These are two conceptually separate adjustments.

The first adjustment is as important as the CY adjustment, not least since it was the key rationale for the CMA's PR19 FD. CY is in effect an additional layer on top of the CMA's PR19 FD.

4.3.2. AAA corporate bond yields as the risk-free borrowing rate

The CMA used AAA corporate bond yields as the risk-free borrowing rate because: *"…the risk of loss resulting from default on these bonds is exceptionally low…"*[47] and *"…non-government bonds with the highest possible credit rating provide an input that is both very close to risk free (issuers with a higher credit rating than the UK government, but with some inflation and default risk) and is at least closer to representing a rate that is available to all (relevant) market participants*"[48].

The September 2023 CoE report explained that what matters is the rate at which investors, not corporates, borrow since it is investors who provide capital to corporates. Investors are backed by securities whose prices can significantly fluctuate whereas, corporates are backed by hard assets and thus can achieve lower borrowing costs. It follows that the AAA corporate borrowing rate is a conservative and likely understated estimate of the investor borrowing rate[49].

The AAA corporate borrowing rate is used as the risk-free borrowing rate even though it is (almost but) not perfectly risk-free as specified by Brennan (1971). This is because the AAA corporate borrowing rate represents the lowest possible rate at which investors (or indeed corporates) can borrow in the real world. In this context, the AAA corporate borrowing rate is the best possible estimate of the risk-free investor borrowing rate for the practical application of Brennan (1971).

The CMA shared this view, noting that it *"…consider*[s] *that the yield on these* [AAA] *indices provides information on the lowest risk borrowing costs available to nongovernment market participants…*"[50].

Ofwat appears to deduct default and illiquidity premia from the AAA corporate borrowing rate to derive the risk-free borrowing rate[51]. This is not appropriate for three reasons.

First, it is not appropriate to adjust for illiquidity premia because perfect liquidity is not a property of the CAPM risk-free asset as explained in section 4.2.1.

Second, it is not appropriate to adjust for default premia because investors have default risk which is reflected in their borrowing rate. In consequence, investors will not be able to borrow at the default-free AAA corporate borrowing rate. Even without an adjustment for default risk, the AAA corporate borrowing rate is a conservative estimate of the investor borrowing rate.

Third, investors factor their default risk into their asset allocation decision so it is not appropriate to adjust for this. For example, an aggressive investor can achieve a high risk position by either (1) investing their initial wealth in high beta stocks such as tech; or (2) borrowing and investing more than their initial wealth in the market portfolio. The aggressive investor will take account of the default premium within their borrowing rate in making this asset allocation decision.

[47] CMA (2021), PR19 Final Determination, para. 9.146.
[48] Ibid., para. 9.149.
[49] KPMG (2023), Estimating the Cost of Equity for PR24, section 6.5.4.
[50] CMA (2021), PR19 Final Determination, para. 9.150.
[51] Ofwat (2024), PR24 Draft Determination, Aligning risk and return – Allowed return appendix, p. 13.

Further, Ofwat adopts estimates of default and illiquidity premia cited in the CMA PR19 FD. However, it has not engaged with the risk premia estimates provided in the September 2023 CoE report which are based on more recent data[52].

For clarity, the risk premia estimates in the previous report are used to derive CY from AAA corporate bonds, not to derive the risk-free borrowing rate. Ofwat in the PR24 FM endorsed this approach to deriving CY but did not suggest this was required to derive the risk-free borrowing rate[53].

Ofwat may still consider it is not possible to identify the risk-free borrowing rate. In this case, Ofwat should use the zero-beta return *plus* shorting costs in place of the risk-free borrowing rate in the Brennan (1971) framework. This is explained in the September 2023 CoE report[54].

4.3.3. Application of Brennan (1971) and the standard CAPM

Ofwat considers that *"…a proper calibration of the Brennan (1971) concept…would involve consideration of borrowing and lending restrictions affecting market participants, as well as how to average the participant-specific risk-free lending and borrowing rates, which are likely to be more numerous than the two rates featured in the CMA's analysis*"[55].

The CMA was clear on the rationale for its application of Brennan (1971) in the PR19 FD: "*We* [the CMA] *acknowledge that we have not tried to undertake the exercise of assessing all investor borrowing and lending rates, or the precise balance of current and potential borrowers and lenders, in our target market. We consider that such an exercise would be impractical within a redetermination process. Rather, we have applied a highly-simplified but, in our opinion, reasonable assumption that we can gain sufficient insight into the market RFR…*"[56].

The CMA's application of Brennan (1971) appears reasonable. It balances the desirability for an accurate estimate of the risk-free rate that reflects the real world with the need to avoid undue complexity. Hence the approach in the September 2023 CoE report built on the CMA's PR19 FD.

Ofwat's position appears to be that since it is challenging to apply Brennan (1971) in full form, the right alternative is to do nothing. However, the CMA's application of Brennan (1971) is clearly an improvement on doing nothing. Further, Ofwat indicates that it is not aware of another regulatory jurisdiction that uses the full Brennan (1971) framework[57]. This should not be a reason for dismissing the CMA's application of Brennan (1971) which represents an improvement on Ofwat's DD approach. A regulator should seek to be a thought leader and implement best practice.

CEPA considers that in Brennan (1971) the marginal investor in utilities is likely to be a net lender (e.g. pension fund) for whom the risk-free saving rate would be appropriate[58]. This argument was made by Ofwat and its advisers at the PR19 appeal.

CEPA has not engaged with the rationale in the September 2023 CoE report which shows this argument is flawed based on the intuition behind Brennan (1971)[59]. The report explained that the higher cost of capital for pension funds is not due to facing the risk-free borrowing rate themselves. It is to compensate them for being overweight on utilities compared to the market portfolio and therefore not being fully diversified. Indeed, the CMA ultimately decided that it is was not necessary to define the exact nature of the marginal investor and the rate at which they borrow[60].

Ofwat appears to advocate the standard CAPM on the basis of its simplicity[61]. CEPA indicates that adopting a more sophisticated model that relaxes the standard CAPM assumptions would require significant care and effort as well as depart from regulatory precedent[62].

52 KPMG (2023), Estimating the Cost of Equity for PR24, section 6.6.5.
53 Ofwat (2022), PR24 Final Methodology, Appendix 11 – Allowed return on capital, p. 15.
54 KPMG (2023), Estimating the Cost of Equity for PR24, section 6.5.6.
55 Ofwat (2024), PR24 Draft Determination, Aligning risk and return – Allowed return appendix, p. 17.
56 CMA (2021), PR19 Final Determination, para. 9.263.
57 Ofwat (2024), PR24 Draft Determination, Aligning risk and return – Allowed return appendix, p. 17.
58 CEPA (2024), PR24 Cost of Equity, p. 46.
59 KPMG (2023), Estimating the Cost of Equity for PR24, section 6.5.2.
60 CMA (2021), PR19 Final Determination, paras. 9.159 and 9.265.
61 Ofwat (2024), PR24 Draft Determination, Aligning risk and return – Allowed return appendix, p. 17.
62 CEPA (2024), PR24 Cost of Equity, p. 46.

The Brennan (1971) framework as applied in the September 2023 CoE report is relatively simple to implement and is not a significant departure from the standard CAPM. Further, the Brennan (1971) framework is theoretically justified, long established and is covered in standard corporate finance textbooks for practitioners which suggests it is well accepted[63]. Whilst it is not possible to correct all the imperfections of the standard CAPM, moving to the Brennan (1971) variant of the CAPM would be an improvement and is relatively straightforward to implement.

The CMA at PR19 recognised that prior to the publication of the 2018 UKRN report there was a consistent precedent of setting the risk-free rate above spot 20Y ILG yields[64]. The purpose of this gap was not explicitly to compensate CY or differing risk-free borrowing and saving rates. Nevertheless, the CMA considered that the gap *"…may have removed an inadvertent mitigation to problems associated with the standard regulatory approach of sole reliance on the potentially imperfect RFR proxy of government bond yields"*[65].

In more recent price controls UK regulators have broadly followed the CMA PR19 FD approach to setting the risk-free rate. This includes CAA H7 FD[66], CAA NR23 FD[67] and UREGNI GD23 FD[68].

4.3.4. Ofwat's and CEPA's points on the analysis of RPI AAA bonds vs ILGs

The September 2023 CoE report estimated an upper bound adjustment to the 20Y ILG yield based on the difference between the risk-free borrowing rate proxied by RPI AAA bond yields and maturity-matched ILG yields[69]. Ofwat and CEPA have reviewed this analysis and raised a number of points.

High-level response

Before discussing each point, there is merit in first providing a high-level response. In principle, it does not appear reasonable to dismiss the analysis entirely on the basis of data limitations. The analysis was based on the complete population of RPI AAA bonds that have been rated as such since their issuance. Thus the analysis simply reflects the extent of the best available data.

The limitations of the data have been recognised in the way the analysis was treated. The analysis used a c.5Y horizon given the yields on the bonds may be unstable over a short time horizon. Further, the analysis informed the upper bound adjustment to 20Y ILG yields but the midpoint of the range was selected as the point estimate. This avoided attaching excessive weight to the upper bound.

Importantly, the AAA corporate borrowing rate is a conservative and likely under-estimate of the investor borrowing rate. Hence, the analysis may be pointing to an adjustment that is already too low.

Detailed response

The individual points that Ofwat and CEPA raise are discussed in turn below.

The bonds in the analysis were chosen by KPMG

CEPA suggests that the bonds in the analysis were chosen by KPMG.

This appears to mischaracterise the approach taken to the analysis. The bonds in the analysis were not chosen, they represent those which met a range of relevant criteria. These criteria are:

- Bond is linked to RPI
- Bond has been rated AAA throughout its life
- Bond is GBP denominated
- Bond is not an asset-backed security

63 Such as Berk and DeMarzo (2014), 'Corporate Finance' as highlighted in the September 2023 CoE report, and Brealey, Myers, Allen and Edmans (forthcoming 2025), 'Principles of Corporate Finance'.
64 CMA (2021), PR19 Final Determination, para. 9.99.
65 Ibid., para. 9.107.
66 CAA (2022), H7 Final Proposals, Section 3: Financial issues and implementation, paras. 9.247-9.248.
67 CAA (2023), NR23 Final Decision, paras. 5.64 and 5.91-5.93.
68 UREGNI (2022), GD23 Final Determination, para. 10.17.
69 KPMG (2023), Estimating the Cost of Equity for PR24, section 6.6.6.

- Refinitiv has data for the bond
- Bond is active at some point during the window 02/07/2018 to 30/06/2023

The estimation window for the analysis was selected to optimise for data availability in Refinitiv. This is line with Ofwat's approach to CY analysis in the PR24 FM[70]. Ofwat adopted an estimation window that was not entirely consistent with Diamond and Van Tassel (2021) due to data availability issues.

Most of the bonds are issued by the EIB and the EIB is not completely risk-free

CEPA comments that most of the bonds have been issued by the EIB and supranational organisations like the EIB are not completely risk-free.

The CMA recognised that supranational organisations like the EIB are common issuers of AAA rated bonds in its decision to base the risk-free borrowing rate on nominal AAA indices[71]. Supranational bonds are backed by multiple sovereign sponsors which means they are effectively sub-sovereign. As a result, they are very low risk and less risky than bonds issued by private institutions.

These bonds are very but not completely risk-free. Despite this, they represent the best possible estimate of the risk-free borrowing rate as explained in section 4.3.2. An investor wanting to invest in safe assets would likely choose supranational bonds.

CEPA comments that the sample of bonds in the analysis is limited (12 bonds of which 8 are issued by the EIB). This could mean the analysis will not lead to a more widely accessible borrowing rate.

The nominal AAA indices used by the CMA had similar characteristics but the CMA decided that these indices were still able to provide useful information. In any case, the yields on AAA rated bonds are a conservative estimate of the investor borrowing rate as explained in section 4.3.2. Thus it would be expected that most investors in practice could only borrow above this rate.

Berk and DeMarzo (2020) notes that: *"In practice, investors receive a lower rate when they save than they must pay when they borrow. For example, short-term margin loans from a broker are often 1% to 2% higher than the rates paid on short-term Treasury securities. Banks, pension funds, and other investors with large amounts of collateral can borrow at rates that are generally within 1% of the rate on risk-free securities, but there is still a difference"*[72]. This suggests that even collateral-rich investors have to borrow at a premium over government rates that is above that implied by the AAA corporate borrowing rate (66bps based on September 2023 CoE report).

The bonds are subject to thin-trading and wider bid-ask spreads than gilts

CEPA comments that the bonds in the analysis are thinly-traded and less liquid than gilts.

It is plausible that investors hold RPI-linked AAA bonds until maturity i.e. investors use them like the risk-free asset. This would explain why the bonds are not actively traded. The result of this thin-trading would be wider bid-ask spreads on the bonds relative to gilts.

Perfect liquidity is not a property of the CAPM risk-free asset as explained in section 4.2.1. As such, the liquidity of the bonds in the analysis is not a relevant consideration for assessing whether they can be used as a proxy for the risk-free borrowing rate.

If liquidity was assumed to be a relevant consideration, CEPA shows that the nominal AAA bonds in its own analysis are broadly as liquid as the RPI-linked AAA bonds in the KPMG analysis[73]. This implies that liquidity would not be a differentiator between the two analyses.

Ofwat indicates that the data for the RPI-linked AAA bonds in the KPMG analysis is 'Refinitiv evaluated' which is due to the thinly-traded nature of the bonds.

CEPA implies that nominal AAA bonds are also likely to be thinly-traded by showing these bonds have similar bid-ask spreads as the RPI-linked AAA bonds. However, nominal AAA bonds still served as the basis for CEPA's analysis, which Ofwat quotes in the DD, and for the CMA's PR19 FD. This

[70] Ofwat (2022), PR24 Final Methodology, Appendix 11 – Allowed return on capital, p. 97.
[71] CMA (2021), PR19 Final Determination, paras. 9.111 and 9.150.
[72] Berk, J. and DeMarzo, P. (2020), 'Corporate Finance', p. 440.
[73] CEPA (2024), PR24 Cost of Equity, p. 98.

suggests that CEPA and the CMA, like KPMG, rely on AAA bonds with the understanding that the data available for these bonds is not perfect but reflects the best that exists.

The weighted-average years to maturity of the analysis does not reach >10Y

Ofwat considers that the weighted-average years to maturity of the analysis does not reach >10Y over the estimation window of 02/07/2018 to 30/07/2023.

The September 2023 CoE report noted that the market value weighted-average years to maturity was 10.3Y over the estimation window. It is not clear how Ofwat carried out its weighting.

There are discontinuities in the time series of the analysis

Ofwat comments that there are discontinuities in the time series of the analysis.

The analysis has been updated to incorporate the short-end of the ILG yield curve. The long-end of the yield curve starts at a maturity of 2.5Y but the short-end starts at 2Y[74]. This lengthening of the ILG yield curve for the analysis by 0.5Y has helped to reduce discontinuities.

The analysis has also been updated to use data from Bloomberg instead of Refinitiv. This has two key benefits for the analysis. First, Bloomberg's data availability allowed for a longer estimation window which begins from 01/01/2007. Second, Bloomberg's data availability allowed for 6 new bonds to be added to the analysis. These are issued by the EIB, EBRD, NWB Bank and KBN.

The updates to the analysis have enhanced its robustness and reliability. The updated analysis still has a market value weighted-average years to maturity of >10Y based on the long-term average.

The results of the updated analysis are discussed in section 4.5.2.

4.4. Convenience yield

The academic literature on the convenience yield is limited to shorter-dated safe assets. Ofwat has challenged whether these estimates of the convenience yield for shorter-dated safe assets can be extrapolated to longer-dated safe assets. The evidence suggests this is reasonable: (1) the term structure of the convenience yield in academic literature is mostly upwards sloping; and (2) the collateral value component of the convenience yield for longer-dated safe assets is at least the same as that for shorter-dated safe assets. Ofwat also notes the academic literature uses a data cut-off in 2020 but the estimates of the convenience yield are likely to be higher based on a more recent cut-off.

This section (1) provides a recap of CY; (2) considers the term structure of CY; and (3) considers whether Diamond and Van Tassel's analysis of CY(NG) can inform the allowed return for AMP8.

4.4.1. Recap of CY

The concept of CY is explained in section 4.3.1 and further in the September 2023 CoE report[75]. CY exists in the real world and thus should be adjusted for in the practical application of the CAPM.

The academic literature on CY is largely focused on the US. Diamond and Van Tassel (2021) is the only academic paper that provides UK-specific estimates of CY, which were for NGs. As the paper only considered NGs, it was important to assess whether its findings would extend to ILGs.

The September 2023 CoE report analysed whether the CY factors cited in academic literature apply to ILGs to the same extent as NGs[76]. The analysis implied that the vast majority of factors apply similarly to NGs/ILGs but NGs may be more liquid than ILGs. This suggested that there was CY in ILGs and CY(NG) may be a good benchmark for CY(ILG).

Whilst the September 2023 CoE report acknowledged that NGs may be more liquid than ILGs, CEPA shows for a sample of NGs/ILGs that ILGs have lower bid-ask spreads than NGs[77].

[74] The short-end of the ILG yield curve starts at a maturity of 25m but this is used as a close proxy for 2Y ILGs.
[75] KPMG (2023), Estimating the Cost of Equity for PR24, section 6.4.1.
[76] Ibid., sections 6.4.2-6.4.3.
[77] CEPA (2024), PR24 Cost of Equity, p. 98.

Ofwat may consider that it is not possible to estimate CY(ILG) and therefore identify the risk-free saving rate. In this case, Ofwat should use the zero-beta return in place of the risk-free saving rate in the Brennan (1971) framework. This is explained in the September 2023 CoE report[78].

4.4.2. Term structure of CY

Diamond and Van Tassel estimate CY for NGs with tenors of 3m to 2Y. Ofwat has challenged whether these estimates of CY for shorter-dated safe assets can be extrapolated to longer-dated safe assets[79]. The evidence on this issue is set out below.

Empirical analysis of CY term structure

The September 2023 CoE report relied on Diamond and Van Tassel (2021) to derive CY(ILG). The paper was most recently updated in April 2024. The updated version of the paper presents a 2Y CY(NG) of 29bps which is smaller than the 38bps shown in previous versions. CY for shorter tenor NGs have not moved. The data cut-off nor the approach for the paper have changed.

The CY term structure in the previous version of the paper was clearly upward sloping between tenors of 3m and 2Y. This suggested that CY could be higher than 2Y NGs for the long tenors on which the risk-free rate is based. The CY term structure in the updated paper is less definitive.

However, the term structure remains mostly upwards sloping (2Y is the exception but may be an outlier) and there is not enough of a time series to conclude that CY declines at longer tenors. As such, it appears reasonable to assume that the 2Y CY could hold at longer tenors, all else equal.

Qualitative analysis of CY term structure

Ofwat indicates there are two reasons for why CY may be less relevant for longer-dated safe assets relative to shorter-dated safe assets. First, accounting definitions of cash and cash equivalents tend to include only highly liquid short-term instruments. Second, the market value of longer-dated assets is more sensitive to interest rate expectations, which could undermine their usefulness as collateral.

Accounting definitions

Ofwat does not explain conceptually why accounting definitions are a relevant driver of CY. Accounting definitions are focused on a company's solvency whereas CY is focused on an investor's asset allocation decisions. These seem completely unrelated. Accordingly, accounting definitions do not appear to be referenced in the academic literature on CY.

It could be the case that Ofwat is applying a very literal definition of 'money-like' and so is assuming that only shorter-dated safe assets can bear CY. This interpretation is more narrow and prescriptive than the conceptual use of 'money-like' in the academic literature on CY. Many non-cash equivalents are also 'money-like' as they are still safe, liquid and collateralisable.

In any event, IAS 7 requires that only investments with a maturity of 3m or less from the date of acquisition are reported as cash equivalents[80]. Diamond and Van Tassel (2024) show that CY(NG) for 6m, 1Y and 2Y tenors are markedly above that for 3m. This suggests that empirically accounting definitions are not relevant for CY.

Collateral value

The most robust way to assess whether there is a difference in CY between shorter- and longer-dated safe assets due to collateral value is to review the applicable legislation.

Counterparties need to pledge collateral to banks in order to engage in a range of transactions such as borrowing money, trading derivatives, entering into security financing transactions with banks. Banks require collateral to mitigate the credit risk generated by undertaking these transactions.

[78] KPMG (2023), Estimating the Cost of Equity for PR24, section 6.5.6.
[79] Ofwat (2024), PR24 Draft Determination, Aligning risk and return – Allowed return appendix, p. 16.
[80] IAS 7 Statement of Cash Flows, para. 7. Standard can be found here.

The collateral value of an asset is derived by applying a haircut to its current market value to account for valuation uncertainty[81]. The haircuts for gilts and AAA corporate bonds required by the applicable legislation are set out in the table below[82].

Table 7: Haircuts for gilts and AAA corporate bonds

Remaining maturity	Gilts			AAA corporate bonds		
	20-day liquidation period	10-day liquidation period	5-day liquidation period	20-day liquidation period	10-day liquidation period	5-day liquidation period
≤1Y	0.707%	0.5%	0.354%	1.414%	1%	0.707%
>1 and ≤5Y	2.828%	2%	1.414%	5.657%	4%	2.828%
>5Y	5.657%	4%	2.828%	11.314%	8%	5.657%

Source: KPMG analysis and data from Articles 197 and 224 and EBA mapping table

Reading the table vertically indicates that the haircuts on (1) gilts with tenors of 1-5Y are 4x that of gilts with tenors of ≤1Y; and (2) gilts with tenors of >5Y are 2x that of gilts with tenors of 1-5Y. This is irrespective of the liquidation period of the transaction for which the gilt is used as collateral[83].

However, the difference in collateral value between shorter- and longer-dated gilts is not relevant for the term structure of CY as Ofwat suggests. This is because CY for gilts is the difference in yield between gilts and other safe assets, such as AAA corporate bonds, *of the same maturity*. It is necessary to hold constant the maturity as CY is the difference in yield between two assets with the same cash flow profile that differ only in terms of their convenience. As such, the table should only be read horizontally, not vertically, to evaluate the term structure of CY.

Reading the table horizontally indicates that the haircuts on gilts are half that for AAA corporate bonds at the same maturity (and liquidation period). The difference between the two in absolute terms becomes larger at higher maturities (and liquidation periods). This means that the collateral value component of CY does not decline at longer tenors.

In addition, the haircuts on gilts of 3m, 6m and 1Y tenor are the same under equivalent liquidation periods. However, CY(NG) for 1Y tenor is markedly above that for 3m and 6m based on Diamond and Van Tassel (2024). This clearly demonstrates that collateral value is not the sole driver of CY[84] and so CY cannot be assumed to move one-for-one with collateral value.

On balance, it appears reasonable to assume that CY holds for longer-dated safe assets.

4.4.3. Relevance of Diamond and Van Tassel analysis

Ofwat argues that the relevance of the Diamond and Van Tassel analysis of CY(NG) for setting the allowed return for AMP8 may be limited by a data cut-off of 27/07/2020[85].

First, Ofwat relied on the Diamond and Van Tassel analysis of CY(NG) as a starting point for its analysis of CY(ILG) in the PR24 FM[86]. It follows that Ofwat has previously considered that the Diamond and Van Tassel analysis is relevant for setting the allowed return at AMP8.

Second, the Diamond and Van Tassel analysis is based on a very long-run of data so should be reflective of long-term conditions.

81 The value of the non-cash asset may not be fixed. It may differ over time as a result of changes in market conditions or the perceived credit quality of the issuer of the bond/equity.

82 Article 224 illustrates the haircuts that have to be applied to the current market value of assets to derive their collateral value. Gilts fall in the category Article 197(1)(b) whereas AAA corporate bonds fall in the category Article 197(1)(c) and (d) based on Article 197. Gilts and AAA corporate bonds are both of credit quality step 1 based on the EBA mapping table. Articles can be found here and the EBA mapping table can be found here.

83 The liquidation periods that apply for different types of transactions are explained in Article 224(2).

84 CY is driven by *inter alia* the liquidity of government bonds and the ease at which they can be traded by uninformed agents, posted as collateral, satisfy regulatory capital requirements, or perform other roles similar to that of money. This is explained in section 6.4.1 of the September 2023 CoE report.

85 Ofwat (2024), PR24 Draft Determination, Aligning risk and return – Allowed return appendix, p. 16.

86 Ofwat (2022), PR24 Final Methodology, Appendix 11 – Allowed return on capital, p. 96-97.

Third, Diamond and Van Tassel observe that CY(NG) appears to have a positive relationship with interest rates. Given that interest rates in the UK have risen significantly over 2020-2024, it may be likely that CY(NG) is higher based on a more recent data cut-off.

Fourth, the September 2023 CoE report estimated CY(NG) *less* CY(ILG) of 27bps for the quantitative analysis of CY(ILG)[87]. This was over Ofwat's FM estimation window which had a data cut-off in line with Diamond and Van Tassel. Updating the data cut-off to 30/06/2024 implies a slightly smaller value of 24bps. This would result in a higher estimate of CY(ILG), all else equal.

This suggests that Ofwat's argument may not be material.

4.5. Quantitative analysis of adjustments to ILG yields

The lower bound adjustment to ILGs is based on the convenience yield (CY) and the upper bound adjustment is based on the difference in yield between AAA corporate bonds and ILGs (AAA-ILG).

AAA-ILG: The difference in yield between RPI AAA bonds and ILGs provides the most direct estimate of the AAA-ILG difference. This produces an estimate of 67bps.

CY(ILG): 2Y CY(ILG) is based on (1) estimate of 2Y CY(NG) in academic literature; and (2) analysis aiming to estimate the equivalent 2Y CY(ILG) from the academic literature estimate of 2Y CY(NG). The result is a range of 2-29bps. The midpoint of 15.5bps is selected as the point estimate for 2Y CY(ILG). It is reasonable to assume this holds for longer-dated ILGs. The cross-check for CY(ILG) based on >10Y RPI AAA bonds implies a significantly higher value than 15.5bps.

Overall range and point estimate for the adjustment to ILGs: A range of 0-67bps is adopted for the adjustment required to ILGs. The upper bound position of 67bps is based on the AAA-ILG difference. The lower bound position of 0bps assumes no CY(ILG) is required, but this is not used to inform the point estimate for the adjustment to ILGs. The point estimate of 41bps is slightly below the midpoint of 15.5bps (point estimate for CY(ILG)) and 67bps.

This section estimates the adjustment required to the ILG yield to arrive at the appropriate risk-free rate for the CAPM in RPI terms.

4.5.1. Bounds for the appropriate risk-free rate in the CAPM

The sections above discuss the bounds for the appropriate risk-free rate in the CAPM. These bounds are summarised in the table below. In the table, r^* is the appropriate risk-free rate, r_s is the risk-free saving rate and r_b is the risk-free borrowing rate.

Table 8: Bounds for the appropriate risk-free rate in the CAPM

Bounds for r^*	r_s can be identified	r_s cannot be identified
Lower bound for r^* (r_s)	ILG yield + CY(ILG)	Zero-beta return
Upper bound for r^* (r_b)	AAA corporate bond yield	Zero-beta return + shorting costs

Source: KPMG analysis

The table indicates that r^* lies between r_s and r_b in line with Brennan (1971). It shows that r_s is derived by adding CY(ILG) to the ILG yield and r_b is derived by adding the difference in yield between ILGs and AAA corporate bonds to the ILG yield. In other words, the lower bound adjustment to the ILG yield is CY(ILG) and the upper bound adjustment is the AAA-ILG difference.

The AAA-ILG difference and CY(ILG) are estimated in sections 4.5.2 and 4.5.3 respectively.

4.5.2. Adjustment for risk-free borrowing rate (AAA-ILG difference)

CMA PR19, CEPA and the September 2023 CoE report all estimated the AAA-ILG difference using distinct approaches. These approaches are discussed in turn.

87 KPMG (2023), Estimating the Cost of Equity for PR24, section 6.6.1.

CMA PR19 and CEPA analysis of nominal AAA bonds

Both the CMA and CEPA inferred the AAA-ILG difference from nominal AAA bonds.

The CMA at PR19 compared the yield on ILGs to the yield on its nominal AAA index[88]. The CMA inflated the yield on ILGs by the long-term RPI-CPIH wedge assumption and deflated the yield on its nominal AAA index by the long-term CPIH assumption. This enables a like-for-like comparison between the two yields in CPIH terms, but the resulting difference between the two yields is highly sensitive to the inflation assumptions adopted. CEPA recognises the same[89].

CEPA considers that comparing the yield on NGs to the yield on the CMA's nominal AAA index represents a more robust approach as it avoids the need for inflation adjustments.

iBoxx indices start on 01/01/1998 which means the longest averaging window that can be taken for the AAA-NG difference is from this date until 30/06/2024 (>26Y). The yield on the CMA's AAA index has been 48bps above that of maturity-matched NGs in RPI terms over this averaging window[90].

As the CMA's AAA index comprises only a small sample size of instruments, the yield on the index may be unstable over short averaging windows. Thus it is preferable to use the longest possible averaging window to ensure the estimate of the AAA-NG difference is not distorted by temporary factors. The implication is that the long-term average provides the most reliable estimate.

It may be relevant to consider short term averages of the AAA-NG difference solely because Ofwat uses a 1m trailing average of 20Y ILG yields as the starting point for the risk-free rate. The yield on the CMA's AAA index has been 3bps below that of maturity-matched NGs over June 2024.

This negative AAA-NG difference over the 1m average is out of line with expectations (e.g. AAA bonds have a small, but non-zero, risk of default unlike gilts) and the long-term average. This suggests it may be reflective of temporary factors and is therefore not a reliable estimate.

In any case, it appears more appropriate to estimate the AAA-ILG difference directly from RPI-linked AAA bonds rather than to infer this nominal AAA bonds. This was the premise behind KPMG's analysis of RPI-linked AAA bonds and ILGs in the September 2023 CoE report.

This is fully consistent with Ofwat's PR24 FM position on CY that CY for NGs cannot be assumed to apply directly to ILGs without justification[91]. For clarity, CY is the not the same as AAA-ILG difference.

For completeness, CEPA considers a second approach for estimating the AAA-NG difference. This second approach is based on comparing the yield on each individual constituent bond in the CMA's AAA index to the yield on maturity-matched NGs over March 2024. CEPA describes this approach as the same as that adopted by the CAA at H7[92].

For accuracy, the CAA did not carry out bond-by-bond analysis like CEPA which was explained in the September 2023 CoE report[93]. More importantly, CEPA's second approach, like its first, suffers from the same underlying issue in that it assumes the AAA-NG difference applies directly to ILGs.

KPMG analysis of RPI AAA bonds

The September 2023 CoE report estimated the AAA-ILG difference directly by comparing the yield on RPI-linked AAA bonds to the yield on maturity-matched ILGs[94].

The analysis has been updated to incorporate the short-end of the ILG yield curve and use data from Bloomberg instead of Refinitiv as discussed in section 4.3.4.

The updated analysis is carried out as follows:

- Download the daily yield, daily price and daily amount outstanding as well as the issue and maturity dates for the RPI-linked AAA bonds.

88 Simple average of the iBoxx non-gilts AAA 10Y+ and 10-15Y indices.
89 CEPA (2024), PR24 Cost of Equity, p. 96.
90 Based on daily maturity-matching.
91 Ofwat (2022), PR24 Final Methodology, Appendix 11 – Allowed return on capital, p. 15-16 and 97.
92 CEPA (2024), PR24 Cost of Equity, p. 97.
93 KPMG (2023), Estimating the Cost of Equity for PR24, section 6.6.3.
94 Ibid., section 6.6.4.

- Calculate the daily AAA-ILG difference for each RPI-linked AAA bond based on its yield *less* the yield on a maturity-matched ILG where data for both is available.
- Calculate the daily market value for each RPI-linked AAA bond based on its price *multiplied* by its amount outstanding.
- Calculate the daily market value weighted-average of the AAA-ILG difference across the group of RPI-linked AAA bonds.
- Average the daily market value weighted-average over the estimation window.

The updated analysis comprises of 18 bonds which represent those that meet the criteria outlined in section 4.3.4, apart from two differences which arise due to the move to Bloomberg. First, Bloomberg must have data for the bond. Second, the bond must have been active at some point since 01/01/2007. This is the earliest date for which Bloomberg has amount outstanding data.

The longest averaging window is therefore 01/01/2007 until 30/06/2024 (>17Y). The AAA-ILG difference is 69bps in RPI terms over this averaging window. There are on average 10 active bonds with a market value weighted-average years to maturity of 10.4Y across the window.

The 1m average over June 2024 is also considered given Ofwat's use of a 1m trailing average. The long-term average is still preferred on the basis that it produces a more reliable estimate. The AAA-ILG difference is 65bps over June 2024. There are on average 8 active bonds with a market value weighted-average years to maturity of close to 10Y across the window.

In this case, the 1m average is broadly aligned with the long-term average which suggests it is not affected by temporary factors and so is a reliable estimator. On this basis, the midpoint of the 1m and the long-term averages is selected as the point estimate for the AAA-ILG difference (67bps).

As noted in section 4.3.2, the AAA corporate borrowing rate is a conservative estimate of r_b.

This means that at least 67bps needs to be added to the ILG yield to derive r_b.

4.5.3. Adjustment for risk-free saving rate (CY)

CY(ILG) can be estimated based on approaches using Diamond and Van Tassel (2024) and RPI AAA bonds. These approaches are discussed in turn.

Reworking of Ofwat's analysis based on Diamond and Van Tassel (2024)

Diamond and Van Tassel (2024) estimates CY(NG) using the put-call parity relationship on European FTSE100 options. It finds 2Y CY(NG) of 29bps.

In the PR24 FM, Ofwat inferred 2Y CY(ILG) from the 2Y CY(NG) in Diamond and Van Tassel by applying the following formula from Liu et al. (2015)[95]:

CY(NG) – CY(ILG) = Gilt BEI – Swap BEI (breakeven inflation)

The September 2023 CoE report indicated that this formula assumes the entire gap between gilt BEI and swap BEI is due to higher CY for 2Y NGs relative to 2Y ILGs. However, it should reflect that the gap could also be due to the illiquidity of inflation swaps[96]. The modified formula becomes:

CY(NG) – CY(ILG) = Gilt BEI – Swap BEI + inflation swap illiquidity premium

Ofwat highlighted the inflation swap illiquidity issue in the DD and did not disagree with it[97]. Moreover, Ofwat recognises in the DD that inflation swap rates incorporate an illiquidity premium[98].

In the PR24 FM, Ofwat used an estimation window for CY of 18/06/2007 to 27/07/2020 which broadly aligns with that in Diamond and Van Tassel. 2Y CY(NG) *less* 2Y CY(ILG) is 27bps over Ofwat's estimation window based on the modified formula above. This implies a 2Y CY(ILG) of 2bps.

[95] Liu, Z., Vangelista, E., Kaminska, I. and Relleen, J. (2015), 'The informational content of market-based measures of inflation expectations derived from government bonds and inflation swaps in the United Kingdom'.
[96] KPMG (2023), Estimating the Cost of Equity for PR24, section 6.6.1.
[97] Ofwat (2024), PR24 Draft Determination, Aligning risk and return – Allowed return appendix, p. 16.
[98] Ibid., p. 123.

The September 2023 CoE report considered that 2Y CY(ILG) is likely to lie between the estimate from the modified Ofwat analysis and the 2Y CY(NG) estimate from Diamond and Van Tassel. This approach reflects a key finding from the report that the majority of CY factors cited in academic literature appear to apply similarly to NGs/ILGs but NGs may be more liquid than ILGs.

The result of the approach is a range for 2Y CY(ILG) of 2-29bps. The bounds of 2bps and 29bps are both likely to be higher based on a more recent data cut-off as explained in section 4.4.3.

As such, it does not appear appropriate to place excessive weight on the lower bound. The midpoint of the range of 15.5bps is selected as the point estimate for 2Y CY(ILG).

It is reasonable to assume this 15.5bps holds for longer-dated ILGs based on section 4.4.2.

This means that CY(ILG) of 15.5bps needs to be added to the 20Y ILG yield to derive r_S.

Cross-check based on RPI AAA bonds

CY(ILG) can be estimated by comparing the yield on RPI AAA bonds after adjusting for default risk to the yield on maturity-matched ILGs. In this context, ILGs are the risk-free asset with CY and RPI bonds after adjusting for default risk are the risk-free asset without CY.

This approach was adopted by academic literature on CY prior to the publication of van Binsbergen et al. (2022)[99], which was basis of Diamond and Van Tassel (2024). For example, Krishnamurthy and Vissing-Jorgensen (2012) compare the yield on AAA corporate bonds controlling for default risk to US Treasuries to estimate CY for US Treasuries[100]. Importantly, the paper only adjusts for default risk and is clear that the superior liquidity of US Treasures relative to other safe assets is part of its CY.

In the PR24 FM, Ofwat endorses this approach for estimating CY: *"The CAA's 32bp estimate of the convenience yield is derived by comparing the yield of the nominal gilt closest in tenor to the CMA's AAA-rated corporate bond index with that index. It has the advantage of being derived via a simple and easily-reproducible approach, but the estimate is likely to capture other risk premia (eg default and complexity risk) in AAA rated gilts alongside the convenience yield"*[101].

The RPI AAA bonds are not asset-backed (senior unsecured) so complexity risk is not relevant. Moreover, there do not appear to be established asset pricing models that feature complexity risk and this seems to have been developed with limited theoretical or empirical justifications. For clarity, liquidity should not be adjusted for as it is not a property of the risk-free asset, it is a driver of CY as explained in section 4.2.1. This is affirmed by the academic literature on CY including Krishnamurthy and Vissing-Jorgensen (2012) and van Binsbergen et al. (2022).

Relatedly, van Binsbergen et al. (2022) comments that the approach above could underestimate CY for US Treasuries. This is because a AAA corporate bond is sufficiently safe, liquid, and collateralisable to be somewhat money-like and therefore may itself bear CY. In this case, the yield on AAA corporate bonds controlling for default risk may be lower than the CY-free risk-free rate.

The estimate of CY(ILG) based on Diamond and Van Tassel (2024) should serve as the primary approach as this is at present the leading academic study on CY. However, estimates of CY(ILG) based on the approach above can serve as a cross-check as it originates from earlier academic literature on CY and has been endorsed by Ofwat in the PR24 FM.

The September 2023 report estimated that the default risk embedded in AAA corporate bonds yields was 0-9bps with a point estimate of 5bps, which is slightly above the midpoint of the range. This point estimate recognised that AAA corporate bonds are not risk-free but are very low risk.

This suggests that estimates of CY(ILG) can be obtained by reducing the point estimate of the AAA-ILG difference by 0-9bps. The result is an estimate for CY(ILG) of at least 58bps. This cross-check provides a quantitative indication of what CY may look like at longer tenors and could exert upwards pressure on the estimate of CY based on Diamond and Van Tassel (2024).

This cross-check supports a CY(ILG) adjustment of at least 15.5bps to the 20 ILG yield to derive r_S.

[99] Van Binsbergen, J., Diamond, W., and Grotteria, M. (2022), 'Risk-free interest rates'.
[100] Krishnamurthy, A. and Vissing-Jørgensen, A. (2012), 'The Aggregate Demand for Treasury Debt'.
[101] Ofwat (2022), PR24 Final Methodology, Appendix 11 – Allowed return on capital, p. 15.

4.5.4. Conclusion

This section sets out the range and point estimate for the adjustment required to the ILG yield to arrive at the risk-free rate in RPI terms.

Range

The range adopted for the adjustment required to the ILG yield is 0-67bps.

The upper bound position of 67bps is based on the minimum adjustment required to the ILG yield to derive r_b. At this position it would be assumed that r* is equal to r_b. In principle, r* could be equal to r_b as the estimate adopted for r_b is below the true investor borrowing rate.

The lower bound position of 0bps is based on assuming that r* is equal to r_s and there is no CY(ILG) adjustment required to derive r_s.

This position is not used to inform the point estimate for the adjustment required to the ILG yield. This is because 0bps is below the absolute lower bound for CY(ILG) of 2bps (albeit close to it) and the point estimate for CY(ILG) of 15.5bps which are both conservative.

Point estimate

The ILG yield requires an adjustment of at least 15.5bps to derive r_s and 67bps to derive r_b. Accordingly, a truncated range of 15.5-67bps is used to inform the point estimate.

Brennan (1971) states that r* is a weighted average of r_b and r_s; however the theoretical weights cannot be translated into empirical measures. The CMA in its application of Brennan (1971) at PR19 decided it was not necessary to assess the precise balance of borrowers and savers[102]. The CMA ultimately determined r* to be the midpoint of its estimates of r_b and r_s[103].

In this context, it appears reasonable to select a point estimate of 41bps for the adjustment to the ILG yield which is slightly below the midpoint of 15.5bps and 67bps. This is conservative as the estimates adopted for r_b and r_s are themselves conservative.

Separately, Ofwat may consider it is not possible to identify r_s because it considers either there is no risk-free asset or the risk-free asset bears CY which cannot be estimated. If this is the case, Ofwat should follow the zero-beta return option in Table 8. This will imply a significantly higher adjustment to the ILG yield than 41bps based on the evidence presented in section 4.2.1.

4.6. RPI-CPIH wedge

Ofwat estimates a 20Y RPI-CPIH wedge of 0.34% by placing equal weight on 20Y forecasts for the RPI-CPI wedge from inflation swaps and official forecasters (OBR for DD). Ofwat uses CPI as a proxy for CPIH as it considers that the CPI-CPIH wedge is generally small. Ofwat's estimate appears reasonable in principle. Ofwat should continue to monitor evidence and revisit its estimate at FD.

This section evaluates Ofwat's estimate of the RPI-CPIH wedge.

Ofwat comments that regulators have typically used the OBR's long-run RPI-CPI wedge of 0.9-1% to convert ILG yields into CPIH terms. However, the UKSA RPI reform should mean that there is no RPI-CPIH wedge after 2030. In this context, Ofwat has estimated the RPI-CPIH wedge in the PR24 DD using a different approach to that in previous price reviews[104].

In the PR24 DD, Ofwat estimated an RPI-CPIH wedge of 0.34%.

Ofwat has estimated this RPI-CPIH wedge by placing equal weight on forecasts for the RPI-CPI wedge from inflation swaps and official forecasters (OBR for DD). These forecasts are at the 20Y horizon reflecting that Ofwat's starting point for the risk-free rate is 20Y ILGs.

102 CMA (2021), PR19 Final Determination, para. 9.263.
103 Ibid., para. 9.265.
104 Ofwat (2024), PR24 Draft Determination, Aligning risk and return – Allowed return appendix, p. 123.

These two approaches are briefly described below:

- Inflation swaps – uses 20Y zero-coupon RPI and CPI swap rates to directly estimate the 20Y wedge priced in financial markets. These swap rates do not include a forward rate adjustment.
- Official forecasts – uses OBR forecasts of the annual wedge and assumes the annual wedge is zero post-2030 due to the UKSA RPI reform. This is a more fundamentals-based approach.

Ofwat does not place sole weight on swap-implied forecasts because swap rates contain illiquidity and inflation risk premia that may distort the swap-implied wedge as a measure of the true wedge expected by investors. It places equal weight on swap-implied forecasts and official forecasts because it considers the current macroeconomic environment could widen the gap between the inflation expectation priced-in financial markets and in official forecasts[105].

Ofwat assumes CPI can proxy CPIH because it considers the CPI-CPIH wedge is generally small and not persistently negative or positive over time. In the PR24 FM, Ofwat commented that CPIH was 6bps higher than CPI on average over the longest run of data available until September 2022[106].

Ofwat's estimate for the RPI-CPIH wedge of 0.34% appears reasonable in principle. Ofwat should continue to monitor evidence and revisit its estimate at FD, particularly as it is not making a forward rate adjustment on its inflation swap approach. Ofwat should reassess at FD whether it is appropriate to assume a CPI-CPIH wedge of zero over the period until the 2030 UKSA RPI reform[107].

4.7. Derivation of the risk-free rate range for PR24

The table below summarises the overall range for the risk-free rate.

Table 9: Overall range for the risk-free rate

Component	Index	Formula	Ofwat DD	KPMG	
				Lower	Upper
1m average of 20Y ILG yields	RPI	A	1.21%	1.21%	1.21%
Adjustments	RPI	B	0%	0%	0.67%
Risk-free rate	RPI	C = A+B	1.21%	1.21%	1.88%
RPI-CPIH wedge	n/a	D	0.34%	0.34%	0.34%
Risk-free rate	CPIH	E = (1+C)*(1+D)-1	1.55%	1.55%	2.22%

Notes: Based on a cut-off date of 30 June 2024
Source: KPMG analysis and data from Refinitiv

The table below summarises the truncated range and point estimate for the risk-free rate.

Table 10: Truncated range and point estimate for the risk-free rate

Component	Index	Formula	Ofwat DD	KPMG		
				Lower	Upper	Point
1m average of 20Y ILG yields	RPI	A	1.21%	1.21%	1.21%	1.21%
Adjustments	RPI	B	0%	0.155%	0.67%	0.41%
Risk-free rate	RPI	C = A+B	1.21%	1.36%	1.88%	1.62%
RPI-CPIH wedge	n/a	D	0.34%	0.34%	0.34%	0.34%
Risk-free rate	CPIH	E = (1+C)*(1+D)-1	1.55%	1.71%	2.22%	1.96%

Notes: Based on a cut-off date of 30 June 2024
Source: KPMG analysis and data from Refinitiv

[105] Ofwat (2022), PR24 Final Methodology, Appendix 11 – Allowed return on capital, p. 22.
[106] Ibid., p. 22.
[107] The RPI-CPIH wedge is expected to become zero after 2030 which will make the CPI-CPIH wedge irrelevant from that point. This means the CPI-CPIH wedge is only relevant for 5Y out of the 20Y horizon of Ofwat's RPI-CPIH wedge estimate.

5. Total Market Return

The total market return (TMR) is the expected return on a market portfolio that represents the investment opportunity set of a well-diversified investor considering adding the asset in question to her portfolio. The asset's return is defined in relation to the relative risk that this asset contributes to the well-diversified market portfolio. TMR is not directly observable, as it is a forward-looking estimate of investors' expectations of return for taking on equity market risk. As a result, it requires estimation.

This section is structured as follows:

1 It sets out a summary of the methodology and the estimate adopted in the PR24 DD.

2 It considers the methodology for the estimation of the ex post TMR and presents the resulting estimate.

3 It considers the methodology for the estimation of the ex ante TMR and presents the resulting estimate.

4 It derives an overall TMR range based on the estimates implied by ex post and ex ante approaches.

5.1. Ofwat's approach to estimate TMR

Ofwat estimated a TMR range of 6.29% to 6.87% CPIH-real in the PR24 DD. This range is based on the approach set out in the table below.

Table 11: Ofwat's approach for TMR estimation

Component	Approach
Historical ex post	Range formed based on 10- and 20-year overlapping averages of returns, estimated directly on a CPIH-real basis.
Historical ex ante	Range formed based on the (1) DMS decompositional approach and (2) implementation of the Fama-French Dividend growth model using the Barclays Equity and Gilt Study (BEGS) data.
Overall TMR range	Lower bound based on the midpoint of the ex ante range and the upper bound on the midpoint of the ex post range.

Source: KPMG analysis and PR24 DD

5.2. Estimation of TMR using the historical ex post approach

This Report adopts a historical ex post TMR estimate of 6.93% CPIH-real, calculated as the simple 1-year arithmetic average. This figure is slightly above the DD point estimate of 6.87%.

The use of the simple 1-year average is appropriate unless there are compelling reasons to justify an alternative approach. Departure from the simple 1-year average is not justified in this case as:

(1) there is no statistically significant evidence of serial correlation[108] based on the empirical analysis undertaken in this Report. Ofwat contends that statistical tests are of limited use for detecting serial correlation and presumes it presence by default, requiring proof to the contrary. Serial correlation is not a default feature of data, and the burden of proof lies in demonstrating its presence through empirical analysis. Consistent with this, the absence of serial correlation is considered the null hypothesis in conventional statistical testing.

(2) both investor (providers of capital)) and capital budgeter (users of capital) perspectives are relevant for the estimation of TMR[109], as recognised by the CMA at PR19[110]. In consequence. TMR should be estimated such that it is a 'neutral' rate in the form of the long-run arithmetic average, not assuming a specific holding period[111]. In contrast, Ofwat consider that the investor perspective is the relevant one, resulting in a TMR that is unsuitable for capital budgeters.

These two factors indicate that a divergence from the 1-year simple arithmetic average is not justified.

5.2.1. Ofwat's approach in the PR24 DD

The PR24 DD ex post TMR range is 6.81 – 6.93%, with a midpoint of 6.87%. This midpoint is 5bps lower than the FM estimate (6.92%), due to the inclusion of an additional year of returns data. The table below summaries the PR24 DD approach, which remains unchanged from the FM.

Table 12: Ofwat's methodology for estimating ex post TMR

Parameter	Approach
Data source	Global Investment Returns Yearbook 2024 (DMS 2024)[112].
Averaging technique	10- and 20-year overlapping averages only.
Inflation	Derived in CPIH-real terms using a synthetic CPIH series, constructed based on (1) BoE 'Original' Millenium dataset (1899-1949); (2) ONS CPIH backcast (1950-1988); (3) ONS outturn CPIH data (1988+)[113].
Cross-checks	Geometric-plus-conversion-factor approach, which adds half the variance of log returns to the geometric mean return, with a 9bps deduction for serial correlation.

Source: KPMG analysis and PR24 DD

108 Serial correlation (or autocorrelation) refers to the degree of correlation of variables between two (or more) different observations. The presence of serial correlation would indicate variables are not random and hence would need to be adjusted to reflect the 'true' market return.

109 This is because the regulatory WACC serves a dual purpose: it facilitates investors in calculating the expected future value of their investments in regulated companies, and it assists regulated companies in determining present values for capital budgeting decisions.

110 CMA (2021), PR19 Final Determination, para. 9.328.

111 A neutral TMR allows capital budgeters and investors to make adjustments to obtain unbiased figures for their specific requirements. If the rate provided is not neutral, there is a risk of rate distortion when applied from the opposite perspective.

112 Dimson, Marsh, and Staunton (2023), Global Investment Returns Yearbook and associated data. This publication is referred to hereafter as 'DMS 2024'.

113 Ofwat do not rebase the BoE dataset which results in a minor discrepancy due to a mismatch between financial data year end (December) and Inflation year end (June) for the 1899-1949 period. The impact is not material.

Ofwat has continued to reject the use of the simple arithmetic 1-year average as it considers that:

- there is serial correlation present in the UK returns data.
- the investor perspective, which would imply an average holding period of 10-20 years, is the relevant one for the estimation of TMR as (1) Ofwat's primary objective is to secure investment and (2) capital budgeters would use company-specific WACC for discounting, rather than the allowed return.

The application of these criteria is consistent with the September 2023 report, which considered that the simple 1-year arithmetic average should be used unless compelling reasons – i.e. the presence of serial correlation or either perspective being more relevant – justify deviation from this approach. However, the application of the criteria to determine the appropriate approach to TMR estimation in the PR24 DD is flawed as discussed below.

5.2.2. Consideration of serial correlation

Ofwat assumes that returns are serially correlated, citing the serial correlation coefficient value for UK equity returns from DMS 2024 (-0.08). However, it does not address the statistical significance of this value. Ofwat also disregards evidence from the September 2023 report, which found no statistically significant evidence of serial correlation within UK historical equity returns series.

Ofwat contends that statistical tests are of limited use for detecting serial correlation and that such correlation should be *expected* in the returns data. It notes that:

- If returns were truly uncorrelated, the variance ratio would be higher than observed; however, Ofwat acknowledges that the observed variance ratio falls within the 95% confidence interval for a series without serial correlation.
- "*A degree of serial correlation in returns is a key premise underpinning the use of long-run average historical returns to identify the TMR*"[114].
- At the RIIO-2 CMA appeals, the CMA accepted Ofgem's arguments that statistical significance was "*extremely hard to find*"[115] in this area and that a lack of serial correlation "*would imply that commonly used valuation criteria (such as price-earnings ratios) were spurious information in terms of predicting whether returns were likely to be high or low in the future*"[116].

First, it is not appropriate to assume that serial correlation is present by default and must be *disproven*. Instead, the burden of proof lies in demonstrating its presence, as serial correlation is not a default feature of data but rather a condition that must be established through empirical analysis. Consistent with this, the absence of serial correlation is considered the null hypothesis in conventional statistical testing.

There is no statistically significant evidence of serial correlation based on the empirical analysis undertaken in this Report. The serial correlation coefficient value cited by Ofwat from DMS 2024 is not statistically significant[117] and should not be relied upon to inform the approach for the estimation of ex post TMR. Furthermore, it appears to be inconsistent for Ofwat to dismiss the value of statistical testing while also citing a serial correlation figure from DMS 2024 which itself appears to have been derived through statistical analysis.

Second, while the variance of the series may be lower than what would be observed if returns were uncorrelated, as acknowledged by Ofwat, this variance falls within the confidence interval of the theoretical variance ratio for a series without serial correlation. Consequently, this observation does not provide sufficient evidence to conclude that serial correlation is present.

Third, a degree of serial correlation in returns is not a necessary premise for using long-run average historical returns to estimate the TMR. Instead, the use of historical returns to estimate TMR is

[114] Ofwat (2024), PR24 Draft Determination, Aligning risk and return appendix, p. 30.
[115] CMA (2021), RIIO-2 Final Determination Volume 2A: Cost of equity, para. 5.250.
[116] Ibid.
[117] DMS 2024 does not comment on the statistical significance of this value, However, the value can be replicated by applying the Cumby-Huizinga statistical test to the UK return series which allows for the examination of statistical significance.

grounded in the principle that these returns represent a reasonable expectation of future performance based on historical data.

Fourth, although the detailed submissions by Ofgem to the CMA at RIIO-2 regarding the implications from valuation criteria are not publicly available for scrutiny, the commentary in the final determination suggests that this argument may not meet the required evidential standard. Specifically, the hypothesis that valuation models are reliant on serially correlated returns is not well substantiated and likely to be flawed. This is because:

- Adjusting historical returns based on a supposition from forward-looking valuation models would be fundamentally inconsistent with the historical ex post approach, which is intended to represent actual past performance.
- The predictive power of P/E ratios is fundamentally a function of the relationship between CoE, earnings, re-investment ratios and return on equity[118]. These relationships – and hence the effectiveness of P/E ratios in forecasting returns – are dependent on the quality of the underlying inputs and assumptions, particularly those concerning short- and long-term return on equity, as well as payout policies and retention ratios. This has no implications for serial correlation, nor does it imply any assumption of serial correlation.

Notably, Ofgem itself appears to have changed its view as it is proposing to estimate the ex post TMR for RIIO-3 based on the 1-year simple arithmetic average without any adjustments for serial correlation[119].

Overall, a departure from the 1-year simple arithmetic average on the grounds of serial correlation is not required or justified. This is driven by the fact that if real returns follow a random walk with stationary mean and standard deviation, the best estimate of future returns is the long run historical average.

5.2.3. Consideration of the appropriate perspective for estimating the TMR

TMR estimates will differ depending on whether one or both of investors' (the provider of capital) and capital budgeters' (the users of capital) perspectives are deemed to be relevant.

Ofwat contends that the investor perspective is the more relevant one as its primary objective is to secure investment. However, this position does not take into account that the regulatory WACC serves a dual purpose: it facilitates investors in calculating the expected future value of their investments in regulated companies, and it assists regulated companies in determining present values for capital budgeting decisions. This regulatory WACC is essential for both parties and plays a significant role in guiding investment and financial planning within the regulated environment. Given that both perspectives are equally relevant, the regulator's determination of the TMR should give equal consideration to both. The CMA recognised this point at PR19, noting that "*there is no reason to conclude that one perspective, either that of the capital budgeter or of the portfolio investor, is 'correct'*"[120].

Ofwat additionally considers that capital budgeters would use a company-specific WACC for discounting, rather than the allowed return, suggesting that the regulatory WACC need not accommodate the requirements of capital budgeters. This assumption is flawed.

First, the regulatory WACC is estimated for a notionally structured company, based on an assumption in the DD of no out- or under-performance at the P50 level. In this context, the allowed return and the company-specific WACC are conceptually indistinguishable[121]; assuming otherwise would invalidate the notional construct. Therefore, a distinction between the allowed return and the company-specific WACC does not apply in this notional framework.

118 This is shown mathematically in Appendix D.
119 Ofgem (2024), RIIO-3 Sector Specific Methodology Decision – Finance Annex, para. 3.120, 3.123.
120 CMA (2021), PR19 Final Determination, para. 9.328.
121 If the two concepts were not indistinguishable, the notional company would require some form of adjustment (in either direction) to ensure it represented a 'fair bet' for investors, as the asymmetry would need to be priced to ensure cashflows equate to the notional allowed return.

Second, from an actual company perspective, while the capital budgeter would use a company-specific WACC for discounting, the allowed return remains a critical factor for investors. The comparison between the allowed return and the required return is integral to investor decision-making. Thus, both the allowed return and the company-specific WACC are relevant in this context.

Overall, as both perspectives are equally valid, the correct approach in a regulatory setting – as noted by Schaefer (2020)[122] – is to provide a 'neutral' estimator of market return in the form of the long-run arithmetic average. Capital budgeters will then make positive adjustments, while compounders will make negative adjustments, to obtain unbiased figures for their specific requirements. If the rate provided is not neutral, there is a risk of rate distortion when applied from the opposite perspective.

5.2.4. TMR estimate from the historical ex post approach

The evidence presented in this section implies that there are no compelling reasons to depart from the simple 1-year arithmetic average in the estimation of the ex post TMR for PR24. This is because (1) there is no statistically significant evidence of serial correlation and (2) both investor and capital budgeter perspectives are relevant which requires the estimation of a neutral TMR in the form of the long-run arithmetic average.

The table below sets out the results from the primary approach and the cross-check using the geometric-plus-conversion-factor approach. Both the primary approach and the cross-check imply a TMR of 6.93 CPIH-real. This estimate is slightly higher than the PR24 DD point estimate of 6.87% and slightly lower than the midpoint of the CMA's range of 6.55 – 7.46%[123] at PR19, reflecting the influence of the most recent returns data.

Table 13: Ex post TMR estimates

CPIH-real	Assumption
Primary approach	6.93%
Cross-check based on geometric-plus-conversion-factor approach	6.87%

Source: KPMG Analysis

5.3. Estimation of TMR using the historical ex ante approach

This Report adopts a historical ex ante TMR estimate of 6.75% CPIH-real, derived as the midpoint of the range based on (1) the DMS decompositional approach and (2) the implementation of the Fama-French dividend discount model. Both approaches utilise data directly from DMS 2024. This figure compares to a midpoint estimate of 6.29% CPIH-real in the PR24 DD.

The overall approach adopted in this Report aligns with the PR24 DD and the CMA's methodology at PR19. However, it uses the newly extended DMS dataset for both approaches, substituting the BEGS[124] data due to known shortcomings. Estimates are derived directly on a CPIH-real basis, thereby obviating the need for a -35bps COLI-CED adjustment.

[122] Steven Schaefer (2020), Comments on CMA views on Estimating Expected Returns.
[123] CMA (2021), PR19 Final Determination, para. 9.334. 5.6 – 6.5% RPI-real, translated into CPIH using the CMA's wedge of 0.9%.
[124] The Barclays' Study calculates equity returns between 1899 and 1935 based on an index constructed by Barclays consisting of the 30 largest shares by market capitalisation in each year; between 1935 and 1962, they are calculated from the FT 30 Index, and from 1962 onward, they are derived from the FTSE All-Share Index.

5.3.1. Ofwat's approach in the PR24 DD

The PR24 DD ex ante TMR range is 5.98 – 6.60%, with a midpoint of 6.29%. This range is higher than that estimated in the PR24 FM due to substantial methodological changes. Specifically, Ofwat has removed two novel and untested approaches[125] and implemented some analytical improvements to the retained approaches. The table below summaries the PR24 DD approach.

Table 14: Ofwat's methodology for estimating ex ante TMR

Approach	Description	Changes from FM Approach
DMS decompositional approach	Combines the UK-specific geometric mean dividend yield and real dividend growth assumptions from DMS with adjustments for (1) geometric-to-arithmetic-mean conversion, (2) differences between COLI-CED inflation[126].	The adjustment for serial correlation has been removed as the original Fama-French (2002) DGM does not feature such an adjustment. The conversion factor is now calculated as half the variance of log returns for the UK, as opposed to the generic 1.50% used in the PR24 FM based on World data.
Fama-French DGM approach	Combines the UK-specific geometric mean dividend yield and real dividend growth assumptions from BEGS data with adjustments for (1) geometric-to-arithmetic-mean conversion, (2) differences between COLI-CED inflation and (3) RPI-CPIH wedge.	The adjustment for serial correlation has been removed.

Source: KPMG analysis and PR24 DD

These adjustments have materially increased the ex ante TMR range relative to the PR24 FM. However, the range remains understated, primarily due to continued reliance on BEGS data. Ofwat did not adopt the alternative composite index proposed in the September 2023 report, noting its lack of peer review, its unpublished status and absence of a track record of use in prior regulatory determinations unlike BEGS and DMS. The selection of the appropriate dataset for ex ante TMR estimation is discussed in detail below.

5.3.2. The appropriate data for ex ante estimates

BEGS has well documented and material flaws that render it unsuitable for the derivation of a robust TMR estimate. This is most evident when the constituents of the BEGS index are benchmarked against reputable academic research. The September 2023 report pointed to research from two sets of authors that cast doubt on the robustness and suitability of BEGS data for the estimation of regulatory TMR[127].

In the PR24 DD, Ofwat only comments on one cited paper (Foreman-Peck et al. (2011)) and attributes the differences in constituents compared to BEGS to the former's use of "*a more specific and time-bound criterion*" for constituent selection.

[125] Ofwat amended its approach to exclude estimates based on the World index. Ofwat recognised that – in line with the September 2023 report – different legals systems would have a bearing on the relevance and comparability of returns from the World index for the estimation of PR24 TMR. It considered that reflecting the role of different legal systems is an added complexity and that the use of a purely UK-derived TMR may be more aligned with the use of other CAPM components that also derive from UK data.

[126] This adjustment is to reflect that the DMS data uses COLI in the early years, which is a viewed as a less robust dataset than the CED equivalent. For example, there are known issues with the weightings used for different categories of consumer expenditure. These are discussed and addressed in O'Donoghue et al (2004), within which the CED is derived. The value of the adjustment is based on the CMA's PR19 decision.

[127] The research undertaken by Foreman-Peck and Hannah and Campbell, Grossman, and Turner is published in highly respected, peer-reviewed journals. Based on this research one would expect railway companies to denominate the BEGS index in early 1900s, but they are absent from the index. Foreman-Peck, J. and Hannah, L. (2011), 'Extreme divorce: the managerial revolution in UK companies before 1914' and Foreman-Peck, J. and Hannah, L. (2013), 'Some consequences of the early twentieth-century British divorce of ownership from control' and Campbell, G., Grossman, R. and Turner, J. (2021), 'Before the cult of equity: the British stock market, 1829–1929',

The 'Blue Chip' index constructed by Campbell, Grossman, and Turner (2021)[128] is conceptually equivalent to the BEGS index for the period 1899-1935, as both indices select constituents based on market capitalisation. A comparison of the membership of (1) the Blue Chip index in 1929 and BEGS in 1934 and (2) the Blue Chip index in 1870 and BEGS in 1899 shows material differences. Railway companies are included in the Blue Chip index in both 1870 and 1929, consistent with Foreman-Peck et al. In contrast, railway companies are absent from the BEGS list in both 1899 and 1934. This corroborates the view that the differences between Foreman-Peck et al. and BEGS are more likely due to limitations in the BEGS dataset.

Historically, there has not been a published and peer reviewed alternative dataset that could replace BEGS for regulatory decision-making. DMS – the main source of historical returns information – only provided calculated values for the Decompositional approach and did not include the granular data[129] required to either replicate estimates under this approach or implement the Fama-French DGM approach.

However, this is no longer the case as DMS 2024, for the first time, contains the data necessary to implement both Decompositional and Fama-French DGM approaches. The availability of this data eliminates the need for alternative sources and ensures internal consistency with the ex post estimates.

The overall purpose of historical ex ante approaches is to *"identify investors reasonable TMR expectations by **using historic data but making adjustments** to take into account one-off good or bad 'luck' that investors might not expect to be repeated in the future"*[130] (emphasis added). This purpose is best served by ensuring that ex ante estimates adjust historical data from the same source as used for the historical ex post estimate.

This Report adopts the DMS data for both ex ante approaches.

5.3.3. TMR estimate from the historical ex ante approach

DMS Decompositional approach

This Report adopts the same approach as the PR24 DD but re-calculates the ex ante estimate directly in CPIH terms instead of using the published value in Table 12 of DMS 2024[131] and converting it to CPIH. The values cited in this table are quoted in CPI-real terms based on the DMS' own series, which is based on COLI[132] in the earlier years. COLI is rated as a lower quality data series by the ONS[133] and has been recognised to result in overstated real values. Consequently, when using the estimate from DMS regulators have historically applied a downwards COLI-CED adjustment.

As it is now possible to replicate the values in DMS Table 12, it is also possible to replace the DMS CPI series with a CPIH inflation series in the calculation. Expressing returns directly in CPIH terms is a more precise approach which eliminates the impact of COLI at source, meaning that there is no empirical or conceptual requirement to apply a COLI-CED adjustment.

128 Campbell, G., Grossman, R. and Turner, J. (2021), 'Before the cult of equity: the British stock market, 1829–1929'.
129 The DMS data previously lacked a timeseries of the detailed splits between returns from dividends and capital gains.
130 CMA (2021), PR19 Final Determination, para. 9.340.
131 DMS 2024, Table 12, p.76.
132 COLI is viewed as a less robust dataset than the CED equivalent. For example, there are known issues with the weightings used for different categories of consumer expenditure. These are discussed and addressed in O'Donoghue et al (2004), within which the CED is derived.
133 The ONS notes that COLI has 'relatively limited coverage in terms of both products and population, and concerns about the quality of the weights. See ONS, Consumer Price Indices Technical Manual – 2007, p73 available here.

Table 15: Estimation of the ex ante TMR under the DMS Decompositional approach

	DMS Decompositional approach estimated in CPIH directly	The PR24 DD	Cumulative differential
Geometric mean dividend yield	4.55%	4.55%	-
Growth rate of real dividends	0.65%	0.75%	(0.10%)
Unadjusted ex ante TMR	5.20%	5.30%	(0.10%)
Geometric-to-arithmetic conversion	1.62%	1.65%	(0.13%)
COLI-CED adjustment	0.00%	(0.35%)	0.22%
Ex ante TMR (arithmetic)	**6.82%**	**6.60%**	**0.22%**

Source: KPMG analysis

Applying the Decompositional approach in CPIH terms results in a decrease of the growth rate by 10bps. This is unsurprising, given the COLI series is known to be upwards biased. At the same time, the fact that the growth rate decreased by only 10bps suggests that the 0.35% adjustment was likely overstated[134].

The net impact is a 22bps increase in the estimate relative to the PR24 DD.

Fama-French DDM approach

The Fama-French DGM approach adopted in this Report follows the same methodology as the PR24 DD, though it substitutes the BEGS series with DMS 2024 data.

The Fama-French DGM approach is similar to the DMS decompositional approach, though they differ in averaging methods. As detailed in the 2002 paper[135], the former uses arithmetic averages for dividend yield and growth rate. When projected forward these averages yield an equivalent of an expected geometric return. It is necessary to then apply an adjustment to account for the fact that dividend growth is less volatile than price growth[136].

[134] The adjustment was originally estimated based on differences in ex post data, not ex ante. Adjusting the inflation at source is significantly more accurate and requires much less subjective judgment.

[135] Fama, E. and French, K. (2002), 'The Equity Premium'.

[136] This is the same approach as applied by Ofwat, which this Report has confirmed by replicating the numbers in the PR24 FM. Ofwat refers to the figures as geometric averages in the DDs/FM as in practice they are geometric averages.

Table 16: Estimation of the ex ante TMR under the DMS Decompositional approach

	Fama-French DGM approach using DMS Data	Fama-French DGM approach using BEGS Data (Ofwat)	Cumulative differential
Average dividend yield[137,138]	4.41%	4.42%	(0.03%)
Average dividend growth rate	1.74%	0.95%	0.76%
Unadjusted ex ante TMR	6.13%	5.38%	0.76%[139]
Bias adjustment	0.53%	0.61%	0.68%
Ex ante TMR (arithmetic)	**6.68%**	**5.98%**	**0.68%**

Source: KPMG analysis

Replacing BEGS with the DMS 2024 data – a reputable and well-established dataset with a long track record of being used in the estimation of regulatory returns – increases the TMR estimate from this approach by approximately 68bps.

TMR estimate from the historical ex ante TMR approach

The two approaches adopted in this Report result in an ex ante TMR range of 6.68% to 6.82% CPIH-real. The overall methodology is consistent with that adopted in the PR24 DD and by the CMA at PR19. The increase in the estimates is driven by data improvements resulting from additional information being made available in DMS 2024.

Table 17: Ex ante TMR estimates

Parameter	Assumption
DMS decompositional approach	6.82%
Fama-French DGM approach	6.68%

Source: KPMG analysis

5.4. Derivation of the TMR range for PR24

This Report derives a TMR range of 6.75 – 6.93% CPIH-real compared to the PR24 DD range of 6.29 – 6.87%. The key drivers of differences with the DD range are ex ante estimates, where this Report (1) uses DMS 2024 rather than the BEGS study to implement the Fama-French DGM approach and (2) calculates the DMS Decompositional approach directly in CPIH terms.

The TMR midpoint in this Report of 6.84% is aligned with the CMA PR19 midpoint of 6.81%. This is in line with the standard regulatory assumption that the TMR is a relatively stable parameter.

Table 18 sets out the TMR estimates derived in this Report based on approaches best justified based on a balanced evaluation of the most current market data, pertinent financial literature, and relevant regulatory precedent.

[137] Fama and French (2002) calculate a real dividend based upon opening market values. Conversely, DMS Table 12 appears to be contemporaneous dividend yields that are not adjusted for inflation.

[138] DMS provides indices for total returns and capital gains, necessitating the formulation of an income index. Fama and French calculate a real dividend yield based on the opening value of the price index. Depending on the assumptions underpinning DMS data, additional transformation may be required to ensure the inputs are compatible with the Fama-French calculation. If the dividend stream is assumed to be continually reinvested, DMS inputs can be used in the Fama-French without additional transformation. If the dividend stream is assumed to be reinvested once at the end of the year, it needs to be divided by the opening price index. DMS does not explicitly state the assumed method. Clarification from the authors revealed that pre-1955 data assumes annual reinvestment, while post-1955 data assumes dividends are reinvested when received (although monthly data is not available). The calculation in this report has been tailored to accommodate this switch in assumptions. However, maintaining the pre-1955 assumption of annual reinvestment would increase the Fama-French estimator by approximately 23bps.

[139] Rounding in Ofwat's estimate causes a +/-1bps variance.

Table 18: Summary of TMR evidence

CPIH	Lower bound	Upper bound
Historical ex post	6.93%	
Historical ex ante	6.68%	6.82%

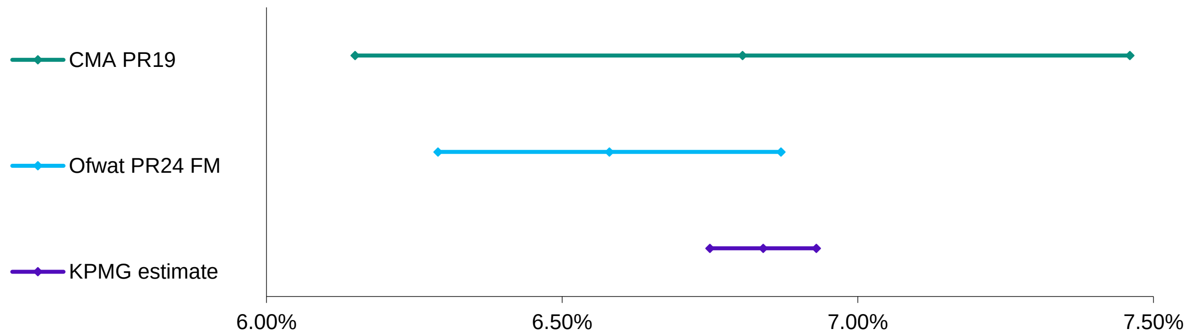
Source: KPMG analysis

Consistent with the PR24 DD, this Report uses the midpoint of both estimates to form the overall TMR range. This Report therefore adopts a range of 6.75% to 6.93% CPIH-real, with a midpoint of 6.84%.

This midpoint aligns closely with the CMA's PR19 point estimate of 6.81%[140]. This is in line with the standard regulatory assumption that the TMR is a relatively stable parameter and that estimates developed in quick succession should be broadly consistent with one another. In contrast, the point estimate from the PR24 DD is 23bps lower than the CMA's and falls within the lower half of the CMA's range.

The figure below compares the KPMG TMR range to the CMA PR19 and PR24 FM ranges.

Figure 2: The KPMG TMR range compared to CMA PR19 and PR24 DD



The KPMG estimate is fully encompassed within the CMA's PR19 range. The significant narrowing of the range in this Report compared to CMA PR19, is primarily due to data-driven factors:

- The lower bound of the KPMG range is materially higher than the CMA's, mainly due to the incorporation of new data from the DMS dataset that was not available to the CMA during the PR19 redetermination. This new information affects the implementation of both ex ante approaches.
- The upper end of the KPMG range is lower than the CMA's primarily due to the movement in market data since the CMA's final decision.

By contrast the Ofwat approach implies TMR estimates in the lower half of the CMA's range.

[140] CMA (2021), PR19 Final Determination, Table 7.

6. Beta

Beta measures the sensitivity of a firm or sector's returns to the overall market's returns. This sensitivity reflects the level of systematic risk which affects the entire market and cannot be diversified away.

For the allowed CoE to represent a true expected return over the chosen investment horizon, beta should be estimated such that it is expected to apply over a forward-looking period consistent with that used to estimate other CAPM parameters. This has been recognised by both Ofwat and the CMA. For example:

- In the PR24 DD, Ofwat notes that its "*estimate of beta attempts to proxy for market participants' view of long-run (10-20 year) systematic risk exposure over 2025-30*".
- During the H7 appeal, the CMA noted that "*the cost of capital should reflect the forward-looking risk of investing in the regulated activities*"[141] and that "*the purpose of the asset beta assessment is…to determine a forward-looking estimate that will capture appropriately the systematic risks expected by investors* [in HAL] *in the long run*"[142].
- The CMA further noted that "*the available evidence on risk is backward-looking*"[143] and that "*it does not follow that betas based on historical data are necessarily the most appropriate guide to the future assessment of risk*"[144].
- In the SSMD for RIIO-3, Ofgem noted that "*regulators typically use historical beta data as the base of the estimate for beta on a forward-looking basis. This means that estimating beta is easier in a 'steady state' environment than a dynamic environment*"[145] and that "*to ensure that we are capturing the risk of the sector on a forward-looking basis as accurately as possible, we have considered ways to make our beta assessment more robust*"[146].

The exam question when estimating beta is therefore how to use available comparators and estimation techniques to derive estimates that best reflect systematic risk on a forward-looking basis over the assumed long-run investment horizon.

In this context, this section develops a beta estimate that reflects the systematic risk of the sector over the forward-looking 20Y investment horizon. It is structured as follows:

1 It sets out a summary of the methodology and the estimate adopted in the PR24 DD.

2 It considers the nature and materiality of the distortive events affecting water company betas and their appropriate treatment in the estimation of the forward-looking beta for PR24.

3 It considers the impact of the step up in capital intensity on forward-looking risk and beta estimation.

4 It considers which available comparators can most closely capture the underlying systematic risk for the sector on a forward-looking basis.

5 It comments on available data frequencies and averaging techniques and their relevance and reliability for the estimation of PR24 beta.

6 It derives an overall beta range for PR24.

[141] CMA (2023), H7 Final Determination, para. 6.69.
[142] Ibid., para. 6.87.
[143] Ibid., para. 6.69.
[144] Ibid., para. 6.74.
[145] Ofgem (2024), RIIO-3 Sector Specific Methodology Decision – Finance Annex, para. 3.192.
[146] Ibid., para. 3.192.

6.1. Ofwat's approach to and estimate of beta

Ofwat estimated a range for unlevered beta of 0.26 to 0.29 in the PR24 DD. This range is based on the approach set out in the table below.

Table 19: Ofwat's approach to beta estimation

Component	Approach
Treatment of distortive events	15 years of data incorporated into the estimate to capture diverse range of systematic risk events.
Treatment of forward-looking risk	No adjustment for forward-looking risk. Ofwat's approach assumes that risk is unchanged relative to that implied by historical data.
Comparators	SVT and UUW only. No weight attached to PNN.
Data frequency	Daily frequency betas are the primary basis of estimation, but weekly and monthly betas are also considered.
Estimation windows	2-, 5-, 10-year betas calculated but the range formed based on the latter two.
Averaging windows	Spot, 1-, 2-, and 5-year averages calculated but the range formed based on the latter two.
Debt beta	Debt beta of 0.10. This Reports adopts the same assumption.

Source: KPMG analysis and PR24 DD

6.2. Treatment of distortive events

The impact of distortions from Covid-19 and the Russia-Ukraine war on water company betas was both material and transient. The flight-to-safety (FTS) effect led to a notable reduction in the volatility ratio between SVT/UUW and FTSE All Share returns, causing a significant decrease in betas. This decrease, driven by the FTS effect, is temporary, as evidenced by empirical data on water company betas. Methods designed to address the impact of such distortive events indicate that unlevered beta estimates below 0.28, based on SVT/UUW data, would not be appropriate. By contrast, Ofwat has adopted 0.26 as the lower bound of the PR24 DD range.

6.2.1. The impact of Covid19 and Russia-Ukraine war on water company betas

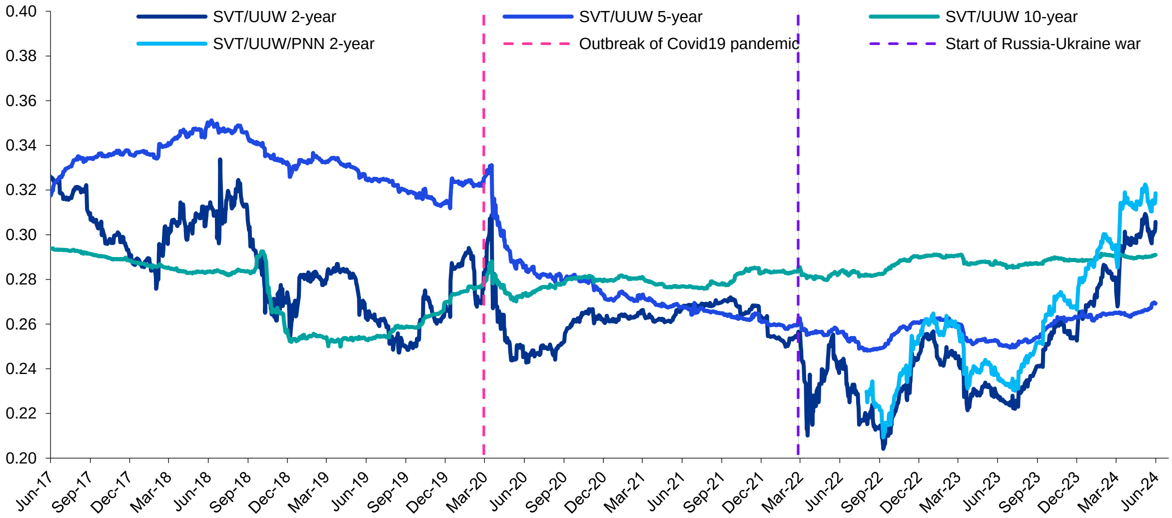
The estimation of a forward-looking beta which appropriately captures the systematic risks expected by investors over the long term requires careful consideration of distortive events and their potential impact on estimates of systematic risk over a long-run horizon. In the context of estimating betas for PR24, it is essential to consider how much weight should be assigned to data distorted by the Covid-19 pandemic, the Russia-Ukraine war, and their economic repercussions.

The impact of these events on water sector betas is both material and transient. It is driven by the 'flight to safety' (FTS) phenomenon, whereby investors shift from higher-risk to lower-risk assets during market turbulence. FTS is inherently temporary and linked to specific economic conditions, which is also evidenced by the empirical data on water company betas.

Since the onset of Covid-19, 2-year unlevered betas for SVT/UUW were consistently below the 5-year and 10-year betas, including after the start of the Russia-Ukraine war. This is intuitive as shorter-term betas are the most responsive to market movements and are more affected by distortions. However, from mid-December 2023, 2-year betas have been consistently higher than 5-year betas. Since March 2024, 2-year betas have exceeded 10-year betas. The sustained increase of 2-year betas suggests that at a minimum there has been a reversal of the Covid-19 and Russia-Ukraine war distortions. The increase of 2-year betas above 10-year betas could also signal that the market is pricing in higher systematic risk for water stocks. For example, market commentary in relation to the

DD indicates that cost and performance risks to which the sector is exposed are increasing. As such, this Report adopts December 2023 as the end date for the distorted period.

Figure 3: Evolution of SVT/UUW unlevered betas



Source: KPMG analysis using Refinitiv Eikon and Refinitiv Datastream data.

Based on this FTS end date, the table below shows the impact of distortions on various beta estimates compared to those observed in February 2020. The numbers in brackets indicate the extent of the decrease relative to undistorted betas. Ofwat considers that Covid19 is an "*uninfluential factor*" and does not warrant a reweighting approach applied by the CAA. The table below indicates that this position is not consistent with the empirical data.

Table 20: Impact of distortions due to Covid19 and Russia-Ukraine war

Timeframe	Spot	1-year average	2-year average	5-year average
2-year	-0.02 (-7%)	-0.03 (-10%)	-0.04 (-16%)	-0.07 (-22%)
5-year	-0.06 (-19%)	-0.07 (-21%)	-0.08 (-23%)	-0.03 (-10%)
10-year[147]	0.01 (+3%)	0.03 (+10%)	0.02 (+7%)	-0.00 (-2%)

Source: KPMG analysis using Refinitiv Eikon and Refinitiv Datastream data.

The effect of the FTS behaviour is to simultaneously (1) increase prices and reduce the return of lower risk assets; and (2) lower prices and increase the expected return on higher risk assets.

However, Ofwat considers that a flight to safety (FTS) would primarily affect enterprise value (EV) gearing, leading to higher unlevered betas due to a reduced de- and re-levering adjustment. There are two critical flaws with this argument.

First, the argument appears to assume that equity beta would remain unchanged, leading to a higher unlevered beta due to lower observed gearing. However, this assumption is not justifiable because:

- Equity beta reflects both business and financial risks. Lower gearing would imply lower financial risk, which would likely lead to a change in equity beta.
- Unlevered beta solely reflects underlying business risk. It should not change as a result of changes in gearing.

Second, the argument does not take into account how market turbulence affects the perception of the sector's riskiness *relative* to the market.

[147] The observed increase in 10-year betas is likely driven by the relatively lower betas before the regime change at PR14 being assigned less weight relative to 2020. Refer to section 8 of the September 2023 report.

These issues are explored in more detail below.

Equity beta can be decomposed to the following:

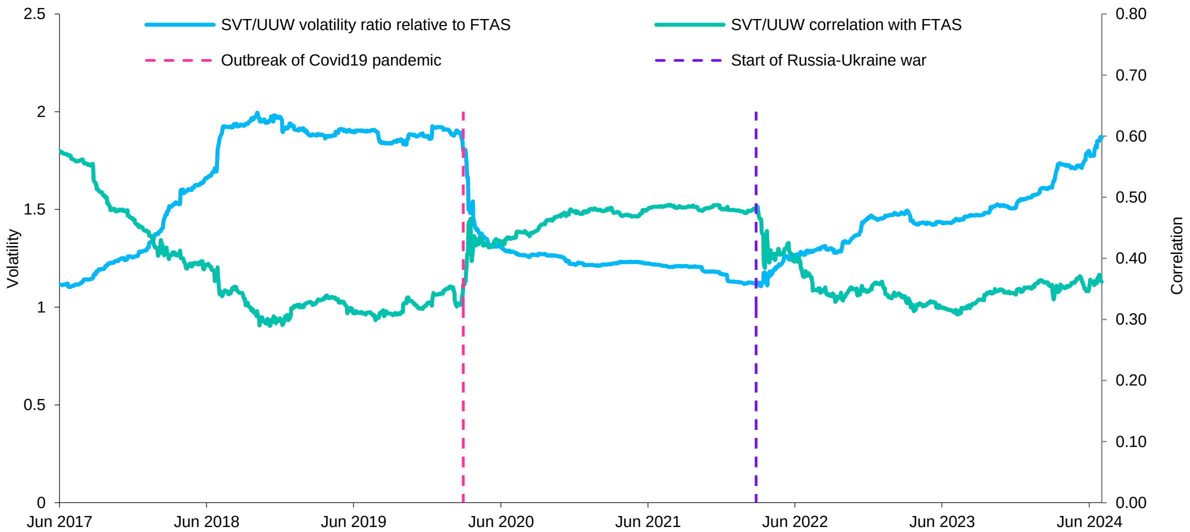
$$\beta_i = \rho_{i,m} \frac{\sigma_i}{\sigma_m}$$

Where:

- $\rho_{i,m}$ is the correlation between the returns of a company and the market portfolio.
- σ_i is the standard deviation of a company's returns.
- σ_m is the standard deviation of the market portfolio's returns.
- $\frac{\sigma_i}{\sigma_m}$ is the volatility of the company's returns relative to the market portfolio's returns (volatility ratio).

The chart below illustrates the movement of the correlation between SVT/UUW and the FTSE, as well as the volatility ratio between SVT/UUW and the FTSE over a 2-year rolling window. A 2-year window is chosen for illustrative purposes due to its responsiveness to market information which allows for a more direct capture of the impact of the outbreak of Covid19.

Figure 4: 2-year correlation and volatility ratio between SVT/UUW and the market



Source: KPMG analysis using Refinitiv Eikon and Refinitiv Datastream data.

The pandemic had a material impact on both metrics:

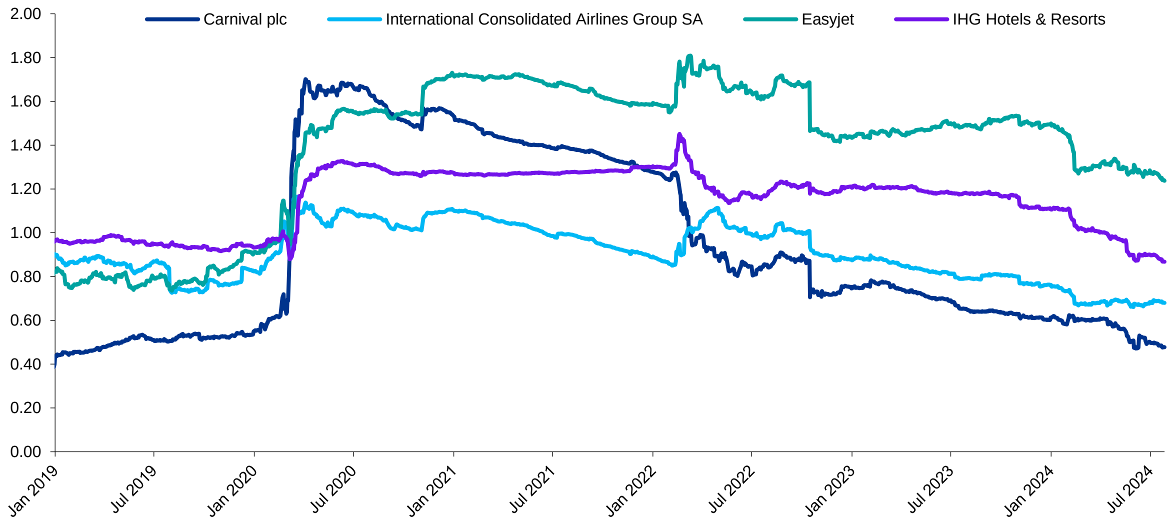
- The correlation between SVT/UUW returns and the market, which was at relatively low levels fromn late 2018, increased significantly at the onset of the Covid-19 pandemic. This elevated correlation persisted for approximately two years before reverting to pre-pandemic levels.
- Conversely, the volatility ratio, which had been increasing and stabilising at historically high levels by late 2018, decreased significantly at the onset of the pandemic. This decrease is in line with expectations for regulated water companies during periods of macroeconomic volatility, which are generally considered defensive stocks and thus less sensitive to market downturns. The volatility ratio is now on an upward trajectory, as reflected in the increasing 2-year betas.

The decrease in the volatility ratio offset the increase in correlation, leading to a net reduction in equity betas. Had gearing remained constant, this reduction would have resulted in a higher reduction in unlevered betas. However, a reduction in gearing *partially mitigated* the decrease in equity betas, resulting in unlevered betas that were higher than they would have been otherwise.

Betas measure relative risk compared to the overall market index. Consequently, betas may increase or decrease due to fluctuations in broader market risk, even if the inherent risk of the underlying business remains unchanged. Intuitively, it is expected that during periods of market stress, betas of defensive stocks would decrease, while those of discretionary sectors would increase, due to changes in the relative volatility of these stocks compared to the broader market. Defensive stocks are typically less sensitive to economic downturns as the demand for their services remains relatively stable regardless of the economic cycle. By contrast, discretionary sectors, such as travel and leisure, are more sensitive to economic fluctuations as consumer spending on non-essential goods and services tends to decrease during economic downturns.

Covid19 represented an extraordinary level of stress and disruption for companies in the travel and leisure sectors. The chart below illustrates the evolution of unlevered betas for companies these sectors. These companies experienced a significant increase in betas at the onset of the pandemic, although this increase was temporary, and the betas are now trending downwards. This case study illustrates that an increase in unlevered betas as a result of market turmoil is a characteristic of cyclical, discretionary stocks which are inherently riskier than water companies. Furthermore, as the value-weighted beta of the overall market is assumed to be 1, the observed increase in betas for discretionary sectors must be accompanied by a corresponding decrease in betas for sectors perceived as less risky, such as utilities. This ensures the market beta remains balanced at 1.

Figure 5: Evolution of 2-year unlevered betas for companies in the travel and leisure sectors



Source: KPMG analysis using Refinitiv Eikon and Refinitiv Datastream data.

The economic impact of the Russia-Ukraine war is also temporary and not correlated with the duration of the war itself. Initially, the war triggered a massive shock to the global economy, especially to energy and food markets, squeezing supply and pushing up prices to unprecedented levels and exacerbating the inflationary pressures building up in the post-pandemic recovery. According to the Bank of England, the main channel through which the war affected the UK economy was inflation[148] and the war was one of the shocks driving high inflation during 2022 and 2023[149][150]. Whilst the war continues, the corresponding economic impacts have become significantly less pronounced over time, with BoE noting that "*inflationary pressures from external cost shocks have dissipated over the past 18 months*"[151]. In consequence, this Report assumes that the economic impacts of the war are transient in nature.

The material and transient nature of these distortive events on water company betas means that placing excessive weight on data from these periods would distort beta estimates intended to reflect systematic risk over a long-term investment horizon.

[148] Bank of England (May 2022), Monetary Policy Report.
[149] Bank of England (August 2023), Monetary Policy Report.
[150] With the other two shocks being the pandemic itself and a big fall in the number of people available to work which is also linked to the pandemic.
[151] Bank of England (February 2024), Monetary Policy Report.

6.2.2. Consideration of approaches to address the impact of distortive events on water company betas

Regulatory precedents offer potential approaches for mitigating the impact of distortive events to derive a representative pricing of systematic risk over a long-term forward-looking window.

- At PR19, the CMA calculated beta estimates using February 2020 (i.e. before the onset of the Covid-19 pandemic) and December 2020 cut-off dates. It limited the weight assigned to estimates affected by distortions (i.e. December 2020 cut-off) by excluding outliers[152], which were all December 2020 estimates. It also set a range that encompassed the upper end of the data to December 2020 and the full range of that to February 2020[153]. The CMA considered that an economic crisis such as the one caused by Covid-19 is relatively rare and that would likely be over-weighted in its range of beta estimates. The approach adopted by the CMA is replicated in this Report.
- The CAA in the Final Decision for the H7 price control for Heathrow set a beta which assumed that a pandemic-like event would occur once in every 20 or 50 years and last 17 or 30 months[154]. This approach recognised that similar events may occur again in the future, but not with the same prominence implied by the then recent market data. CAA's objective was to ensure the impact of the pandemic was not over-represented in the asset beta estimate. A reweighting approach informed by the CAA's methodology is also considered in this Report. Notably, during the H7 appeal, the CMA considered that assigning bespoke weighting to historical data was "*in many respects…similar to standard regulatory practice*" with the main difference being that the CAA applied different weights to historical datapoints to reflect its view that historical betas (if taken unadjusted) would not be reflective of the forward-looking balance of risk[155].

These two approaches inform the analysis set out in the remainder of this subsection.

I The CMA PR19 approach

The CMA's PR19 approach is replicated below based on daily data in line with the focus in PR24 DD and this Report on daily beta estimates (see section 6.5).

Beta estimates are calculated using 2-, 5-, and 10-year estimation windows, alongside spot, 1-, 2-, and 5-year averaging windows, with data as at February 2020, June 2024, and March 2024 for comparison with the PR24 DD. Outlier testing, based on the interquartile range, did not identify any outliers. Average betas are calculated for each averaging window and timeframe.

Using the upper end of the estimates from June 2024 and the full range from February 2020, consistent with the CMA's approach, implies a beta range of 0.28 to 0.30.

Table 21: Average unlevered daily betas per timeframe (June 2024)

Timeframe	Spot	1-year average	2-year average	5-year average
Feb 2005 to Feb 2020	0.30	0.28	0.29	0.31
May 2009 to Jun 2024	0.30	0.27	0.27	0.27

Source: KPMG analysis using Refinitiv Eikon and Refinitiv Datastream data.

The same approach implies a range of 0.28 to 0.30 based on a March 2024 cut-off.

152 The CMA identified and excluded outliers using a statistical rule based on the interquartile range. The CMA did not identify any outliers for the beta estimates as at 28 February 2020 (i.e. pre-Covid) but excluded both individual data points and headline estimates from the 31 December 2020 estimates as outliers. CMA (2021), PR19 Final Determination, para. 9.475.

153 Ibid., para. 9.494.

154 The CAA (2023), Economic regulation of Heathrow Airport Limited: H7 Final Decision, Section 3: Financial issues and implementation, para 9.83 and The CAA (2023), Economic regulation of Heathrow Airport Limited: H7 Final Decision, Section 3: Financial issues and implementation, section 9.

155 CMA (2023), H7 Final Determination, para. 6.72.

Table 22: Average unlevered daily betas per timeframe (March 2024)

Timeframe	Spot	1-year average	2-year average	5-year average
Feb 2005 to Feb 2020	0.30	0.28	0.29	0.31
Feb 2009 to Mar 2024	0.28	0.27	0.26	0.27

Source: KPMG analysis using Refinitiv Eikon and Refinitiv Datastream data.

These ranges align with the 0.28 to 0.30 range determined by the CMA at PR19. In contrast, the lower bound of the PR24 DD range (0.26) is significantly lower.

II Reweighting approach

Adjusted betas are calculated based on the assumption that a distortive event which is similar in impact to the pandemic and war, would affect 1, 2 or 3 out of 20 years[156]. This recurrence frequency informs the weighting of distorted versus undistorted data.

Undistorted betas are calculated as at 28 February 2020, consistent with the CMA's approach at PR19, while distorted betas are calculated as at 18 December 2023. The calculations utilise several spot estimation windows: (1) from 2014 to the cut-off date, (2) a 10-year estimation window to the cut-off date, and (3) an average of 5-year and 10-year estimation windows to the cut-off date.

The analysis considers different assumptions regarding recurrence and estimation windows to mitigate the dependency on specific assumptions.

The analysis indicates an adjusted beta range of 0.28 to 0.32, compared to the PR24 DD range of 0.26 to 0.29.

Table 23: Betas adjusted to assume some reoccurrence of distortive events

Estimation window	Total number of distorted years out of 20		
	1	2	3
From 2014	0.32	0.32	0.31
10-year	0.28	0.28	0.28
Average of 5- and 10-year	0.30	0.30	0.30

Source: KPMG analysis using Refinitiv Eikon and Refinitiv Datastream data.

Both this approach and the replication of the CMA methodology suggest that beta estimates below 0.28 are not appropriate as they are significantly distorted by Covid-19 and the Russia-Ukraine war and are not representative of systematic risk on a forward-looking basis.

6.3. Treatment of forward-looking risk

PR24 capital programmes continue to imply increasing risk exposure for companies even after accounting for new risk mitigations introduced in the PR24 DD. This increase is not yet reflected in beta estimates, which lag in capturing the impact on share prices and total returns due to their reliance on historical data.

Analysis of non-financial UK stocks within the FTSE 350 reveals a positive and statistically significant relationship between capital intensity and beta. Consequently, beta estimates based on historical data for listed water companies are unlikely to fully account for forward-looking risks. Additional comparators and cross-checks are necessary to accurately capture and price these forward-looking systematic risks.

[156] This analysis differs from that included in the September 2023 report. That report effectively assumed that a distortive event would affect 2 years out of 20; this Report assumes that 1, 2, or 3 years would be affected. The September 2023 report also did not take into account data after the start of Russia-Ukraine war in February 2022. This Report calculates distorted betas as of mid-December 2023.

There is an unprecedented step change in the scale of required investment for PR24 and beyond, driven by environmental obligations. To the extent that these additional investments introduce new risks or amplify existing ones, after the application of regulatory mitigations, adjustments to required returns may be necessary to estimate risk-reflective and investable returns.

As a result, it is important to consider whether (1) the marked increase in capital intensity at PR24 changes capital delivery risk and the overall risk exposure of the sector; and (2) betas based on historical data can appropriately price this risk over a long-term forward-looking horizon.

The capital programmes for PR24 and beyond are likely to exacerbate exposure to several risk drivers – *inter alia,* higher complexity of spend, higher uncertainty in ex ante cost forecasts, supply chain risk, input price risk – and increase risk exposure relative to returns. Step changes in forward-looking risk have been highlighted by Moody's, who considers that "*risk of cost overruns or future underperformance has increased*"[157].

The analysis of the risk exposure implied by the PR24 DD Totex using KPMG's stochastic risk model (the KPMG model) finds that there is a material increase in Totex risk relative to PR19 even after accounting for new risk mitigations introduced in the DD (including increased cost sharing, true-up mechanisms for energy costs, Aggregate Sharing Mechanisms and greater use of gated allowances).

To assess the impact of increasing capex intensity on the RoRE range, the PR24 RoRE range from the KPMG model[158] is considered (1) based on a Totex range reflecting risk in previous price controls in line with the PR19 FD[159] (2) based on a Totex range reflecting forward-risk for PR24, holding all other risk factors constant. The change in the Totex RoRE is assumed to be predominantly driven by increased capex intensity.

The resulting variance in the total RoRE range (the average of P10-P50 and P90-P50) for PR24 Totex is *higher* than the corresponding variance based on PR19 Totex[160]. This is in line with CEPA's consideration of capital intensity, which notes that "*larger capex-to-RCV ratios create a greater potential impact on financial returns from cost efficiency incentives, relative to their base return. This can be shown by changes in Return on Regulatory Equity (RoRE)*"[161].

This risk analysis may underestimate the scale of incremental risk exposure driven by AMP8 capital programs due to its reliance on historical data from the water sector and the wider infrastructure project database complied by KPMG. Past data is unlikely to reflect the full extent of the delivery challenge that large infrastructure programmes will face going forwards and may understate forward-looking risk. For example, supply chains will be strained by unprecedented competition for resources due to simultaneous large-scale infrastructure investments across various sectors and globally, significantly impacting delivery risk for water companies.

The appropriate pricing approach for changes in risks depends on whether the drivers of higher risk are systematic (to be captured in beta), asymmetric (factored into the point estimate for CoE), or idiosyncratic (not reflected in pricing).

The drivers of increasing capital delivery risk are likely to have a systematic component, as they are linked to broader economy-wide factors. For example, factors contributing to increased supply chain risk include constraints in the availability of suppliers and materials, compounded by residual impact of disruptions from Brexit, Covid-19, and the war in Ukraine. The competition for resources from other

[157] Moody's (2024), Ofwat's draft determination increases sector risk, p.1.

[158] Moody's (2024), Ofwat's draft determination increases sector risk, p.1. KPMG risk analysis assesses, based on the available empirical evidence and historical sector performance data, whether the DD parameters and mechanisms allow the notional company to earn base allowed return on a median expected basis. The stochastic risk model is constructed to simulate the notional company's risk exposure in RoRE terms by key risk drivers, accounting for risk mitigations purposed by Ofwat in PR24 DD. In this report, the RoRE outputs are based on the "Unmitigated rebased" numbers in the club risk model, which is the scenario with full estimated risk exposure of the notional company under DD regulatory regime, but removing the miscalibration risk, i.e. assuming that companies are able to improve their performance to the levels required in AMP8 to meet the submitted BP targets.

[159] Sourced from Ofwat's published wholesale cost RoRE model in PR24 draft determination, which assumes a +/- 8.5% variance in wholesale Totex over/underspend based on the 2015-2020 data. This information would have been available at the time of PR19 Final Determination, thus this Totex is used as a stand-in for PR19 Totex RoRE.

[160] See Appendix B for detailed results.

[161] CEPA (2024) PR24 Cost of Equity, page. 78.

infrastructure projects adds to these pressures, while the scale and complexity of investments can stress the reliability and stability of the supply chain. These issues relate to broader economic and business environment factors. Similarly, incremental input price risks are influenced by macroeconomic factors that affect a wide range of industries and companies within the economy. As a result, the step change in capital intensity is likely to increase systematic risk and will need to be taken into account in beta estimation.

In the PR24 DD Ofwat noted that while not entirely discounting the possibility that the PR24 capex programme may increase systematic risk, it did not consider the plausible magnitude of such risk increases to support a departure from relying on econometric water company beta estimates.

Ofwat considers that the link between higher capital intensity and increased beta risk is weak. This Report investigates the relationship between capital intensity and beta based on the analysis of non-financial UK stocks included in the FTSE 350[162]. Portfolios formed from FTSE 350 constituents, which are well-diversified and hence 'look through' company-specific factors, can isolate the impact of capital intensity on market beta.

The analysis covers the period from 1 July 1993 to 28 June 2024. This timeframe reflects data availability on capex[163].

The capex-to-opening-total-assets ratio is used as a measure of capital intensity based on which stocks are ranked to form ten equally populated decile portfolios[164] each year. On average, there are 193[165] non-financial UK listed firms with capital intensity ratio available each year.

Table 24: Average capital intensity ratio for each decile (from FY1993/94 to FY2023/24)

Decile	Capital intensity ratio for each decile
1st	0.8%
2nd	1.8%
3rd	2.6%
4th	3.4%
5th	4.3%
6th	5.2%
7th	6.4%
8th	7.9%
9th	10.6%
10th	21.8%

Source: KPMG analysis using Refinitiv Datastream data

162 Financials firms are excluded from the sample, given that the interpretation and implications of ratios, such as the leverage ratio and book-to-market ratios, are different across financials and non-financials firms. Foreign firms are excluded to be consistent with regulatory approach of focusing on the UK listed stocks.

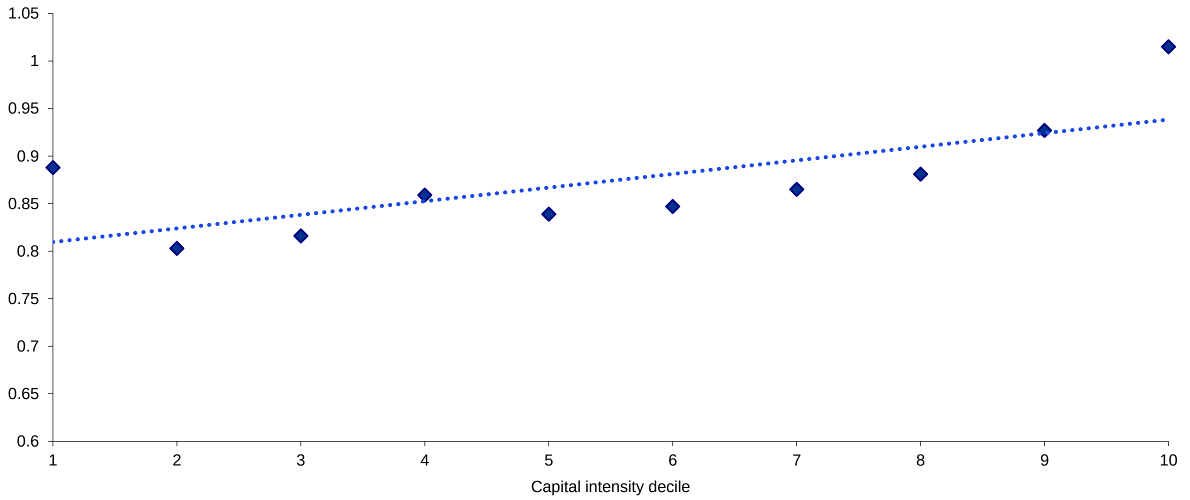
163 The earliest year with sufficient data availability for capex is 1993. Before 1993, more than 50 companies lacked capex data. In 1993, the number of companies with missing capex data dropped significantly to 2, and since then, an average of only 4 companies per year have missing capex data.

164 The portfolios get rebalanced as of July 1st each year to reflect the capital intensity ranking of the year. Stocks are weighted equally within deciles.

165 There are in total 5958 observations from FY 1993/94 to FY 2023/24, i.e. an average of 193 non-financial UK listed firms with capital intensity ratio available each year.

The CAPM beta is estimated for each decile portfolio. As shown in the figure below, a positive relationship between equity beta and capital intensity ratio is evident in the majority of decile portfolios.

Figure 6: Relationship between capital intensity and equity beta based on FTSE350 market-wide evidence



Source: KPMG analysis using Refinitiv Datastream data

The figure indicates a clear and statistically significant relationship between increases in capital intensity and betas. It is intuitive that first and last deciles are relative outliers as they will include firms with no capex and very significant capex respectively – and in consequence a linear relationship with adjacent deciles would not be expected.

Ofwat expects that betas would reflect signalled regulatory changes to some extent as share prices – which inform betas – incorporate views about the future, including news of future regulatory changes. As such it considers that there is a risk of double counting impacts if econometric estimates of betas are adjusted for forward-looking risk.

In principle, it is reasonable to expect the market to incorporate the impact of additional risks into prices once information about the scale of investment and related regulatory policies becomes widely disseminated and understood. However, there is a lag between the impact on share prices and total returns and when betas meaningfully reflect this new information, due to the reliance of beta estimates on historical data. This is consistent with the CMA's view from the H7 appeal that "*while at any point in time a stock's share price is expected to reflect the market's latest expectations of future cash flows and returns, assuming markets are efficient, it does not follow that betas based on historical data are necessarily the most appropriate guide to the future assessment of risk*"[166]. In practice, the scale of required investment has become clear only recently and whilst it is likely to be reflected in shorter-term estimates, it does not follow that it would be reflected in the long-term beta estimates used by Ofwat which assign significantly greater weight to periods with significantly lower investment levels.

Ofwat suggests that betas should reflect changes in risk but does not account for the material increase in 2-year betas in its DD beta estimates. This is particularly notable given that Ofwat commented on the importance of considering "*whether more recent beta data may indicate potential trends that may contradict the 0.26-0.29 unlevered beta range that we have implicitly anchored on 15 years of historical data*".

Ofwat also notes that if the capture of signalled regulatory changes in betas is "*imperfect, data from the affected period will in any case feed into the beta calculations used for the subsequent price control ensuring that data from that period is reflected in the allowed return – albeit with a lag*".

[166] CMA (2023), H7 Final Determination, para. 6.74.

However, the current investability of the price control cannot be contingent on future corrections of under-pricing, as investors base decisions on current market conditions and risk assessments. Additionally, relying on long-term beta estimates means that data from any single price control period will be significantly diluted and may not sufficiently influence beta estimates unless the methodology is revised.

Overall, this Report considers that delivery risk associated with capital programmes is increasing based on the PR24 DD. Capital programmes and associated risks faced in previous price controls are not a good guide for the forward-looking risk exposure. As a result, beta estimates calculated from historical listed water company data are unlikely to price forward-looking risk. Consideration of additional comparators and cross-checks is required to adequately capture and price in forward-looking systematic risks.

6.4. Selection of comparators

Additional data from PNN is both valuable and relevant for estimating the beta for PR24 as SVT and UUW reflect only a subset of the industry whose betas embed historical outperformance that is not representative of the notional company. To account for the limitations inherent in the PNN data, PNN has been excluded from determining the lower bound of the beta range in this Report.

Incorporating NG at the higher end of the beta range could better capture the forward-looking risk exposure for the water sector because (1) the regulatory frameworks for the two sectors are relatively similar, and (2) NG's historical RCV growth aligns more closely with the growth anticipated for water, (3) empirical evidence indicates that the market is pricing higher risk for water relative to energy.

6.4.1. Pennon (PNN)

Historically, SVT/UUW have been used as proxies for the systematic risk of the notional company as the only pure play listed water comparators.

PNN has been a pure play water company following the sale of its waste management subsidiary, Viridor, in July 2020[167]. Initially, its gearing was distorted due to the cash proceeds from the sale resulting in a net cash position. However, this impact was limited to one year can be adjusted for by normalising gearing. In any event, 2-year betas can be calculated from January 2024 onwards based on undistorted gearing data[168].

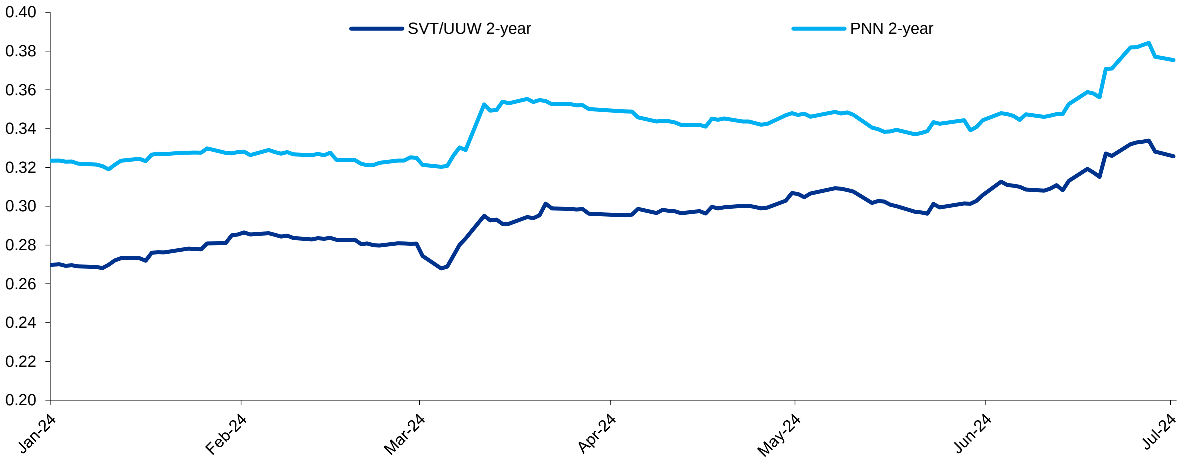
A comparison of the 2-year beta for PNN with the SVT/UUW beta indicates a material differential. In the PR24 DD Ofwat observed that SVT and UUW betas have tracked each other closely over time, while the PNN beta is more volatile and on average higher.

Ofwat questioned whether PNN's higher beta is a persistent feature of the historical data. It also challenged the use of the differential between 2-year betas for SVT/UUW/PNN and SVT/UUW betas for adjusting longer-term beta estimates for SVT/UUW.

[167] Pennon's announcement of disposal of the Viridor Business.

[168] In Thomson Reuters Eikon, the sale of Viridor affects the EV gearing of PNN from 25/11/2020 to 30/11/2021 (the dates at which the Net Debt values from Half Year results of respective years were reflected in the Eikon database). As such 2-year betas from January 2024 can be calculated without normalising for gearing.

Figure 7: Evolution of the differential between pure play PNN and SVT/UUW 2-year betas



Source: KPMG analysis using Refinitiv Eikon and Refinitiv Datastream data.
Note: The chart only covers the periods after the unwinding of the PNN net cash position. These values are based on observed, unadjusted gearing.

The PR24 DD suggests that the lack of convergence between PNN and SVT/UUW betas after the sale of Viridor means that PNN betas are overstated. However, there is no basis for assuming that PNN betas are overstated relative to SVT or UUW. Reliance on SVT/UUW betas as the only pure play listed water companies inherently reflects only a subset of the industry and constrains the breadth and reliability of the beta estimates.

A more plausible hypothesis might be that betas for SVT and UUW are lower relative to PNN as a result of the historical outperformance of these two companies relative to the industry. This outperformance is (1) not representative of the average company, (2) in some cases structural and long term, for example in relation to long term financing arrangements, and (3) crucially, not representative of the notional company, which is assumed to neither out- nor under-perform.

Incorporating additional data from PNN is both valuable and relevant for estimating the beta for PR24, although it must be weighed against the limitation of PNN's data, which is available for only a relatively short period.

To account for the limitations inherent in the PNN data and the uncertainty regarding whether its higher beta is a persistent feature of historical data, PNN has been excluded from determining the lower bound of the beta range in this Report.

6.4.2. National Grid (NG)

Historical betas in the water sector do not sufficiently reflect the forward-looking risks associated with the unprecedented increase in the scale of required investment for PR24. To better capture and price this systematic risk, it is essential to consider comparators that reflect these risks, including data from other UK regulated sectors that have historically exhibited a more significant capital programmes.

In principle, sectors like energy, aviation, and telecoms could serve as useful references for pricing in the risks associated with increased investment intensity. However, the regulatory regimes in the aviation and telecoms sectors differ significantly from that of the water sector, implying distinct exposures to regulatory risk. This contributes to differences between water sector and aviation/telecoms betas and introduces challenges in isolating the impact of investment intensity on beta estimates.

By contrast, the regulatory frameworks for energy networks are more closely aligned to water, making National Grid (NG) a potentially appropriate benchmark for pricing the risk associated with substantial capital programs. The CMA noted at the GD&T2 appeal that "*both sectors enjoy extremely high levels of regulatory protections, in particular in relation to regulated asset bases, inflation protection, revenue certainty and the funding of opex and investment costs. We considered that the most powerful influence on water and energy network unlevered betas is likely to be the fact that they are UK regulated monopolies. As such, water companies are, in principle, reasonable and useful comparators when estimating the beta for the energy networks. This usefulness only increases when the lack of pure-play listed energy networks is taken into account*"[169].

The CMA's comment implies that it is reasonable to consider NG's beta as a proxy. Ofgem also views "*water networks in England and Wales as having very similar characteristics to the GB Energy networks, including a very similar regulatory regime and thematically similar challenges relating to ensuring resilience, managing investment and adapting to climate change*"[170].

There is increasing evidence that the water sector may now be perceived as equally or even more risky than energy networks along some dimensions by equity and credit market participants. For example:

- Barclays notes that "*Ofwat sees water as a lower-risk asset than other regulated assets. We do not see evidence of this, nor do investors... for example, we now see an asset beta for water of 0.40 versus 0.37*[171] *for power*"[172]. Barclays refers to the same investor survey cited by Ofwat in the DD, where both debt and equity investors rated the water sector as the riskiest utility sector and the U.K. as the riskiest country in Europe.
- Moody's notes that "*the lower cost of equity allowance for water companies* [relative to energy networks] *implies that the overall risk should be lower in the water sector. However, the water companies in England and Wales face heightened public and political attention, and tougher performance incentives may prevent them from achieving the allowed returns*"[173]. The score for the stability, predictability, and supportiveness of the regulatory framework for water is currently under review[174], and if downgraded would result in a two-notch delta between water and energy.

Table 25: Comparison of the assessment of business profile factors between NG and water

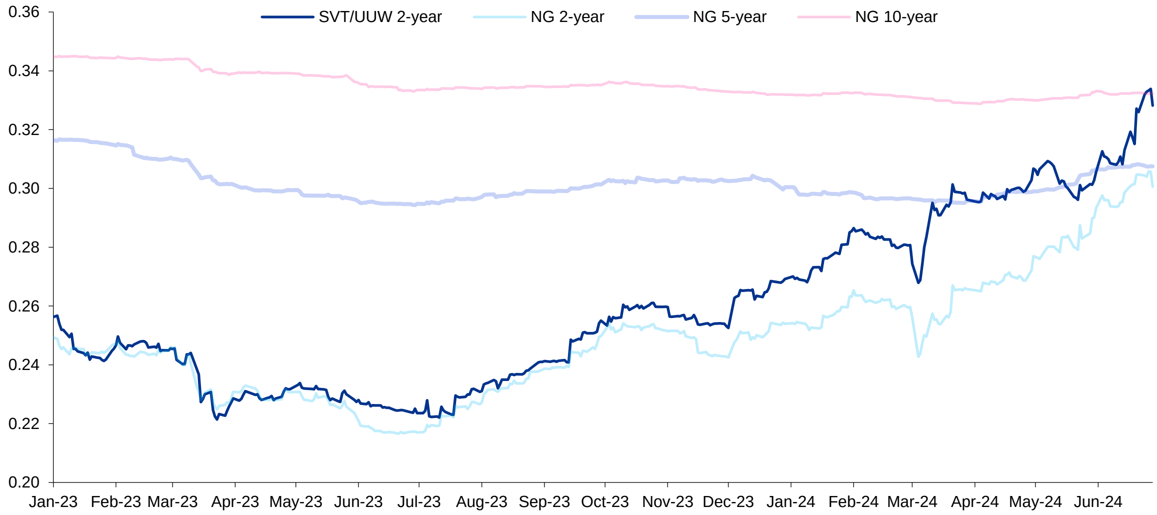
Factor	NG[175]	UK Water[176]	Differential
Stability and predictability of regulatory regime	Aaa	Aa	One notch
Cost and investment recovery (ability and timeliness)	A	Baa	One notch
Revenue risk	Aa	Aa	-

Source: Moody's rating reports

The growing perception of increased risk for the water sector is supported by current market evidence. Since December 2023, the gap between 2-year betas for SVT/UUW and NG has widened. Water sector betas now exceed both 2- and 5-year betas for NG and are aligning closely with NG's 10-year betas.

169 CMA (2021), GD&T2 Final determination, Volume 2A: Joined Grounds: Cost of equity, para. 5.347.
170 Ofgem (2024), RIIO-3 Sector Specific Methodology Decision – Finance Annex, para. 3.197.
171 Barclays uses a debt beta of 0.2.
172 Barclays (2024), Breaking the water cycle – no longer, so positive, p.64.
173 Moody's (2024), Ofwat's draft determination increases sector risk, p.8.
174 Ibid., p.1.
175 Moody's (April 2024), National Grid Electricity Transmission plc, Update to credit analysis, p.12.
176 Moody's (2024), Ofwat's draft determination increases sector risk, p.12.

Figure 8: Evolution of the differential between SVT/UUW 2-year and NG 2-, 5- and 10-year betas



Source: KPMG analysis using Refinitiv Eikon and Refinitiv Datastream data.

These factors support the inclusion of NG among the comparators for PR24. Incorporating NG at the upper end of the beta range could better capture the forward-looking risk exposure for the water sector because (1) the regulatory frameworks for the two sectors are similar, and (2) NG's historical RCV growth aligns more closely with the growth anticipated for water, (3) empirical evidence indicates that the market is pricing higher risk for water relative to energy.

Ofgem is similarly considering the inclusion of additional comparators, specifically European energy networks, to enhance the pricing of forward-looking risk, despite these networks not being directly comparable to GB energy networks. Ofgem noted that "*to ensure that we are capturing the risk of the sector on a forward-looking basis as accurately as possible, we have considered ways to make our beta assessment more robust. As we cannot 'create' pure-play listed comparators, and manual adjustments to historical data (as suggested by the GDNs) are likely to be extremely subjective, we view the best improvements are likely to focus on including other relevant comparators in our dataset.*"[177] This supports inclusion of NG at the upper end of the range as the primary approach to pricing in forward-looking risk for the water sector.

6.5. Data frequency

The Report relies on daily betas which are more statistically robust for liquid stocks. No weight has been attached to weekly or monthly estimates as these have higher standard errors and are subject to a reference day effect.

Typical frequencies used in the estimation of betas include daily, weekly, and monthly. For liquid stocks, which are less prone to asynchronous trading[178], daily betas provide the highest precision due to their lower standard errors and absence of the reference day effect[179]. The PR24 DD considers daily, weekly, and monthly estimates but focuses on the former for these reasons, while recognising that "*this is not the only way of looking at the data*".

[177] Ofgem (2024), RIIO-3 Sector Specific Methodology Decision – Finance Annex, para. 3.192.

[178] Asynchronous trading occurs when a stock trades less frequently than the overall market portfolio, resulting in a lag between the assimilation of new information in the stock price and its reflection in the broader market.

[179] The reference day effect refers to the phenomenon where the calculation of a stock's beta is influenced by the specific days selected as the reference period for the analysis.

6.6. Averaging windows

This Report does not use rolling averages of beta estimates, as these introduce arbitrary weighting of the underlying data and amplify the impact of distortive events compared to spot estimates. Using longer averaging windows does not adequately address the limitations inherent in rolling averages.

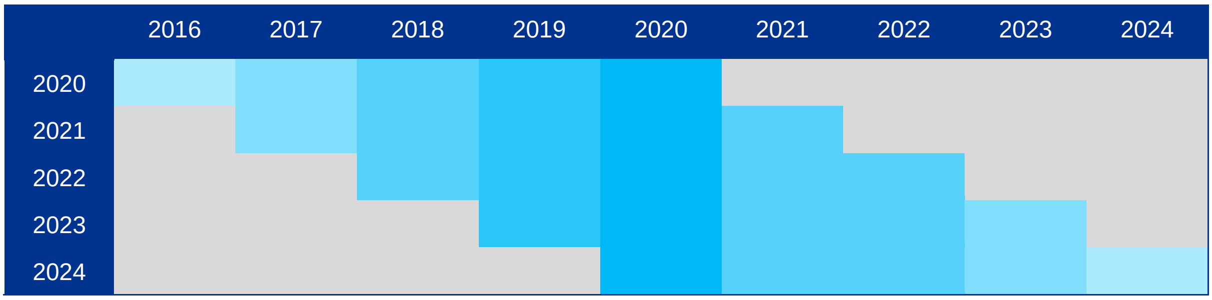
The PR24 DD beta range is based on 2- and 5-year rolling average beta estimates. Rolling averages significantly alter both the period covered and the weight assigned to each data point compared to a spot estimate.

For a given estimation window, spot estimates reflect only the data from that specific window, whereas rolling averages incorporate data from periods before the start of the estimation window.

In a spot regression, each data point (i.e. market and asset return pair) receives equal weighting.

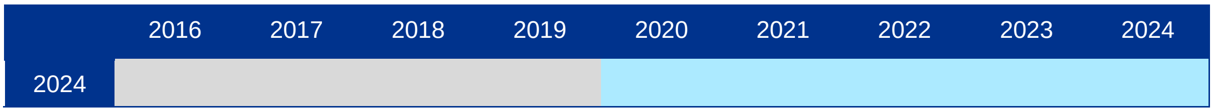
In contrast, rolling regressions assign increasing weight to data points as they approach the centre of the window, such that data within the centre receives greater weight than data at both ends. The figures below illustrate this weighting effect by comparing the relative weight assigned to data by spot and 5-year rolling averages of a 5-year beta. Darker blue indicates higher relative weight.

Figure 9: The relative weighting of data in a 5-year rolling average of a 5-year beta estimate



Source: KPMG analysis

Figure 10: The relative weighting of data in a spot 5-year beta estimates



Source: KPMG analysis

As rolling averages place greater weight on data within the middle of the estimation period, they can introduce bias if beta estimates are unstable, leading to potential upward or downward distortion of the beta estimates.

There is alignment between various parties regarding the shortcomings of rolling averages:

- The CMA at PR19 noted that "*rolling averages place different weight on the various underlying data points and that this can give rise to potential distortions in the figures*"[180] .
- The UKRN CoE Study highlighted that "*the econometric basis for this approach is actually fairly shaky: in particular all parameter standard errors are invalidated by this methodology*"[181].
- Ofgem is proposing to amend its beta methodology for RIIO3 to exclude rolling averages, on the basis that "*this approach can overweight certain parts of the data, providing an inappropriately skewed assessment of the beta over the period*"[182].

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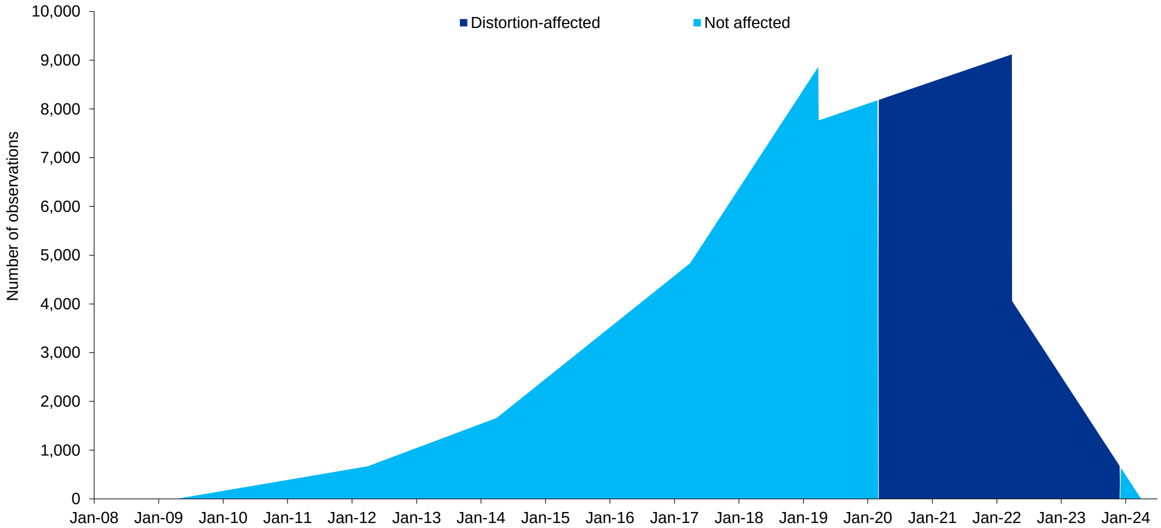
180 CMA (2021), PR19 Final Determination, para. 9.473.
181 UKRN CoE Study, p.50 footnote 67.
182 Ofgem (2024), RIIO-3 Sector Specific Methodology Decision – Finance Annex, para. 3.333.

- Professors Wright and Mason – Ofwat's advisers during the PR19 appeal – consider that rolling beta estimates are a legitimate diagnostic tool for addressing the issue of whether the true (and unobservable) beta is stable over time. However, if the true beta is assumed not to be stable over time, rolling betas have a number of problems as estimators of this time-varying value at any point in time – and most notably standard errors (whether OLS or heteroscedastic-consistent) are spurious[183].

Ofwat recognises that rolling betas can affect the weight placed on data (and particularly more recent data) but considers that using rolling average periods encompassing 15 years of data (up from five at PR19) compensates for this. However, rolling averages tend to amplify the impact of distorted data compared to spot estimates. Under Ofwat's rolling average approach, approximately 40% of the data is affected by distortions. In contrast, a spot 15-year beta as of March 2024 would allocate only 25% of the weight to the affected data.

Figure 11: The proportion of data affected by distortions in the Ofwat DD beta estimate



Source: KPMG analysis and PR24 DD

For these reasons, while this Report considers that rolling beta estimates might be useful for visual inspection of the data, and to indicate possible changes in risk and structural breaks in the data, 'averaging' across the estimates is not an appropriate interpretation of the data. This is because conceptually the average rolling beta estimate does not result in any more 'relevant' estimate of the current pricing of risk than a spot estimate, whilst introducing arbitrary weighting of the underlying pricing signals within the sample under consideration.

6.7. Derivation of the beta range for PR24

An overall beta range of 0.28 to 0.35 is adopted in this Report. This estimate (1) substantially mitigates the impact of transient distortive factors and (2) takes into account – at the upper end of the range – the likely increase in systematic risk going forwards.

[183] Wright, S. and Mason, R. (2020), Comments prepared for Ofwat on the CMA's Provisional Findings Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations: Cost of capital considerations, para. 5.6.

6.7.1. Business-as-usual beta (BAU)

The first step in the estimation of the BAU beta, which reflects the fundamental business risk for water stocks, involves deriving a beta for SVT/UUW that is not significantly impacted by transient events. Replicating the CMA's PR19 approach yields an unlevered beta range of 0.28 to 0.30, aligning with the CMA's estimate[184]. This range is further supported by the beta reweighting method informed by the CAA's H7 methodology.

This beta is then adjusted to include the impact of PNN at the upper end of the range based on the difference between 2-year betas for SVT/UUW/PNN and SVT/UUW. This increases the range to 0.28 to 0.33.

6.7.2. Forward-looking beta

The upper end of the unlevered beta range is derived from NG, whose historical RCV growth more accurately represents the anticipated growth levels for the water sector going forward. This results in an unlevered beta estimate of 0.35[185].

I Cross-checks

Evidence from the relationship between capital intensity and beta based on FTSE 350 excluding financials

The potential impact of the step change in capital intensity on water betas is assessed through a long-short portfolio analysis[186] based on the regression below.

$$r_{\text{long-short porfolio}} = r_{\text{high capital intensity portfolio}} - r_{\text{low capital intensity portfolio}}$$

The long portfolio reflects the forecast capital intensity ratio for the water sector in AMP8 based on the PR24 DD. The short portfolio represents the outturn capital intensity ratio for water companies from recent price control periods. Both ratios are compared to the values from Table 24 to determine their corresponding deciles. The overall approach is set out in the table below.

Table 26: Specification of the long-short portfolio analysis

	Case 1	Case 2
Regression window	FY1993/94 to FY2023/24	
Calculation of the historical capital intensity decile	Based on a 10-year capital intensity ratio	
Resulting capital intensity decile	Between 6th and 7th deciles	
Calculation of the forecast capital intensity decile	Based on the PR24 DD projection of SVT/UUW capex and RCV (7.83%)	Based on the PR24 DD projection of WASC capex and RCV (8.78%)
Resulting capital intensity decile	8th decile	Between 8th and 9th deciles

Source: KPMG analysis using Refinitiv Datastream data

184 CMA (2021), PR19 Final Determination, table 9-17.

185 The estimate is derived based on a replication of the PR19 approach consistent with SVT/UUW betas

186 $r_{\text{long-short porfolio}} = \alpha + \beta_m (r_m - r_f)$.

The deciles used in this analysis – namely the 6th through 9th – encompass a total of approximately 80 stocks per year[187]. The sector decomposition for each of the portfolio is listed in the table below.

Table 27: Sector breakdown in proportion (%) for each decile portfolio

	6th decile	7th decile	8th decile	9th decile
Basic materials	8	10	11	11
Consumer discretionary	29	24	20	24
Consumer staples	13	9	11	10
Energy	2	4	9	9
Healthcare	5	8	5	2
Industrials	30	24	20	18
Technology	3	5	2	3
Telecommunications	2	4	4	8
Utilities	7	12	18	14
Total (%)	100	100	100	100

Source: KPMG analysis using Refinitiv Datastream and Bloomberg data

The long-short portfolio for case 1 is:

$$r_{\text{long-short porfolio}} = r_{\text{8th decile portfolio}} - r_{\text{equally weighted (EW) 6th and 7th decile portfolios}}$$

The long-short portfolio for case 2 is:

$$r_{\text{long-short porfolio}} = r_{\text{EW 8th and 9th decile portfolios}} - r_{\text{EW 6th and 7th decile portfolios}}$$

The CAPM-beta for the portfolio is then calculated. Where the market beta β_m is positive and statistically significant, this indicates that the high capital intensity portfolio has a higher market beta compared to the low capital intensity portfolio. This suggests that higher capital intensity may be associated with greater systematic risk.

$$r_{\text{long-short porfolio}} = \alpha + \beta_m\,(r_m - r_f)$$

The results show a statistically significant (with p-value of 0.00%) increase in priced systematic risk between the deciles. The beta estimates have a relatively tight 95% confidence interval that is very close to the coefficient estimates, suggesting a high level of precision and certainty on the estimation of beta[188]. The regression outputs suggest an increase in capital intensity ratio for PR24 corresponds to an increase in equity beta ranging from 0.0251 to 0.0479 before adjusting for gearing.

Table 28: Equity beta value from the long-short portfolio analysis, case 1

Coefficient	Coefficient value	Standard error	p-value	95% confidence interval	
Equity beta (β_m)	0.0251	0.0065	0.00%	0.0122	0.0379
Constant term (α)	-0.0000	0.0001	85.8%	-0.000	0.000

Source: KPMG analysis using Refinitiv Datastream data

Table 29: Equity beta value of the long-short portfolio analysis, case 2

Coefficient	Coefficient value	Standard error	p-value	95% confidence interval	
Equity beta (β_m)	0.0479	0.0056	0.00%	0.0370	0.0589
Constant term (α)	0.0000	0.0001	72.8%	-0.000	0.000

Source: KPMG analysis using Refinitiv Datastream data

[187] There are in total 1199 and 1192 total number of observations in the equally weighted 6th and 7th decile portfolios and equally weighted 8th and 9th decile portfolios, respectively, from FY1993/94 to FY2023/24. This means on average 20 stocks per decile portfolio per year and in total approximately 80 stocks from 6th to 9th decile portfolios per year.

[188] The 95% confidence interval suggests that 95% of the time the equity beta will fall within the range.

Based on the average EV gearing of the constituent stocks under the relevant decile portfolios, changes in the capital intensity ratio for PR24 correspond to an increase in unlevered beta ranging from in an unlevered beta range of 0.02 to 0.04. This results in implied forward-looking beta of 0.35 to 0.37.

Table 30: Results of the long-short portfolio analysis, unlevered beta impact

	Case 1	Case 2
Equity beta impact	0.03	0.05
Average EV gearing level of the 6-8th decile portfolio	16.3%	
Average EV gearing level of the 6-9th decile portfolio		16.1%
Unlevered beta impact	0.02	0.04
BAU beta for SVT/UUW *plus* PNN	0.33	
Implied forward-looking beta	0.35	0.37

Source: KPMG analysis using Refinitiv Datastream data

Evidence from translating the impact of the increasing capex intensity on RoRE range to the equity beta

Regulators typically consider risk in RoRE terms and calibrate risk allocation such that the allowed CoE reflects the risks implied by ex ante RoRE ranges.

In this context, the potential impact of the increasing capex intensity on the equity beta is assessed through the associated change in RoRE risk exposure arising from the step change in the scale and complexity of capital programmes at PR24.

The increase in PR24 Totex RoRE relative to previous price controls (see section 6.3) is expected to be at least partly driven by systematic factors, such as heightened supply chain risks influenced by broader economic conditions, input prices as well as complexity of investment.

In this analysis, the marginal change in Totex RoRE is assumed to be driven entirely by systematic risk and translated in beta. This could overstate the impact on betas. At the same time, as discussed in section 6.3 risk analysis may underestimate the scale of incremental risk exposure driven by AMP8 capital programs due to its reliance on historical data which would understate the impact on betas.

The variance in RoRE range is converted to an implied standard deviation of the company return, which is a traditional measure of the total risk exposure faced by companies, assuming that each risk driver performance is normally distributed.[189] Based on the RoRE outputs from the KPMG risk model, the total risk exposure of a notional company with higher capital intensity at PR24 is 0.54%, compared to 0.50% with lower capital intensity from previous price controls. This implies a scaling factor of 1.07x in the standard deviation of returns.

The scaled-up standard deviation is translated into equity beta uplift based on the following decomposition of beta:

$$\beta_i = \rho_{i,m} \frac{\sigma_i}{\sigma_m}$$

Where:

- $\rho_{i,m}$ is the correlation between the returns of a company and the market portfolio.
- σ_i is the standard deviation of a company's returns.
- σ_m is the standard deviation of the market portfolio's returns.

[189] See Appendix B for technical details.

This decomposition implies that equity beta should increase proportionally to the increase in total risk exposure of a notional efficient company, assuming that the correlation between the company and the overall market, as well as the volatility of market returns, remains constant. The assumption of a constant correlation holds when the total equity risk exposure is scaled up by a constant multiplier.[190]

A reverse stress test has been carried out to assess whether it is plausible that correlation would change to offset the increased equity risk exposure[191]. The results show that the likelihood of a lower correlation completely offsetting the increase in equity return volatility is less than 10% for the 5- and 10-year estimation windows used for the DD beta.

Based on the difference in the total risk exposure associated with the increasing capex intensity, the unlevered beta expected to be uplifted by the same scaling factor from the BAU beta to 0.35, as shown in the table below:

Table 31: Results of the translating RoRE variance to equity beta, unlevered beta impact

	Unlevered beta
BAU beta for SVT/UUW *plus* PNN	0.33
Scaling factor on beta	1.07x
Implied forward-looking beta	0.35

Source: KPMG analysis using KPMG club risk model and Ofwat PR24 DD wholesale cost model.

Overall, the two cross-checks indicate an unlevered beta range post the impact of higher systematic risk due to the increased capital intensity of 0.35 to 0.37. NG's beta is consistent with the lower end of this range.

6.7.3. Overall beta range

An overall unlevered beta range of 0.28 to 0.35 is adopted in this Report.

Table 32: Overall unlevered beta range for PR24

	Lower bound	Upper bound
BAU beta	0.28	0.33
Forward-looking beta		0.35
Overall range	0.28	0.35

Source: KPMG analysis

[190] $\rho_{i,m}$ (Pearson's correlation coefficient) can be rewritten as follows:

$$\rho_{i,m} = \frac{Covariance(i,m)}{\sigma_i * \sigma_m}$$

The analysis above suggests the totex risk associated with PR24 expected scale of investment, is 1.07 times greater than that of PR19 FD level. Based on the decomposition of $\rho_{i,m}$, the impact of the scaled-up total equity risk exposure of the totex risk will cancel out on the upper and lower side of the formula, due to the fact that:

$Covariance(1.07 * i, m) = 1.07 * Covariance(i,m)$, and

$$\sigma_{1.07*i} = 1.07 * \sigma_i$$

Resulting in:

$$\rho_{1.07*i,m} = \frac{1.07 * Covariance(i,m)}{1.07 * \sigma_i * \sigma_m} = \rho_{i,m}$$

Therefore, the Pearson's correlation coefficient can be assumed to be constant when the total equity risk exposure is scaled up by a constant scaling factor of 1.07.

[191] See Appendix B for details.

7. Notional gearing

7.1. Ofwat's approach in the PR24 DD

Ofwat has retained the 55% notional gearing assumption from the FM, intending for it act as a "*clear signal to companies about the allocation of risk where they adopt financial structures which depart from the notional structure"*[192].

As with the FM, Ofwat's primary motivation for reducing notional gearing is to increase the financial resilience of the notional company and to ensure that it is able to raise finance efficiently. Ofwat maintains its position from the FM that recent high inflation has resulted in a natural reduction in gearing for the notional company. Ofwat also notes that the impact of PR14 'blind year' and PR19 reconciliation models allows for a further organic reduction in notional gearing.

7.2. Commentary on the assumed reduction in notional gearing

The proposed reduction in notional gearing to 55% is not supported by robust market evidence or corporate finance principles. Critically, assuming a lower level of notional gearing does not improve the overall financial position if business risk has increased – assuming lower gearing in practice reallocates risk from debt to equity. In consequence, this Report adopts notional gearing of 60% in line with CMA PR19.

This section comments on each rationale for a reduction in notional gearing as set out in the PR24 DD.

Financial resilience

Assuming a lower notional gearing cannot improve the company's overall financial position with the same level of business risk; rather it transfers risk exposure from debt to equity. Where financial headroom implied by a given level of returns is not adequate to support financial resilience or management of forward-looking risk, the efficient market outcome would be a higher required return on capital to reflect changes in business risk. A reduction in notional gearing to reflect, inter alia, higher risk without adequately pricing in changes in risk through beta could introduce a significant misalignment between risk and return. This approach is not appropriate in isolation as it assumes that a change in capital structure can sufficiently price in higher risk at the enterprise level for the notional firm.

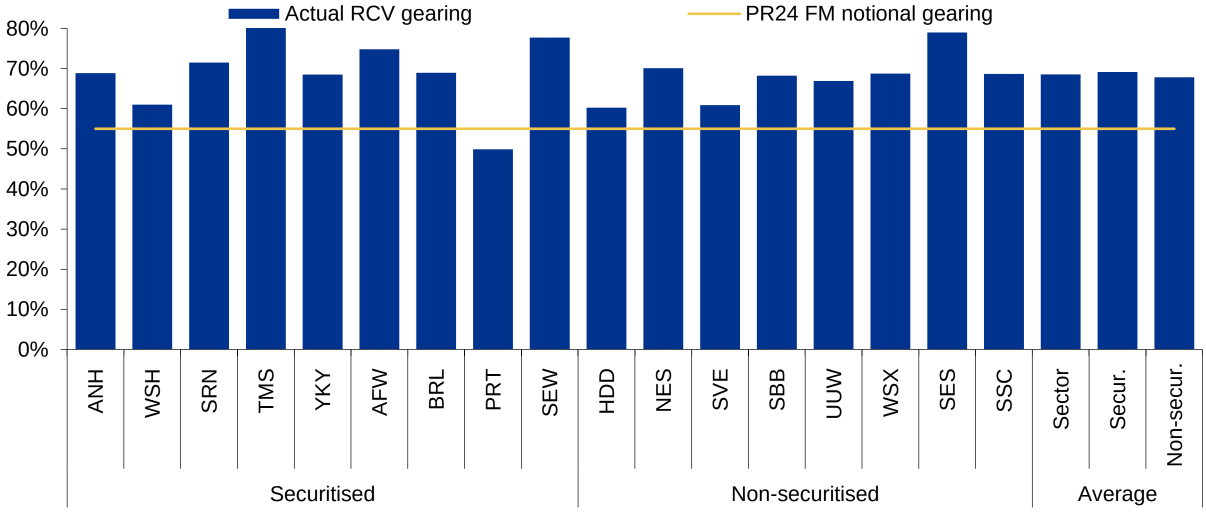
Appropriate benchmarks

Ofwat considers the decision to reduce notional gearing is well justified by the EV gearing of listed water companies (including movement), and the gearing of regulated energy companies in the UK and Europe.

[192] Ofwat (2024), PR24 Draft Determination, Aligning risk and return appendix, p. 24.

The regulatory gearing of water companies – as measured by rating agencies – is more relevant, given rating agency metrics form a critical part of the financeability assessment. As shown in the figure below, the proposed gearing of 55% sits materially below the average for the sector, including companies which have recently sought to de-gear. All else equal, this suggests that 55% gearing is below efficient market levels for the water sector.

Figure 12: Sector gearing, 2023-24



Source: KPMG analysis of 2023-24 APRs.
Note: BRL gearing is for FY23, as the FY24 figure is not separate from the overall SBB figure

7.3. Evolution of gearing in AMP7

In the PR24 DD, Ofwat notes that companies should be able to organically achieve a gearing reduction of at least 5% and that additional equity is not required. However, Ofwat's assumed method for achieving this reduction appears to omit relevant evidence.

Impact of inflation

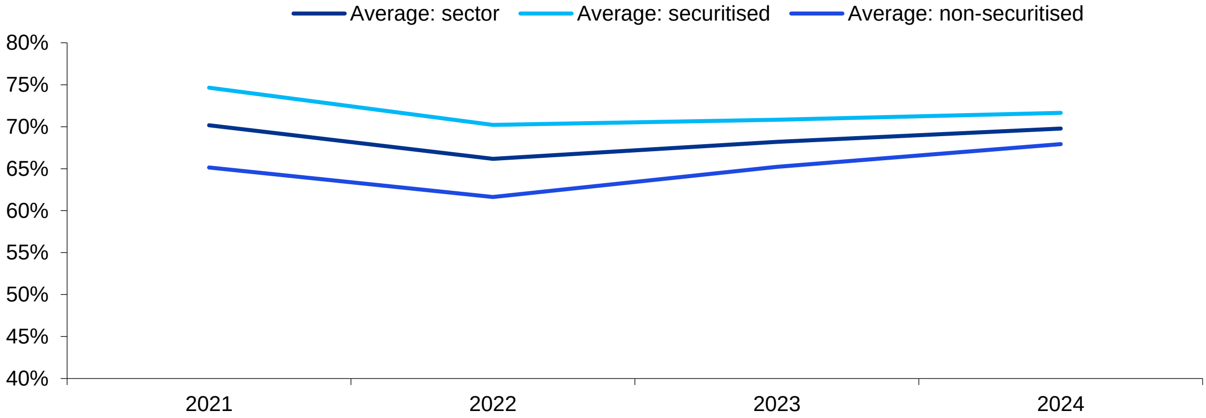
Higher than forecast inflation did act to reduce observed gearing in the sector, particularly in 2022, though inflation has subsequently stabilised at close to BoE target levels and sector average gearing has increased.

However, consideration of outturn inflation in isolation does not capture all drivers of company gearing levels. There are other factors which exert upwards pressure on gearing across the sector in AMP7, most prominently performance in AMP7. Net RoRE[193], which considers all risk drivers including financing, is significantly below allowed returns on a sectorial basis. All else equal, this exerts upwards pressure on gearing which is reflected in the sector's upwards trend in gearing post-2022.

Further, it is necessary to consider drivers of cashflows across the long-run investment horizon, such as the cashflow negative profile expected to arise from the scale of capital programmes in AMP8 and beyond.

[193] Cumulative for AMP7, to end of year 4.

Figure 13: Sector gearing, 2021 to 2024



Source: KPMG analysis

Impact of PR19 reconciliation models

Ofwat also supports a reduction in notional gearing by relying on RCV uplifts arising from PR19 (and PR14) reconciliation models, noting that the average reduction in gearing is 2.7%.

The consideration of specific reconciliation adjustments from the preceding price control for the calibration of AMP8 is inconsistent with the long-standing regulatory stance that each price control is set on a standalone basis and on its own merits, with financeability assessments and notional company specification excluding positive or negative impacts of true ups from previous price control periods.

Consequently, the impact of reconciliation models is not considered relevant for the calibration of notional gearing at PR24.

8. Retail margin adjustment

This Report does not apply a retail margin adjustment (RMA).

The assumption that the retail creditor balance is entirely comprised of trade creditors drives half of the RMA adjustment but does not hold in practice as c.90% of the creditor balance is intercompany. Using the appropriate working capital balance excluding intercompany reduces the RMA from 6bps to 3bps. Updating the assumed financing rate to be internally consistent with the cost of new debt reduces the RMA to less than 1bp.

Ofwat remunerates financing costs for the household retail price control with a net margin which is applied to retail cost-to-serve and wholesale revenues and funds financing costs. A margin approach is applied to this control as the asset-light nature of the retail business means traditional return on capital approaches are less suited to estimation of required returns.

The DD incorporates a 6bps deduction to the appointee WACC in the form of a retail margin adjustment (RMA) to prevent double counting of retail returns. The risk of double count arises because allowed returns are set at the appointee level, incorporating risk from all controls (including retail), while the retail margin also provides compensation for systematic risk in the retail business.

Key assumptions underpinning the RMA

In the DD, Ofwat increased the retail margin from 1% to 1.2%. The application of the RMA in the DD is underpinned by the following assumptions:

1. The systematic risk of retail activities is higher than that of wholesale activities. This assumption is necessary because otherwise, the wholesale WACC would either be equal to or higher than the appointee WACC.
2. The risks attributable to retail activities are fully priced in by the allowed retail margin. If this assumption did not hold, the margin would already be understated, reducing the scope for double counting.

The DD does not include evidence to support these assumptions. The retail margin is estimated using an imprecise approach based on the ratio of allowed household retail revenues at PR24 relative to PR19, rather than based on analysis of retail risks and benchmarking the remuneration required for these risks. For example, the retail business is exposed to inflation risks. While Ofwat has applied a labour cost RPE for retail costs, labour costs account for only 45% of retail costs on average across the sector, leaving a significant residual exposure to inflation risk on non-labour costs. It is unclear whether the 1.2% margin adequately compensates for these residual risks.

Treatment of creditor balances

The calculation of the RMA is materially affected by the inclusion of creditor balances within the working capital requirement. However, the retail creditor balance primarily represents amounts owed to the wholesale business and is largely offset by an equivalent debtor balance therein.

Ofwat does not consider that the creditor balance is fully intercompany as it includes trade creditors as well. However, the inclusion of the full creditor balance in the RMA calculation assumes that none of the balance is intercompany, whereas based on the DD financial models, almost 90%[194] of the creditor balance is attributable to wholesale.

This means that almost all the creditor balance effectively cancels out against wholesale debtors at the consolidated appointee level. The consolidated position is the relevant position for estimation of any RMA as beta is estimated at the appointee level and is de- and re-levered based on gearing which reflects appointee-level cash flows and movements in working capital. Adjusting the calculation to only include 10% of the creditor balance and exclude intercompany creditor positions reduces the adjustment from 6bps to 3bps.

[194] As can be seen from rows 856 on the <Retail Residential> tab and 527 on the <Retail Business> tab.

Working capital financing assumptions

The RMA calculation in the DD uses a working capital financing rate of 4.61% based on BP submissions. There is a wide distribution of financing cost rates across companies, and it is not clear that these estimates have been developed on a consistent basis or cut-off date.

In practice, for an integrated wholesale-retail business, the financing used to manage the retail working capital requirements may be indistinguishable from the rest of the company's debt portfolio as financing is managed at the appointee level. In consequence, this Report considers that it is appropriate to adopt the cost of new debt as the working capital financing assumption. Using the cost of new debt reduces the RMA adjustment from 3bps to less than 1bp.

Alternatively, if the retail business is assumed to be standalone, as implied by the inclusion of the creditor balance in the RMA, all forms of capital a standalone retailer might utilise should be factored into the calculation. A review of credit arrangements for the non-household retail market[195] indicates that associated retailers operating on a standalone basis make extensive use of contingent forms of capital such as Parent Company Guarantees (PCGs) which are a form of contingent capital. Where creditor balances are included in the calculation of capital requirements for a standalone retailer, contingent capital should be included and priced appropriately.

Conclusion

Overall, the DD RMA calculation remains heavily reliant on assumptions. Using the appropriate working capital balance and financing rate reduces the adjustment to less than 1bp. In consequence, this Report does not apply an RMA.

[195] KPMG (2018), Review of credit arrangements for the non-household retail market.

9. Cross-checks

9.1. The role of and evidential bar applied to CoE cross-checks

The DD does not apply a structured and consistent approach to cross-check evaluation. Only the multi-factor model (MFMs) evidence has been evaluated as a cross-check based on stringent criteria that are inconsistent with its intended role as a cross-check rather than a primary model for estimation of returns. Notably, the MAR cross-check used in the DD is not subject to any form of systematic evaluation, suggesting a significantly lower bar compared to the cross-checks proposed by companies.

Applying different criteria and hurdles to different cross-checks risks introducing bias and omission of relevant evidence for cross-checking returns. To ensure a comprehensive and objective assessment, criteria should be applied consistently to all cross-checks.

The primary criteria used to assess cross-checks in this Report are whether they are transparent, targeted, objective, and unbiased and consistent with established academic research. Cross-checks that meet these criteria can, in principle, be effective in increasing the reliability and robustness of the CoE estimate derived based on the CAPM.

The assessment against these criteria indicates that MFMs and inference analysis are likely to represent balanced cross-checks which are targeted, unbiased and grounded in academic research.

By contrast, MAR and market-based cross-checks are less targeted at CoE, more reliant on assumptions and exhibit significant volatility, which all else equal, suggests that less weight should be assigned to these approaches to cross-check CAPM-implied returns.

The role of cross-checks is to validate CAPM estimates using market data and other estimation methodologies, ensuring they are neither excessively high nor low, and to mitigate potential limitations inherent in the CAPM.

However, not all cross-checks are effective, accurate, or unbiased. As a result, it is essential to develop criteria that can reliably assess the effectiveness and accuracy of different cross-checks.

Cross-checks inherently are not designed to replace the CAPM as the primary method for estimation of returns but to ensure that its outputs are aligned with other potential indicators. The criteria applied to determine whether to attach weight to specific cross-checks should reflect their role as supplementary tools.

Balancing the need for meaningful cross-checks with their inherent limitations is crucial when establishing inclusion criteria. While the focus should be on identifying effective and unbiased cross-checks to enhance the reliability of the CAPM-based estimate, overly stringent criteria could restrict the availability of useful inputs. This Report applies the following criteria to evaluate the usefulness of cross-checks in calibrating the allowed CoE:

- Transparent: The cross-check should use widely observable and verifiable information and reflect replicable methodologies, calculations, and results. Any variation in outcomes should be explainable by reference to plausible and defensible assumptions.
- Targeted: The cross-check should effectively isolate variable it is intended to assess from other factors. If the cross-check introduces significant noise, it becomes difficult to distinguish the variable's influence from irrelevant factors, undermining its robustness.
- Objective and unbiased: The cross-check should be an unbiased indicator, free from underlying assumptions that skew towards a predetermined outcome. There should be a degree of independence between the cross-check and the variable that it is intended to assess.
- Consistent with established academic research: The cross-check should be consistent with reputable academic research, providing confidence that regulatory approaches follow best practice.

These criteria are applied to the cross-checks considered in this Report, namely the multi-factor model (MFMs) and inference analysis cross-checks developed by KPMG, as well as market-asset-ratio (MAR) and market-based cross-checks typically applied by regulators. The table below sets out the results of the assessment.

Table 33: Assessment of cross-checks against inclusion criteria

Criteria	MFMs	Inference analysis	MAR	Market-based cross-checks
Transparent	MFMs use observable and verifiable but extensive data. MFMs are based on prescriptive methodologies set out in seminal academic papers. Results can be replicated consistently.	Inference analysis uses observable and verifiable data. It follows a methodology that is clearly laid out in an academic paper. Results can be replicated consistently.	It is difficult to consistently decompose MAR to isolate the contribution of the regulatory CoE given the calculation is assumption-driven and judgmental. There is a wide range of estimates assigned to each value driver by analysts.	The consistency of results from market-based cross-checks, such as infrastructure fund IRRs, and survey evidence, is challenged by their dependence on the specific sample chosen.
Targeted	MFMs estimate CoE directly for water companies.	Inference analysis estimates CoE directly for water companies but not precisely due to the presence of some noise in the estimation of equity risk premia from debt risk premia, driven by the different nature and risk exposures of each type of capital.	MAR is not targeted, as it is influenced by multiple factors beyond the regulatory CoE. Isolating the CoE's contribution requires forward-looking assumptions, which inherently involve a degree of uncertainty.	Infrastructure fund IRRs are affected by different investment mandates (in terms of sectors and geographies) so do not provide a direct signal for the required returns of UK network utilities. Survey evidence and Dividend Discount Models (DDMs) are more targeted.
Objective and unbiased	MFMs can yield both higher and lower CoE estimates compared to the CAPM, depending on a given company's exposure to the additional factors, which can be positive or negative.	Inference analysis can yield both higher and lower CoE estimates compared to the CAPM, depending on the relationship of a company's ERP to its DRP.	The objectivity of MAR is limited by its reliance on assumptions and also depends on the inputs and methodologies used.	Objectivity is inherently limited by reliance on assumptions. These cross-checks can exhibit high volatility.
Consistent with established academic research	Academic research widely recognises the superior explanatory power of MFMs relative to the CAPM. The q-factor and FF5F models are leading MFMs.	Inference analysis is grounded in Merton's contingent claim framework and its practical application by Campello, Chen, and Zhang (CCZ).	There is academic support for the use of Tobin's Q, which is analogous to MARs. It suggests that establishing a meaningful correlation between enterprise value and a specific determinant requires controlling for all other quantifiable and controllable variables. This is not feasible conclusively.	Academic literature recognises both the value and limitations of forward-looking evidence like DDMs and survey evidence, using them in combination with other methods rather than in isolation.

Source: KPMG analysis Note: Green indicates that the cross-check meets the criterion well; Amber that it partially does so; and Red that it does not do so.It is important to acknowledge that any cross-check will be necessarily subject to some limitations, and it is unlikely that a single cross-check could fully satisfy all relevant criteria.

The assessment indicates that MFMs and inference analysis are likely to represent balanced cross-checks which are transparent, targeted, unbiased, and grounded in academic research.

MFMs are the only cross-check that has been demonstrated to enhance the explanatory power of the CAPM, meaning that it can most directly and effectively address any potential misstatements in the CAPM-derived returns.

Inference analysis, while yielding a less precise estimate of the required CoE, provides a useful cross-check as it allows the directly unobservable CoE to be estimated based on generally observable debt pricing.

By contrast, MAR and market-based cross-checks are less targeted, more reliant on assumptions and exhibit significant volatility. This suggests that all else equal, less weight should be assigned to these approaches in cross-checking CAPM-implied returns.

The DD does not set out a structured and consistent approach to cross-check evaluation. In their evaluation of MFM evidence, for example, Robertson & Wright draw on the principles of implementability[196] and defensibility[197] that they applied in the formation of recommendations in the UKRN CoE Study (2018)[198] to introduce specific criteria that alternative asset pricing models such as MFMs must meet to be considered capable of providing reliable CoE estimates.

These criteria include: (1) stronger explanatory power than the CAPM, (2) replicable data construction yielding consistent estimates, (3) stable, statistically significant factor loadings, betas, and risk premia. These criteria imply a high bar, requiring stronger performance across several dimensions than the CAPM, the primary methodology for return estimation. Consequently, they may be more appropriate for evaluating asset pricing models intended to replace the CAPM as the primary model and are unlikely to be proportionate in the evaluation of cross-checks.

These overly stringent criteria increase the risk of miscalibration of the regulatory CoE by excluding evidence that could indicate potential miscalibration of the CAPM-derived estimate. Notably, the MAR cross-check used in the DD is not subject to any form of systematic evaluation, suggesting a significantly lower bar compared to the cross-checks proposed by companies.

Overall, inclusion criteria are not applied systematically and consistently to each cross-check based on the DD. Applying different criteria and hurdles to different cross-checks risks introducing bias and omission of relevant evidence for cross-checking returns. To ensure a comprehensive and unbiased assessment, criteria should be applied consistently to all cross-checks.

9.2. Multifactor models (MFMs)

The differential between q-factor- and CAPM-derived CoE is 0.71 – 1.54% as at June 2024, indicating that listed water companies (SVT/UUW) have higher systematic risk exposure than is priced in by the CAPM.

The updated MFM analysis presented in this Report is based on an academic paper available on SSRN[199] and incorporates enhancements that have increased the size of the dataset which underpins the analysis and improved the statistical performance of the q-factor model.

This Report includes the q-factor model as a cross-check to CAPM-implied CoE, with the weight assigned to it reflecting its stronger explanatory power than the CAPM for the UK market and its ability to enhance the accuracy of regulatory CoE estimates.

The initial commentary on the q-factor model from Ofwat's advisers does not provide sufficient and robust grounds for its exclusion from the suite of cross-checks at PR24 FD. The analysis developed by Ofwat's advisers has significant shortcomings, including mischaracterisation of the analysis, flawed statistical testing methods that deviate from established academic approaches, and the dismissal of robust statistical testing evidence included in the original MFM report.

[196] An approach is considered implementable if it does not entail excessive cost or complexity to carry out.
[197] An approach is considered defensible if it is robust to reasonable criticism.
[198] UKRN CoE Study, p. 5.
[199] Available at SSRN: An investigation of multi-factor asset pricing models in the UK.

MFMs are an extension of the CAPM. Both the CAPM and MFMs start with observed stock returns and use the same basic empirical methodology to explain the variation in returns. However, while the CAPM relies on a single factor to explain observed returns, MFMs incorporate multiple explanatory factors.

The additional factors in MFMs serve as proxies for market-wide systematic, non-diversifiable risks that investors demand compensation for but that are not directly observable[200].

Over time, academic research has converged on a small number of factors to augment the market factor and derive better asset pricing models. These additional factors are integrated into MFMs to better explain observed returns, optimise model accuracy based on observed data, and enhance the robustness of expected return estimates for specific assets.

MFMs have been widely adopted in both corporate finance and academic research for explaining observed returns. A recent study in the Journal of Finance has noted that the use of MFMs has substantially increased in popularity over the last 20 years, with 69% of large corporate users adopting at least one MFM as a measure of the CoE[201].

9.2.1. The methodology for MFM analysis and analytical improvements since the 2022 report

This Report relies on the academic analysis of Tharyan, Gregory and Chen (2024), available on SSRN. The academic paper calibrates and evaluates the performance of the leading MFMs[202], Hou et al's q-factor model (2015)[203] and Fama and French's five-factor model (FF5F) (2015)[204], based on UK data.

[200] Importantly, the factors themselves are not systematic risks; rather, they signal systematic risks faced by a firm that are not directly observable to outsiders. For example, the size factor proxies macroeconomic risks that impact stocks differently based on their size.

[201] Graham, J. (2022). Presidential Address: Corporate Finance and Reality, The Journal of Finance VOL. LXXVII, NO. 4, 1993-1995.

[202] Both the q-factor model and the FF5F have been shown to have strong empirical performance based on US data. The two papers which established these models have, more than 2000 and 6000 citations respectively, which confirms their relevance for the estimation of returns.

[203] Hou, K., Xue, C., & Zhang, L. (2015). Digesting anomalies: An investment approach. The Review of Financial Studies, 28(3), 650-705.

[204] Fama, E. F., and K. R. French. “A Five-Factor Asset Pricing Model.” Journal of Financial Economics,116 (2015), 1–22.

Figure 14: Overview of the methodology for the estimation of MFM-CoE

Data collection

Inputs include:

- data to enable the filtration to exclude companies with non-viable market and book values, foreign companies, financial services and real estate companies and AIM listings.
- returns, market value and accounting data required for the construction of factors.

Factor construction

The premia for additional factors are derived by (1) grouping stocks into portfolios based on characteristics and (2) subtracting the return of lower-risk portfolios from higher-risk portfolios.

Statistical testing

Statistical tests are carried out and regression statistics examined to determine (1) whether the models are superior in terms of explanatory power to the CAPM, and (2) whether one of the two models is superior to the other, based on UK data.

Calculation of MFM-CoE

Factor betas are derived for each factor by running separate multivariate regressions for each estimation window.

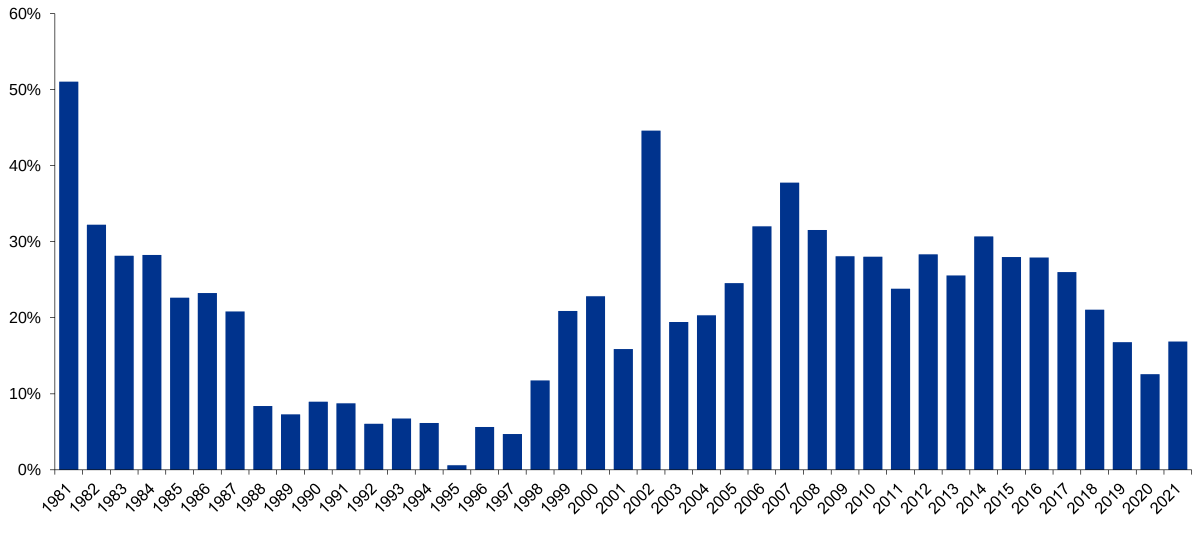
MFM-CoE is estimated under the MFM which (1) is superior to the CAPM and (2) has the best empirical performance based on statistical tests and regression statistics

This CoE is compared to CAPM-CoE

Compared to previous iteration of the analysis developed by KPMG in 2022, the analysis in Tharyan et al. (2024) has been enhanced in several respects. As the 2022 analysis was the first time that these models had been calibrated using UK data, it was anticipated that further improvements would likely be required.

First, the previous analysis had identified significant gaps in DataStream and Bloomberg before 2000, primarily related to companies which have since de-listed. It has now been possible to obtain additional, primary accounting, data from DataStream[205] and significantly increase the sample size.

Figure 15: Percentage increase in the number of companies meeting filtration criteria



Source: KPMG analysis

[205] As noted in Tharyan et al. (2024), this has been made possible by an academic source providing information that enables mapping of company identifiers in LSPD to identifiers from Datastream. It appears that some of the data which previously appeared deleted is accessible but only with a Datastream-specific identifier.

Second, previous analysis followed the Gregory et al. (2013) methodology[206], aligning September market capitalisation data with accounting data from March of the same year. This differed from the approach used in US-based studies, which matched December accounting data with June market capitalisation data. The UK convention was originally based on the prevalence of March year-ends. However, recent analysis indicates a shift towards more December year-ends[207]. As a result, the analysis now aligns December year-end accounting data with end-June market data.

Third, the logic for breakpoint cut-offs was re-examined. The US convention is to use NYSE to establish breakpoints. The nearest equivalent for this in the UK context is the FTSE 350 which can be used as a proxy for the NYSE (the latter has a much higher threshold for inclusion than LSE in terms of market capitalisation). However, the LSPD data only provides a flag for current membership. To address this issue, a “Pseudo 350” index was constructed by ranking all firms on the LSPD each end-June (the point of portfolio formation) according to their market capitalisation. Breakpoints are based on membership of this “Pseudo 350” index to proxy the NYSE.

Fourth, the analysis is updated to the latest cut-off date, June 28th, 2024.

There have no other changes to the construction and application of MFMs.

The enhancements above have resulted in a material increase in sample size and improvement in statistical test results.

[206] Gregory, Alan & Tharyan, Rajesh & Christidis, Angela. (2013). Constructing and Testing Alternative Versions of the Fama-French and Carhart Models in the UK. Journal of Business Finance & Accounting. 40. 172-214.

[207] Agarwal and Taffler (2008) showed that 22% of UK firms had March year ends while 37% of firms had December year ends, based on non-finance industry UK firms listed on the London Stock Exchange from 1979 to 2002. A larger proportion of companies now have a fiscal year end in December. According to the dataset of UK non-financial firms used in this report from 2003 to 2023, 47% of the firms have a December year end, whereas only 19% have a March year end.

9.2.2. Analysis of Robertson & Wright commentary on the application of MFMs

The table below provides an overview of the main technical points raised by Ofwat and Robertson & Wright regarding the MFM analysis in the DD. A more detailed evaluation is included in section 11.1.

Table 34: Overview of the main technical points raised by Ofwat and Robertson & Wright regarding MFM analysis

Key technical points raised by Ofwat and Robertson & Wright	Analysis and commentary
For the water portfolio, the unexplained component of the returns (alpha) is indistinguishable between CAPM and q-factor The improvement in goodness-of-fit from the q-factor model is marginal.	First, it is not appropriate to assess the goodness-of-fit of a model using only two stocks, as this conflates model validity with individual stock performance. Validity should be assessed with well-diversified portfolios that cover the listed equities in an exchange, as the idiosyncratic volatility in individual stocks is expected to significantly reduce the goodness-of-fit. Second, Robertson & Wright do not acknowledge the evidence from the factor spanning test, the standard method in asset pricing literature, which shows that the q-factor model subsumes the CAPM and provides additional explanatory power for returns. Third, although Robertson & Wright's method is not appropriate for evaluating model performance, the updated alpha test based on their approach shows that the value of alpha for the q-factor model is always lower than that of the CAPM, which suggests that the excess returns unexplained by q-factor model is smaller than that by CAPM. Further, the q-factor model's alpha terms are not statistically significant, indicating that the q-factor can explain a significant proportion of the returns of the water portfolios. By comparison, the alpha term of CAPM is statistically significant at 10% in some cases.
Both the CAPM and q-factor model fail the standard GRS test[208], indicating that significant excess returns remain unexplained by these models.	Based on updated analysis of UK non-financial stocks in the FTSE350 from July 1980 to June 2024, the q-factor model passes the GRS test for portfolios sorted by (1) standard deviation and (2) investment ratios, which CAPM fails. This indicates that the q-factor model accounts for a significant proportion of excess returns in well-diversified portfolios that the CAPM fails to explain.
Ofwat notes that "*rerunning KPMG's multi-factor model on daily data instead...generates almost identical estimates on the allowed cost of equity compared to using the simpler CAPM approach*". This finding is attributed to Robertson & Wright's analysis.	The basis of this comment is not entirely clear, but it does not appear to capture the nature of the KPMG analysis as well as of the findings from Robertson & Wright. All the q-factor regressions conducted by KPMG for estimating the CoE are based on daily data. Robertson & Wright's assertion that the CoE derived from the q-factor model being identical to that from the CAPM pertains to their analysis over a long-term window from 2000 to 2020, rather than to changes in data frequency. Note that Robertson & Wright estimate the CoE using raw factor betas without de-levering based on the portfolio gearing

[208] The GRS test indicates whether an asset pricing model could explain the observed returns of all the test portfolios. The test regresses portfolio returns on factor premia for each portfolio separately. If the intercept terms of all the tested portfolios are jointly indistinguishable from zero, the model passes GRS test. The test is binary in the sense that a model could either pass or fail the test, but to assess the performance of different models on a relative basis, the next question would be how much of the variation in observed returns could be explained by the model.

Key technical points raised by Ofwat and Robertson & Wright	Analysis and commentary
	and re-levering to 55% notional gearing. In addition, the window from 2000 to 2020 is not the longest possible regression window. Rerunning Robertson & Wright's analysis based on the updated dataset and a full-period regression from December 13th, 1989, to June 31st, 2024, shows that the q-factor model CoE is materially higher than the CAPM-derived CoE by 70bps.
Two out of three factor premia (size and RoE) are statistically insignificant.	First, based on the enhanced analysis set out in this Report, two out of three premia are statistically significant (RoE and investment). Second, the insignificance of some premia does not invalidate the q-factor model. This model is designed to capture the combined effect of multiple factors, including their interactions. Evaluating MFMs solely based on individual factor significance is inappropriate. Unlike the CAPM, which relies on a single factor, MFMs derive their explanatory power from the interplay of multiple factors. Thus, the overall performance of an MFM should be assessed by its combined ability to explain returns, not by the significance of individual factors in isolation. Overall, based on the analysis set out in this Report: (1) two out of three factor premia are significant, and (2) the GRS and factor spanning tests confirm that these factors, together, improve the q-factor model's empirical performance compared to the CAPM.
The additional factors in the q-factor model exhibit wide confidence intervals. Notably, the 2-year beta for the size factor as of February 28, 2020, is positive, unlike in other cases where the size beta is negative.	Ofwat's advisors use 2-year and 5-year factor betas to demonstrate that additional factor betas may exhibit higher instability compared to the market beta. However, factor betas derived from 10-year regressions tend to be relatively stable. CAPM-betas show significant variability when calculated over 2-year periods. Both CAPM-betas and factor betas fluctuate over time, and this does not appear to represent a robust basis to dismiss the q-factor model. This Report attaches weight primarily to 10-year regression windows.
The daily return of the additional factors does not cumulate exactly to monthly returns, which leads to differences in cumulative returns based on monthly and daily factors over the sample period.	It appears that Robertson & Wright have carried out this check incorrectly as they appear to be compounding factor returns rather than compounding underlying portfolio returns. Additionally, exact reconciliation between daily and monthly factors is not feasible because daily returns for delisted firms cease around the date of delisting, whereas monthly returns for the same firms stop one month before the delisting date.

Source: KPMG analysis

9.2.3. MFM analysis results and implications for CAPM-implied returns at PR24

Each step of the MFM analysis has been re-performed in Tharyan et al. (2024) to incorporate additional accounting data and methodological refinements set out above.

The performance of the q-factor and FF5F models is evaluated relative to the CAPM. The statistical tests deployed – the factor spanning test – is the standard test applied in the academic literature to assess the statistical robustness of asset pricing models. The factor spanning test assesses whether one model has more explanatory power than another by examining if the factors in one model can explain the factors in another. The spanning test directly assesses whether one model is superior to or subsumes another model.

Overall, the results show the q-factor model subsumes both CAPM and FF5F, while FF5F subsumes CAPM but not the q-factor model. Both MFMs add to the explanatory power of the CAPM, however the q-factor model performs better empirically than the FF5F model.

These results are consistent with the findings from the US which show that the q-factor model (1) has stronger empirical performance than older MFMs and (2) outperforms the FF5F in head-to-head spanning tests. Academic literature recognises that (1) the inclusion of the redundant value factor in the FF5F may add 'noise' to the model, (2) cross-correlations amongst factors and a weaker explanatory power due to the hidden investment effect[209], and (3) divergence from the definition of profit in the well-established Peasnell model which may result in a weaker explanatory power for observed returns[210].

Table 35: Summarised factor spanning tests on MFMs (for detailed test results see Tables 2 and 3 in Tharyan et al. (2024), and section 12.3 Appendix C in this Report)

	FF5F vs. the CAPM	q-factor vs. the CAPM	q-factor vs. FF5F	FF5F vs. q-factor
Additional factors	SMB, HML, RMW, CMA	ROE, investment, size	ROE, investment, size	SMB, HML, RMW, CMA
Existing factors	$R_{M} - R_{f}$	$R_{M} - R_{f}$	$R_{M} - R_{f}$, SMB, HML, RMW, CMA	$R_{M} - R_{f}$, ROE, investment, size
Pass / fail	Individually: Pass (CMA), Fail (SMB, HML, RMW) Jointly: Pass	Individually: Pass (ROE, investment), Fail (size) Jointly: Pass	Individually: Pass (RoE), Fail (size, investment) Jointly: Pass	Individually: Pass (CMA), Fail (SMB, HML, RMW) Jointly: Fail
Implication	FF5F model subsumes the CAPM[211]	q-factor model subsumes the CAPM[212]	q-factor model subsumes FF5F[213]	FF5F does not subsume the q-factor[214]

[209] This is because the FF5F measure of profitability divides in-year profit by contemporaneous book equity which, relative to the q-factor approach for calculating this value, incorporates an extra measure of the investment factor (difference between contemporaneous assets and one-year lagged assets).

[210] Some academics have posited that the structure behind the FF5F could be seen as another variant of the accounting model described by Peasnell (1982). Peasnell derives a discount model which computes the economic valuation of firms using accounting measures of profit, provided the accounting is clean surplus. In "clean surplus" accounting all valuation changes in book value (e.g. depreciation and revaluation) must flow through the P&L account. The FF5F measure of profitability uses a definition of in-year profit that is close to a pre-tax operating profit definition. This is quite different to the clean surplus definition of profit assumed by Peasnell which is instead closer to the bottom line. The Peasnell model has long been established and is widely recognised in academic literature. Thus, by adopting a different definition of in-year profit to Peasnell, the FF5F profitability factor may have weaker explanatory power for observed returns.

[211] Whilst the size, value and profitability factors fail individually, the investment factor passes individually and the model passes the joint test, the overall result is a pass.

[212] Whilst the size factor fails individually, as two of the three additional factors pass individually and the model passes the joint test, the overall result is a pass.

[213] While the size and investment factor individually are subsumed by FF5F, the q-factor model overall subsumes FF5F.

[214] SMB, HML and RMW are individually subsumed by q-factor, and all FF5F factors are jointly subsumed by q-factor model.

On that basis, the q-factor model is used in this Report as a cross-check for CAPM-based estimates of the CoE.

The table below sets out the estimates derived using the q-factor model and the CAPM for the SVT/UUW portfolio based on regressions using daily data.

Extending the cut-off date to June 2024 and incorporating the PR24 DD TMR and RFR methodologies implies a differential between q-factor- and CAPM-derived CoE of 0.71 – 1.54%.

Table 36: Differentials between q-factor- and CAPM-derived CoE

Cut-off date	Estimation window	Differential (q-factor CoE less the CAPM)
28/06/2024	10-year	0.71%
28/06/2024	5-year	1.06%
28/06/2024	2-year	1.54%

Source: KPMG analysis
Note: The results are for a value-weighted portfolio.

This suggests that listed water companies have higher systematic risk exposure than that priced by the CAPM.

Overall, MFM evidence *improves* the explanatory power of the CAPM based on a more granular and nuanced assessment of risk than the CAPM.

The evidence considered in this Report implies that the q-factor model should be included in the suite of cross-checks for PR24, with the weight assigned to it reflecting its stronger explanatory power than the CAPM for the UK market and its ability to enhance the accuracy of regulatory CoE estimates.

9.3. Inference analysis

Inference analysis indicates that the CAPM-derived CoE based on the PR24 DD methodology as of June 2024 is c.153bps below the lower bound of the inferred CoE range.

Inference analysis is an asset pricing model that estimates the expected return on equity based on a *relative* pricing approach. This method derives asset returns based on the prices of other assets, specifically the cost of debt and the ratio of return on equity to the return on debt (i.e. elasticity).

Following the analytical approach developed by Campello, Chen, and Zhang (CCZ), inference analysis uses elasticity to estimate expected equity returns for water stocks. This estimate is then used as a cross-check for the regulatory CoE.

The evaluation of inference analysis by Ofwat’s advisers has significant shortcomings and does not provide sufficient and robust grounds for its exclusion from the suite of cross-checks in the FD. These include mischaracterisation of the conceptual and analytical foundations of inference analysis, as well as flawed statistical testing methods.

9.3.1. The premise and basis for inference analysis

Inference analysis uses observed debt pricing and the relationship between the costs of equity and debt to infer the CoE which can be applied as a sense-check to a CAPM-derived estimate. The methodology for inference analysis is grounded in the principles that (1) debt and equity are both claims on the same underlying asset and are sensitive to the underlying factors that affect the firm's asset value[215] and (2) due to its higher risk profile, equity requires a substantially higher expected return compared to debt to attract investor interest.

[215] When the firm's asset value rises, equity holders benefit from larger residual claims, and debt value benefits from the reduction in the firm's leverage and the lower likelihood of default. Conversely, a decline in asset value diminishes the residual claims of equity holders and heightens the risk of default.

9.3.2. Analysis of Mason & Wright commentary on the application of the CCZ analytical approach

As Cochrane (2009)[216] notes, asset pricing theory seeks to "*understand why prices or returns are what they are*". Cochrane differentiates between absolute pricing and relative pricing approaches. In absolute pricing, an asset is priced by "*reference to its exposure to fundamental sources of macroeconomics risks*". This approach is most common in academia, with the CAPM and multi-factor models serving as prime examples. Conversely, the relative pricing approach aims to "*learn about an asset's value given the prices of some other assets*".

Inference analysis is an example of a relative pricing approach. Like the CAPM, inference analysis is an asset pricing model; however, while the CAPM represents an absolute pricing approach, inference analysis is grounded in relative pricing.

Inference analysis serves as a cross-check that is derived from outside the CAPM framework while still being based on an asset pricing model. In this context, Ofwat's advisors Mason & Wright[217] incorrectly characterise inference analysis as an approach that "*bypasses asset pricing models entirely*".

There are clear parallels between CAPM and inference analysis, both of which adopt market-based approaches to CoE estimation by estimating a factor that reflects the risks of a specific company. The key difference is that CAPM estimates required returns based on the sensitivity of a company's equity returns to market returns, whilst inference analysis considers the sensitivity of a company's equity returns relative to debt returns of the same company[218]. The CAPM relates expected returns for the company to expected market returns. In doing so it relies on historical data which may not accurately reflect future expected returns. Inference analysis offers a key advantage by utilising generally observable expected debt returns, over a long-term forward-looking horizon, to estimate the CoE.

Inference analysis uses the analytical formula and methodology developed by Campello, Chen and Zhang (2008)[219] to estimate the expected equity return based on the relationship between equity and debt. This approach draws on Merton's[220] contingent claim framework[221] developed as part of his work on option and derivative pricing.

The objective of the CCZ paper is to derive firm-level expected equity returns using elasticity and corporate bond yields and to investigate whether the different factors in multi-factor models can explain the cross-sectional variation in expected returns. The CCZ paper ultimately develops two asset pricing models:

1 The inference analysis model which infers expected equity returns based on the relationship between equity and debt, specifically using the yield spreads.

2 A multi-factor model incorporating market, size, value, and momentum factors. Typically, factor models are estimated by regressing realised stock returns on realised factor returns, but this methodology requires realised returns to be an accurate proxy for expected returns. CCZ are able to directly regress expected stock returns on expected factor returns by using the expected returns estimated from the first asset pricing model. They find that factor models based on expected returns have significantly more explanatory power than factor models based on realised returns.

216 Cochrane, J. (2009), Asset pricing: Revised edition. Princeton university press, p. 8.
217 Robin Mason and Stephen Wright (2024), A Note for Ofwat on what the cost of debt means for the cost of equity.
218 A comparison between the CAPM and inference analysis in terms of estimation approaches and underlying intuition is set out in Appendix A.
219 Campello, M., Chen, L., & Zhang, L. (2008). Expected returns, yield spreads, and asset pricing tests. *The Review of Financial Studies*, 21(3), 1297-1338.
220 Merton, R. C. (1974). On the pricing of corporate debt: The risk structure of interest rates. *The Journal of Finance*, 29(2), 449-470.
221 In Merton's framework, debt and equity are considered contingent claims over a firm's assets and their values are intrinsically related to the value of the firm's assets.

CCZ is an academic paper and thus it needs to test a hypothesis. Without the second asset pricing model, they would have no way of demonstrating to the reader that the expected returns derived from the first asset pricing model are accurate. The second asset pricing model allows them to test the hypothesis that expected stock returns are related to expected factor returns. They find support for this hypothesis, providing evidence that the expected returns estimated from the first asset pricing model are reliable.

The objective of the KPMG analysis is not to test a hypothesis. It is interested in the expected returns themselves, rather than whether they are related to factors. Its goal is to derive expected returns for water stocks based on debt-equity relationship and debt pricing as a cross-check to the regulatory CoE. The first asset pricing model from CCZ is sufficient for the estimation of expected returns. There is no need to estimate an additional factor model, unlike CCZ.

Mason & Wright contend that KPMG's approach deviates from CCZ by using their method to develop an asset pricing model, rather than employing elasticities "*as an intermediate step to be used subsequently in an asset pricing model*".

This critique misrepresents the CCZ approach, which does not utilise elasticities as an intermediate step but directly derives expected returns through elasticities. Although they then use the expected returns to calibrate multi-factor models and assess the usefulness of expected factor premia, this second step is not pertinent to the KPMG analysis, and thus, constructing the second model is unnecessary in this context.

The table below provides an overview of the primary technical points raised by Ofwat and Mason & Wright regarding inference analysis. A more detailed evaluation is included in section 11.2.

Table 37: Overview of the main technical points raised by Ofwat and Mason & Wright regarding inference analysis

Key technical points raised by Ofwat and Mason & Wright	Analysis and commentary
The regression-based estimates underpinning inference analysis have low statistical significance – in terms of the t-statistics of independent variables and the regression R-squared – and as a result a wide 95% confidence interval which encompasses elasticities which are negative as well as positive.	The F-test, rather than the t-statistics, is relevant for assessing the model's statistical significance as it considers whether the model overall has explanatory power, whereas the t-statistics are better suited for assessing the significance of individual independent variables in isolation, in particular to test a hypothesis concerning a particular independent variable (which is not the goal of this analysis). F-test indicates that the independent variables are able to jointly explain the variation of elasticity and are jointly significant at a 5% significance level. Based on the fixed effect model, the 95% confidence interval on expected elasticity does not incorporate any negative values and is much narrower than suggested by Mason & Wright. In consequence, the expected elasticity is positive and statistically significant. In addition, due to the specific nature of the regressions[222], the R-square is likely to result in lower values.

[222] (1) The regression is performed at the individual firm level rather than on a well-diversified portfolio, which is expected to significantly reduce the model's goodness-of-fit due to the material idiosyncratic volatility in individual stock debt and equity returns. It is well-known that individual stock returns are difficult to predict, which is why tests of asset pricing models are typically performed on portfolios rather than individual stocks. (2) Elasticity is calculated as the return on equity divided by the return on debt where small changes in the return on debt can lead to large variations in elasticity. The dependent variable in this regression – i.e. the ratio of return on equity to return on debt – is inherently more volatile than the dependent variable in the CAPM regression, which is the equity return.

Key technical points raised by Ofwat and Mason & Wright	Analysis and commentary
Elasticity estimates for SVT and UUW differ significantly by 17%, which is implausible given that their betas are similar.	The differences in elasticity between two comparable companies will has no bearing on the differences in their equity betas. Elasticity measures the sensitivity of a company's equity returns to changes in its debt returns, while beta measures sensitivity to overall market fluctuations. As elasticity and beta capture different types of risk, their values are not directly comparable.

Source: KPMG analysis

9.3.3. The methodology for inference analysis and analytical improvements since BP submission

The inferred CoE is calculated based on the expected elasticity of the water portfolio and estimates of debt risk premia and risk-free rate. The figure below summarises the methodology for the analysis.

Figure 16: Overview of the methodology for the estimation of inferred CoE

Data collection	Regression analysis	Calculation of inferred CoE
Data inputs based on the CCZ methodology include firm-level bond and stock returns – outturn elasticity, market leverage, equity volatility and risk-free rate.	• Outturn elasticity is regressed on market leverage, equity volatility and the risk-free rate based on the regression specified by CCZ. • The outputs of the regression analysis are (1) coefficients representing the relationship between elasticity and market leverage, equity volatility and risk-free rate and (2) firm-specific regression intercepts.	• The inferred CoE is derived based on expected elasticity, debt risk premia and risk-free rate. • The range for the inferred CoE for each cut-off date is formed based on the minimum and maximum CoE implied by the 1-, 3-, 6- and 12-month averaging windows as at that date.

Compared to previous analysis submitted alongside BPs which incorporated data since October 2014, the latest iteration has been enhanced by extending the start date to October 2013, the earliest date that allows for a robust sample size on bond returns[223]. There are no identified structural breaks in the regression data from October 2013 onwards[224], so the analysis now covers the full period from this date. Additionally, the analysis in this Report incorporates data up to June 2024.

The table below provides the specification of methodology and assumptions underpinning the calculation of inferred CoE in this Report, along with associated rationale. The averaging windows of 1-, 3-, 6- and 12-month are used to calculate the expected elasticity and debt risk premium to be consistent with the averaging window typically used for estimation of risk-free rate and cost of debt and to stabilise the estimation of inferred CoE.

The market pricing of debt is based on the yields on the iBoxx Non-financials A/BBB 10+ index plus 34bps. This reflects the findings from KPMG's analysis of the yield-at-issue performance of water company issuances during AMP7 that[225]:

[223] Relative to the later years, the number of companies with bond data available before 2013 decreases significantly to be less than 50 companies. This could be because Bloomberg does not have the bond data for stocks listed in the earlier years which subsequently de-listed and could result in the results being affected by survivorship bias should these periods be included in the analysis.

[224] Based on all the three structural break tests: Supremum Wald test, Average Wald test and Average LR test. The null hypothesis of no structural break cannot be rejected at 5% significance level. Therefore, no structural break is identified.

[225] KPMG (2024), Estimating the Cost of New Debt and Additional Borrowing Costs for PR24.

- Issuances after November 2022, which are the most representative and relevant for estimating the allowance for PR24, underperform on all metrics against the A/BBB index, including like-for-like comparison and that without controlling for tenor or rating. Baa1/BBB+ rated issuances specifically underperform the A/BBB 10+ index.
- Whilst Ofwat has removed the benchmark index adjustment in the DD, this measure alone does not ensure the allowance is reasonable and achievable for the notional company. The exclusion of issuances post-March 2023 significantly understates the extent of underperformance of water company bonds.
- An adjustment of 34bps to the yields on the iBoxx A/BBB 10+ index is required to ensure the benchmark is reasonable and achievable for water companies.

Table 38: Methodology and assumptions underpinning the estimation of inferred CoE

	Approach	Rationale
Cut-off date	28 June 2024	Market data cut-off used in the DD (31 March 31) extended to reflect the impact of latest market data.
Averaging window	1-, 3-, 6-, 12-month averages used	Consistent with averaging windows typically considered for estimation of risk-free rate and cost of debt.
Debt risk premium	Market pricing of debt is derived based on outturn yields on the benchmark index, adjusted for default risk by subtracting an expected default loss rate. It is assumed that the effective rating of iBoxx Utilities £ 10+ is A/BBB. The expected default loss rate of 0.15% is calculated based on a 0.24% annualised default rate (the average of highlighted values in Table 2 below) and a 37.6%[226] recovery rate for senior unsecured bonds sourced from Moody's 2024 default study. Debt risk premium is derived by subtracting the yields on the 20Y nominal gilt from default-adjusted nominal yields on the benchmark index. This subtraction isolates the additional return required for credit risk relative to the nominal gilt.	Consistent with the regulatory approach for setting the allowance for debt. CCZ apply a similar default loss rate adjustment based on Moody's data in their analysis.

[226] Moody's (2023), Annual default study: Corporate default rate will rise in 2023 and peak in early 2024, Exhibit 7.

	Approach	Rationale
Treatment of inflation[227]	Inferred CoE is derived in CPIH-deflated terms in three steps: First, an equity risk premium is calculated by multiplying expected elasticity by the debt risk premium. Then an inferred CoE is calculated as the sum of the yields on the 1-month average 20Y nominal gilt and the equity risk premium. Lastly, the nominal inferred CoE is converted into a CPIH-deflated value based on the 20Y CPI swap rate[228].	Consistent with the approach for estimating the regulatory CoE which does not reflect compensation for the inflation risk premium (given that it is estimated using index-linked gilts and a real TMR). The deflation using the CPI-swap rate strips out both market-based inflation expectation and the inflation risk premium from nominal inferred CoE. The resulting inferred CoE is thus consistent with the regulatory methodology.

Source: KPMG analysis

Table 39: Cumulative and annualised default rates for A/BBB corporate issuers

Rating category	Time period	Time horizon	Cumulative default rate	Annualised default rate	Source
A3	1983 – 2023	10Y	2.15%	0.22%	[1]
		20Y	5.48%	0.27%	[1]
Baa1	1983 – 2023	10Y	2.15%	0.22%	[1]
		20Y	5.82%	0.29%	[1]
A/BBB	1983 – 2023	10Y	2.15%	0.22%	[1]
		20Y	5.65%	0.28%	[1]
A3	1998 – 2023	10Y	2.35%	0.24%	[2]
Baa1	1998 – 2023	10Y	2.16%	0.22%	[2]
A/BBB	1998 – 2023	10Y	2.26%	0.23%	[2]

Note: Cumulative default rates are issuer-weighted; (2) Annualised default rate = cumulative default rate / time horizon.
Source: KPMG analysis of Moody's 2024 Annual default study, [1]: Moody's 2024 Annual default study Exhibit 41; and [2] Moody's 2024 Annual default study Exhibit 42.

The range for the inferred CoE for each cut-off date is formed based on the minimum and maximum CoE implied by the 1-, 3-, 6- and 12-month averaging windows as at that date.

Differentials between the inferred CoE and debt pricing for comparison with the CAPM-implied differentials are calculated as follows:

- 1-month average iBoxx yields are converted to CPIH-real values using long-term inflation of 2% consistent with the approach used in the PR24 DD. The same debt pricing is used for the calculation of CAPM- and inferred CoE-implied differentials[229].
- The real iBoxx yields are deducted from the real inferred CoE (derived using CPI swaps) and CAPM-derived CoE.

[227] Consistent with the regulatory CoE, the inferred CoE estimates are derived in real terms, and are assumed to be unaffected by inflation and inflation risk premia. First, although the inputs in the elasticity regression are nominal, both the numerator and denominator of the elasticity ratio (i.e., the dependent variable) incorporate inflation which is likely to limit the extent to which inflation affects elasticity and means that elasticity can be used to underpin estimation of CoE in real terms. Second, the debt risk premium is calculated by subtracting the yield on a 20-year nominal gilt from the yield on a similarly long-term corporate benchmark. This approach isolates the impact of credit risk differences, adjusted for default, without including inflation risk premia, as inflation expectations are similar for bonds of the same maturity. Third, while the company-specific ERP is combined with a nominal risk-free rate to derive the CoE in nominal terms, the resulting nominal CoE is deflated using inflation swaps. This deflation removes any inflation risk premia introduced by the nominal risk-free rate.
[228] Sourced from Bloomberg.
[229] This means that the differentials are not affected by whether 2% inflation or inflation swaps are used for deflation.

9.3.4. Inference analysis results and implications for CAPM-implied returns at PR24

The starting point for the derivation of inferred CoE is the estimation of expected elasticity.

The firm fixed effect regression, excluding outliers[230], results in the following coefficients for α and β.

$$\frac{\partial E/E}{\partial D/D}_{it} = \alpha_i - 0.03\ Leverage_{it} + 110.2\ Volatility_{it} - 0.33\ r_{f_t} + \varepsilon_{it}$$

Stock volatility is positively correlated with elasticity, while the market leverage and risk-free rate are negatively correlated. F-statistics indicate that all three independent variables are jointly statistically significant and can jointly explain the elasticity at a 5% significance level. Additionally, stock volatility is individually statistically significant at a 5% significance level.

To assess the impact and implications of the inference analysis for the allowed CoE at PR24, the Report undertakes two comparisons, which consider (1) how the CAPM-derived CoE estimates compare to inferred CoE estimates and (2) how the differentials between CoE and current debt pricing implied by the CAPM-derived CoE compare to those implied by the inferred CoE (this effectively represents the difference between implied equity and debt risk premia)[231].

The CAPM-derived CoE based on the PR24 DD methodology as of June 2024 is c.153bps below the lower bound of the inferred CoE range.

Table 40: Comparison of CAPM-derived CoE and inferred CoE (June 2024)

CAPM-CoE methodology	Inferred CoE	CAPM-derived CoE	Difference between the CAPM-derived CoE and the lower bound of the inferred CoE range
PR24 DD	6.39 – 6.85%	4.86%	-153bps

Source: KPMG analysis

The differential with current debt pricing implied by the CAPM-derived CoE based on the PR24 DD methodology is similarly significantly below the range implied by inference analysis (152bps).

Table 41: Comparison the differentials with current debt pricing implied by CAPM-derived and inferred CoE (June 2024)

CAPM-CoE methodology	Differential between inferred CoE and current debt pricing	Differential between CAPM-derived CoE and current debt pricing	Difference between the CAPM-implied differential and the lower bound of the inference analysis-implied differential range
PR24 DD	2.42 – 2.88%	0.90%	-152bps

Source: KPMG analysis

All else equal, this suggests that the CAPM-derived CoE based on the PR24 DD is not consistent with current market pricing of debt and the relationship between debt and equity pricing.

The scale of the disconnect between equity and debt pricing implied by the CAPM-derived CoE based on the PR24 DD may be indicative of a material miscalibration of the allowed CoE. This, in turn, could mean that the cost of capital materially exceeds allowed returns for AMP8, making investment in water less attractive compared to other opportunities with better risk-reward profiles. Investors are likely to be disincentivised to invest in water sector equity where CAPM-derived equity risk premia,

[230] This is done by winsorisation, a data cleaning technique commonly adopted in statistics to mitigate the impact of extreme values (outliers) on the coefficient estimates of the regression, which reduces estimation bias and provides more accurate regression outputs. In this Report outliers are 'capped' meaning that they are replaced with the nearest non-outlying values within a specified range. A 5% winsorisation is applied to elasticity ($\frac{\partial E/E}{\partial D/D}_{it}$), which means that all observations greater than the 97.5th percentile are set to be equal to the 97.5th percentile, and all observations lower than 2.5th percentile are set to be equal to 2.5th percentile.

[231] The ranges for inferred CoE and inferred differentials between inferred CoE and current pricing of debt for each cut-off date are formed based on the (1) minimum and maximum CoE and (2) minimum maximum differentials implied by the 1-, 3-, 6- and 12-month averaging windows as at that date.

which underpin allowed returns, do not align practically with and reflect appropriate differentials to lower-risk debt pricing. An investor wishing to invest in the water sector may be significantly more likely to choose debt rather than equity since equity returns are not high enough to compensate for their greater risk.

The availability of equity capital required to meet the substantial investment needs in PR24 is contingent on allowed returns that adequately compensate for forward-looking risk exposure and the opportunity cost of capital in current market conditions. Limitations in the available equity capital could result in a significant customer detriment as well as potential increases in gearing to address the shortfall.

The inference analysis evidence implies that a careful re-examination of the methodology and estimates of the PR24 DD allowed CoE is required to ensure that allowed returns and equity risk premia are sufficient to attract equity capital in current macroeconomic conditions and relative to current levels of observed debt pricing.

9.4. Market-based cross-checks

Market-based cross-checks typically used by regulators like Ofwat and Ofgem indicate that the expected market return has significantly increased relative to PR19.

These approaches, although reliant and sensitive to assumptions, can provide a directional signal on the evolution of expected market return.

The evidence from a dividend growth model, equity analyst estimates, infrastructure fund internal rates of return (IRR) and a survey indicate that expected market return has increased by 115 – 282bps relative to equivalent figures in 2019.

This section examines the implications of market-based cross-checks, such as those typically used by Ofwat and Ofgem, on the PR24 CoE. These market-based cross-checks are inherently more subjective and sensitive to assumptions and have not been demonstrated to improve the accuracy of CoE estimates derived from the CAPM.

Consequently, these approaches are not used as primary cross-checks in this Report but instead provide a directional signal on the evolution of expected market return relative to PR19. They aid in the estimation of an investable CoE for PR24, ensuring water companies remain competitive in attracting capital.

This Report considers evidence from a dividend discount model (DDM), equity analyst estimates, infrastructure fund internal rates of return (IRR) and a survey. Each of these cross-checks indicates that the expected market return has increased relative to PR19.

9.4.1. Dividend discount model

This Report constructs a two-stage DDM model following the approach from the Bank of England (BoE)[232].

However, it departs from this methodology by using long-run dividend growth from the DMS Decompositional approach (in nominal terms) rather than GDP forecasts as a proxy for long-term growth. This approach reflects the CMA's PR19 view that "*historic real dividend growth has been significantly lower than historic GDP growth (at around 2% in the UK) over the longer term and hence it was not clear that assuming that dividends should grow in line with GDP growth forecasts was reasonable*"[233]. In its commentary, the CMA referred to the growth rate of dividends from DMS which is adopted in this Report[234].

[232] Bank of England Quarterly Bulletin (2017), An improved model for understanding equity prices. The detail of the DDM model approach can be found in the appendix.

[233] The ranges for inferred CoE and inferred differentials between inferred CoE and current pricing of debt for each cut-off date are formed based on the (1) minimum and maximum CoE and (2) minimum maximum differentials implied by the 1-, 3-, 6- and 12-month averaging windows as at that date.

[234] For each year this is derived as the average of the historical nominal dividend growth rate between 1899 and that year.

The resulting estimates are set out in the table below. They indicate that the implied estimate of expected market return has increased by 115bps relative to the equivalent figure in 2019.

Table 42: Estimates from the DDM

Calendar year	Estimate (CPIH-real)[235]	Change relative to 2019 (PR19)
2019	8.87%	-
2020	8.04%	(0.83%)
2021	6.71%	(2.16%)
2022	8.47%	(0.40%)
2023	10.02%	1.15%

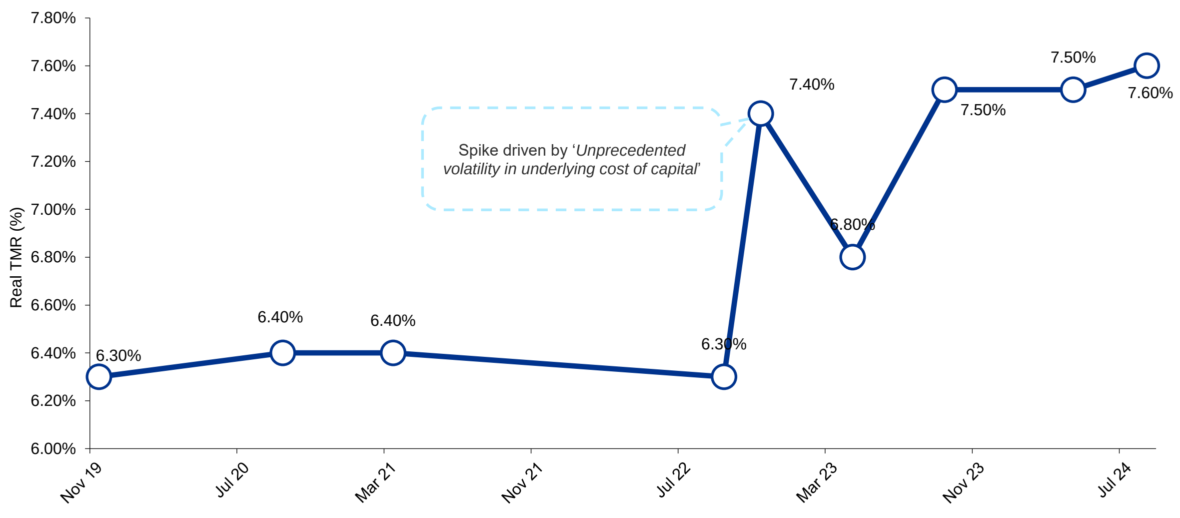
Source: KPMG analysis using Bloomberg and Refinitiv Datastream data

9.4.2. Equity analyst estimates

This report uses Barclays broker reports, as they are one of few investment banks who regularly publish a house view of the real CAPM-CoE.

As of August 2024, the estimate of expected market return has increased by 130bps relative to the equivalent figure in 2019.

Figure 17: Barclays estimates of market returns (CPIH[236])



Source: KPMG analysis using Barclays Equity Research on UK Water

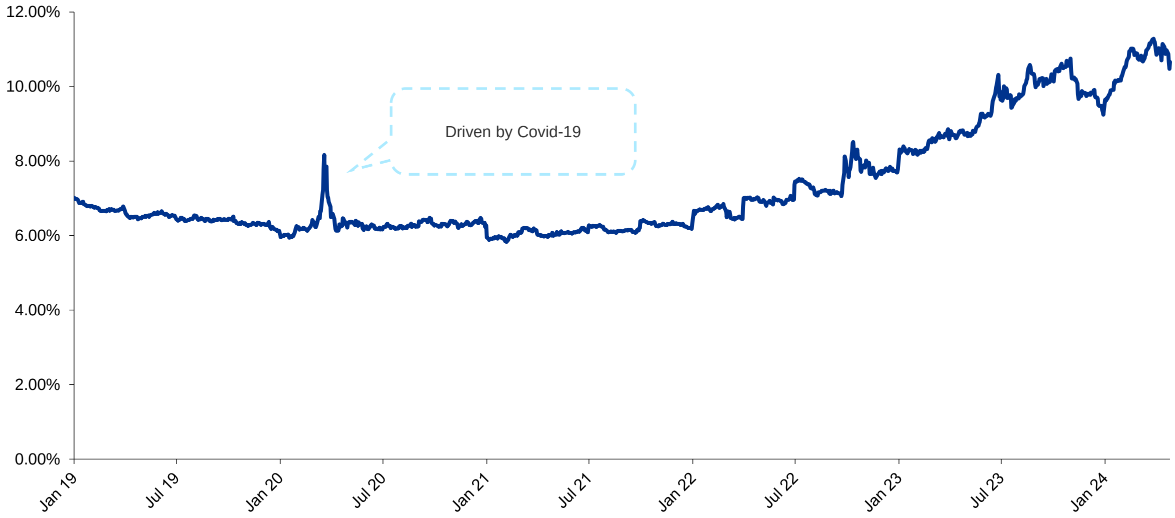
9.4.3. Infrastructure fund IRRs

This Report replicated Ofgem's RIIO-2 approach[237], including the selection of funds[238], used to derive implied IRR values for infrastructure funds.

Implied IRR has increased by approximately 282bps relative to the PR19 level. This figure is higher than the other market-based cross-checks, potentially reflecting the different investment mandates of these funds in terms of sector and geography focus, for example.

[235] Derived using a long-term inflation assumption of 2%.
[236] The model covers the period between 2004 – 2023 due to data availability. Inputs required to derived expected equity cash flow and the price index are sourced from Bloomberg. Analyst forecasts used for short-term growth for the first three years are sourced from the IBES database from Refinitiv Datastream. Long-term dividend growth rate is sourced from DMS.
[237] Ofgem (2020), RIIO-2 Draft Determinations – Finance Annex, p62.
[238] Ibid. This report excludes JLIF LN Equity as data was unavailable.

Figure 18: Infrastructure fund implied IRRs, simple average (CPIH[239])



Source: KPMG analysis using infrastructure fund annual report, Bloomberg and Refinitiv DataStream data

9.4.4. Survey evidence

This Report incorporates evidence from Fernandez et al.[240], a periodical publication that gathers insights from finance and economics professors, analysts, and company managers on the required equity risk premium.

Based on these forecasts, the implied expected market return (defined as MRP plus RFR) has increased by 127bps relative to the equivalent figure in 2019.

Table 43: Estimates from Fernandez et al. survey (CPIH[241])

Forecasts	2019	2020	2021	2022	2023	2024
Expected market return	6.18%	4.80%	4.71%	6.27%	7.65%	7.55%

Source: KPMG analysis

[239] Derived using a long-term inflation assumption of 2%.
[240] Fernandez at al. (2024), Survey: Market Risk Premium and Risk-Free Rate used for 96 countries in 2024. The implied UK TMR is derived as the sum of the average estimate on the risk-free rate and equity risk premium for the UK produced by respondents. The data can be accessed here.
[241] Derived using a long-term inflation assumption of 2%.

10. CoE range and estimate for PR24

The preceding sections of this Report considered the estimation of each of the CoE parameters. The resulting CoE range is set out in the table below on a 55% and 60% notional gearing basis.

This section focuses on the selection of the point estimate for allowed return on equity from a range constructed based on parameter-level estimates. It explores the potential application of an adjustment to the CoE to account for parameter uncertainty, investability and evidence from cross-checks, including alternative pricing models.

Table 44: PR24 CoE range based on parameter-level estimates

Parameter (CPIH)	KPMG (Jun 2024) 55% gearing Lower bound	KPMG (Jun 2024) 55% gearing Upper bound	KPMG (Jun 2024) 60% gearing Lower bound	KPMG (Jun 2024) 60% gearing Upper bound
Notional gearing	55%	55%	60%	60%
TMR	6.75%	6.93%	6.75%	6.93%
RFR	1.55%	2.22%	1.55%	2.22%
Unlevered beta	0.28	0.35	0.28	0.35
Debt beta	0.10	0.10	0.10	0.10
Observed gearing	53.74%	43.72%	53.74%	43.72%
Asset beta	0.34	0.39	0.34	0.39
Notional equity beta	0.63	0.74	0.70	0.83
CoE, appointee	4.82%	5.73%	5.16%	6.11%
RMA	0.00%	0.00%	0.00%	0.00%
CoE, wholesale	4.82%	5.73%	5.16%	6.11%

Source: KPMG analysis

10.1. Aiming up

The CMA considered that the need to promote investment should be a consideration in selecting the point estimate for CoE, stating that *"there are risks of an exit of capital from the long-term investors in the sector, should the cost of capital be set too low"* and *"there are risks that there will be underinvestment in new assets, if the expected return on capital on new investment in AMP8 and beyond does not provide incentives to reinvest capital and maintain or grow the asset base over time"*[242].

The CMA in its PR19 redetermination set the point estimate for CoE 25bps above the midpoint of the CoE range to address investment incentives, comprised of c15bps[243] for parameter uncertainty and 10bps for asymmetric risk on ODIs.

However, the risks to underinvestment identified by the CMA at PR19 are likely to be particularly acute at PR24, driven by the step-change in investment and the associated requirement for equity injections to maintain the financeability of the notional structure. It is imperative that the sector is able to attract capital to finance these investments to avoid the real risk of significant detriment to consumer welfare.

[242] CMA (2021), PR19 Final Determination, para. 9.1394.

[243] The CMA does not provide an explicit split of the 25bps adjustment into that related to investment incentives and to asymmetry. However, the CMA does comment that the 15bps adjustment indicated by Ofwat as "sufficient if we were to make any adjustment to the midpoint at all" in the context of parameter uncertainty is insufficient to address all the concerns that have informed the CMA's decision to aim up. Furthermore, the CMA's estimate of structural asymmetry was 0.1-0.2% RoRE. In this context, it is not unreasonable to assume that 15bps of the 25bps adjustment related to investment incentives and 10bps to asymmetry.

The core principle underpinning aiming up is to mitigate the greater welfare loss arising from underestimation rather than over-estimation of the cost of capital. If the allowed return is set too high, customers end up paying more in their bills than they would have had the allowance been based on the true cost of capital. On the other hand, if the allowed return is set too low, companies are discouraged from making new investments or adequately maintaining existing ones, resulting in suboptimal levels of investment and a significant loss in consumer welfare. As the demand for most regulated services is driven by the essential nature of the services provided, the welfare loss from under-investment is substantial. Consequently, the detrimental impact on consumers is not symmetric when the allowed return deviates significantly from the true cost of capital.

This is in line with the UKRN CoE study, which demonstrates that the consumer welfare loss from under-investment is greater than the consumer welfare loss from marginally higher prices. The study notes that "*with relatively low elasticities, the reduction in consumer surplus from setting the RAR, and hence the regulated price, too high is relatively small. In contrast, the welfare loss from setting the RAR (and hence the price) too low is relatively large. This leads to considerable aiming up, as the optimal choice by the regulator*"[244].

In this context, evidence from alternative pricing models with better explanatory power than the CAPM can be critical in assessing whether the CAPM is appropriately calibrated or whether it requires adjustment. Consequently, the MFM cross-check evidence explored in this Report is used as the primary method for assessing whether and how much aiming up is required.

The table below sets out the aiming up implied by the CoE cross-checks adopted in this Report, namely MFMs, inference analysis and market-based cross-checks. All cross-checks imply that significant aiming up, ranging from 56 to 170bps, is required to address parameter uncertainty and to support investability in current market conditions.

[244] UKRN CoE Study, p. 72.

Table 45: Commentary on cross-check evidence

Cross-check	Implied aiming up adjustment	Commentary on cross-check evidence
MFMs	CAPM may understate the systematic risk of water companies by between 71bps and 154bps.	• By virtue of their additional factors, MFMs more completely capture a stock's systematic risk, which leads to a more accurate estimate of returns than the CAPM. • The q-factor model considered in this Report has stronger explanatory power than the CAPM. • In consequence, MFMs can directly inform the selection of an investable CoE point estimate. MFMs can indicate which CoE outcomes in the CAPM-implied range are investable, ensuring the CoE point estimate is set to attract and retain equity capital. • MFM evidence is assigned the most weight in the calibration of the aiming up adjustment. • The lower bound of the MFM range reflects the 10Y differential between MFMs and CAPM for water companies[245].
Inference analysis	CAPM may understate the required CoE by 66bps.	• Equity investors often have multiple investment options, each with varying risk and return profiles. When making capital allocation decisions, an investor would carefully consider the risk-return profile of each opportunity. Given the riskier nature of equity, the expected return on equity needs to be substantively above the expected return on debt of the same company, as otherwise an investor is unlikely to be incentivised to invest in equity. • If the allowed WACC does not consistently reflect the subordinated nature of equity relative to debt, equity investors may seek alternative investments that appropriately reflect these factors, which could undermine the investability of the sector. • In the context of relative debt-to equity pricing and the need to attract more capital, it is necessary to ensure that the price control is sufficiently attractive to equity. Moody's notes that '*based on the proposed parameters, the cost of equity allowance provides a slightly better buffer to the cost of new debt allowance than the early view estimate. However, it still indicates a rather low equity premium to attract new funding in a higher interest rate environment*[246]. • Inference analysis suggests that the CAPM-derived CoE in this Report (midpoint, pre-aiming up) is at least 66bps lower than would be expected relative to the current market pricing of debt in the sector and the relationship between debt and equity pricing.

[245] June 2024 cut off.
[246] Moody's (2024), Ofwat's draft determination increases sector risk, p.7.

Cross-check	Implied aiming up adjustment	Commentary on cross-check evidence
Market based cross-checks	When combined with midpoint CAPM parameters in this Report, the observed evolution of expected market return relative to 2019 suggests upward pressure on CAPM-derived CoE, ranging from 56 to 170bps[247].	• A range of market-based cross-checks, which consider contemporaneous market evidence, indicates that expected market return has significantly increased relative to PR19. • These cross-checks vary in application but consider a range of benchmarks to assess the market required returns. In this report, the following sources are used: a DDM, equity analyst reports, survey evidence and infrastructure fund discount rates. • Regulators have used these cross-checks in the past to calibrate the TMR range, predominantly Ofgem at RIIO-T2.
Market-to-asset ratios (MARs)	N/A	• This Report considers that MAR as a cross-check is unlikely to assist regulators in determining an investable CoE estimate as it cannot be relied upon as an unbiased indicator. This is driven by the fact there are many unknowns in the determination of a company's value, which means that MAR cannot be accurately attributed to a difference in investors' assumed return of equity from the allowed return. Notwithstanding this, it is noted that Ofwat's MAR-implied cost of equity implies a midpoint of 5.2% CPIH real, approximately 41bps higher than Ofwat's CAPM midpoint.

Source: KPMG analysis

[247] These figures are calculated by subtracting the mid-point CoE estimate, pre-aiming up, at the 55% notional gearing level (5.31% per Table 44) from the same estimate, but with the TMR replaced by the value implied by the sum of the delta and the PR19 FD TMR. For DDM and infrastructure funds, the figures used are averages for the last full year of data (2023).

CPIH-real	DDM	Analyst estimates from Barclays	Infrastructure fund IRRs	Fernandez survey
Delta to 2019	115	130	282	127
RFR	1.96%			
TMR	7.65%	7.80%	9.32%	7.77%
Equity beta	0.69			
CoE	5.87%	5.97%	7.02%	5.95%
Delta mid-point CoE estimate, pre-aiming up, at the 55% notional gearing	*56*	*66*	*170*	*64*

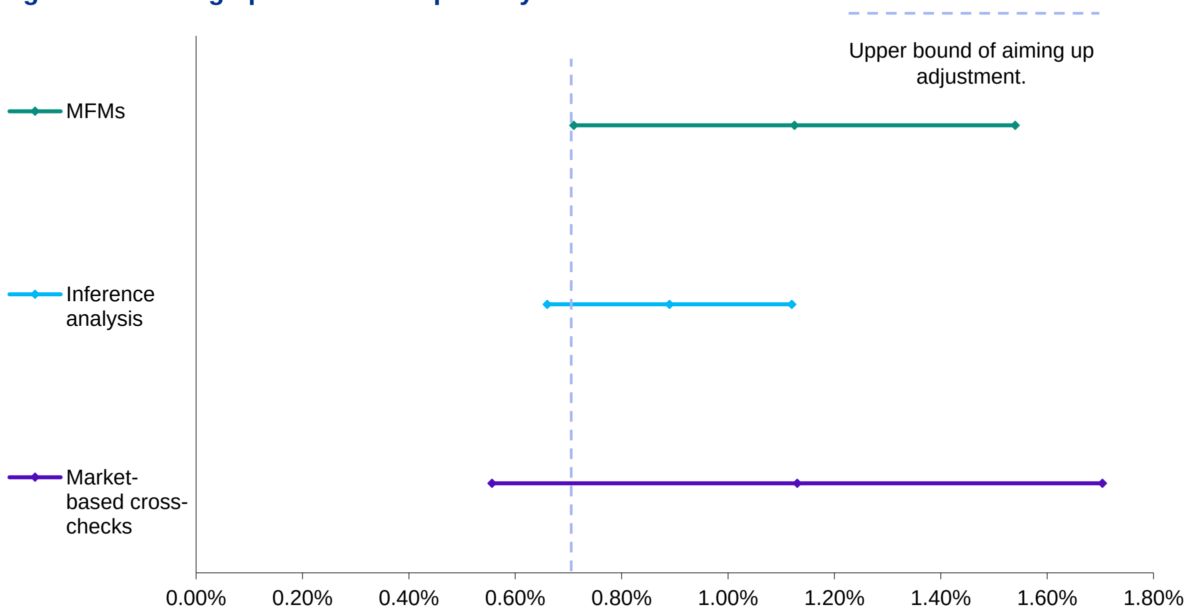
The Report adopts a **lower bound adjustment of 15bps** – in line with the CMA's decision at PR19 – which represents the minimum required to avoid disincentivising high levels of investment projected for AMP8 and beyond in the context of parameter uncertainty.

There is inherent uncertainty in estimating the unobservable CoE and greater potential harm from underestimation of returns compared to overestimation. As a result, there is merit in setting the point estimate for the allowed CoE of essential service providers above the midpoint. The CMA recognised the validity of this rationale when it aimed up on the PR19 CoE to maximise consumer welfare in the context of estimation uncertainty.

The CMA's decision indicates that its concerns around incentives for investment and customer welfare would be particularly acute in case of a step change in investment. In referencing the need for sufficient financial incentives to ensure that appropriate capital projects were identified and designed at a desirable level, the CMA noted that this "*would be particularly the case if Ofwat required a step change in investment to meet changing resilience requirements in the face of climate change challenges or other stresses on existing infrastructure*"[248].

This Report considers that an adjustment of 15bps – in line with the CMA's decision at PR19 – is the minimum required to avoid disincentivising levels of investment required for AMP8 and beyond in the context of parameter uncertainty. This estimate does not take into account cross-check evidence which indicates that higher aiming up would be appropriate to support investability at PR24 as set out in the figure below.

Figure 19: Aiming up estimates implied by CoE cross-checks



Source: KPMG analysis

MFM evidence – and in particular the CoE derived using the q-factor model – is considered the primary cross-check to the CAPM-derived CoE. This is because, *inter alia*, the q-factor model provides a more granular view of risk than the CAPM, improves upon the empirical performance of the CAPM based on UK data and has met the high bar for statistical robustness applied in academic literature for the evaluation of asset pricing models. The q-factor model evidence suggests that the CAPM materially under-prices systematic risk for water companies by at least 70bps. The Report in consequence adopts an **upper bound adjustment of 75bps** based on the MFM evidence.

The Report adopts the midpoint of the implied aiming up range of 45bps but notes that it may be necessary to increase the point estimate to at least the upper end of the aiming up range to support investability.

[248] CMA (2021), PR19 Final Determination, para. 9.1391.

This Report does not aim up to reflect asymmetric risk exposure. The presence of unremunerated asymmetric exposure can undermine the financeability of an investment. This is because investments with (1) expected returns materially below required returns (i.e. with expected loss) and (2) material negative skewness[249] may be deemed less attractive than other available opportunities with better risk-reward profiles.

As a result, the distribution of expected returns is a relevant and important criterion for selection of a point estimate for CoE. Analysis of the DD indicates that the proposed calibration of regulatory mechanisms implies material asymmetry due to the presence of both expected loss and negative skewness. In practice, these factors are likely to affect different notional companies to varying degrees. In consequence, this Report recommends that each company undertake this analysis based on the DD and their DD representations. Where companies identify the presence of expected loss or negative skewness, they should apply an adjustment when selecting a point estimate from the CoE range implied by the analysis in this Report.

10.2. CoE range and point estimate for PR24

The CoE range below is presented pre and post aiming up. On a 60% gearing basis – i.e. reflecting the notional gearing assumption adopted in this Report – the CoE range is 5.16 – 6.11% pre aiming up, and 5.31 – 6.86% post aiming up.

The CoE estimate is also presented on a 55% notional gearing basis to enable like-for-like comparison with the DD estimate. This implies a CoE range of 4.82 – 5.73% pre aiming up and 4.97 – 6.48% post aiming up.

Table 46: PR24 CoE range based on parameter-level estimates, with aiming up included

Parameter (CPIH)	KPMG (Jun 2024) 55% gearing Lower bound	KPMG (Jun 2024) 55% gearing Upper bound	KPMG (Jun 2024) 60% gearing Lower bound	KPMG (Jun 2024) 60% gearing Upper bound
Notional gearing	55%	55%	60%	60%
TMR	6.75%	6.93%	6.75%	6.93%
RFR	1.55%	2.22%	1.55%	2.22%
Unlevered beta	0.28	0.35	0.28	0.35
Debt beta	0.10	0.10	0.10	0.10
Observed gearing	53.74%	43.72%	53.74%	43.72%
Asset beta	0.34	0.39	0.34	0.39
Notional equity beta	0.63	0.74	0.70	0.83
Coe before aiming up, appointee	4.82%	5.73%	5.16%	6.11%
Aiming up	0.15%	0.75%	0.15%	0.75%
CoE, appointee	4.97%	6.48%	5.31%	6.86%
RMA	0.00%	0.00%	0.00%	0.00%
CoE, wholesale	4.97%	6.48%	5.31%	6.86%

Source: KPMG analysis

249 Skewness measures the lack of symmetry in a distribution. If the distribution is negatively skewed, it means that there is a longer left tail, and extreme negative returns are more likely to occur. Conversely, if the distribution is positively skewed, it means that there is a longer right tail, and extreme positive returns are more likely. When an investment exhibits a greater negative skewness compared to available alternative opportunities, risk-averse investors might perceive it as less appealing due to the increased likelihood of unfavourable outcomes, potentially hampering its ability to secure financing and compete effectively with other opportunities.

The point estimate for CoE is 6.12% on a 60% notional gearing basis, incorporating aiming up of 45bps relative to the midpoint. The point estimate on a 55% notional gearing basis is 5.76% which compares to the DD estimate of 4.71% (updated for June 2024 cut-off).

Table 47: Point estimates of PR24 CoE

Parameter (CPIH)	KPMG (Jun 2024) 55% gearing	KPMG (Jun 2024) 60% gearing	Ofwat DD (Jun 2024) Point estimate
Notional gearing	55%	60%	55%
TMR	6.84%	6.84%	6.58%
RFR	1.96%	1.96%	1.55%
Unlevered beta	0.32	0.32	0.27
Debt beta	0.10	0.10	0.10
Observed gearing	48.73%	48.73%	52.91%
Asset beta	0.36	0.36	0.33
Notional equity beta	0.69	0.76	0.60
Coe before aiming up, appointee	5.31%	5.67%	4.57%
Aiming up	0.45%	0.45%	0.28%
CoE, appointee	5.76%	6.12%	4.85%
RMA	0.00%	0.00%	0.13%
CoE, wholesale	5.76%	6.12%	4.71%

Source: KPMG analysis

The key drivers of difference between the KPMG CoE estimate (55% gearing basis) and the DD (updated for June 2024 cut-off) are as follows:

- RFR: The difference relates to the inclusion of adjustments to reflect the convenience yield in ILGs and that investors' risk-free borrowing rate is higher than their risk-free saving rate.
- TMR: The difference relates to the use of a reputable and established data source (DMS 2024) to calculate both ex ante estimates, replacing BEGS, a data source with well-documented deficiencies. Additionally, the data available in DMS 2024 facilitates the direct calculation of the DMS Decompositional estimate in CPIH terms and enables the elimination of likely overstated downwards adjustment for inflation differences.
- Beta: The difference relates to the pricing of systematic risk expected by water investors in the long run:
  - BAU-beta: This estimate replicates the CMA's PR19 approach to mitigate the impact of distortive events, capturing the fundamental business risk for SVT/UUW. The beta is then adjusted to include the impact of PNN at the upper end of the range, based on the difference between 2-year betas for SVT/UUW/PNN and SVT/UUW.
  - Forward-looking beta: The upper end of the beta range is based on NG to better capture the forward-looking risk exposure for the water sector given that (1) the regulatory frameworks for the two sectors are similar, (2) NG's historical RCV growth aligns more closely with the growth anticipated for water, and (3) empirical evidence indicates that the market is pricing higher risk for water relative to energy.
- Aiming up: The estimate adopted in this Report reflects cross-check evidence and the need to incentivise investment. In contrast, the DD adjustment focuses solely on incentivising investment, although it is unclear how the exact estimate has been derived.

- RMA: The RMA is not applied in this Report. When the flaws in the calculation are corrected, the implied adjustment reduces to less than 1bp.

The CoE estimate derived in this Report is consistent with several principles implied by the CMA's determination of the allowed CoE at PR19, supporting consistency with the outcomes of previous price control whilst recognising the new challenges faced by the sector. These principles are important for investor confidence and availability of capital given the long-term financing commitments made by investors in regulated infrastructure. Most drivers of difference between the CoE estimate in this Report and the DD stem from the application of these principles.

Table 48: Analysis of consistency with CMA PR19 principles for CoE estimation

CMA PR19 principles	KPMG CoE estimate	DD CoE estimate
The appropriate risk-free rate for the CAPM lies above the yield on index-linked gilts as gilts and other government bonds benefit from the convenience yield[250].	✓	×
The appropriate risk-free rate for the CAPM lies between the risk-free saving and borrowing rates in line with Brennan (1971) [251].	✓	×
Ex post and ex ante approaches are the most robust basis for deriving the TMR[252].	✓	✓
Beta estimates should not attach significant weight to very rare events such as Covid19 as this could be distortive[253]. The CMA's approach to deriving the beta range resulted in an estimate that was relatively unaffected by observations from the Covid period.	✓	×
Reductions in notional gearing are not required to alleviate financeability constraints, as the WACC is the primary factor which ensures that an efficient firm can finance its functions[254].	✓	×
It is important to avoid disincentivising levels of investment required in the context of parameter uncertainty which supports aiming up when selecting a point estimate for CoE[255].	✓	✓
The need for sufficient financial incentives would be particularly acute "*if Ofwat required a step change in investment to meet changing resilience requirements in the face of climate change challenges or other stresses on existing infrastructure*" [256].	✓	×
Investors should have a reasonable expectation of earning required returns[257].	✓	×
The RMA is required to the cost of capital for the appointee is required to avoid double counting compensation for systematic retail risks given that allowed returns are set at the appointee level taking into account risk from all controls (including retail).	×	✓

Source: KPMG analysis

[250] CMA (2021), PR19 Final Determination, para. 9.264.
[251] Ibid., paras. 9.263-4.
[252] Ibid., para. 9.393.
[253] Ibid., para. 9.493.
[254] Ibid., para. 10.72.
[255] Ibid., para. 9.1402.
[256] Ibid., para. 9.1391.
[257] Ibid., para. 9.1339.

11. Analysis of the commentary from Ofwat and its advisers on MFMs and inference analysis

11.1. Analysis of the commentary on MFM analysis from Ofwat and Robertson & Wright

This section provides responses to the technical points raised by Ofwat and Robertson & Wright regarding MFM analysis.

11.1.1. The empirical performance of q-factor model compared to the CAPM at the water portfolio level

Ofwat and its advisers consider that applying the q-factor model to the water portfolio results in only a marginal improvement in the goodness-of-fit. They also consider that the unexplained component of returns, α, is indistinguishable between the CAPM and q-factor. Consequently, they conclude that the q-factor model does not offer any substantial advantage over the CAPM.

Instead of relying on the factor spanning and GRS tests typically applied in asset pricing literature to well diversified portfolios, Ofwat's advisers adopt an unconventional approach of assessing the validity of q-factor model based on a portfolio comprised of two water stocks. Evaluating performance based on individual stocks does not provide a robust test of the model's overall validity. The adjusted R-squared of both CAPM and q-factor models is expected to be relatively low due to the high idiosyncratic volatility associated with individual stocks, which diminishes the goodness-of-fit for any model.

Although evaluating model performance with a portfolio of only two stocks is inappropriate, applying the alpha test on water portfolios based on the updated analysis shows that the q-factor model has better empirical performance than the CAPM. In particular, as set out in the table below:

- The value of alpha for q-factor model is always lower than that of the CAPM, which suggests that the excess return unexplained by the q-factor model is smaller than that by the CAPM.
- For the q-factor model, the alpha terms are statistically insignificant across various cut-off dates and regression windows, indicating that the q-factor model effectively explains the returns of the water portfolio.
- In comparison, the alpha terms of the CAPM are statistically significant at the 10% level in both the 2-year and 10-year regressions with a February 28, 2020 cut-off, which suggests that a significant proportion of returns remains unexplained by the CAPM.

Table 49: Alpha test based on applying CAPM and q-factor model on the water portfolio (SVT/UUW) based on the current cut-off date and previous cut-off dates submitted to Ofwat

Model	Parameter	Cut-off date	Regression window		
			10-year	5-year	2-year
CAPM	alpha	28/06/2024	0.0001	0.0003	-0.0002
	p-value	28/06/2024	0.534	0.499	0.693
q-factor	alpha	28/06/2024	0.0001	0.0002	-0.0001
	p-value	28/06/2024	0.658	0.587	0.836
CAPM	alpha	31/03/2022	0.0003	0.0003	0.0004
	p-value	31/03/2022	0.132	0.420	0.463
q-factor	alpha	31/03/2022	0.0003	0.0003	0.0001
	p-value	31/03/2022	0.125	0.409	0.188
CAPM	alpha	28/02/2020	0.0003	0.0002	0.0010
	p-value	28/02/2020	0.095	0.511	0.091
q-factor	alpha	28/02/2020	0.0003	0.0001	0.0008
	p-value	28/02/2020	0.128	0.624	0.115

Source: KPMG analysis

In summary, while evaluating performance based on individual stocks does not provide a robust test of the model's overall validity, the q-factor model demonstrates a superior ability to explain returns for the water portfolio compared to the CAPM.

11.1.2. The empirical performance of q-factor model compared to the CAPM based on test portfolios

I GRS test

The appropriate method for evaluating whether an asset pricing model can explain returns is through the GRS test, which is performed based on a set of test portfolios. The null hypothesis is that all alphas across the test portfolios are jointly equal to zero, indicating that an asset pricing model can explain the returns on the test portfolios.

This test is applied to the updated MFM dataset as described in Table 6 in Tharyan et al. (2024). Four types of test portfolios are constructed using UK non-financial stocks listed in FTSE350 during the period from July 1980 to June 2024:

1 Based on the ranking of investment ratio measure employed by the q-factor and FF5F models.

2 Based on the ranking of the standard deviation of annual returns calculated over the previous twelve months, a method that is neutral[258] in terms of model construction (Llewellyn and Shanken, 2010)[259] and used as a UK test portfolio in Gregory et al. (2013).

3 Based on the ranking of market capitalisation, which aligns with the size measurement used in the q-factor and FF5F models.

4 Based on the ranking of momentum of returns over the previous 12 months.

[258] In this setting, neutral means that the measurement is not incorporated as a factor in an asset pricing model and therefore does not favour a particular model.

[259] Lewellen, J., S. Nagel and J. Shanken (2010). A Skeptical Appraisal of Asset-Pricing Tests, Journal of Financial Economics, Vol. 96, pp. 175-194.

Table 50: Results of GRS tests on test portfolios formed by deciles, full period from July 1980 to June 2024 (based on Table 6 of Tharyan et al. (2024))

Test portfolio	Element	CAPM	q-factor
Investment ratio	p-value	0.01	0.31
	Result	Fail	Pass
Standard deviation	p-value	0.10	0.23
	Result	Pass	Pass
Size	p-value	0.03	0.03
	Result	Fail	Fail
Momentum	p-value	0.09	0.04
	Result	Fail	Fail

Source: Source: Tharyan et al. (2024)

Both models fail the GRS test for value-weighted size and momentum portfolios. However, the q-factor model passes the GRS test for investment ratio and standard deviation test portfolios, indicating it can explain the returns of these test portfolios. Conversely, the CAPM fails the GRS test based on the investment ratio, and marginally passes the neutral test based on standard deviation of returns at 10% significance level. This suggests that a significant portion of excess returns in the test portfolios remains unexplained by the CAPM. Additionally, the CAPM's failure to price portfolios based on investment ratio, particularly given the scale of investment required in the water sector for AMP8 and beyond, underscores a significant and relevant limitation of the model.

Taken as a whole, the GRS test results suggest that the factors in the q-factor model are relatively complete in explaining return variations and demonstrate superior explanatory power compared to the CAPM.

II Alpha test on hedged portfolios

Rather than relying on the alpha terms of a water portfolio consisting of two stocks, a more systematic approach involves testing the statistical significance of alpha terms using hedge portfolios constructed from the test portfolios. This method is also used in the statistical tests of Hou et al. (2021), where a hedge portfolio is created by subtracting the bottom decile from the top decile. A CAPM regression is then performed on this hedge portfolio.

$$r_{\text{hedged portfolio}} = r_{\text{top decile portfolio}} - r_{\text{bottom decile portfolios}}$$

The results in the table below confirm that there is a substantial proportion of returns that remains unexplained by CAPM for the hedge portfolio constructed using investment ratio. Additionally, the adjusted R-squared for the q-factor model is at least 21% higher than that for the CAPM, and nearly 60% higher compared to the CAPM for large-minus-small size portfolios.

Table 51: Alpha tests on the hedged portfolios, full period from July 1980 to June 2024 (based on Table 7 of Tharyan et al. (2024))

Test portfolio	Element	CAPM	q-factor
Investment ratio	alpha	-0.76%	-0.37%
	t-stat	-3.31	-1.79
	Adjusted R^2	0.019	0.229
Standard deviation	alpha	-0.40%	0.08%
	t-stat	-1.22	0.28
	Adjusted R^2	0.139	0.357
Size	alpha	-0.23%	-0.16%
	t-stat	-1.19	-1.35
	Adjusted R^2	0.028	0.622

Source: Tharyan et al. (2024).

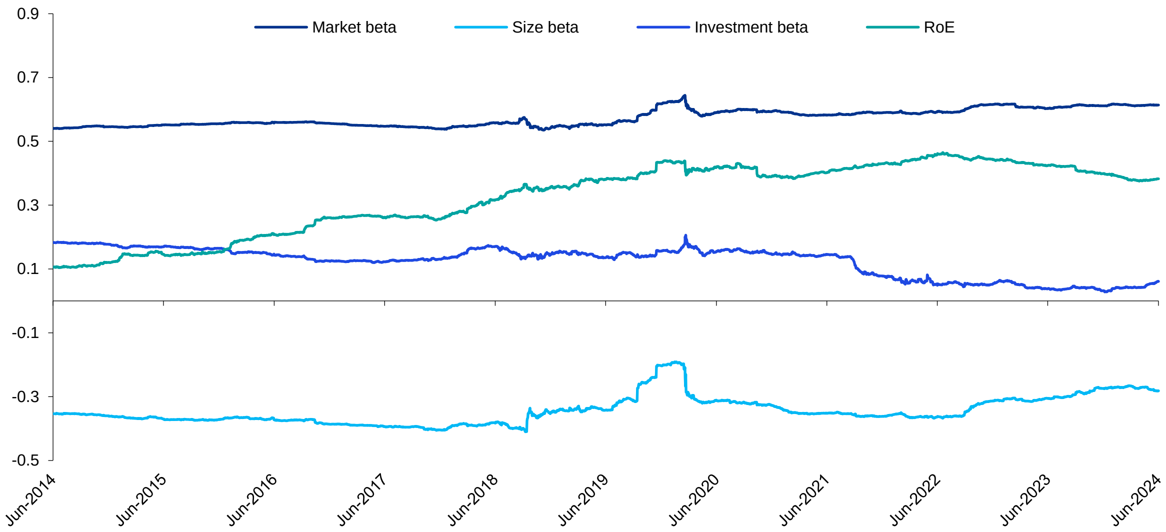
11.1.3. The stability of the factor loadings in q-factor model

Robertson & Wright highlight the instability of the 2-year and 5-year betas for the additional factors in the q-factor model without considering the relatively stable 10-year factor betas. This appears to be somewhat inconsistent with Ofwat's stated focus on longer-term beta estimates.

While they acknowledge that this instability also affects the market beta, which exhibits nontrivial variation over time, they appear to apply a higher bar the q-factor model evidence in terms of factor stability.

Figure 20 illustrates the evolution of the 10-year factor betas over the last decade. While there is some volatility in both market beta and the additional factor betas, they generally exhibit greater stability than the 2- and 5-year factor betas highlighted by Robertson & Wright.

Figure 20: Evolution of 10-year factor beta over the last decade



Source: KPMG analysis

11.1.4. The CoE differentials between CAPM and q-factor based on full period regression window

To evaluate the impact of factor loading volatility on the CoE, Robertson & Wright re-estimate the CoE using regression analysis for the period from April 1, 2000, to March 31, 2022. They state that this is the longest timeframe considered feasible based on the data submitted by KPMG in 2022. They find that the CoE estimated using the q-factor model is 3.35%, which is almost identical to the CoE derived using the CAPM (3.32%).

First, the dataset submitted to Ofwat includes daily returns for all factors in the q-factor model, as well as daily returns for SVT and UUW from December 13th, 1989, to March 31st, 2022. This represents the longest possible period since the water stocks were listed. As a result, it is feasible to conduct a full-period regression starting from 1989.

Second, Robertson & Wright estimate the CoE using raw factor betas without de-levering based on the portfolio gearing and re-levering to 55% notional gearing. The rationale for using raw betas in the context of determining the differential for setting the notional CoE is not clear.

A full-period regression from December 13th, 1989, to June 31st, 2024, is conducted to estimate the CoE for the water portfolio based on the longest possible window. The outputs from the CAPM and q-factor regressions are set out in Table 52 below. All factor betas from the CAPM and q-factor model are statistically significant, with p-value of 0.00%. The 95% confidence intervals for all factors are tightly clustered around the coefficient estimates, indicating a high level of precision and certainty. This precision translates into a robust estimate of the CoE derived from the full-period regression.

Table 52: Factor betas from CAPM and q-factor regressions based on full period

Coefficient	Coefficient value	Standard error	p-value	95% confidence interval	
β_{market} coefficient (CAPM)	0.5842	0.0124	0.0000	0.5599	0.6085
β_{market} coefficient (q-factor)	0.5335	0.0139	0.0000	0.5062	0.5608
β_{size} coefficient (q-factor)	-0.2271	0.0205	0.0000	-0.2672	-0.1870
$\beta_{investment}$ coefficient (q-factor)	0.1666	0.0249	0.0000	0.1177	0.2155
β_{RoE} coefficient (q-factor)	0.0891	0.0263	0.0010	0.0375	0.1407

Source: KPMG analysis

The raw betas obtained from the regressions are de-levered based on the full-period market cap weighted EV gearing of SVT and UUW (41.61%), and re-levered using the 55% notional gearing. The resulting CoE estimates are 5.32% for the CAPM and 6.02% for the q-factor model, leading to a CoE differential of 70bps. This figure is closely aligned to the differential for the 10-year regression window of 71bps as of June 28th, 2024, cut-off date.

Overall, the CoE differential between the q-factor model and CAPM, based on the updated q-factor model and full-period regressions, is significantly higher than that calculated by Robertson & Wright.

11.2. Analysis of the commentary on inference analysis from Ofwat and Mason & Wright

This section provides responses on the technical points raised by Ofwat and Mason & Wright regarding inference analysis.

11.2.1. Specification of the panel regression model

CCZ use a pooled Ordinary Least Square (OLS) regression, which assumes that the average elasticity is the same across firms. If the assumption of uniform average elasticity across firms does not hold, alternative models, such as the fixed effect model, should be used. The fixed effect model incorporates firm-specific, time-invariant effects, relaxing the assumption of uniform elasticity and accounting for individual heterogeneity[260] across firms that affects elasticity.

The pooled OLS regression can be expressed as follows, where the intercept term α is fixed across firms.

$$\frac{\partial E/E}{\partial D/D}_{it} = \alpha + \beta_L Leverage_{it} + \beta_V\ Volatility_{it} + \beta_r\, r_{f_t} + \varepsilon_{it}$$

The fixed effect model can be expressed as follows, where the term u_i represents the firm-specific, time-invariant effects.

$$\frac{\partial E/E}{\partial D/D}_{it} = \alpha + u_i + \beta_L\ Leverage_{it} + \beta_V\ Volatility_{it} + \beta_r\, r_{f_t} + \varepsilon_{it}$$

The fixed effect model can also be expressed as:

[260] Individual heterogeneity, in statistical terms, refers to differences among individuals or firms that are not completely random.

$$\frac{\partial E/E}{\partial D/D}_{it} = \alpha_i + \beta_L\, Leverage_{it} + \beta_V\, Volatility_{it} + \beta_r\, r_{f_t} + \varepsilon_{it}$$

This alternative expression may be more intuitive, as the firm-specific, time-invariant effect is represented by a firm-specific intercept α_i, rather than a constant intercept term (α) as in the pooled OLS regression.

It is standard practice for econometricians to base the selection of the panel regression model on statistical testing[261]. While CCZ do not mention any such tests and directly use pooled OLS regression for estimating elasticity, this Report performs statistical tests to select the appropriate panel regression models. The tests are implemented based on the practical guide by Park (2011)[262]. In particular, the F-test and Breusch-Pagan Lagrange Multiplier (LM) test are conducted to inform the selection of the appropriate model. The null hypotheses for these tests are as follows:

- F-test: the firm-specific fixed effects (u_i) are jointly zero.
- Breusch-Pagan Lagrange Multiplier (LM) test: random effects are insignificant.

The table below summarises the suggested approach based on the guide depending on the conclusion of the F-test and the LM test:

Table 53: Guidance on the selection of the model for panel data[263]

F-test (for fixed effect)	Breusch-Pagan LM test (for random effect)	Suggested approach
H_0 is not rejected (no fixed effect)	H_0 is not rejected (no random effect)	Pooled OLS
H_0 is rejected (fixed effect)	H_0 is not rejected (no random effect)	Fixed effect model
H_0 is not rejected (no fixed effect)	H_0 is rejected (random effect)	Random effect model
H_0 is rejected (fixed effect)	H_0 is rejected (random effect)	Conduct Hausman test to decide between fixed effect and random effect models

First, applying the F-test on the fixed effect regression on elasticity yields a p-value of 0.02%, which indicates that the null hypothesis of no firm-specific fixed effects should be rejected at the 1% significance level. This suggests the presence of fixed effects. Second, applying the Breusch-Pagan LM test yields a p-value of 100%, which means the null hypothesis of no random effects cannot be rejected. Based on these results and the guidance provided in the table above, the fixed effect model is deemed the appropriate choice for the regression on elasticity.

The results of this empirical testing align with economic intuition. It is reasonable to expect that the average elasticity would vary across firms due to factors such as sector, business segment, and geography. These characteristics are firm-specific and time-invariant, which corresponds to the firm-specific intercept term (α_i) in the fixed effect model. Indeed, firm fixed effects are used in the vast majority of corporate finance analysis and research.

11.2.2. Statistical significance of inference analysis

Ofwat and its advisers argue that that the regression-based estimates underpinning inference analysis have low statistical significance – in terms of the t-statistics of independent variables and the regression R-squared – and as a result a wide 95% confidence interval which encompasses elasticities which are negative as well as positive. The section below comments on each measure of statistical significance in turn.

261 See, for example, sections 10.4 and 10.5, Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.

262 Park, H. M. (2011). Practical guides to panel data modelling: a step-by-step analysis using Stata. Public Management and Policy Analysis Program, Graduate School of International Relations, International University of Japan, 12, 1-52.

263 Based on the table in p. 50, Park (2011).

I The 95% confidence interval of expected elasticity

Confidence intervals provide a range within which the true value of a population parameter is likely to fall. They quantify the uncertainty around an estimate, with wider intervals indicating greater uncertainty.

Ofwat's advisers use the wrong model for this purpose. They estimate the confidence interval for the expected elasticity of the fixed effect constant of SVT and UUW based on the Least Square Dummy Variable (LSDV) model rather than the fixed effect model.

The fixed effect model can be expressed as follows, where α_i represents the firm-specific intercept.

$$\frac{\partial E/E}{\partial D/D}_{it} = \alpha_i + 0.096\ Leverage_{it} + 91.391\ Volatility_{it} - 0.299\ \ r_{f_t} + \varepsilon_{it}$$

Note that this regression is based on the period underpinning the previous iteration of the analysis (i.e. October 2014 to June 2023) for comparability with Mason & Wright. The regression presented in section 9.3.4 is based on the window of October 2013 to June 2024.

The LSDV model can be expressed as follows, where D is a dummy variable that equals 1 for firm i.

$$\frac{\partial E/E}{\partial D/D}_{it} = \alpha + \mu_1 D_1 + \mu_2 D_2 + \ \mu_3 D_3 + \cdots + \mu_n D_n + 0.096\ Leverage_{it} + 91.391\ Volatility_{it} - 0.299\ \ r_{f_t} + \varepsilon_{it}$$

The coefficient values and standard errors for leverage, volatility and risk-free rate are consistent between the two models. The distinction lies in how the models account for firm-specific, time-invariant effects[264]: the fixed effect model considers these effects through de-meaning the individual specific effects, while the LSDV model uses dummy variables ($D_1, D_2, \ldots, D_n$) to explicitly account for the specific effect for each firm.

Applying the LSDV model to the elasticity regression results in 189 dummy variables, which correspond to 190 non-financial non-AIM listed UK firms listed in London Stock Exchange with data availability[265]. As a result, the LSDV model includes a total of 192 independent variables (189 dummy variables plus leverage, volatility, and risk-free rate), whereas the fixed effect model includes only three independent variables.

The use of the LSDV model can be problematic when the number of dummy variables is this high, as each additional dummy variable consumes one degree of freedom. The significant reduction in degrees of freedom due to the inclusion of 189 dummy variables results in a wider confidence interval and lower efficiency. In statistical terms, efficiency refers to the precision of an estimate; a less efficient estimator has higher variance between the estimated value and the true parameter value. In addition, the significant number of independent variables could also lead to issues such as near multicollinearity[266] and model overfitting. As a result, the confidence interval on the dependent variable becomes wider and the ability to achieve statistical significance is compromised. All else equal, researchers prefer more efficient models because they offer greater precision and confidence in estimating the true population parameter.

The impact of using an LSDV model with 189 dummy variables is demonstrated by the wide 95% confidence intervals on the intercept term and the dummy variables for SVT and UUW reported by Ofwat's advisers in Table 1 of their report. In the LSDV model, the intercept term represents the baseline level of the firm that is not included as the dummy variable. The presence of the many dummy variables introduces greater uncertainty in estimation of the baseline level. As a result, the confidence interval for expected elasticity ranges is wide, ranging from negative to positive.

[264] Firm-specific, time-invariant effect refers to firm characteristics that are not expected to change over time. Some examples of firm-specific and time-invariant factors include sectors, business profile, and geography.

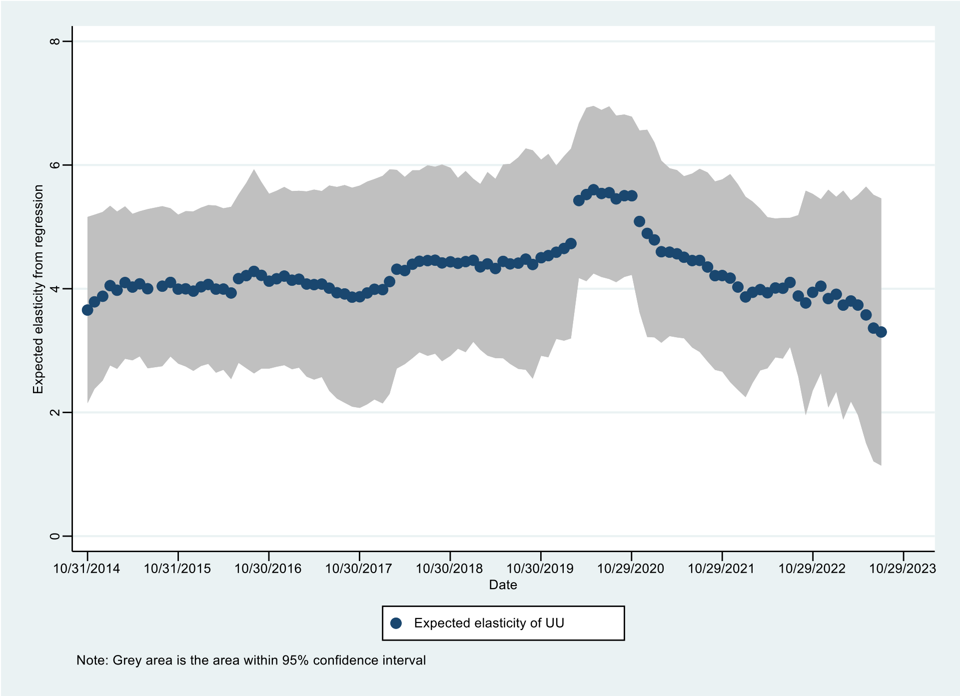
[265] Note that the number of dummy variables needs to be less than the total number of firms, otherwise it will lead to perfect multicollinearity. Stata automatically considers this in its model specification to avoid perfect multicollinearity.

[266] Multicollinearity occurs where two or more independent variables in a regression are highly correlated. This high correlation makes it difficult to separate the individual effects of these variables on the dependent variable, potentially leading to inflated standard errors and unreliable coefficient estimates.

In summary, the effectiveness of the LSDV model diminishes as the number of dummy variables increases and this reduction would be particularly pronounced with 189 dummy variables. Further, although both models control for the firm-specific, time-invariant effects, the fixed effect model focuses on how the elasticity varies over time for a firm, while the LSDV model captures all the variations, including the variation of elasticity within a firm and across all the firms. As the objective of the analysis is to examine temporal variation in elasticity for SVT and UUW, rather than to capture the variation across all the UK firms, the fixed effect model should be used.

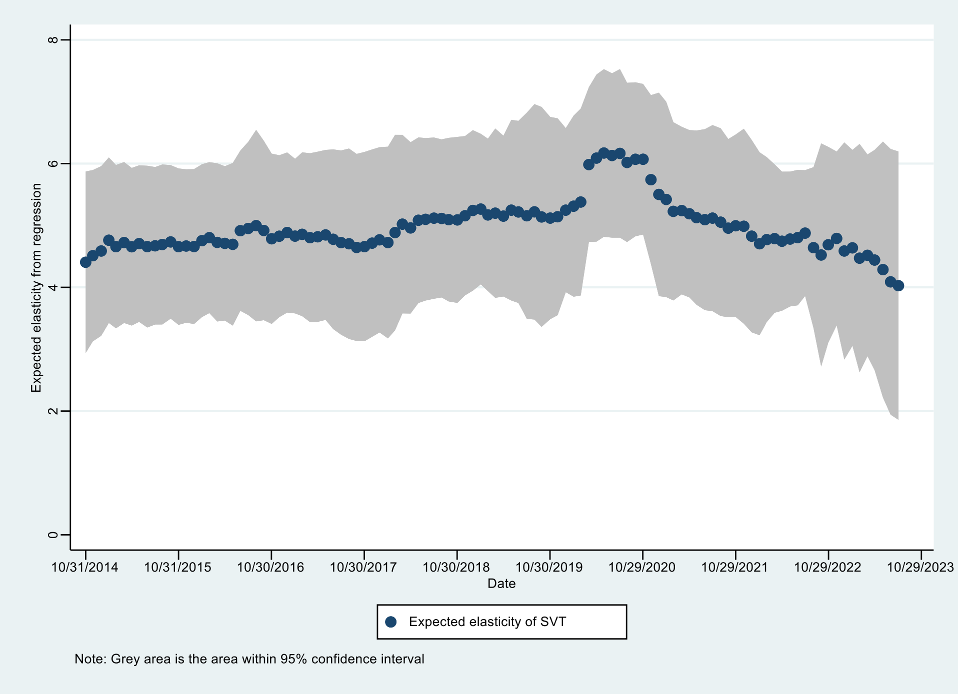
This Report uses the fixed effect model to re-estimate the confidence interval of the expected elasticity. Based on the dataset submitted to Ofwat alongside the previous iteration of the analysis, the results show a significant narrowing of the confidence intervals for the expected elasticity of SVT and UUW , with no negative values observed in any period (refer to the grey areas in Figure 21 and Figure 22). The same applies to the expected elasticity derived based on the extended regression window between October 2013 and June 2024 (which underpins the inferred CoE values in this Report).

Figure 21: Expected elasticity estimated from the regression and 95% confidence interval – United Utilities



KPMG analysis, output generated using Stata.

Figure 22: Expected elasticity estimated from the regression and 95% confidence interval – Severn Trent



KPMG analysis, output generated using Stata.

II Statistical significance of market leverage and risk-free rate

The updated analysis with the latest cut-off of June 2024 gives a p-value of 4.35% for the F-statistics, which suggests that the independent variables are able to jointly explain the variation of elasticity and are jointly significant at a 5% significance level.

The use of F-statistics is appropriate in the context it assesses the overall statistical significance of the regression model based on the collective impact of all independent variables.

In contrast, t-statistics used by Ofwat's advisers are better suited for assessing the significance of individual independent variables in isolation, in particular to test a hypothesis concerning a particular independent variable (which is not the goal of this analysis). It does not assess the combined effect of all variables. This means t-statistics alone are not suitable for evaluating the overall explanatory power of the regression model for inference analysis.

III The R-squared for the regression on elasticity

R-squared measures the proportion of variation in the dependent variable that is explained by the independent variables.

CCZ observe a relatively low R-squared for the elasticity regression, though the exact value is not reported.

KPMG's analysis also finds a relatively low R-squared for the elasticity regression.

The low R-squared is primarily due to two factors inherent to the analysis:

1 The regression is performed at the individual firm level rather than on a well-diversified portfolio, which is expected to significantly reduce the model's goodness-of-fit due to the material idiosyncratic volatility in individual stock debt and equity returns. It is well-known that individual stock returns are difficult to predict, which is why tests of asset pricing models are typically performed on portfolios rather than individual stocks.

2 Elasticity is calculated as the return on equity divided by the return on debt where small changes in the return on debt can lead to large variations in elasticity. The dependent variable in this

regression – i.e. the ratio of return on equity to return on debt – is inherently more volatile than the dependent variable in the CAPM regression, which is the equity return.

Ofwat's advisers observe that the regression on elasticity yields a low R-squared, suggesting limited explanatory power. However, it is important to recognise that due to the specific nature of the analysis, R-squared is likely to be low.

Other statistical measures, such as the F-test and 95% confidence intervals for the expected elasticity, provide more direct insights into the model's statistical significance and the estimation certainty and should be given primary consideration in the assessment of the model's effectiveness. The F-test indicates that market leverage, volatilities and risk-free rate collectively explain the variation in elasticity to a reasonable degree of accuracy. A positive and relatively narrow confidence interval for the expected elasticity, based on the fixed effect model, indicates that the expected elasticity is positive and statistically significant.

IV The comparison of the differences between elasticity and beta estimates for SVT and UUW

Ofwat and its advisers note that the elasticity estimates for SVT and UUW differ significantly by 17%, which they contend is implausible given that their betas are similar.

The differences in elasticity between two comparable companies has no bearing on the differences in their equity betas.

Elasticity measures the sensitivity of a company's equity returns to changes its debt returns, reflecting how variations in debt impact equity. Beta measures the sensitivity of a company's equity returns to fluctuations in overall market returns, capturing how a company's stock reacts to market-wide movements. As elasticity and beta assess different types of risk[267] their values and differences between companies are not directly comparable. As a result, variations in elasticity between companies will not necessarily align with differences in beta.

V The use of debt risk premia and debt returns in inference analysis

Mason & Wright argue that the debt risk premium used in the analysis is generic, derived from iBoxx A/BBB indices for investment-grade companies, whereas CCZ calculate firm-specific bond excess returns. They highlight significant differences in firm-specific bond credit spreads for SVT and UUW and suggest that elasticity estimates would be lower if the firm-specific returns on debt were used.

This argument appears to conflate how debt risk premia and bond returns are used in the analysis.

- Realised (outturn) elasticity, the dependent variable in the regression analysis, is calculated as the ratio of month-on-month total return on equity to total return on debt. The return on debt is the weighted average total return of fixed-rate bonds. This input is firm-specific and is necessary for all companies included in the sample, which consists of stocks listed on the London Stock Exchange each year, excluding foreign, financials[268] and AIM-listed firms[269].

[267] The CAPM (and hence the CAPM-beta) prices required equity returns relative to the risk and return of the wider market. Inference analysis (and hence elasticity) prices required returns relative to the risk and return of a specific company's debt or a debt benchmark.

[268] The implications of high leverage are different across financial and non-financial firms (consistent with CCZ). Whilst high leverage is common for financial firms and not indicative of financial distress, in non-financial firms, high leverage may indicate financial distress or difficulty.

[269] AIM-listed firms are excluded to capture the tradable and investable universe for institutional investors. AIM-listings include many small and illiquid stocks. AIM stocks have not historically been viewed as investible by many fund managers due to their high failure rates and poorer standards of reporting. Therefore, the UK studies focus on the Main Market of the London Stock Exchange and exclude AIMs.

- The debt risk premium, derived from the benchmark index, is used to calculate the inferred CoE based on expected elasticity. The benchmark index yields proxy the current borrowing costs of the notional company, consistent with the approach used for setting the allowed cost of new debt which effectively assumes that all companies in the sector have the spread on a forward-looking basis.

Mason & Wright conflate the firm-specific total return on debt used to derive realised elasticity with the iBoxx benchmark rate used for the debt risk premium. As the firm-specific total return on debt is already incorporated in the elasticity calculation, the argument that elasticity estimates would be lower if the firm-specific returns on debt were used is unfounded.

Mason & Wright also cite the cost of debt differences reported for UUW and SVT in the 2023 Monitoring Financial Resilience Report as evidence of significant variations in firm-specific bond credit spreads. However, the overall outturn cost of debt for a portfolio does not directly indicate differences in credit spreads. Instead, it reflects a combination of factors, including different financing strategies, debt mix, currency mix, timing of issuance, weighted-average tenor. To accurately compare credit spreads, one should examine the pricing of instruments with identical features, such as for 15-year fixed-rate GBP-denominated issuances made at the same time.

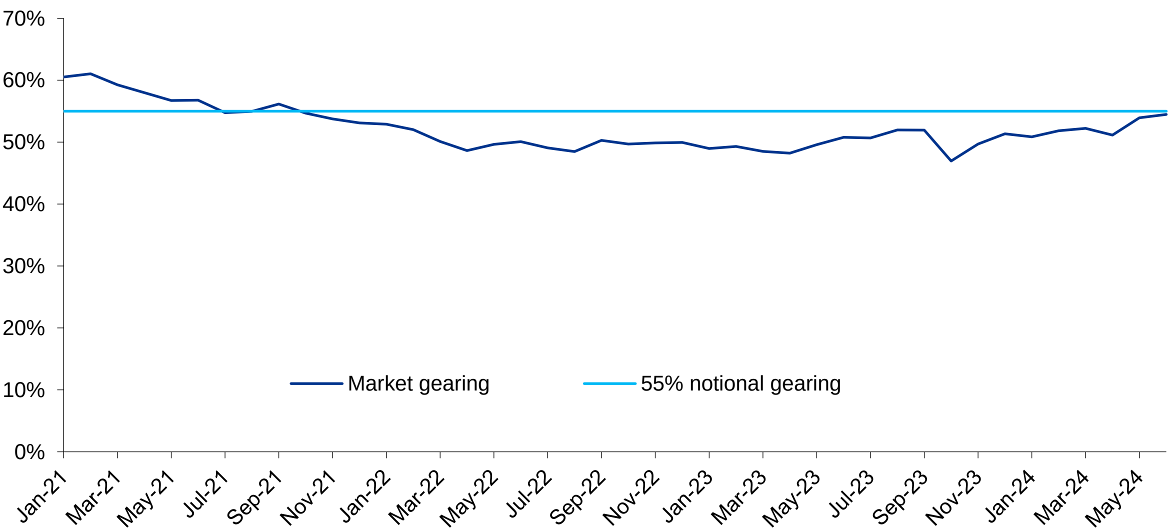
In summary, the calculation of expected elasticity via regression analysis relies on firm-specific inputs for the return on debt for all companies in the sample, while the inferred CoE for SVT/UUW is based on the assumed debt risk premium for the notional company. Critically, attributing differences in the outturn cost of debt to variations in firm-specific bond spreads is inaccurate.

VI The impact of re-levering on expected elasticity and inferred CoE

Elasticity is derived from regression analysis based on market leverage which may differ from the 55% notional gearing assumption used in the PR24 DD.

As illustrated in the figure below, market leverage for SVT/UUW has been below the assumed notional gearing level since late 2021. The longest averaging window used in the calculation of inferred CoE is 12 months, with expected elasticity estimates extending back from June 2024. During this period, the average market leverage for SVT/UUW was 51%, ranging from 47% to 54%.

Figure 23: Evolution of market leverage (SVT/UUW average) relative to the PR24 notional gearing



Source: KPMG analysis, output generated using Stata.

Mason & Wright argue that elasticity is sensitive to de- and re-levering. However, given that market leverage is below notional gearing, de- and re-levering would increase elasticity and CoE estimates. As the Report does not perform this conversion, inferred CoE estimates are likely to somewhat *understate* the required returns at the notional gearing level for PR24 and can thus be considered conservative.

12. Appendices

12.1. Appendix A: Comparison between the CAPM and inference analysis

The inferred CoE is derived based on expected elasticity, debt risk premia and risk-free rate. The table below sets out a comparison between the CAPM and inference analysis in terms of estimation approaches and underlying intuition.

Table 54: Comparison between CAPM and inference analysis

	CAPM	Inference analysis (based CCZ approach)
Intuitive interpretation	Investors require higher returns for holding stocks that exhibit greater sensitivity to market movements, with the magnitude of this premium contingent upon the asset's systematic risk	Investors require higher returns for assuming the higher risk associated with holding equity – the lowest priority claim against a firm's assets and returns – compared to debt which has a higher priority. This premium is contingent upon the firm's security structure, equity volatility, and the underlying macroeconomic conditions
Formula for estimating returns	$E[r_E] = r_f + \beta_{equity} (E[r_M] - r_f)$	$E[r_E] = r_f + \frac{\partial E/E}{\partial D/D} (E[r_D] - r_f)$ Where: $(\frac{\partial E/E}{\partial D/D})$ represents the elasticity of equity to debt and reflects the % change in the value of equity relative to the % change in the value of debt (elasticity). It measures the sensitivity of equity value to debt value
Reference for pricing required equity returns	Relative to the risk and return of the wider market	Relative to the risk and return of a specific company's debt or a debt benchmark
Estimation of a company's equity risk premium	A product of equity beta and market risk premium	A product of elasticity and debt risk premium
Risk factor	Equity beta (β), a systematic risk factor, measures the sensitivity of a company's equity return to the changes in the overall market return. Higher sensitivity indicates higher compensation required by the investors	Elasticity $(\frac{\partial E/E}{\partial D/D})$, a relative risk factor, measures the sensitivity of a company's equity return to its debt return. Higher sensitivity implies higher compensation required by equity investors compared to the debt investors of the same company
Determinant of the risk factor	Equity beta (β) is determined by: 1) the covariance between a stock's return and the market return, which can be positive, negative or zero; 2) the volatility of the stock's return relative to the market return	Elasticity $(\frac{\partial E/E}{\partial D/D})$ is determined by several factors such as risk-free rate, asset volatility, and market leverage

	CAPM	Inference analysis (based CCZ approach)
Regression model	Regress a stock's realised equity return on realised market return	Regress realised elasticity on risk-free rate, volatility, and market leverage which are the determinants of elasticity commonly cited in academic research Realised elasticity = $\alpha + \beta_{lev}$ leverage + β_{vol} volatility + β_{rf} risk-free rate
Regression output	Equity beta (β_{equity})	Betas for realised risk-free rate, volatility, and market leverage ($\beta_{lev}, \beta_{vol}, \beta_{rf}$) To derive expected elasticity, betas from the regression are multiplied by the outturn leverage, volatility, and risk-free rate, plus α Expected elasticity = $\alpha + \beta_{lev}$ company's outturn leverage + β_{vol} company's outturn volatility + β_{rf} risk free rate

The table above underscores the clear parallels between CAPM and inference analysis, both of which adopt market-based approaches to CoE estimation by estimating a factor that reflects risks of a specific company. The key difference is that CAPM estimates required returns based on the sensitivity of a company's equity returns to market returns, whilst inference analysis considers the sensitivity of a company's equity returns to debt returns of the same company.

12.2. Appendix B: Methodology for translating the RoRE variance into standard deviation of the company return

This appendix describes a three-step approach for translating the RoRE variance, arising from increasing capital intensity, into changes in total risk exposure. This is expressed as the standard deviation of total return, a traditional measure of risk.

To assess the impact of increasing capex intensity on the RoRE range, the PR24 RoRE range from the KPMG risk model[270] is considered (1) based on a Totex range reflecting risk in previous price controls in line with the PR19 FD[271] (2) based on a Totex range reflecting forward-risk for PR24, holding all other risk factors constant. The change in the Totex RoRE is assumed to be predominantly driven by increased capex intensity.

Step 1 – Simulate RoRE performance in terms of P10/P50/P90 for each risk driver using the KPMG risk model

The tables below set out the RoRE outputs from the KPMG risk model for PR24, 'as is' and with the PR24 Totex RoRE being replaced by PR19 FD level, holding all other risk factors constant. P10 and P90 represent the downside and upside of the expected performance for each factor. The only difference between the tables is the Totex RoRE range (in terms of average variance P90-P50/P10-P50 at 1.43% vs. 0.92%).

[270] KPMG risk analysis assesses, based on the available empirical evidence and historical sector performance data, whether the DD parameters and mechanisms allow the notional company to earn base allowed return on a median expected basis. The stochastic risk model is constructed to simulate the notional company's risk exposure in RoRE terms by key risk drivers, accounting for risk mitigations purposed by Ofwat in PR24 DD. In this report, the RoRE outputs are based on the "Unmitigated rebased" numbers in the club risk model, which is the scenario with full estimated risk exposure of the notional company under DD regulatory regime, but removing the miscalibration risk, i.e. assuming that companies are able to improve their performance to the levels required in AMP8 to meet the submitted BP targets.

[271] Sourced from Ofwat's published wholesale cost RoRE model in PR24 draft determination, which assumes a +/- 8.5% variance in wholesale Totex over/underspend based on the 2015-2020 data. This information would have been available at the time of PR19 Final Determination, thus this Totex is used as a stand-in for PR19 Totex RoRE.

Step 2 – Calculate the risk exposure for each risk factor

The standard deviation for each risk factor is derived by averaging the P10-P50 and P90-P50 ranges and dividing by 1.268[272].

This approach aligns with the CAPM assumption that returns are normally distributed, meaning they are symmetrically clustered around the mean. While there may be asymmetric downside risks in the expected performance of each risk factor under the PR24 DD regulatory framework, such risks are beyond the scope of this specific analysis.

Step 3 – Aggregate the individual risk exposure to the whole company

The standard deviation of each risk factor is aggregated to determine the total risk exposure for the notional company using the following formula:

$$\sigma_P^2 = \sum_{i=1}^{n} \omega_i^2 \, \sigma_i^2$$

$$\sigma_P = \sqrt{\sigma_P^2}$$

Where:

- σ_P is the total risk exposure measured as standard deviation
- σ_i is the risk exposure of each driver, e.g. Totex risk
- ω_i is the relative weight of each risk driver.[273]

The tables set out the total risk exposure for a notional water company, measured as the weighted average of the standard deviations for each risk driver, based on PR24 and PR19 Totex RoRE ranges. Keeping all risks constant except for Totex risk, the total risk exposure of a notional company with higher capital intensity in PR24 is 0.54%, compared to 0.50% with the lower capital intensity from PR19, which implies an increase in total risk by a scaling factor of 1.07x[274].

Table 55: Simulated RoRE outcome and total risk exposure for a water company in PR24 vs. PR19

PR24 DD	Implied P10	Implied P50	Implied P90	Average of Variance	Standard Deviation of risk drivers (σ_i)	*Relative weight (ω_i)*	Implied risk variance ($\sigma_i^2 \omega_i^2$)	Implied total risk (σ_P)
Totex	**-2.43%**	**-0.91%**	**0.42%**	**1.43%**	**1.11%**	***22.02%***	**0.00060%**	
Retail	-1.55%	0.00%	1.55%	1.55%	1.21%	*23.96%*	0.00084%	
ODIs	-2.56%	-0.84%	0.37%	1.47%	1.14%	*22.64%*	0.00067%	
Financing	-1.49%	0.05%	1.55%	1.52%	1.19%	*23.49%*	0.00078%	
C-MeX	-0.33%	0.04%	0.48%	0.41%	0.32%	*6.26%*	0.00000%	
Revenue & other	-0.05%	-0.03%	0.00%	0.03%	0.02%	*0.39%*	0.00000%	
DPC	-0.16%	0.00%	0.00%	0.08%	0.06%	*1.24%*	0.00000%	
Total	**-8.57%**	**-1.69%**	**4.37%**	**6.47%**	**5.05%**	***100.00%***	**0.00289%**	**0.54%**

Source: KPMG analysis using the KPMG risk model, extracted August 19, 2024.

[272] This methodology assumes that performance is normally distributed, and thus that (1) P50, mean, and median values for each risk driver are equivalent and (2) the range of P90-P50 and P10-P50 should conceptually be the same and equal to 1.285 standard deviation (SD), where 1.285 is the critical value for the 10% confidence level in a normal distribution. Where the P90-P50 and P10-P50 ranges from the simulation differ, standard deviation is assumed to be the average of P90-P50 and P10-P50.

[273] The relative weight of each risk driver is derived as the proportion of its P90-P50/P10-P50 average variance to total RoRE variance. The same weights are applied to PR19 as derived from the KPMG risk model for PR24.

[274] Scaling factor 1.07 = 0.54%/0.50%.

PR24 DD with PR19 Totex	Implied P10	Implied P50	Implied P90	Average of Variance	Standard Deviation of risk drivers (σ_i)	*Relative weight (ω_i)*	Implied risk variance ($\sigma_i^2 \omega_i^2$)	Implied total risk (σ_P)
Totex	**-0.92**	**0.00%**	**0.92%**	**0.92%**	**0.72%**	***22.02%***	**0.00025%**	
Retail	-1.55%	0.00%	1.55%	1.55%	1.21%	23.96%	0.00084%	
ODIs	-2.56%	-0.84%	0.37%	1.47%	1.14%	22.64%	0.00067%	
Financing	-1.49%	0.05%	1.55%	1.52%	1.19%	23.49%	0.00078%	
C-MeX	-0.33%	0.04%	0.48%	0.41%	0.32%	6.26%	0.00000%	
Revenue & other	-0.05%	-0.03%	0.00%	0.03%	0.02%	0.39%	0.00000%	
DPC	-0.16%	0.00%	0.00%	0.08%	0.06%	1.24%	0.00000%	
Total	**-7.06%**	**-0.78%**	**4.87%**	**5.97%**	**4.66%**	***100.00%***	**0.00254%**	**0.50%**

Source: KPMG analysis using the KPMG risk model, extracted August 19, 2024.

Reverse stress test on the correlation

Accurately estimating the potential change in correlation resulting from the increased standard deviation of company returns due to capital intensity is challenging.

As such, a reverse stress test is conducted to assess the plausibility of a reduced correlation to offset the increased equity risk exposure. This involves calculating how much the correlation would need to decrease to keep the beta unchanged and evaluating whether such a decrease is realistic based on historical correlation trends. If the required correlation to offset the increased volatility is lower than the P10 of historical levels, it would indicate that maintaining a constant beta might be unrealistic. For completeness, the offsetting correlation is compared with 2-year, 5-year and 10-year windows with historical data since 2006.

The results of the test are shown in the table below. Based on the scaled-up standard deviation in equity return, the likelihood of correlation decreasing enough to maintain beta unchanged is lower than 10% for the 5- and 10-year windows used for beta estimation in the DD. Therefore, the possibility of a lower correlation to completely offset the increase in equity return volatility is low, thus the equity beta is more likely to increase.

Table 56: Correlation reverse stress test results

Estimation Window	2-year	5-year	10-year
Correlation as of 30 Jun 2024	0.36	0.42	0.44
Required correlation to offset the increased volatility	**0.34**	**0.39**	**0.41**
Historical correlation from Jan 2004 to 30 Jun 2024 (P10)	0.33	0.41	0.44
Historical correlation from 1 Oct 2014 to 30 Jun 2024 (P10)	0.32	0.41	0.44
Compare with Jan 2004 to 30 Jun 2024	Likelihood > 10%	Likelihood < 10%	Likelihood < 10%
Compare with 1 Oct 2014 to 30 Jun 2024	Likelihood > 10%	Likelihood < 10%	Likelihood < 10%

Source: KPMG analysis using Refinitiv Datastream data

12.3. Appendix C: Factor spanning test results

The factor spanning tests set out below are sourced from from Tharyan et al. (2024), which replicates the tests in Hou, Xue and Zhang (2019)[275]. In the context of evaluating the empirical performance of MFMs compared with CAPM, the ability of CAPM to explain the factor premia of both the q-factor model and the FF5F model is also tested.

[275] Hou, K., Mo, H., Xue, C., & Zhang, L. (2019). Which factors? *Review of Finance*, 23(1), 1-35.

I Factor spanning test on the FF5F model

Regarding the explanatory power of the CAPM for the individual factors in the FF5F model, although the hypothesis that the CAPM can explain the SMB, HML, and RMW factor premiums cannot be rejected, it is evident that the CAPM fails to capture the FF5F investment premium, the CMA factor.

Table 57: Explanation of the individual factors in the FF5F model using the CAPM

Factor	Parameter	Alpha	RMRF	Adjusted R^2
SMB	Coefficient	0.001	0.088	0.013
	t-statistics	0.580	2.820	
HML	Coefficient	0.002	0.101	0.014
	t-statistics	1.000	2.920	
CMA	Coefficient	0.005	-0.085	0.023
	t-statistics	4.710	-3.690	
RMW	Coefficient	0.001	0.020	0.001
	t-statistics	1.180	1.110	

Source: Tharyan et al. (2024)

Regarding the explanatory power of the q-factor model for the individual factors in the FF5F model, it subsumes the SMB, HML, and RMW factors, but not the CMA factor. Nonetheless, the alpha is materially smaller than that under the CAPM, and the explanatory power, as measured by adjusted R^2, is substantially higher.

Table 58: Explanation of the individual factors in the FF5F model using the q-factor model

Factor	Parameter	Alpha	RMRF	SIZE	INV	ROE	Adjusted R^2
SMB	Coefficient	0.000	0.020	1.031	-0.046	-0.072	0.923
	t-statistics	0.850	2.260	76.180	-2.840	-4.300	
HML	Coefficient	0.000	0.090	0.064	0.652	-0.707	0.392
	t-statistics	-0.290	3.200	1.510	12.770	-13.550	
CMA	Coefficient	0.001	-0.032	0.019	0.886	-0.266	0.858
	t-statistics	2.150	-3.540	1.420	54.160	-15.900	
RMW	Coefficient	0.001	0.018	0.042	0.059	-0.053	0.009
	t-statistics	0.880	0.980	1.530	1.790	-1.560	

Source: Tharyan et al. (2024)

In the joint factor spanning test for the FF5F model, the null hypothesis is that the pricing errors of the additional factors in FF5F are jointly zero. Rejecting this hypothesis indicates that the FF5F model provides additional explanatory power compared to the model it is being evaluated against.

A p-value of 0.0% for the CAPM indicates that the null hypothesis is rejected, suggesting that the additional factors in the FF5F model provide additional explanatory power compared to the CAPM.

In contrast, the p-value of 20.6% for the q-factor model indicates that the FF5F model does not add to the explanatory power of the q-factor model, and therefore, is subsumed by the q-factor model.

Table 59: Factor spanning tests with null hypothesis that the factors in FF5F model are jointly subsumed by another model

Tested by	The CAPM	Q-factor
p-value	0.000	0.206

Source: Tharyan et al. (2024)

II Factor spanning test on the q-factor model

The individual factor spanning test for the q-factor model indicates that the CAPM fails to explain both the investment factor and the RoE factor within the q-factor model. This suggests that these two factors provide additional explanatory power for returns compared to the market factor in the CAPM.

Notably, two out of three additional factors in the q-factor model add to the explanation of returns compared to CAPM. In contrast, only one of the four additional factors in the FF5F model adds to the explanation of returns compared to CAPM.

Table 60: Explaining the individual factors in q-factor model using CAPM

Factor	Parameter	Alpha	RMRF	Adjusted R^2
Size	Coefficient	0.001	0.055	0.005
	t-statistics	0.64	1.92	
Investment	Coefficient	0.005	-0.089	0.025
	t-statistics	4.82	-3.77	
RoE	Coefficient	0.002	-0.093	0.028
	t-statistics	1.98	-4.04	

Source: Tharyan et al. (2024)

Regarding the explanatory power of the FF5F model for the individual factors in the q-factor model, the FF5F model subsumes the size and investment factor, but not the ROE factor.

Table 61: Explanation of the individual factors in the q-factor model using the FF5F model

Factor	Parameter	Alpha	RMRF	SMB	HML	CMA	RMW	Adjusted R^2
Size	Coefficient	0.000	-0.029	0.877	0.045	-0.024	0.009	0.920
	t-statistics	0.410	-3.390	76.940	3.890	-1.380	0.440	
Investment	Coefficient	0.001	-0.004	-0.078	-0.014	0.909	0.012	0.797
	t-statistics	1.530	-0.340	-5.200	-0.890	39.150	0.450	
RoE	Coefficient	0.003	-0.052	-0.134	-0.290	-0.003	-0.028	0.246
	t-statistics	2.830	-2.440	-4.720	-9.960	-0.070	-0.550	

Source: Tharyan et al. (2024)

Regarding the factor spanning tests that examine all variables in the q-factor model jointly, a p-value of 0.0% for the CAPM and 4.5% for the FF5F indicate that the null hypotheses are rejected in both cases. This suggests that the additional factors in the q-factor model offer additional explanatory power for returns compared to both the CAPM and the FF5F. Consequently, the q-factor model subsumes both the CAPM and the FF5F models.

Table 62: Factor spanning tests with null hypothesis that the factors in q-factor model are jointly subsumed by another model

Tested on	CAPM	FF5F
p-value	0.000	0.045

Source: Tharyan et al. (2024)

Overall, while both the FF5F model and the q-factor model subsume the CAPM, the q-factor model also subsumes the FF5F model, whereas the reverse is not true. Therefore, the q-factor model provides additional explanatory power for returns compared to both the CAPM and the FF5F model and is the preferred MFM based on the UK dataset.

12.4. Appendix D: P/E ratios and the predictability of returns

At the RIIO-2 CMA appeals, Ofgem argued that a lack of serial correlation "*would imply that commonly used valuation criteria (such as price-earnings ratios) were spurious information in terms of predicting whether returns were likely to be high or low in the future*"[276].

The predictive power of price-to-earnings (P/E) ratios for future returns is independent of any assumptions regarding the presence or absence of serial correlation in the data. To demonstrate this, the relationship between the cost of equity, earnings, reinvestment ratios, and return on equity needs to be examined.

The basic dividend growth formula, which values a share or firm as the year 1 dividend divided by the discount rate minus the growth rate (*r-g*) can be re-written in terms of earnings as follows:

$$P_0 = \frac{(1-b)E_1}{r-bR}$$

Where:

- *b* is the retention ratio (the proportion of earnings retained by the company rather than paid out as dividends),
- *r* is the CoE,
- *R* is the long run return on equity (ROE),
- P_0 is the current price,
- E_1 represents the forecasted earnings for the next period.

b, r and *R* are assumed to be constant in perpetuity.

Growth, *g*, is calculated as the product of the retention rate and the achieved returns, represented by *bR.*

Deriving this in terms of current earnings is slightly more complex, as it is necessary to specify the short-run ROE and the short-run retention ratio. E_1 will be a function of current earnings, E_0, the short-run retention ratio, b_0 and the short-run ROE, R_0:

$$P_0 = \frac{(1-b)(1+b_0R_0)E_0}{r-bR}$$

Dividing by E_0 gives the trailing P/E ratio:

$$\frac{P_0}{E_0} = \frac{(1-b)(1+b_0R_0)}{r-bR}$$

Based on earnings, prices, expected return on equity (ROE), and payout ratios, one can solve for the expected return on equity capital using the following formula:

$$r = \frac{(1-b)(1+b_0R_0)}{P_0/E_0} + bR$$

It is also possible to derive an implied cost of capital using various accounting variables, such as book-to-market ratios and forecast earnings. This methodology is extensively documented in financial literature. Importantly, this analytical approach is independent of serial correlation and does not assume any form of serial correlation in the data.

The relationships between accounting variables, firm value, and the cost of equity are fundamentally influenced by the assumptions regarding both short-term and long-term ROE, as well as short-term and long-term payout policies. Any discussion of these relationships should be considered within the context of these assumptions, without conflating them with issues of serial correlation.

[276] CMA (2021), RIIO-2 Final Determination Volume 2A: Cost of equity, para. 5.250.

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Annex 2 – KPMG Report on Cost of Embedded Debt - analysis of and commentary on Ofwat's DD position

Cost of Embedded Debt – analysis of and commentary on Ofwat's PR24 DD position

Prepared for Water UK

–

August 2024

Contents

1. Introduction and scope

On 11 July 2024, Ofwat published the Draft Determination (DD) for PR24. In the DD, it set the cost of embedded debt primarily based on a balance sheet approach. It forms the balance sheet estimate by placing equal weight on the median ‘all-in’ cost and ‘actual-notional cost’ across larger companies. It cross-checks the balance sheet estimate using a benchmark index approach.

Water UK has commissioned KPMG to develop a report in relation to Ofwat’s DD position on the cost of embedded debt. In particular, the position set out in Ofwat’s DD appendix on the KPMG March 2024 CoD report and the accompanying KPMG Tool submitted to it by Water UK.

The scope of this report is to comment on how best to estimate the cost of embedded debt under a sector average approach, such as the balance sheet approach adopted by Ofwat in the DD.

A sector average approach implicitly assumes that the sector average cost represents a good proxy for the efficient cost incurred by the notional company. It is outside the scope of this report to consider whether this assumption is appropriate.

For reference, the confidential information used in the analysis in this report was collected as part of the March 2024 CoD report. This comprises company-specific and sector-wide market information.

The water companies for which company-specific information was collected are Affinity Water, Anglian Water, Bristol Water, Hafren Dyfrdwy, Northumbrian Water, Portsmouth Water, SES Water, Severn Trent Water, South East Water, South Staffs Water, South West Water, Southern Water, Thames Water, United Utilities, Welsh Water, Wessex Water and Yorkshire Water.

The sector-wide market information is based on third-party and publicly available sources.

We draw the reader’s attention to the important notice set out in section 12.3.

2. Executive summary

On 11 July 2024, Ofwat published the Draft Determination (DD) for PR24. In the DD, it set the cost of embedded debt primarily based on a balance sheet approach. It forms the balance sheet estimate by placing equal weight on the median ‘all-in’ cost and ‘actual-notional cost’ across larger companies. It cross-checks the balance sheet estimate using a benchmark index approach.

Water UK has commissioned KPMG to develop a report in relation to Ofwat’s DD position on the cost of embedded debt. In particular, the position set out in Ofwat’s DD appendix on the KPMG March 2024 CoD report and the accompanying KPMG Tool submitted to it by Water UK.

The key findings of the report are summarised below.

In-principle issues implied by Ofwat’s balance sheet approach

Ofwat’s balance sheet approach as applied in the DD implies three key in-principle issues.

First, Ofwat’s balance sheet approach excludes several categories of instrument. In contrast, the CMA’s balance sheet approach at PR19 included all instruments.

Second, Ofwat’s balance sheet approach ‘double notionalises’ the sector’s actual cost: (1) the ‘all-in’ cost is based on instruments that Ofwat considers would have been issued by the notional company. It follows that despite being labelled an ‘all-in’ cost, it is a notional cost; and (2) the ‘actual-notional’ cost is based on superimposing the notional debt mix on the already notional ‘all-in’ cost.

Third, Ofwat’s exclusions to company balance sheets are one-sided in that it does not reflect what the plausible counterfactual would have been if the company had not issued the excluded debt.

The implication of these issues is that the balance sheet estimate underfunds the sector’s actual cost.

Issues for calculating the ‘all-in’ cost under the balance sheet approach

Ofwat has reconciled between the ‘all-in’ cost in its DD balance sheet model and the KPMG Tool. The treatment of each material item in Ofwat’s reconciliation is considered in turn below.

Forecast AMP7 issuance

Ofwat’s DD model reflects FY23 debt data and new debt to refinance included instruments maturing in FY24-25. Ofwat’s reconciliation suggests that the ‘all-in’ cost could increase in nominal terms by 27bps if additional new debt in FY24-25 in line with Business Plan data tables is included.

Ofwat has committed to update its DD model at FD to reflect FY24 debt data and new debt for RCV growth in FY25 based on notional gearing. However, Ofwat should reflect RCV growth based on actual gearing to more closely match the sector’s actual planned issuance. In addition, Ofwat should refinance excluded instruments maturing in FY25 with new debt for the same reason.

It will be important for Ofwat to cross-check its modelled quantum of new debt against company plans for FY25 debt issuance based on Business Plan data tables.

Separately, Ofwat’s DD model raises AMP7 new debt at the DD cost of new debt which is based on the iBoxx A/BBB index. The August 2024 Cost of New Debt and Additional Borrowing Costs report estimates the cost of new debt as iBoxx A/BBB index *plus* 34bps. This represents the cost of new debt for a company with the notional rating and issuing at a tenor in line with the index.

It will be important that at FD the pricing of new debt is in line with recent pricing of water debt. For reference, new debt in FY24 was issued at yields above the iBoxx A/BBB index *plus* 34bps.

Effective interest rate and accretion on index linked debt

Ofwat is consulting on whether to adjust its DD model to (1) accrete the principal balance on index linked debt over AMP8; and (2) allow bespoke effective interest rates to be entered for index linked debt not issued at par.

It is positive that Ofwat has recognised these issues with its DD model and is consulting on whether to amend for them. These issues should be amended to reflect how the cost on index linked debt are modelled in practice and thus improve the accuracy of Ofwat’s model.

Additional clarity on how these amendments will be implemented in practice is welcome.

Ofwat's reconciliation suggests that the 'all-in' cost could increase in nominal terms by 1bp after amending for the accretion issue and by 7bps after amending for the effective interest rate issue.

Treatment of swaps

Ofwat includes only the cost of cross-currency swaps in the 'all-in' cost. However, the cost of all swaps should be included in the 'all-in' cost for the reasons set out below.

First, the sector routinely uses swaps and thus consider swaps to form part of an efficient strategy. In the same vein, the exclusion of swaps appears to depart from the principle that underpins the balance sheet approach. This is the principle that, like for other sector average approaches, what the sector has done on average represents the proxy for efficiency.

Second, the sector uses swaps for efficient purposes:

- Interest rate swaps to hedge the cost of new debt allowance.
- Inflation swaps to (1) raise synthetic index linked debt during times of illiquidity in the direct debt market; (2) achieve cheaper pricing than in the direct debt market; and (3) hedge CPIH basis risk.
- Cross-currency swaps to hedge currency risk on foreign bonds. Companies raise debt in foreign debt markets to widen their investor pool and in turn achieve cheaper pricing.

There are a small number of swaps that have been used for cash profiling which could distort debt costs over time. However, the cash profiling component was removed in the KPMG Tool.

Third, Ofwat appears to have determined ex-post that swaps would not have been issued by the notional company. This is because Ofwat only explicitly considered swaps for the first time at PR19 and in any case its decision to exclude swaps at PR19 was ultimately overturned by the CMA. Further, Ofgem ensured that swaps costs were covered by its cost of debt allowance at RIIO-2.

Fourth, if Ofwat decides to exclude swaps, it should put in place a plausible counterfactual which would similarly have achieved companies' risk management objectives at the time. For example, it should replace a synthetic index linked bond (via fixed rate bond *plus* inflation swap) with a direct index linked bond. However, this counterfactual may be more expensive than the factual.

Ofwat's reconciliation suggests that the 'all-in' cost could increase in nominal terms by 11bps if interest rate and inflation swaps are included. It will be important for these costs to be included at FD.

Role of the 'actual-notional' cost in the balance sheet approach

Ofwat considers the 'actual-notional' cost aligns with its long standing principle that companies are responsible for their own financing choices. However, no weight should be attached to this cost for the reasons set out below.

First, the incentive benefit of including the 'actual-notional' cost is limited. This is as companies cannot change their past decisions (embedded debt), only their future decisions (new debt).

Second, the 'actual-notional' cost as calculated by Ofwat does not solely adjust a company's portfolio for the notional debt mix. It also adjusts for timing of issuance. In consequence, it does not fulfil the purpose for which it was designed.

Third, the 'actual-notional' cost can provide a misleading view of the actual sector cost:

- Ofwat's 'all-in' and 'actual-notional' costs vary materially at the company-level.
- Ofwat's 'all-in' and 'actual-notional' costs are both variants of a notional cost so provide limited insight about the actual sector cost.
- KPMG's 'all-in' cost closely proxies the actual sector cost. The KPMG Tool indicates that 'all-in' and 'actual-notional' costs vary materially at both the company- and sector-level.

As a result, the inclusion of the 'actual-notional' cost could result in the average company being underfunded for its actual cost.

Benchmark index cross-check to the balance sheet approach

Ofwat adopts the benchmark index approach as a cross-check for its balance sheet approach. However, no weight should be attached to this cross-check for the reasons set out below.

First, the use of cross-checks could result in the allowance being set at a different level to the balance sheet estimate. This would undermine the principle behind the sector average approach that the sector average cost represents the proxy for the efficient cost.

Second, Ofwat seeks to use the benchmark index approach as a cap rather than a cross-check. This asymmetry (1) undermines incentives for the sector to issue efficiently against the benchmark; and (2) means companies may not be able to recover actual costs on average.

Third, it is challenging to calibrate a benchmark trailing average that precisely takes account of macroeconomic volatility and the sector's timing, tenor and mix of debt issuance. This means that any benchmark trailing average will be less robust than the balance sheet estimate.

The CMA at PR19 asserted that, at a minimum, differences between the balance sheet estimate and benchmark index estimate should be carefully investigated.

3. Context and structure

This section outlines the context and structure for the report.

3.1. Context

On 11 July 2024, Ofwat published the DD for PR24. Ofwat's DD estimate of the cost of embedded debt is 4.51% (nominal) or 2.46% (CPIH-deflated).

Ofwat has retained its Final Methodology (FM) position for estimating the cost of embedded debt. Its estimate is primarily based on the balance sheet approach and cross-checked using the benchmark index approach. This cross-check is intended to serve as a cap on the balance sheet approach.

Ofwat's specification of the balance sheet approach has not changed. It places equal weight on the 'all-in' and 'actual-notional' cost of the median company across the WaSC and large WoC group. It excludes swaps and debt instruments it considers are non-standard such as junior debt.

Ofwat's DD balance sheet model estimates an 'all-in' cost of 4.52% and an 'actual-notional' cost of 4.50% which leads to a balance sheet estimate of 4.51% (nominal).

Ofwat has moved on a number of methodological issues in its FM model, although only a proportion of these have been amended in its DD model. If the remaining issues are amended in its Final Determination (FD) model, they could reduce the material gap between Ofwat's DD estimate of the 'all-in' cost and the actual cost for the sector. The remaining issues are:

- Ofwat has agreed to include new debt to finance RCV growth over the remainder of AMP7 based on 60% notional gearing.
- Ofwat is consulting on whether to accrete the principal balance of index linked debt over AMP8.
- Ofwat is consulting on whether to allow bespoke effective interest rates to be entered for index linked debt not issued at par.

However, even after these amendments, there could remain a gap between Ofwat's balance sheet estimate at FD and the actual sector cost. This is because Ofwat forms its balance sheet estimate by placing equal weight on its 'all-in' cost and 'actual-notional' cost.

Ofwat's benchmark index approach in the DD comprises of simple, uniform collapsing and weighted collapsing 15Y and 20Y trailing averages of the iBoxx A/BBB index.

The weighted collapsing average is an additional benchmark for the DD which was not included in the FM. This average takes into account the amount of debt that would have been required each year for RCV growth if companies had raised debt in line with the notional structure at the time.

Ofwat's benchmark index range is 3.86-4.57% (nominal). Its balance sheet estimate of 4.51% (nominal) sits at the upper end of, but does not exceed, this range. Ofwat ultimately set the cost of embedded debt based on its balance sheet estimate.

3.2. Structure

This report is structured as follows:

- Section 4 considers the principles behind Ofwat's balance sheet approach.
- Section 5 bridges between the 'all-in' cost in Ofwat's balance sheet model and the KPMG Tool.
- Section 6 considers key changes to Ofwat's balance sheet model signalled in the DD.
- Section 7 considers exclusion criteria for the 'all-in' cost under Ofwat's balance sheet approach.
- Section 8 considers data differences between Ofwat's balance sheet model and the KPMG Tool.
- Section 9 considers the KPMG Tool as an input to refine Ofwat's balance sheet model.
- Section 10 considers the role of the 'actual-notional' cost in Ofwat's balance sheet approach.
- Section 11 considers potential cross-checks to Ofwat's balance sheet approach.

4. Key in-principle issues implied by Ofwat's balance sheet approach

This section outlines the key in-principle issues implied by Ofwat's balance sheet approach in the DD.

First, Ofwat has characterised its balance sheet approach as *"…based on debt instruments relevant for the notional company that are observed on company balance sheets for the larger companies"*[1].

This departs from the CMA's position at PR19. The CMA also used a balance sheet approach but included the cost of all debt instruments. The CMA explained that it *"…included all debt costs, including those 'non-pure' costs previously disputed in Ofwat's balance sheet approach, negating much (but not all) of the disagreement on the correct measurement of actual debt costs"*[2].

Second, (a) Ofwat has specified the notional company for its balance sheet approach ex-post; and (b) this notional company does not resemble any one company or the average company in the sector.

On (a), Ofwat did not signal ex-ante what the notional company would or would not issue. For example, Ofwat considers that the notional company would not issue wrapped debt or swaps. However, Ofwat does not appear to have mentioned wrapped debt in previous price reviews and only explicitly communicated a position on swaps for the first time at PR19.

It is only appropriate for Ofwat to signal policy ex-ante (new debt), not ex-post (embedded debt).

On (b), Table 4 shows that no one company meets every criteria of the notional company and accordingly, neither would the average company in the sector. It appears that Ofwat's notional company exists only in laboratory conditions, not in the real world.

Even larger companies that are close to notionally geared (WSH, SVH and UUW) have raised debt instruments which Ofwat considers the notional company would not have issued. For example, all three companies actively use swaps and WSH has made use of wrappers in the past.

In consequence, Ofwat's notional company does not represent an achievable benchmark.

Third, Ofwat's balance sheet approach 'double notionalises' the sector's actual cost:

- The first round of notionalisation is in the calculation of the 'all-in' cost. Ofwat sanitises company balance sheets for categories of instrument that it considers would not have been issued by the notional company. It follows that despite being labelled the 'all-in' cost, it is a notional cost.
- The second round of notionalisation is in the calculation of the 'actual-notional' cost. Ofwat superimposes the notional debt mix on the already notional 'all-in' cost.
- Ofwat applies equal weight to both of these notional costs to form its balance sheet estimate.

The result of Ofwat's 'double notionalisation' is that its balance sheet estimate does not reflect the reality of the sector's actual cost[3]. In practice, this means that Ofwat's balance sheet estimate underfunds the sector's actual cost.

This contravenes the principle underpinning the balance sheet approach, like other sector average approaches, that the sector's actual cost is the proxy for the efficient cost.

Fourth, Ofwat's exclusions to company balance sheets are one-sided in that it does not reflect what the plausible counterfactual would have been if the company had not issued the 'excluded' debt.

For example, Ofwat excludes wrapping fees but retains the very low coupons of wrapped debt which typically had an AAA rating at inception. This counterfactual assumes that the actual (or notional) company could have raised AAA rated debt without a wrapper. This is not a plausible counterfactual.

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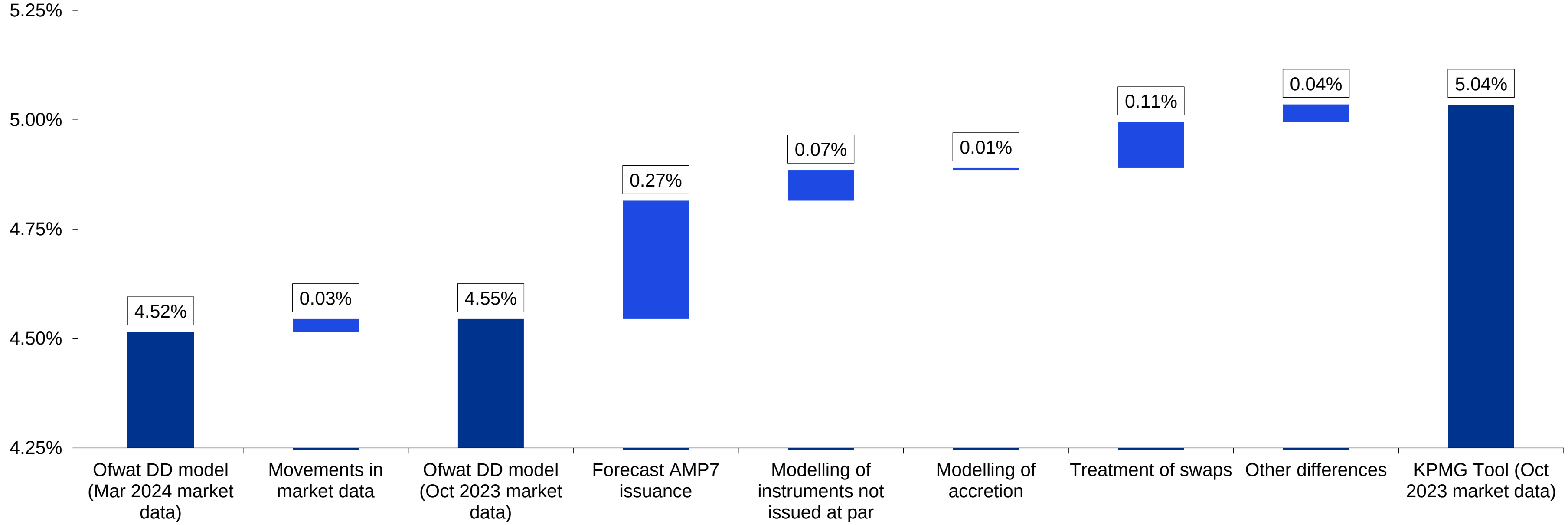
1 Ofwat (2024), PR24 Draft Determination, Aligning risk and return, p. 18.
2 CMA (2021), PR19 Final Determination, para. 9.552.
3 Ofwat critiques the March 2024 CoD report for its focus on the sector's actual costs, noting that: *"KPMG's focus appears to be on understanding the cost of debt taking account of actual financing choices of the companies"*. See Ofwat (2024), PR24 Draft Determination, Ofwat comments on cost of debt report submitted by Water UK, p. 8.

Fifth, Ofwat has effectively carried out a downside-only ex-post review of the sector’s actual cost as its exclusions to company balance sheets seem only to decrease costs. It does not appear to have carried out a balanced assessment which could result in exclusions that both increase and decrease costs. For example, there are a number of debt instruments in the sector that have a higher rating than the notional company. These could in principle be excluded which would increase costs.

5. Bridging between the 'all-in' cost in Ofwat's balance sheet model and the KPMG Tool

Ofwat's DD balance sheet model estimated an 'all-in' cost of 4.52% in nominal terms. The March 2024 CoD report estimated an 'all-in' cost of 5.04% in nominal terms based on the March 2024 KPMG Tool. Ofwat has reconciled between these two estimates as set out in the chart below.

Figure 1: Reconciliation of the 'all-in' cost in the Ofwat DD model and KPMG Tool (nominal)



Notes: (1) Based on 2023 debt data; (2) Ofwat reconciles to the February 2024 KPMG Tool in the DD but the chart is based on the March 2024 KPMG Tool
Source: KPMG analysis and data from PR24 DD

The material bridging items in the chart are discussed in the proceeding sections. In particular:

- Section 6 discusses (1) forecast AMP7 issuance; (2) modelling of instruments not issued at par; and (3) modelling of accretion.
- Section 7.2 discusses the treatment of swaps.

6. Key changes to Ofwat's balance sheet model signalled in the DD

This section considers the key changes that Ofwat has signalled could be made to its DD balance sheet model at FD.

6.1. Forecast new debt issuance

The impact of new debt issuance over the remainder of AMP7 on the cost of embedded debt depends on the quantum of new debt and the cost of new debt. This section considers Ofwat's approach to both in the DD balance sheet model and potential changes at FD.

6.1.1. Quantum of new debt

Ofwat's DD balance sheet model is based on debt data as at FYE 23. It includes new debt to refinance 'included' debt instruments maturing in FY24-25. It does not include new debt to finance RCV growth in FY24-25.

Ofwat's reconciliation suggests that the 'all-in' cost could increase in nominal terms by 27bps if additional new debt in FY24-25 in line with Business Plan data tables is included. For clarity, this relates to the quantum, not the cost, of new debt in FY24-25.

Ofwat has committed to update its model at FD to reflect debt data as at FYE 24 and new debt for RCV growth in FY25 based on notional gearing.

This is a welcome change and will help narrow the gap between Ofwat's assumed and company's planned new debt issuance. However, Ofwat has not addressed three key issues that were highlighted in the September 2023 CoD note which means a gap will still remain[4].

First, Ofwat will include new debt for RCV growth in FY25 based on 60% notional gearing. However, this should be based on companies' actual gearing to more closely match their planned issuance. This would also be consistent with Ofwat's approach to (1) new debt for refinancing; (2) and the current balance sheet, where it does not make direct gearing-based adjustments. For example, it does not adjust debt issued in AMP7 to date to reflect notional gearing.

Second, Ofwat will not refinance 'excluded' instruments that mature in FY25 with new debt. It implies in the DD that 'excluded' instruments should have no bearing on current or future costs.

This position is over simplified. It assumes that all 'included' instruments can only be traced back to other 'included' instruments throughout their history. However, it could plausibly be the case that e.g. an index linked bond on balance sheet today was used to refinance a fixed rate bond with an inflation swap overlay. Ofwat's position would imply that this index linked bond should be excluded.

Hence, the appropriate position for the refinancing of 'excluded' debt is to assume it is replaced with new 'included' debt. To this end, Ofgem at RIIO-2 *"excluded intercompany loans from embedded debt costs but assumed they are refinanced at their maturity with 20-year fixed rate debt raised at the forecast benchmark rate for that year"*[5].

Third, Ofwat has only partially addressed that its FM balance sheet model does not refinance principal repayments on amortising debt over the remainder of AMP7 with new debt. The DD model refinances principal repayments for amortising debt that matures in AMP7 but not for amortising debt that matures after AMP7. This should be corrected for in the FD model.

It would be expected that if the three issues above were addressed, Ofwat's modelled quantum of new debt for refinancing and RCV growth would more closely match company's planned issuance for

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4 KPMG (2023), Initial commentary on the Balance Sheet Cost of Debt Model and implications for the cost of embedded debt, p. 2-5.

5 Ofgem (2022), RIIO-ED2 Draft Determination – Finance Annex, para. 2.59.

FY25. However, it will be important for Ofwat to cross-check its modelled quantum of new debt against company plans for debt issuance in FY25 based on Business Plan data tables.

6.1.2. Cost of new debt

Ofwat's FM balance sheet model refinanced fixed and index linked debt maturing in AMP7 at the FM cost of new debt, which was based on the iBoxx A/BBB index *less* 15bps benchmark index adjustment. The FM model refinanced floating rate debt maturing in AMP7 at the same SONIA compounding period and margin as the maturing instrument.

The FM model contained an error whereby it partially double-counted the cost of new debt raised over AMP8: (1) Ofwat provides separate allowances for the cost of new and embedded debt; but (2) the FM model refinanced embedded debt maturing in AMP8 with new debt and included the cost of this new debt in the cost of embedded debt. This error was highlighted in the September 2023 CoD note.

Ofwat's DD model refinances all debt maturing in AMP7 at the DD cost of new debt which is based on the unadjusted iBoxx A/BBB index. Ofwat has corrected for the double-count error in its DD model.

The March 2024 KPMG Tool refinanced debt maturing in AMP7 at the CMA PR19 cost of new debt which was based on the unadjusted iBoxx A/BBB index. As Ofwat's DD model adopts the same, this has helped reduce the gap between Ofwat's and KPMG's estimate of the 'all-in' cost.

The August 2024 Cost of New Debt and Additional Borrowing Costs report estimates the cost of new debt as the iBoxx A/BBB index *plus* 34bps based on the latest market data. This represents the cost of new debt for a company with the notional rating and issuing at a tenor in line with the index.

This cost of new debt is 34bps higher than Ofwat's DD cost of new debt which would increase the estimate of the all-in cost relative to that in Ofwat's DD model, all else equal. Ofwat should consider changing its cost of new debt at FD to reflect the latest market data.

For reference, new debt in FY24 was issued at yields above the iBoxx A/BBB index *plus* 34bps.

6.2. Effective interest rate and accretion on index linked debt

Ofwat is consulting on whether to adjust its DD balance sheet model to:

- Accrete the principal balance on index linked debt over AMP8.
- Allow bespoke effective interest rates to be entered for index linked debt not issued at par.

It is positive that Ofwat has recognised these issues with its DD model and is consulting on whether to amend for them. These issues should be amended to reflect how the costs on index linked debt are modelled in practice and thus improve the accuracy of Ofwat's model.

Ofwat has not yet outlined the exact mechanism for how it will make these amendments. For example, it is not clear how the bespoke effective interest rates for index linked debt not issued at par will be calculated. Additional clarity on how these amendments will be implemented is welcome.

The March 2024 report outlined the modelling approach taken in the KPMG Tool to address both these issues, which Ofwat could adapt for its FD model[6].

Ofwat's reconciliation suggests that the 'all-in' cost could increase in nominal terms by 1bp after amending for the accretion issue and by 7bps after amending for the effective interest rate issue.

[6] KPMG (2024), Estimating the Cost of Embedded Debt and Share of New Debt for PR24, p. 57-59.

7. Exclusion criteria for the ‘all-in’ cost under Ofwat’s balance sheet approach

This section considers Ofwat’s position on wrapping fees and swaps.

7.1. Wrapping fees

Ofwat in the FM inadvertently took into account the benefit of wrapped debt without the associated cost, and in the DD explicitly does so. This section considers whether this position is appropriate.

7.1.1. Use of wrappers

Wrapped debt is an instrument for which a company has paid fees to a monoline insurer to provide a guarantee to investors that they will be repaid even if the debt defaults. Companies wrapped their debt to achieve a better issue rating and pricing (even after fees to the monoline). Wrapped debt typically had a AAA rating at inception in line with the rating of monolines at the time.

ANH, SRN, WSH, SES and SSC still have outstanding wrapped debt on balance sheet[7].

7.1.2. Ofwat’s policy on wrappers in previous price reviews

Ofwat does not appear to have mentioned wrappers in previous price reviews. Ofwat’s position on excluding wrapping fees appears to have been made for the first time in the DD. The implication is that Ofwat has decided ex-post that the notional company would not use wrappers.

7.1.3. Counterfactual

Ofwat considers that wrapping fees can be excluded but the very low coupons of wrapped debt retained because the notional company would not need to incur such fees to raise highly rated debt. This position effectively assumes that in the counterfactual without wrapping, the notional company could have raised debt with the same rating as that of wrapped debt.

First, this is not a plausible counterfactual for the notional company. The current notional company has a Baa1 rating and so clearly could not raise AAA rated debt without wrapping. It follows that the correct counterfactual for the notional company without wrapping is a Baa1 rated issuance.

Second, the key consideration is not the counterfactual for the notional company but rather for the actual company. Ofwat’s position on wrapping fees goes beyond making exclusions to actual company balance sheets; it seeks to retrofit actual issuances for the notional company. This is not appropriate. The counterfactual for the actual company without wrapping would be an issuance with the same rating that the actual company had at the time.

Wrapping fees are not a material bridging item between Ofwat’s estimate of the ‘all-in’ cost and the actual sector cost. However, Ofwat’s position on wrapping fees is a striking example for the one-sided nature of the exclusions it makes to company balance sheets. Thus it is important to highlight its position on wrapping fees as a matter of principle.

In conclusion, Ofwat should as a matter of principle either reflect the correct counterfactual without wrapping for the actual company or include wrapping fees. The latter will be simpler to implement and lead to a lower cost for customers than the former.

[7] Based on the KPMG dataset for 2023 debt data.

7.2. Swaps

Ofwat has retained its FM position of excluding all swaps in its balance sheet approach except cross currency swaps. This section considers whether this position is appropriate.

7.2.1. Use of swaps

Ofwat considers that its decision to exclude swaps would not disincentivise companies to adopt efficient financing strategies. However, the majority of the sector, including companies with near notional gearing, routinely uses swaps. This suggests that the sector considers swaps to form part of an efficient financing strategy. In consequence, Ofwat's exclusion of swaps could be interpreted as disincentivising efficient financing strategy.

In addition, it appears to depart from the principle that underpins the sector average approach that what the sector has done on average represents the proxy for efficiency.

This section explores why companies have used swaps as part of their financing strategies and whether this use of swaps is efficient.

Interest rate swaps

Interest rate swaps have been used to match Ofwat's cost of debt for the notional company.

UUW has signalled that it has used interest rate swaps in this way since 2008[8]. As a recent example, its policy on interest swaps for AMP7 has been outlined below.

For context, Ofwat's new debt allowance for AMP7 was based on a share of new debt of 20% and a cost of new debt indexed to the iBoxx A/BBB index i.e. a floating rate.

UUW's policy for AMP7 has been to raise long-term fixed rate debt and convert this into floating using interest rate swaps at inception for the life of the debt. It uses a second layer of interest rate swaps to revert the synthetic floating rate debt back to fixed on a 10Y reducing balance basis. At the start of AMP7, a proportion of the debt book remained floating, reflecting the 20% share of new debt, until it is fixed via the 10Y reducing balance mechanism. UUW's rationale for this is to approximate Ofwat's new debt allowance and thus the new debt issuance of the notional company.

UUW's policy suggests that the only way for actual companies to mimic the notional company's debt issuance in practice is through the use of interest rate swaps. This appears reasonable since no company can issue benchmark debt on a daily basis as implied by the new debt allowance.

NGN has adopted a similar strategy to match Ofgem's cost of debt for the notional company in RIIO-2. NGN states in its annual report that: *"In practice, most floating rate debt, in addition to debt issued at fixed rate and swapped back to floating rate for life, has its rate re-fixed with interest rate swaps on a staggered basis in order to align the rate re-fixing profile on this debt with the regulatory cost of debt allowance, which is calculated with reference to a trailing average of certain corporate bond yields"*[9].

Ofwat's primary reason for excluding swaps is that it does not consider the notional company would have issued these instruments. However, companies have used interest rate swaps to proxy the notional company's debt issuance profile which is not directly achievable. It does not appear reasonable to exclude interest rate swaps from company balance sheets in this context.

Inflation swaps

Inflation swaps have been used to efficiently create synthetic index linked debt.

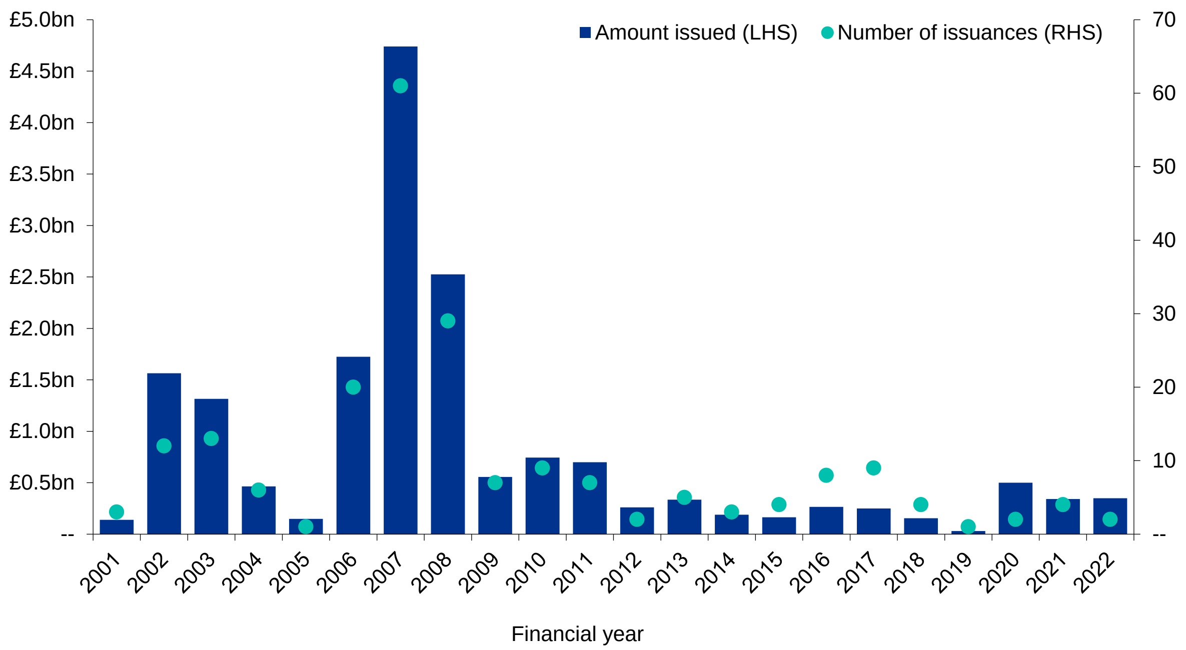
[8] Table 3 sets out UUW's treasury policy on interest rate risk over 2008-2024.
[9] NGN (2023), Annual report 2023, p. 5.

First, the market for direct index linked debt has been completely illiquid at various points in the past, such as during the global financial crisis. During these periods of illiquidity, the only means for companies to maintain their proportion of index linked debt was to raise this synthetically through index linked swaps. This has been recognised by Ofwat and others:

- Moody's: "…*as the availability of index-linked bonds at attractive rates subsided with the dawn of the 2008-09 global financial crisis, issuers sought other means to achieve the benefits that index-linked debt can provide. In many cases, they have turned to synthetic index-linked debt, effectively being a conventional fixed-rate bond swapped to index linked*"[10].
- CMA: "*They* [companies] *may also be required to…increase the use of derivatives in the face of a lack of suitable index-linked debt available at desired maturities*"[11].
- CMA: "*Such* [index linked] *debt may not always be available from the markets in the quantities or calibrations required – leading companies to synthetically create them using derivatives*"[12].
- CEPA for Ofwat/CAA: "…*the lack of liquidity in the index-linked, bond market makes execution easier in the nominal bond market*"[13].
- Ofwat/Ofgem: "*In the past there may have been limited appetite for direct issuance of corporate index-linked debt due to a limited number of investors and constraints on their portfolios*"[14].
- Ofwat: "*Although there has been some issuance of index-linked debt since our draft determinations, evidence of market appetite for the issuance of new index-linked debt remains limited… It is possible that the debt markets could recover such that companies will be able to issue index linked debt either directly or through swap arrangements*"[15].

The chart below illustrates that index linked bond issuance by water and energy sectors peaked in 2007 and subsequently reduced to very low levels after the financial crisis.

Figure 2: Index linked public bonds issuances by water and energy sectors over 2001-2022

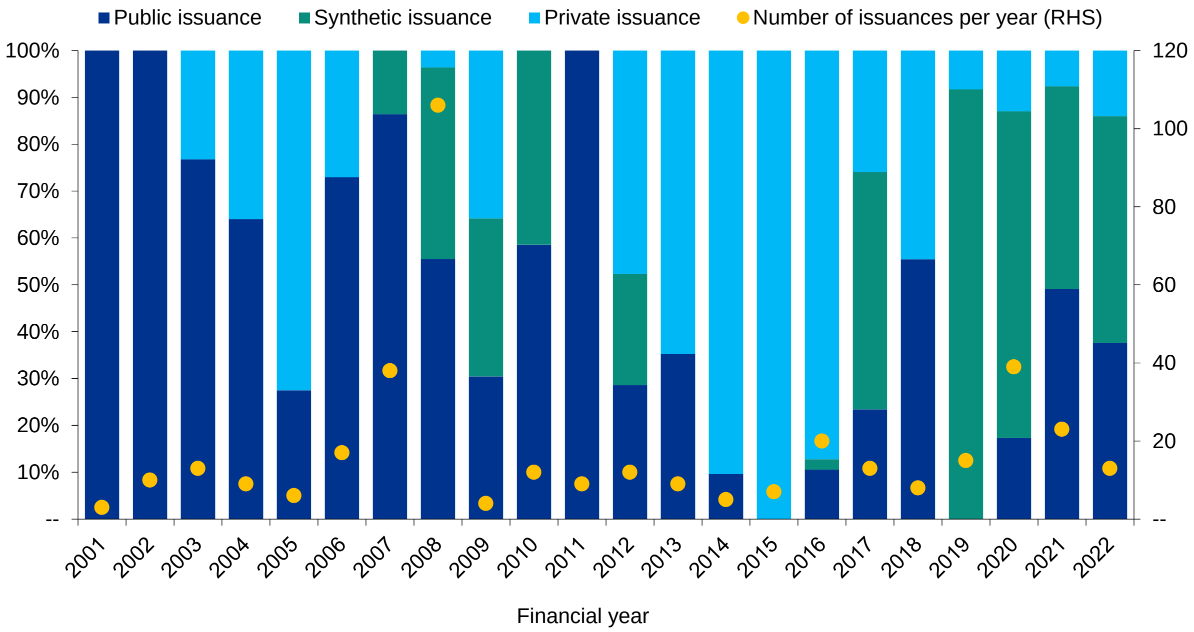


Source: KPMG analysis and data from Bloomberg, Refinitiv, Ofwat FM balance sheet model and DNO annual reports

[10] Moody's (2012), UK Regulated Utilities - Why Index-Linked Swaps May Not Provide the Same Cash Flow Benefit as Index-Linked Bonds, p. 3.
[11] CMA (2021), Water Redeterminations 2020, Cost of Debt – Working Paper, para. 122.
[12] CMA (2021), RIIO-2 Final Determination, Volume 3: Individual grounds, para. 14.219.
[13] CEPA (2016), Ofwat and CAA - Alternative approaches to setting the cost of debt for PR19 and H7, p. 197.
[14] Ofwat and Ofgem (2006), Financing Networks: A Discussion Paper, para. 148.
[15] Ofwat (2009), Future water and sewerage charges 2010-15: Final determinations, p. 139-140.

At the same time, the proportion of index linked debt issued synthetically in the water sector increased significantly during and after the financial crisis as shown in the chart below. Further, the uptick in synthetic index linked debt observed after 2017 in the chart is likely driven by (1) Brexit which removed the option to access direct index linked debt from the EIB; and (2) the move from RPI to CPIH indexation in the context of nascent markets for direct issuance in CPI and CPIH.

Figure 3: Proportion of direct and synthetic index linked debt in 2022 APR water portfolios



Source: KPMG analysis and data from Ofwat FM balance sheet model

Relatedly, on a forward looking basis, companies may need to access the index linked swap market to match the notional company's proportion of index linked debt at AMP8. There may not be sufficient liquidity in the direct index linked debt market to accommodate the sector's requirement for index linked debt, implied by the scale of RCV growth and notional proportion of index linked debt.

Second, raising synthetic index linked debt has been cheaper than equivalent direct issuance at different times in the past.

Companies are incentivised to minimise costs and therefore it would be expected that where they have entered into synthetic positions, this represents the lowest cost option. Indeed, CEPA for Ofwat/CAA recognised that companies use swaps to secure the optimal outcome:

- "*There is no evidence of derivatives being used for speculative purposes, but rather as a way to compensate for shifts in demand in the underlying capital markets, which have meant that companies have not been able to secure their optimal debt position from direct issuance alone*"[16].
- "*Corporate Treasurers thus triangulate between maturity needs, relative investor demand at a maturity for IL debt vs nominal and their outstanding swap positions and hence swap market access, in order to decide what debt to issue in a particular moment in time*"[17].

Notwithstanding the incentives for companies, there are good reasons for why companies may achieve cheaper pricing via synthetic positions.

It is widely recognised by banks that there is greater demand from institutional investors in the inflation swap market compared to the inflation linked corporate debt market[18].

[16] CEPA (2016), Ofwat and CAA - Alternative approaches to setting the cost of debt for PR19 and H7, p. 199.
[17] Ibid., p. 197.
[18] Based on KPMG's bank survey covered in the August 2024 Cost of New Debt and Additional Borrowing Costs report.

One major bank explained that similar investors (pension funds and insurance companies) trade in both markets. These investors break up their investment activities into separate mandates (e.g. equities, corporate debt, government debt) and run overarching liability hedges centrally (e.g. inflation risk, rate risk). Most investors prefer not to mix corporate credit risk (managed in their corporate debt portfolio) with liability hedging (typically managed centrally). In consequence, demand for inflation linked corporate debt tends to be limited compared to that for inflation swaps.

Further, CEPA for Ofwat/CAA explored why some companies prefer index linked swaps to direct issuance. It considered that *"one explanation is that the spread on index-linked debt is typically larger than a comparable spread on nominal debt. Others include the difference in implied inflation breakeven rates between the swap and index-linked bond market"*[19]. This also seems to suggest that it may have been cheaper to raise synthetic index linked debt.

Third, Ofwat has implemented a full transition to CPIH at AMP8 but the market for direct CPI/CPIH debt is still developing. In this context, companies have tapped the basis swap market to proactively manage the mismatch between their embedded RPI debt and CPIH assets at AMP8.

For example, UUW has transacted both RPI-to-CPI and RPI-to-CPIH basis swaps: *"…we have made good progress in transitioning the mix of our index-linked debt away from RPI-linked…to CPI or CPIH-linked…including last summer executing the first ever CPIH-linked swap*"[20].

UUW and SVE have both transacted such swaps according to their 2024 APRs[21].

In conclusion, inflation swaps have been used efficiently by companies and are likely to have led to lower costs than the counterfactual of direct index linked debt issuance.

Currency swaps

Ofwat has included cross-currency swaps in its balance sheet approach. It follows that the notional company is expected to make use of cross-currency swaps.

This appropriately recognises that companies have sought to widen their investor pool and thus lower costs by accessing foreign debt markets. Currency swaps are a core component of these transactions as they fix foreign interest payments in sterling which ensures consistency with sterling revenues.

Interest rate and inflation swaps like cross-currency swaps are an indivisible component of financing strategies. However, Ofwat has not explained why the notional company would only be expected to hedge currency risk, not interest rate or inflation risk through swaps.

Risky use of swaps

Ofwat considers that some companies may have used swaps for risky purposes which may not be reflective of the behaviour of the notional company.

These risky purposes have been highlighted in its 'Financial resilience in the water sector: a discussion paper'. The paper indicates that swaps have been used to profile cashflows, for example, reduce short-term effective interest costs at the expense of highly likely future cash outflows.

Ofwat accepts that "*swaps have been used by* [only] *a small number of companies with already weak levels of financial resilience to alter the profile of cash interest payments*"[22]. The March 2024 CoD report explained that the data collection process for the KPMG Tool reaffirmed it is rare for swaps to be used in this way and where they are, the cash profiling component had been removed. This should have addressed Ofwat's concerns about cash profiling.

In any event, it is not appropriate to conflate a small number of risky swaps with all other swaps.

The paper also indicates that the use of swaps in general may introduce additional risk for companies. For example, counterparties may require swap contracts to include (a) accretion paydowns; and (b) break clauses to limit their credit exposure.

19 CEPA (2016), Ofwat and CAA - Alternative approaches to setting the cost of debt for PR19 and H7, p. 197.
20 UUW (2021), Full year results investor presentation 2021, p. 18.
21 Based on the instrument names in Table 4B, it is possible to pair RPI receive legs to CPI pay legs.
22 Ofwat (2021), Financial resilience in the water sector: a discussion paper, p. 16.

On (a), accretion paydowns on inflation swaps are not dissimilar to repayments on amortising index linked debt. A significant proportion of the index linked debt in the sector has been raised in the form of amortising loans from the EIB.

In the swap case, the company is required to pay down the entire balance of accretion that has accumulated since the last paydown date. In the loan case, the company is required to repay a proportion of the initial size as well the accretion that has accumulated on that proportion since issuance. In both cases, this 'amortising' profile results in lower coupon rates for companies compared to a bullet profile as the 'amortising' profile is less risky for counterparties.

Further, the EIB has required considerably more frequent cash outflows to be made than swap counterparties. The EIB amortising index linked debt in the sector requires repayments to be made every 6m compared to the 5Y accretion paydowns that Ofwat cites for inflation swaps.

This implies the first point is not a material differentiator between swaps and other debt.

On (b), the data collection process for the KPMG Tool indicated that there were not many swaps with mandatory break clauses in the sector.

7.2.2. Ofwat's policy on swaps in previous price reviews

Ofwat asserts it has always excluded swaps in setting the cost of embedded debt in previous price reviews. This maintains a consistent approach which improves the predictability of the regime.

Ofwat's approach to the cost of embedded debt over PR04-PR19 is set out in the table below.

Table 1: Ofwat's approach to the cost of embedded debt over PR04-PR19

Price review	Ofwat's approach to the cost of embedded debt
PR04	Risk free rate *plus* a debt premium based on (1) current and historical spreads on traded water company debt; and (2) current and historical spreads on A and BBB rated bonds
PR09	Actual cost based on direct observations from companies' existing debt portfolios
PR14	10Y fixed average of iBoxx A/BBB index *less* an outperformance wedge (based on yield at issue for water company bonds vs yield on the index at the time)
PR19	Primarily using benchmark index approach: 15Y fixed average of iBoxx A/BBB index *less* an outperformance wedge (based on yield at issue for 10Y+ fixed rate water company bonds vs yield on the index at the time) Cross-checked using balance sheet approach: median cost of embedded debt across WaSCs and large WoCs, excluding swaps and non-standard debt instruments (such as junior debt)

Source: KPMG analysis and data from Ofwat PR04, PR09, PR14 and PR19 FDs

It may be misleading for Ofwat to characterise its approach to setting the cost of embedded debt as never having relied on swaps. Ofwat's approach has varied over time and the balance sheet approach was first used at PR19 (albeit as a cross-check). In previous price reviews, company balance sheets were not the focus and therefore swaps were not explicitly considered.

PR19 was the first time Ofwat gave a clear signal that swaps would be excluded from the assessment of embedded debt. However, Ofwat's exclusion of swaps at PR19 was ultimately overturned by the CMA FD which companies might have expected to be the starting point for PR24.

Even if companies overlooked the CMA FD, Ofwat's signal in PR19 has not given companies sufficient time to change their use of swaps. By PR19, companies had already raised a significant volume of swaps which typically have long tenors and cannot be restructured without significant cost.

In effect, Ofwat has determined ex-post that swaps would not be issued by the notional company. This is not appropriate and could, counter to Ofwat's view, undermine the predictability of the regime.

Further, it is difficult to reconcile Ofwat's decision to exclude swaps with its long history of recognising the importance of swaps. Ofwat has consistently recognised swaps as a valid means of hedging inflation risk in previous price reviews and more recently for hedging interest rate and currency risk:

- Ofwat/Ofgem at PR09: "*The same effect can be produced through adopting financial swaps that convert the company's liability to pay from nominal interest to real interest (with the inflation added to the principal sum borrowed) or by manufacturing synthetic index-linked debt instruments with the help of financial intermediaries*"[23].
- Ofwat at PR14: "*In setting price limits for the future, we could consider a greater proportion of index-linked debt. This may reflect an expectation that greater amounts of index-linked debt might be raised in the future. Or it may reflect the ability of the companies to swap floating or fixed rate liabilities to mimic index-linked liabilities using swaps*"[24].
- Ofwat at PR14: *"…companies will be able to issue index-linked debt either directly or through swap arrangements…If these companies are able to issue more index-linked debt, consumers will not be disadvantaged*"[25].
- CEPA for Ofwat/CAA at PR19: *"The primary use of derivatives has been to convert fixed rate sterling debt into Index linked debt"*[26].
- CEPA for Ofwat/CAA at PR19: "*Issuance of a nominal bond combined with an inflation swap will provide the same cash outcome at the end of the term as issuance of an inflation linked bond of the same term*"[27].
- Ofwat at PR24: "*Swaps can form part of a considered approach to treasury risk management, for example, where linked to underlying instruments and used to hedge interest rate, inflation or exchange rate risks*"[28].

Companies may have interpreted these statements as support for using swaps. As such, Ofwat's exclusion of swaps at PR24 could be seen as extracting the realised benefits of swaps ex-post.

Separately, Ofwat comments that other regulators have consistently excluded swaps from their assessment of sector costs. Ofgem in GD&T2 and ED2 focused on sector costs excluding swaps to calibrate the length of its trailing average, but uses sector costs including swaps as a broad cross-check[29]. Ofgem notes in both price reviews that its chosen trailing average length not only covers but has headroom against this cross-check in a number of scenarios including the base case[30].

7.2.3. Counterfactual

Ofwat's exclusion of swaps from company balance sheets implies a retrospective change to treasury policies. This is because it assumes that in the counterfactual where companies had not entered into swaps, they would have issued the same conventional debt without change.

In practice, it is likely that companies would have adapted their approach to conventional debt issuance to still achieve their risk management objectives in the counterfactual. However, it is not possible to know with certainty exactly what companies would have done in the counterfactual.

[23] Ofwat and Ofgem (2006), Financing Networks: A Discussion Paper, para. 146.
[24] Ofwat (2011), Financeability and financing the asset base – a discussion paper, paras. 65-66.
[25] Ofwat (2009), Future water and sewerage charges 2010-15: Final determinations, p. 140.
[26] CEPA (2016), Ofwat and CAA - Alternative approaches to setting the cost of debt for PR19 and H7, p. 199.
[27] Ibid., p. 189.
[28] Ofwat (2021), Financial resilience in the water sector: a discussion paper, p. 15.
[29] Ofgem (2022), RIIO-ED2 Final Determination – Finance Annex, para. 2.69.
[30] Ibid., para. 2.100; Ofgem (2021), RIIO-2 Final Determinations – Finance Annex (REVISED), para. 2.40.

Plausible counterfactuals for common uses of swaps in the sector are set out in the table below. Ofwat's counterfactuals for the same are also presented.

Table 2: Factual and counterfactual scenarios for swaps

Swap type	Factual with swaps	Plausible counterfactual without swaps	Ofwat counterfactual without swaps
Interest rate	Benchmark floating rate bond with 10Y reducing balance floating-to-fixed swap	Sub-benchmark fixed rate bond issuance every year for 10Y	Benchmark floating rate bond
Inflation	Fixed rate bond with fixed-to-index linked swap	Index linked bond	Fixed rate bond
Currency	Foreign currency bond with sterling swap	Sterling bond	Sterling bond[1]

Notes: (1) This sterling bond is at the same cost as the factual scenario (foreign currency bond with sterling swap) as Ofwat includes currency swaps
Source: KPMG analysis

Ofwat's counterfactual for companies is likely to misstate the actual cost they could have achieved at the time assuming the same risk management objectives. Instead, Ofwat should reflect a plausible counterfactual for companies.

This counterfactual is likely to be challenging to price and in any case be more costly than the factual. If the counterfactual was less costly, companies would likely have executed this instead of the factual given they have been incentivised to meet their risk management objectives at minimum cost.

This suggests it may be more straightforward for Ofwat to include swaps.

Ofwat's reconciliation suggests that the 'all-in' cost could increase in nominal terms by 11bps if interest rate and inflation swaps are included.

8. Data differences between Ofwat's balance sheet model and the KPMG Tool

Ofwat's DD model uses 2023 debt data based on company 2023 APRs. The KPMG Tool uses 2023 debt data based on data templates that were populated by companies specifically for the Tool.

Ofwat's reconciliation suggests that data differences between the 2023 APRs and the data templates have a material impact on the 'all-in' cost for ANH, WSH, SWL and WSX. Ofwat does not go on to comment on the data differences in the DD.

The March 2024 CoD report included an appendix on the process for collecting and checking the data templates. This noted that companies provided confirmation that their data template was accurate. These confirmations were provided in view of the differences between common fields in their data template and their 2023 APRs / Business Plan data tables.

Notwithstanding the above, the data differences for SWL merited investigation as the impact of these are larger than for any other company. Ofwat's reconciliation suggests that the 'all-in' cost for SWL in the Ofwat DD model is 79bps lower than in the KPMG Tool in nominal terms due to data differences.

It was possible to broadly replicate the 79bps. However, it is not clear whether this is based on same calculation as Ofwat because its reconciliation workings have not been provided.

For SWL, there are two data differences between Table 4B of its 2023 APR and its data template which both relate to floating rate debt. In particular, these data differences relate to the SONIA rate on which coupon payments for its floating rate debt are based.

Reference benchmark

SWL populated the 'Reference benchmark' column of Table 4B with "SONIA". Ofwat has assumed this means that floating rate coupons are linked to overnight SONIA.

RAG 4.11 does not specify that companies should provide the SONIA compounded rate to which floating rate coupons are linked so it is not clear why Ofwat has made this assumption: *"Name of floating rate benchmark (e.g. 3 month SONIA). Only needed for floating rate debt or facilities priced using a benchmark"*[31].

The data appendix in the March 2024 report explained that an important check for the data templates was ensuring that reference benchmarks were aligned with coupon frequency.

SONIA itself is strictly an overnight rate. However, the reference benchmark should in practice reflect the compounding period implied by the coupon frequency. For context, it is expected that for a floating rate instrument with coupon payments every 3 months, the coupon payments are linked to SONIA compounded over 3-months in arrears i.e. 3m SONIA.

As a result of this check, the reference benchmarks in the SWL data template were updated to 3-12m SONIA. The SONIA term structure was upwards sloping in October 2023[32]. This meant the use of 3-12m SONIA instead of overnight SONIA led to a higher 'all-in' cost in the KPMG Tool.

Reference benchmark rate

SWL populated the 'Reference benchmark rate' column of Table 4B with 2.189%. SWL indicated to KPMG that this reflects an FY23 average of overnight SONIA with a 5 business day lookback.

Ofwat uses this APR rate as a starting point to calculate the reference benchmark rate it uses for floating rate coupons over AMP8. For SWL, Ofwat has assumed this APR rate is equal to the spot rate on overnight SONIA as at 31 March 2023, which in practice was 4.18%.

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31 Ofwat (2023), RAG 4.11 – Guideline for the table definitions in the annual performance report, Version 1.1, p. 53.

32 Ofwat's reconciliation is based on market data until October 2023.

RAG 4.11 does not specify what exactly companies should provide for the APR rate so it is not clear why Ofwat has made this assumption: "*Nominal interest rate of reference benchmark (e.g. 1.55%). Only needed for floating rate debt or facilities priced using a benchmark'*[33].

SWL's APR FYA rate (2.189%) is lower than the FYE spot rate (4.18%) because spot rates on overnight SONIA (and all other SONIA rates) increased significantly over the course of FY23[34].

The KPMG Tool does not use the APR rate and instead takes the spot rate as at 31 March 2023 directly from data providers. This led to a higher 'all-in' cost in the KPMG Tool.

In conclusion, the KPMG dataset could represent a useful input to calibration of the cost of embedded debt. This is because the differences between the KPMG dataset and 2023 APRs are valid and relevant for modelling of embedded debt costs.

Ofwat has signalled it will use 2024 APRs at FD. For common instruments in the KPMG dataset and 2024 APRs, Ofwat should evaluate whether it is necessary to make any amendments to the 2024 APRs to take account of differences between the two data sources.

[33] Ofwat (2023), RAG 4.11 – Guideline for the table definitions in the annual performance report, Version 1.1, p. 53.

[34] Ultimately what matters is that the SONIA compounded rates, to which floating rate coupons are linked, increase over FY23 given the first data difference. This explanation focuses on the overnight SONIA rate for simplicity.

9. The KPMG Tool as an input to refine Ofwat's balance sheet model

This section considers Ofwat's comments on the KPMG Tool and potential implications.

Ofwat comments that the KPMG Tool is complex and this complexity does not lead to materially different estimates of the 'all-in' cost relative to its DD model at the company level.

Ofwat considers that the only area of noticeable difference is on refinancing. Ofwat comments that its DD model assumes that debt maturing in AMP8 does so mid-year whereas the KPMG Tool uses the exact maturity date. Ofwat comments that it is not clear that the KPMG Tool has taken account of the specific timing of issuance for the new debt that refinances the maturing debt.

Ofwat considers that adopting the complexity of the KPMG Tool will increase the data reporting and assurance burden on companies.

9.1. Materiality of differences between the Ofwat DD model and KPMG Tool

This section considers Ofwat's comments on the materiality of the differences between its DD model and the KPMG Tool and the implications of these differences.

First, the KPMG Tool was designed to address the issues in the Ofwat FM model outlined in the September 2023 CoD note and reflect how the cost on debt instruments are modelled in practice. The aim of this design is for the KPMG Tool to produce a precise estimate of the 'all-in' cost.

Ofwat is clear that the aim for its DD model is different: "*We aim to balance the accuracy of the model …against undue levels of complexity in setting the cost of embedded debt. This will help us to focus on material issues and limit the regulatory burden on setting the allowed return on debt…*"[35].

A high-level approach as applied in the DD model increases scope for miscalibration of the allowance.

Second, the materiality of each issue in Ofwat's FM model could not have been known ex-ante. The KPMG Tool was developed in part to determine the materiality of these issues. In this context, the KPMG Tool is a useful input into Ofwat's calibration of the cost of embedded debt allowance.

Moreover, Ofwat emphasises that it developed its DD model by focusing on material issues. A precise estimate of the 'all-in' cost is required to determine materiality.

Third, Ofwat's reconciliation shows there are material gaps between the 'all-in' cost in the Ofwat DD model and the KPMG Tool at the company level[36].

For example, in the case of SRN, its 'all-in' cost in the Ofwat DD model is 56bps lower than in the KPMG Tool in nominal terms after adjusting for what Ofwat considers are policy differences.

Fourth, Ofwat has sought to narrow the gap between its DD/FD model and the KPMG Tool at the company level through the changes it has signalled / is consulting on in the DD. This is because these changes are linked to material bridging items in its reconciliation.

For some companies, these changes can materially bridge the gap. In the case of SRN, 48bps of the 56bps mentioned above could be closed based on these changes. For other companies, even if Ofwat makes these changes, there will remain material gaps. This is the case for WSH and SWL.

Fifth, bridging items in Ofwat's reconciliation that are less material under current market conditions could be material under different market conditions. This reinforces the need for the DD/FD model to focus on producing a precise estimate.

[35] Ofwat (2024), PR24 Draft Determination, Aligning risk and return – Allowed return appendix, p. 127.
[36] Ofwat's reconciliation is based on the February 2024 KPMG Tool rather than the March 2024 KPMG Tool.

Sixth, Ofwat's view of materiality appears to be inconsistent across categories of debt. For example, Ofwat includes 'immaterial' finances leases in its 'all-in' cost on that basis that it considers *"…it more appropriate to include all pure debt instruments that water companies report, rather than creating criteria to identify immaterial instruments"*[37]. In contrast, Ofwat justifies partially on the basis of materiality *inter alia* the exclusion of intercompany loans and swaps in its 'all-in' cost.

9.2. Complexity of the KPMG Tool

Ofwat has overstated the complexity of the KPMG Tool:

- Ofwat suggests the KPMG Tool produces daily estimates of the cost of embedded debt. This is not the case. The KPMG Tool produces annual estimates of the cost of embedded debt and this was outlined in the March 2024 CoD report.
- Ofwat suggests the KPMG Tool attempts to model bespoke features of company debt instruments. In practice, the KPMG Tool models each category of instrument in line with its characteristics (e.g. bond as bonds, swaps and swaps). There are only two cases where bespoke adjustments were made in the KPMG Tool which were highlighted in the March 2024 CoD report.

In contrast, Ofwat's model may be oversimplified in that it applies a one size fits all approach to its modelling of instruments (e.g. swaps as bonds) and does not reflect how instruments are modelled in practice. Ofwat's model has also not been built in line with modelling best practice which reduces transparency and increases likelihood of error.

There were two further refinements which could have been made to the KPMG Tool to increase its accuracy and would have resulted in a higher 'all-in' cost. These were discussed in the March 2024 report but Ofwat has not engaged with these points.

First, the WACC is an annual coupon. This means that semi-annual or quarterly coupon rates should in principle be converted to equivalent annualised rates and then these annualised rates form the basis of the allowance for embedded debt. For example, a 4% semi-annual coupon is economically equivalent to a 4.04% annual coupon and this 4.04% should form the basis of the allowance. This conversion has not been implemented in the KPMG Tool[38].

Second, a number of companies have in the past paid banks to put in place a 'gilt lock' to fix the gilt component of the coupon in the days leading up to a bond's issuance. The benefit of the gilt lock is that it reduces the pricing uncertainty of the coupon. The KPMG Tool included the benefit of the gilt lock (reflected in the coupon rate) but not the associated fees paid to the bank[39].

In addition, Ofwat has not included scenario functionality in its DD model which means the allowance will underfund the 'all-in' cost as soon as rates increase above current levels. This is different to Ofgem which undertook scenario analysis of plausible macroeconomic outcomes to inform the calibration of its allowance in RIIO-2[40]. The March 2024 CoD report showed that the 'all-in' cost would be 17-25bps higher in a downside scenario where interest rates increase by 2%. For context, iBoxx A/BBB 10Y+ rates increased by 3.26% between the first year of AMP7 and March 2024.

Separately, the March 2024 CoD report materially reduces complexity for setting the cost of embedded debt in some areas relative to Ofwat's DD approach. For example, it does not require the use of the 'actual-notional' cost or the benchmark index approach.

9.3. Timing of refinancing

Ofwat comments that is not clear the KPMG Tool has taken account of the specific timing of issuance for new debt that refinances maturing debt.

[37] Ofwat (2024), PR24 Draft Determination, Ofwat comments on cost of debt report submitted by Water UK, p. 12.
[38] KPMG (2024), Estimating the Cost of Embedded Debt and Share of New Debt for PR24, p. 61.
[39] KPMG (2024), Estimating the Cost of Embedded Debt and Share of New Debt for PR24: Annex to Appendix 4, p. 7.
[40] Ofgem (2022), RIIO-ED2 Final Determination – Finance Annex, para. 2.84.

The KPMG Tool models the maturity of embedded debt instruments based on their actual maturity dates as this is known. In contrast, the issue date for new debt instruments that replace maturing debt is unknown and thus an assumption has to be made. The March 2024 CoD explained that new debt is assumed to be issued in the middle of the year. Whilst this assumed issue date for new debt may not exactly match the actual maturity dates of embedded debt, it appears to be a reasonable assumption.

The Ofwat DD model instead redefines the actual contracted maturity dates of embedded debt instruments to be in the middle of the year. This does not appear to be a superior approach.

9.4. Reporting requirements

Ofwat may overstate the implications of the KPMG Tool on reporting requirements for companies.

The dataset for the KPMG Tool does contain additional information relative to the APRs, mainly for swaps and finance leases. This additional information was required to (1) facilitate accurate modelling of the cost of debt on an annual basis across AMP8; and (2) capture all relevant costs. The need for additional data is also reflected in the Ofwat FM/DD model, which adopted placeholder modelling assumptions where data required to project debt costs was not available in APRs.

Some of this additional data reflects that the APRs are a set of financial statements at a point in time. The APRs were not designed for projecting the cost of embedded debt on a forward-looking basis. For example, the APRs contains the in-year rate but not the annual coupon rate profile for instruments. In practice, there are instruments in the sector with coupon rates that vary over time (e.g. this is common for finance leases) and specifically over AMP8.

This additional data in the KPMG dataset does not need to be provided as part of annual APRs. It can be provided just once every five years in Business Plan data tables for the purposes of setting the cost of embedded debt at each price review.

Separately, there are issues with using the APRs as a basis to estimate the cost of embedded debt due to the lack of specificity in RAG 4.11[41]. For example:

- Companies have adopted different methodologies in the APR for accounting for accretion in the principal balances of index linked debt. This is because RAG 4.11 does not prescribe a specific methodology for accretion accounting. In consequence, differences in accretion accounting across company APRs could undermine the comparability of debt costs across the sector.
- Companies have not provided the SONIA compounded rate for floating rate debt in the APR which is what coupons are linked to in practice. This is because RAG 4.11 does not specify that the compounded rate should be given. This is discussed further section 8.
- RAG 4.11 does not specify exactly what rates companies should provide for their instruments in the APR. In consequence, companies may have adopted different approaches to populating the rate fields in the APR (e.g. coupon vs effective interest rate). Ofwat acknowledges this by noting that it is uncertain about what companies have provided in the APR: *"Companies may have already adjusted rates to take the difference in par value into account…"*[42].
- Ofwat has made a number of manual amendments to company 2023 APRs in its DD model. This is because RAG 4.11 does not e.g. require companies to report currency swaps together with the underlying foreign debt in a single line or report tap issuances in separate lines. There is scope for error when making manual amendments to company data.

41 The basis of 2023 APRs is RAG 4.11 and 2024 APRs is RAG 4.12. As the DD balance sheet model uses 2023 APRs, only RAG 4.11 has been considered.

42 Ofwat (2024), PR24 Draft Determination, Ofwat comments on cost of debt report submitted by Water UK, p. 13.

10. The role of the 'actual-notional' cost in Ofwat's balance sheet approach

Ofwat assigns equal weight to the 'all-in' cost and 'actual-notional' cost to form its balance sheet estimate. This section considers the usefulness of placing weight on the 'actual-notional' cost.

Ofwat's DD model estimates an 'all-in' cost of 4.52% and an 'actual-notional' cost of 4.50% in nominal terms. The average of these costs results in a balance sheet estimate of 4.51%.

Ofwat considers "…*the 'Actual notional' cost to be an important element of our* [Ofwat's] *benchmark efficient cost of embedded debt. Rather than aiming to identify errors, we include it because it aligns with our long-standing principle that companies are responsible for their own financing choices*"[43].

Companies cannot change their past decisions (embedded debt), only their future decisions (new debt) which implies there is a limited efficiency incentive of including the 'actual-notional' cost. Instead, its inclusion could mean that companies are underfunded for their actual cost.

There are two further issues with the 'actual-notional' cost which were explained in the March 2024 CoD report but Ofwat has not engaged with in the DD.

The 'actual-notional' cost does not adjust solely for debt mix

The 'actual-notional' cost does not in practice solely adjust a company's portfolio for the notional debt mix. It also adjusts the weighted-average timing of issuance of a company's portfolio.

For example, assume a company's portfolio comprises two equally sized bonds. One index linked which was issued when rates were high and one fixed rate which was issued when rates were low. The 'actual-notional' cost assumes that 67% of the portfolio was raised when rates were low whereas in reality this was 50%[44]. In this example, the 'actual-notional' cost would understate the actual cost.

Instead, the 'actual-notional' cost should be calculated such that the cost of the additional 17% fixed rate debt is based on the same timing of issuance as the index linked bond.

The implication is that Ofwat's 'actual-notional' cost is over simplified and does not fulfil the purpose for which it was designed. The more robust version of the 'actual-notional' cost above would correct the distortion related to timing of issuance but is likely to be challenging to implement in practice.

The 'actual-notional' cost can give a misleading view of the actual cost

Ofwat's 'actual-notional' cost (and the more robust version above) is synthetically constructed and can give a misleading view of the sector's actual cost.

First, whilst Ofwat's DD model implies that the 'all-in' cost and 'actual-notional' cost are aligned at the sector-level, they do vary materially at the company-level. This is illustrated in Figure 4. For example, in the case of UUW, its 'all-in' cost is 67bps higher than its 'actual-notional' cost in nominal terms.

Hence, it appears to be a coincidence that the 'actual-notional' cost only has a small impact at the sector-level in the DD (1bp). This could change at FD when Ofwat updates its model for the latest debt data, market data and new debt for RCV growth.

Second, as Ofwat's 'all-in' cost and 'actual-notional' cost are both variants of a notional cost, they provide limited insight about the sector's actual cost.

Third, the KPMG 'all-in' cost reflects the actual cost for the sector excluding cash profiling. The March 2024 KPMG Tool indicates that at the sector-level, the 'all-in' cost is 34bps higher than the 'actual-notional' cost in nominal terms. Where swaps are excluded, this difference increases to 38bps.

At the company-level, the differences can be even more material as shown in Figure 5 (includes swaps). For example, in the case of WSH, its 'all-in' cost is 71bps higher than its 'actual-notional' cost. Material differences at the company-level are observed in both the KPMG Tool and Ofwat DD model.

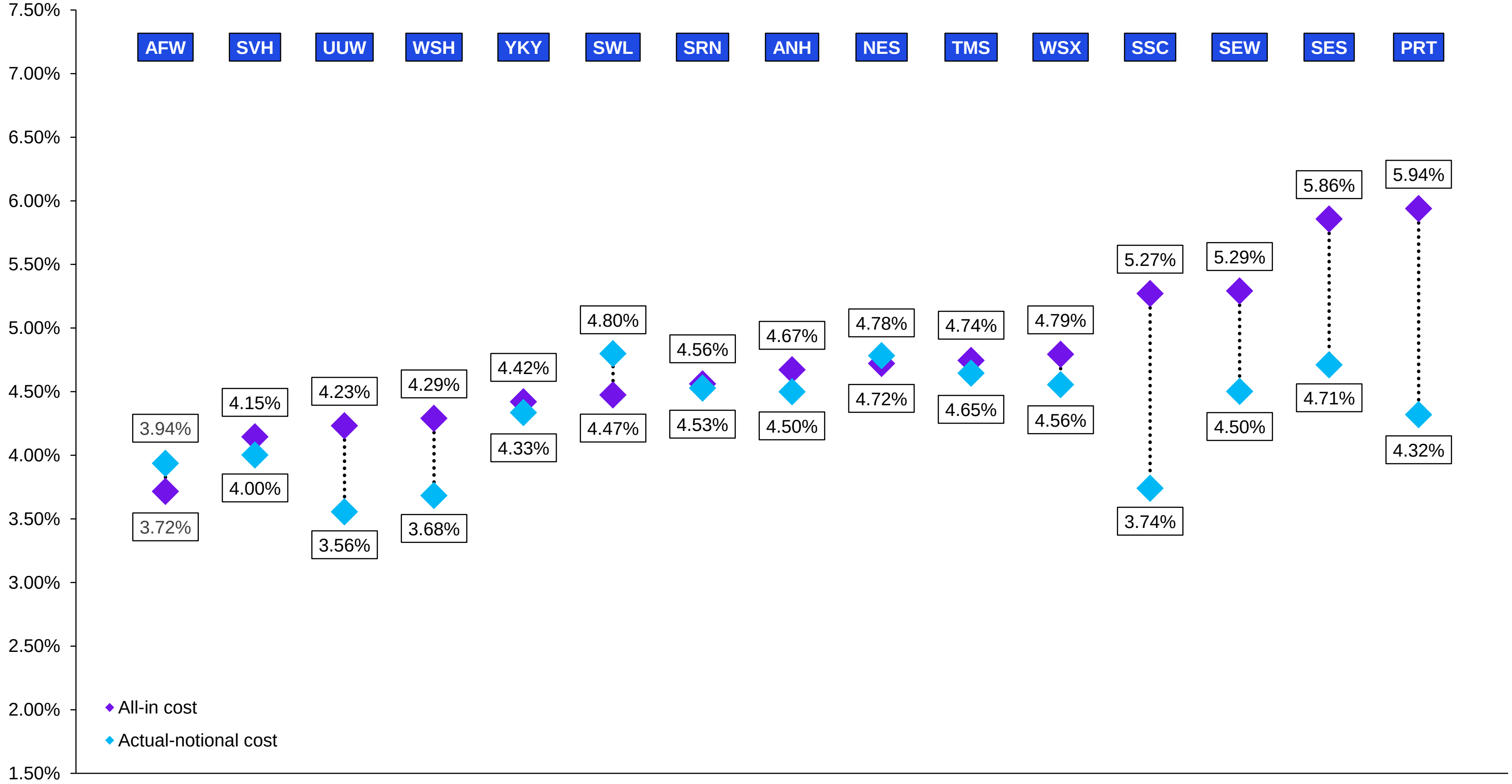
[43] Ibid., p. 8.

[44] The notional debt mix comprises 67% fixed rate debt and 33% index linked debt.

In conclusion, this suggests that the ‘actual-notional’ cost should not be used as an input into the balance sheet estimate. Its inclusion could result in the average company being underfunded for its actual cost. This undermines the principle underpinning the sector average approach.

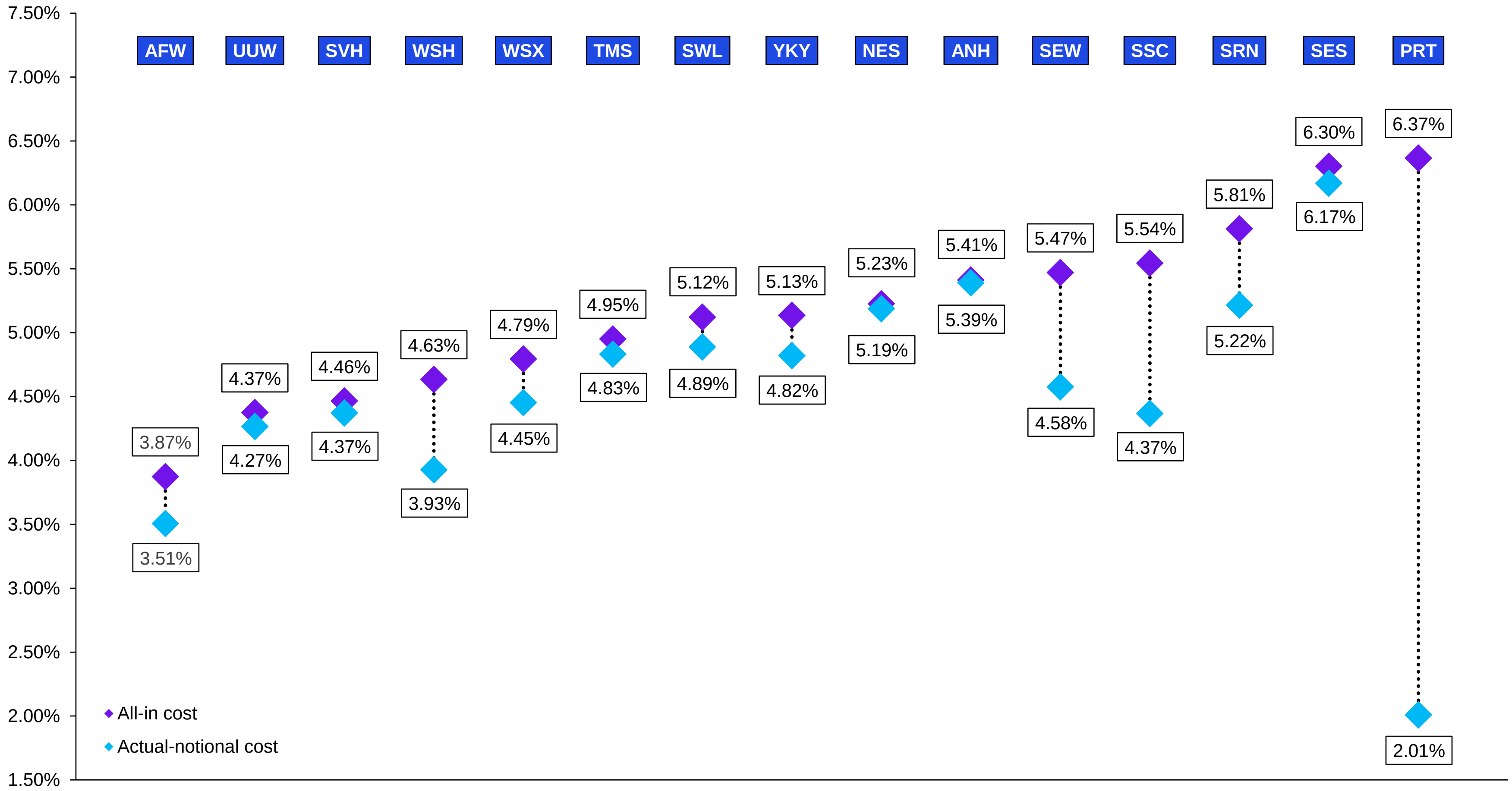
As such, the March 2024 CoD report attached no weight to the ‘actual-notional’ cost in deriving the cost of embedded debt.

Figure 4: Comparison of AMP8 'all-in' cost and 'actual-notional' cost across the sector based on Ofwat DD model (nominal)



Notes: Based on 2023 debt data from APRs and market data up until March 2024
Source: KPMG analysis

Figure 5: Comparison of AMP8 'all-in' cost and 'actual-notional' cost across the sector based on March 2024 KPMG Tool (nominal)



Notes: Based on 2023 debt data from KPMG dataset and market data up until October 2023
Source: KPMG analysis

11. Potential cross-checks to Ofwat's balance sheet approach

Ofwat adopts the benchmark index approach as a cross-check for its balance sheet approach. This section considers whether this position is appropriate.

First, the principle behind the balance sheet approach, like other sector average approaches, is that the sector average cost represents the proxy for the efficient cost. The use of cross-checks, like the benchmark index approach, that could result in the allowance being set at different level to the balance sheet estimate contravenes this principle of a sector average approach.

Ofwat recognised the same at the PR19 appeal: "*We* [Ofwat] *and the CMA recognise the value of the iBoxx A and BBB indices in providing independent data points to inform an efficient allowance. There is however substantially less value in an independent benchmark that systematically overcompensates the majority of the sector*"[45]. To this end, it is not clear why Ofwat considers that over- or under- compensation based on an independent benchmark is appropriate at PR24.

Ofgem in RIIO-2 also used a sector average approach to set the cost of debt allowance. However, unlike Ofwat, it did not cross-check the sector average estimate using alternative approaches which reinforces that this may not be appropriate.

Second, as discussed above, Ofwat's specification of the balance sheet approach already 'double notionalises' the sector's actual cost. The benchmark index approach is just another way of producing a notional cost. In this context, it is not clear whether the benchmark index approach represents a useful cross-check to Ofwat's balance sheet approach.

Third, Ofwat seeks to use the benchmark index range as a cap rather than a cross-check for the balance sheet estimate. This is asymmetric as it implies Ofwat would not provide additional allowance if the sector outperformed the benchmark index range. This asymmetry (1) undermines incentives for the sector to issue efficiently as any outperformance against the benchmark would be clawed back ex-post; and (2) means that companies may not be able to recover their actual costs on average.

Fourth, it is challenging to calibrate a benchmark trailing average that precisely takes account of macroeconomic volatility and the sector's timing, tenor and mix of debt issuance over time. This could give rise to many variants of the trailing average (each with pros and cons) which collectively point to a wide range and are all less precise than the balance sheet estimate.

This implies that benchmark trailing averages cannot provide robust insights into efficiency and so it is more robust to rely solely on the balance sheet estimate which can be directly observed.

The CMA at PR19 asserted that, at a minimum, differences between the balance sheet estimate and benchmark index estimate should be carefully investigated: *"As an alternative to the actual cost approach used as the basis of our cost of embedded debt allowance in this determination, we considered applying a benchmark approach with an associated cross-check against evidence of actual costs. However, as discussed, in order to balance our duties, we would have to carefully consider if there were legitimate reasons why any allowance would reasonably be expected to deviate from that suggested by a bond benchmark"*[46]. This suggests there is a high hurdle to move away from using the balance sheet estimate as the proxy for the efficient cost.

[45] Ofwat (2020), Reference of the PR19 final determinations: Risk and return – response to CMA provisional findings, para. 4.12.

[46] CMA (2021), PR19 Final Determination, para. 9.716.

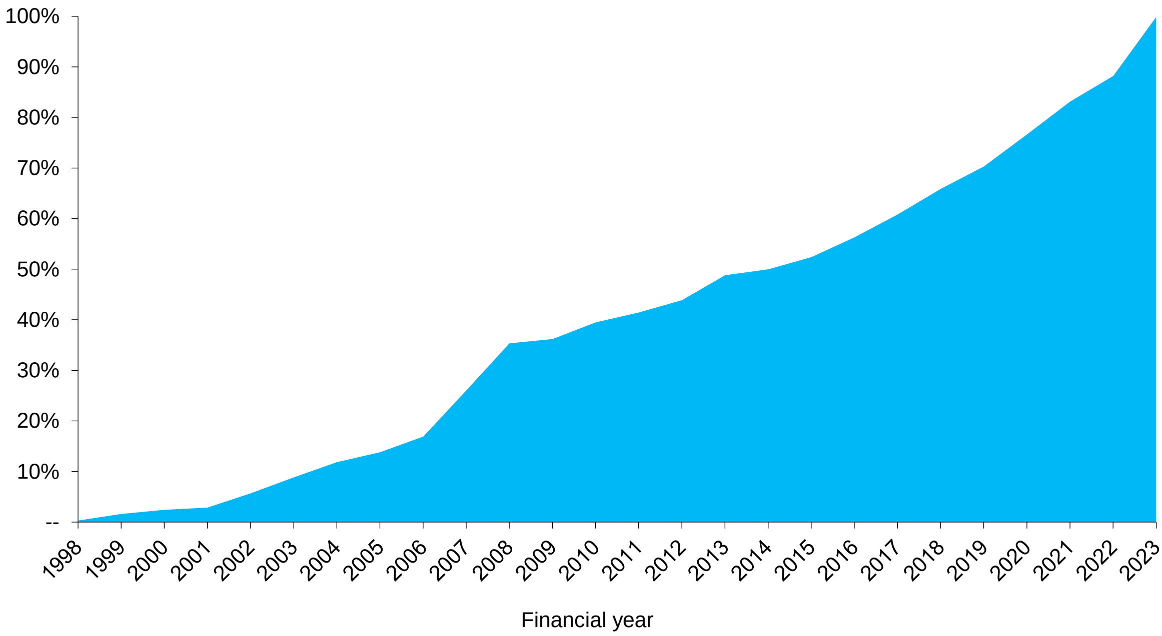
Fifth, Ofwat considers that higher debt costs that have resulted from management choices to raise gearing above notional levels should not be reflected in the benchmark trailing average. However, this view is oversimplified and asymmetric. Some companies have increased gearing when rates were cheap which has contributed to lower allowances. This is the case for AFW who has the lowest cost of debt in the sector based on the 'all-in' cost in both the KPMG Tool and Ofwat DD model.

Sixth, Ofwat's variants of the benchmark trailing average appear oversimplified which limits their usefulness for calibrating the allowance.

For example, Ofwat has developed a variant based on the sector raising debt in line with RCV growth at prevailing notional structures. However, it is not clear whether Ofwat has assumed that (1) companies had 0% gearing after privatisation and geared up to notional levels; or (2) companies were notionally geared after privatisation and the associated debt was refinanced over time.

Ofwat also considers 15Y trailing averages which begin in FY 2011. However, the chart below shows that 40% of debt and 47% of bonds in the sector's 2023 debt portfolio was raised by FYE 2010[47].

Figure 6: Build-up of the sector's 2023 debt portfolio



Source: KPMG analysis

In this context, a trailing average of the iBoxx A/BBB index based on a length of e.g. 25Y would imply a simple average of 4.92% and a uniform collapsing average of 4.77%[48]. These averages are both significantly higher than Ofwat's DD balance sheet estimate of 4.51%.

In conclusion, this suggests that no weight should be attached to the benchmark index cross-check. This position was reflected in the March 2024 CoD report.

47 This chart is based on the KPMG dataset for 2023 debt data.

48 Based on iBoxx A/BBB 10Y+ using the DD data cut-off date of 31 March 2024.

12. Appendices

This section contains the appendices to the report.

12.1. Appendix A: Additional tables

Table 3: UUW's treasury policy on interest rate risk over 2008-2024

Period	UUW's treasury policy on interest rate risk
2008-2011	*"The group's policy is to structure debt in a way that best matches the cashflows generated by its underlying assets… Where long-term debt is raised in a fixed rate form, the group will swap to floating rate, at inception over the life of the liability, through the use of interest rate swaps…* *The group's revenues are determined based upon the real cost of capital fixed by the regulator for each five-year regulatory pricing period. The group fixes a material proportion of the floating cost of debt for the duration of the five-year regulatory pricing period, using a second layer of interest rate swaps to match the group's revenue stream"*
2012-2013	*"The group's policy is to structure debt in a way that best matches its underlying assets and cash flows…* *Where conventional long-term debt is raised in a fixed-rate form, to manage exposure to long-term interest rates, the debt is generally swapped at inception to create a floating rate liability for the term of the liability through the use of interest rate swaps…* *To manage the exposure to medium-term interest rates, the group has fixed interest costs for a substantial proportion of the group's net debt for the duration of the current five-year regulatory pricing period. During the year, the group revised its interest risk management strategy to now extend the fixing of interest rates out to a 10-year maturity on a reducing balance basis, seeking to lock in a 10-year rolling average interest rate on the group's nominal liabilities"*
2014-2017	*"The group's policy is to structure debt in a way that best matches its underlying assets and cash flows…* *Where conventional long-term debt is raised in a fixed-rate form, to manage exposure to long-term interest rates, the debt is generally swapped at inception to create a floating rate liability for the term of the liability through the use of interest rate swaps…* *To manage the exposure to medium-term interest rates, the group fixes underlying interest rates on nominal debt out to ten years in advance on a reducing balance basis. This is supplemented by managing residual exposure to interest rates within the relevant regulatory price control period by fixing substantively all residual floating underlying interest rates on projected nominal debt across the immediately forthcoming regulatory period at around the time of the price control determination"*
2018-2024	*"In the next regulatory period, Ofwat intends to continue using materially the same methodology in setting a fixed real cost of debt in relation to embedded debt (currently assumed to be 70 per cent of net debt), but will introduce a debt indexation mechanism in relation to new debt (currently assumed to be 30 per cent of net debt).* *The group has therefore reviewed its interest rate hedging policy, retaining most elements of the existing policy as Ofwat's embedded debt methodology is materially unchanged…* *Where conventional long-term debt is raised in a fixed-rate form, to manage exposure to long-term interest rates, the debt is generally swapped at inception to create a floating rate liability for the term of the liability through the use of interest rate swaps…* *To manage the exposure to medium-term interest rates, the group fixes underlying interest rates on nominal debt out to 10 years in advance on a reducing balance basis, mirroring Ofwat's expected split of 70 per cent embedded and 30 per cent new debt. However, the group will no longer substantively fix the residual floating underlying interest rates on projected nominal net debt at the start of each regulatory period, leaving this element floating until it is fixed via the above 10-year reducing balance basis, which should more closely mirror Ofwat's new debt indexation mechanism"*

Notes: (1) Extracts are from the annual report in the first year of the period; (2) UUW has referred to the share of new debt for AMP7 as 20% since its 2020 annual report
Source: KPMG analysis and data from UUW annual reports

Table 4: Comparison of the notional company vs actual companies across the sector

Criteria		Notional	WaSC										Large WoC		Small WoC		
			ANH	NES	UUW	SRN	SVH[1]	SWL	TMS	WSH	WSX	YKY	AFW	SEW	PRT	SES	SSC
Credit rating	Fitch	Baa1/BBB+	A- (Stable)	BBB+ (Stable)	BBB+ (Stable)	BBB (Negative)	BBB+ (Stable)	n/a	n/a	A (Stable)	BBB+ (Stable)	n/a	BBB+ (Stable)	n/a	n/a	n/a	n/a
	Moody's		A3 (Stable)	Baa1 (Stable)	A3 (Stable)	Baa3 (Stable)	Baa1 (Stable)		Baa1 (Stable)	A3 (Stable)	Baa1 (Stable)	Baa2 (Stable)	Baa1 (Stable)	Baa2 (Stable)	Baa2 (Stable)	Baa2 (Stable)	Baa2 (Stable)
	S&P		A- (Negative)	n/a	BBB+ (Stable)	BBB (Stable)	BBB+ (Stable)		BBB (Negative)[2]	A- (Negative)	n/a	A- (Negative)	BBB+ (Negative)	BBB (Negative)	n/a	n/a	BBB+ (Negative)
Gearing		60.0%	68.9%	70.2%	67.0%	71.6%	61.0%	68.3%	81.3%	61.1%	68.8%	68.6%	74.9%	77.8%	50.0%	79.1%	68.7%
Debt mix	Fixed rate	67.0%	28.4%	55.1%	31.0%	26.4%	68.3%	66.5%	35.9%	10.6%	55.2%	35.7%	13.4%	29.3%	8.4%	12.5%	20.2%
	Index linked	33.0%	60.5%	36.6%	44.8%	73.3%	28.0%	13.6%	54.6%	84.0%	30.8%	56.9%	86.6%	54.7%	90.5%	67.5%	72.4%
	Floating rate	0.0%	11.2%	8.3%	24.2%	0.2%	3.7%	20.0%	9.4%	5.4%	14.1%	7.4%	0.0%	16.0%	1.1%	20.0%	7.4%
Swaps[3]		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No
Junior debt[3]		No	No	Yes	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Intercompany debt[3]		No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	No
Wrapping fees[3]		No	Yes	No	No	Yes	No	No	No	Yes	No	No	No	No	No	Yes	Yes

Notes: (1) Credit ratings shown for SVH are those for SVE. HDD has only a rating from Fitch of BBB+ (Stable) and this aligns with that for SVE; (2) CreditWatch Negative; (3) Based on the KPMG dataset for 2023 debt data
Source: KPMG analysis and data from 2024 APRs

12.2. Appendix B: Glossary

Table 5: Glossary of select terms

Term	Description
Accretion	Changes to the principal balance of an index linked debt instrument for movements in the inflation index to which the instrument is linked
Amortising	A repayment profile for debt instruments where the principal balance is repaid over the life of the instrument
APR	Annual Performance Report
Balance sheet approach	A form of sector average approach as adopted by Ofwat in the PR24 DD
Benchmark index adjustment	An adjustment applied by Ofwat to the benchmark bond index used to set the cost of new debt to reflect shorter tenor of water company issuance relative to the benchmark index
Benchmark index approach	An approach whereby the cost of embedded debt is set using a trailing average of a benchmark bond index such as the iBoxx A/BBB index
Balance sheet model	A model developed by Ofwat to estimate the cost of embedded debt at the company- and sector-level over AMP8
Bullet	A repayment profile for debt instruments where the principal balance is repaid at maturity of the instrument
ED2	Ofgem's price control for electricity distribution over 2024-2028
EIB	European Investment Bank
Embedded debt	Debt that has been issued in previous price control periods and will continue to be on company balance sheets in AMP8
GD&T2	Ofgem's price control for gas distribution and transmission over 2022-2026
iBoxx A/BBB index	A benchmark bond index that comprises fixed rate, non-financials, A/BBB rated, 10Y+ maturity bonds
Junior debt	Debt that ranks below other more senior forms of debt in terms of repayment priority
KPMG Tool	A tool developed by KPMG to estimate the cost of embedded debt and the share of new debt at the company- and sector-level over AMP8
NGN	Northern Gas Networks
Par value	The face value of a bond is referred to as its par value
Sector average approach	An approach whereby the cost of embedded debt is set using the sector average cost of embedded debt
SONIA	A common benchmark to which floating rate debt instruments are linked
WaSC	Water and Sewerage Company
WoC	Water only Company

Source: KPMG analysis

12.3. Appendix C: Important notice

This Report has been prepared by KPMG LLP (‘KPMG’, ‘we’ or ‘our’) for Water UK on the basis of an engagement contract dated 26 September 2023 and varied by an amendment and restatement agreement dated 16 August 2024 between Water UK and KPMG (together the “Engagement Contract”). Water UK commissioned the work to assist Water UK in its considerations regarding the Water Services Regulation Authority (“Ofwat”)’s PR24 DD on the cost of embedded debt.

Water UK should note that our findings do not constitute recommendations as to whether or not Water UK should proceed with any particular course of action.

The findings expressed in this Report are (subject to the foregoing) those of KPMG and do not necessarily align with those of Water UK.

KPMG has not assisted Water UK in preparation of its separate response to the PR24 Draft Determination on cost of embedded debt to which this Report relates. For the avoidance of doubt, it is Water UK’s sole responsibility to decide what should be included in their response or submission to Ofwat. KPMG has not made any decisions for Water UK or assumed any responsibility in respect of what Water UK decides, or has decided to, include in its response or submission.

This Report is for the benefit of Water UK only. This Report is not suitable to be relied on by any party wishing to acquire rights against KPMG (other than Water UK) for any purpose or in any context. Any party other than Water UK that obtains access to this Report or a copy and chooses to rely on this Report (or any part of it) does so at its own risk. To the fullest extent permitted by law, KPMG does not assume any responsibility or liability in respect of our work or this Report to any party other than Water UK.

The sector-wide market information presented in this Report reflects prevailing conditions as of the date of the Report, all of which are accordingly subject to change. Although we endeavour to provide accurate and timely information, there can be no guarantee that such information is accurate as of the date it is received or that it will continue to be accurate in the future. Information sources and source limitations are set out in the KPMG March 2024 ‘Estimating the Cost of Embedded Debt and Share of New Debt for PR24’ Report. We have satisfied ourselves, where possible, that the information presented in this Report is consistent with the information sources used, but we have not sought to establish the reliability or accuracy of the information sources by reference to other evidence. We relied upon and assumed without independent verification, the accuracy and completeness of information available from public and third-party sources. KPMG does not accept any responsibility for the underlying data.

The company-specific information in relation to water company debt is based on representations made to us by the management of each water company. We do not accept responsibility for such information which remains the responsibility of management. We relied upon and assumed without independent verification, the accuracy and completeness of the information. We have not sought to establish the reliability of the information by reference to other evidence. The company-specific information has been reviewed by the management of each water company and the factual accuracy of the information has been confirmed in writing.

Where our Report makes reference to ‘KPMG Analysis’ this indicates only that we have (where specified) undertaken certain analytical activities on the underlying data to arrive at the information presented. We do not accept responsibility for the underlying data.

Peer performance comparisons for entities named in this Report are solely based upon information from third-party and publicly available sources and management representations.

This engagement is not an assurance engagement conducted in accordance with any generally accepted assurance standards and consequently no assurance opinion is expressed.

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Annex 3 – KPMG Report on Estimating the Cost of New Debt and Additional Borrowing Costs for PR24

KPMG

Estimating the Cost of New Debt and Additional Borrowing Costs for PR24

Prepared for Water UK

—

August 2024

Contents

01

Executive summary

Introduction and scope

On 11th July 2024, Ofwat published its Draft Determination for PR24 (PR24 DD), which includes proposed allowances for cost of new debt and additional borrowing costs. Water UK has commissioned KPMG to:

Cost of new debt (CoD_N)

- Analyse the performance of water company bond issuances up to June 2024
- Compare the findings to the PR24 DD and assess implications for the estimation of CoD_N allowance at PR24.

Basis risk

- Analyse the implications of the accelerated full transition to CPIH on the notional company's financing costs and risks.
- Engage with the leading banks to gather pricing evidence on swap charges and any incremental costs associated with CPIH issuance.
- Consider the implications of pricing and risk evidence for the estimation of the allowance for basis risk management costs at PR24.

Cost of carry

- Develop approaches to estimate the cost of carry that take into account the scale of pre-financing requirements expected at AMP8.
- Compare the cost of carry analysis to the PR24 DD and assess implications for the estimation of the cost of carry allowance at PR24.

The table below compares the estimates for the relevant components of the cost of debt allowance from the PR24 DDs to those proposed in this Report. The subsequent slides detail the derivation of each estimate.

CPIH-real	PR24 DD (March cut-off)	PR24 DD (June cut-off)	KPMG (June cut-off)
Cost of new debt	3.36%	3.63%	3.97%
Cost of carry	0.07%	0.07%	0.13%
Basis risk management costs	-	-	0.06%

The confidential information underpinning the analysis in this Report comprises of (1) sector-wide market information; and (2) company-specific information in relation to water company debt. The water companies for which company-specific information has been collected are Affinity Water, Anglian Water, Bristol Water, Hafren Dyfrdwy, Northumbrian Water, SES Water, Severn Trent Water, South East Water, South West Water, Southern Water, Welsh Water, Wessex Water and Yorkshire Water. The sector-wide market information is based on financial information platforms and publicly available sources. We draw reader's attention to the important notice set out on pages 50-51.

Key messages

Cost of new debt

New debt is the debt expected to be issued during the upcoming price control period to finance Regulatory Capital Value (RCV) growth and refinance existing debt as it matures.

The PR24 DD estimated a cost of new (CoD_N) debt of 3.36% CPIH-real based on a 1-month average of the yields on iBoxx A/BBB 10+ index (the benchmark index). This benchmark index serves as a proxy for the CoD_N, reflecting the creditworthiness of the notional company (Baa1/BBB+ credit rating). It is assumed to provide a reasonable and achievable allowance that incentivises efficient debt issuance without exposing customers to risks related to companies' financing decisions.

Ofwat assessed the ability of water companies to issue debt at the yields implied by the benchmark index. Based on an analysis of debt issuance up to March 2023, Ofwat concluded that no adjustment – either negative or positive – is necessary to the benchmark index.

However, the analysis in this Report indicates that the DD benchmark index is not achievable for the notional company. There is a marked deterioration in performance on a like-for-like basis after April 2023, which is not captured in Ofwat's DD assessment. The exclusion of issuances post-March 2023 means that the DDs do not reflect recent pricing of water company bonds. A positive adjustment of 34bps is required to ensure the allowance is achievable based on performance and market data up to June 2024.

Basis risk management costs

The accelerated transition to full CPIH indexation of the RCV, implemented ahead of the RPI Reform (2030), exposes companies to new risks and costs.

The mismatch between RPI-linked debt and CPIH-linked RCV creates basis risk exposure on embedded debt. Additionally, companies will need to issue CPIH-linked debt in AMP8 to match the RCV. CPIH-linked debt is less liquid and incurs incremental costs on new debt. The market's ability to absorb the additional supply needed to support management of basis risk remains uncertain.

The additional costs and risks associated with basis risk management are not priced in the PR24 DD. Exposing companies to unremunerated additional costs and risks would contravene Ofwat's principles for CPIH transition, particularly its commitment to ensuring that the impact on both company revenues and customer bills remains neutral in net present value terms.

In this Report, the cost of basis risk management is estimated at 6bps across new and embedded debt, based on pricing evidence from banks.

This approach aligns with Ofgem's RIIO-2 methodology, which introduced full CPIH indexation and provided a 5bps allowance to energy networks. The higher estimate for water companies reflects the greater proportion of index-linked debt (ILD) and associated basis risk in the water sector.

Cost of carry

Cost of carry reflects the cost of issuing debt ahead of need (for example, pre-financing maturing debt, capital expenditures, working capital requirements).

In the PR24 DD, Ofwat introduced a 7bps allowance for cost of carry. This estimate assumes companies only need to issue 6 months ahead of need and can issue at iBoxx A/BBB 10+. However, in practice, companies need to issue 18 months ahead to support going concern and rating agency requirements on liquidity. Additionally, they cannot issue at the yields on the benchmark index on an unadjusted basis.

Updating Ofwat's DD analysis for these two factors increases the PR24 DD cost of carry estimate to at least 13 basis points. This aligns with the findings of this Report (cost of carry of 12 – 14bps), which used a similar methodology and the same assumptions.

The estimate is slightly higher than the 10bps allowance provided by Ofgem at RIIO-2. This difference reflects the fact that the Ofwat and KPMG methodologies account for the impact of future financing requirements on the cost of carry.

Cost of new debt

The estimate for the cost of new debt in this Report is based on June 2024 average yields of the iBoxx A/BBB 10+ index.

A 34bps adjustment is applied to this index to ensure that the allowance is reasonable and achievable for the notional company. The adjustment has been estimated as follows:

- **Lower bound: 22bps.** This reflects under-performance of issuances post November 2022 when controlling for rating and tenor.
- **Upper bound: 46bps.** This reflects under-performance of Baa1/BBB+ rated issuances post November 2022 when controlling for tenor.

The midpoint of this range is 34bps, which is consistent with the secondary market spreads of Baa1 rated water company bonds relative to the A/BBB 10+ index during June 2024.

This Report adopts a cut-off date of June 2024, excluding subsequent events from the quantitative analysis. The recent downgrade of Thames Water to sub-investment grade has resulted in removal of its bonds from the benchmark index. This has in turn reduced the yield on the A/BBB index by 14bps. All else equal, this suggests that the adjustment required to ensure the allowance is achievable would increase to 48bps based on an August 2024 cut-off date.

Water company issuances post-November 2022 indicate that water companies are not able to issue debt at the benchmark index specified by Ofwat in the DDs (the iBoxx A/BBB 10+ index). This may be driven by (1) pricing in of higher perceived risk for the sector; and (2) a higher effective rating for the benchmark index (A/BBB) than assumed for the notional company (BBB+).

Positive = under-performance (bps)	Spread controlling for rating and tenor	Spread controlling for tenor	Spread to iBoxx A/BBB 10+
Average of issuances post 1 Nov. 2022	22.37	25.67	23.13
Average of issuances post 1 Nov. 2022, Baa1/BBB+ only		45.95	39.25

Source: KPMG analysis based on Refinitiv Datastream and Capital IQ data

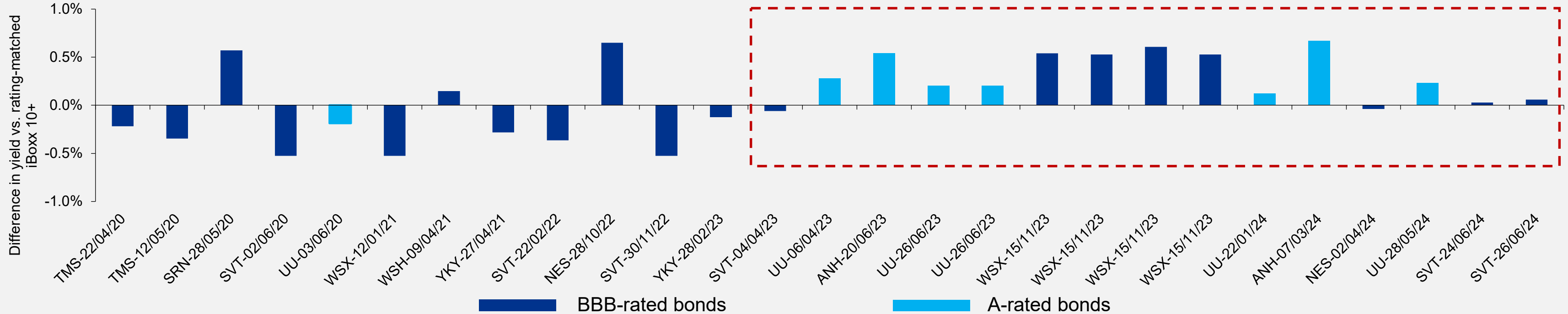
Cost of new debt (cont.)

Ofwat has removed the 15bps benchmark index adjustment in the PR24 DD. However, the analysis in this Report indicates that this measure alone does not ensure the allowance is reasonable and achievable for the notional company.

It is important to assess whether water companies can issue debt at the rates implied by the benchmark index when issuing at the target credit rating assumed for the notional company and at a comparable tenor. The chart illustrates that there is a marked deterioration in performance on a like-for-like basis after April 2023. The exclusion of issuances post-March 2023 in the PR24 DD analysis significantly understates the extent of underperformance of water company bonds.

	PR24 DD	KPMG
Timeframe of issuances included	November 2022 – March 2023	November 2022 – June 2024
Instrument type	Public bonds and private placements	Public bonds in line with iBoxx inclusion criteria
Tenor at issue	All	More than 10 years
Rating at issue	All issuances	1) All issuances, (2) Baa1/BBB+ rated issuances specifically
Metrics considered	Spread to iBoxx A/BBB 10+	Spread controlling for tenor and rating[a] (primary measure), spread to iBoxx A/BBB 10+, spread controlling for rating, spread controlling for tenor

Trend of AMP7 issuances (tenor 10+) yield difference to rating- and tenor-matched iBoxx



Source: KPMG analysis based on Refinitiv Datastream and Capital IQ data

Basis risk management costs

The cost of basis risk management is estimated at 6bps across new and embedded debt, based on pricing evidence from banks.

- For embedded debt, the range of 2 – 3bps reflects the cost of hedging this risk[(a)]. This evidence has been cross-checked by quantifying the additional volatility arising from basis risk, which translates into a 16bps adjustment. This significantly exceeds the cost of hedging through swaps. This cross-check, along with the potential market response to a significantly increased supply of ILD during AMP8, supports adopting 3bps as a conservative estimate for pricing basis risk management on embedded debt.
- For new debt, the range of 1 – 5bps reflects the cost of issuing new CPI(H)-linked debt[(b)]. 3bps is proposed as the point estimate.

The accelerated transition to full CPIH indexation of the RCV from AMP8 introduces additional costs and risks for the notional company that are not compensated in the PR24 DD.

Embedded index-linked debt (ILD) in the sector is predominantly RPI-linked. Historical data reveals significant variability in the RPI-CPIH wedge, resulting in higher variance in the total RoRE range for a notional company exposed to basis risk compared to one without it[(c)]. The optimal hedging strategy, given market demand, involves trading RPI-to-CPI basis swaps; however, this approach leaves companies exposed to risks related to the CPI-CPIH wedge.

Separately, with substantial capital programmes projected for AMP8, the sector is expected to raise new ILD, ideally on a CPIH-linked basis to maintain asset-liability matching. However, the market for CPIH-linked instruments is highly limited, with only direct issuance possible and even then, at a premium. As the CPI swap market has greater capacity, issuing nominal bonds and entering into CPI inflation swaps may be more effective, although the market's ability to absorb the additional supply needed for AMP8 remains uncertain.

Without an allowance, companies will face additional risks and costs due to the regulatory shift to CPIH, which is beyond their control. Such exposure would contravene Ofwat's principles for the transition, including its commitment to ensuring that "*the impact of this is neutral to both company (nominal) revenues and customer bills in net present value terms*"[(d)].

	Embedded debt	New debt
Overall range	7 – 12bps	11 – 60bps
Share of embedded/new debt	74%	26%
ILD proportion	33%	33%
Pricing of basis risk	2 – 3bps	1 – 5bps

Notes: (a), (b) The pricing of basis risk mitigation costs is based on a detailed questionnaire distributed to seven leading banks active in the water sector's debt and swap markets.

(c) The RoRE impact is estimated using the KPMG risk model, considering a Financing RoRE range both with and without the basis risk exposure, while holding all other risk factors constant. KPMG risk analysis assesses, based on the available empirical evidence and historical sector performance data. The stochastic risk model is constructed to simulate the notional company's risk exposure in RoRE terms by key risk drivers, accounting for risk mitigations purposed by Ofwat in PR24 DD.

(d) Ofwat (2015), Water 2020: Regulatory framework for wholesale markets and the 2019 price review

Cost of carry

The analysis in this Report implies a cost of carry of 12 – 14bps, assuming (1) an 18-month pre-financing period; and (2) a pre-financing cost based on iBoxx A/BBB 10+ plus 34bps. This is 5 – 7bps higher than the PR24 DD estimate.

The DD estimate assumes companies only need to issue 6 months ahead of need. However, in practice, companies need to issue 18 months ahead to support going concern and rating agency requirements on liquidity.

The DD estimate also assumes that companies can issue at iBoxx A/BBB 10+. However, the analysis in this Report finds that a 34bps upwards adjustment is required to accurately reflect financing costs experienced by water companies.

Updating the DD estimate for these two assumptions increases it to at least 13bps.

An estimate of 13bps is proposed in this Report based on the midpoint of the KPMG methodology range and the updated Ofwat methodology.

Cost of carry reflects the cost of issuing debt ahead of need (for example, pre-financing maturing debt, capital expenditures, working capital requirements).

This cost is calculated as the spread between CoD_N and the deposit rate earned on the cash proceeds from the debt issuance, over the duration of the pre-financing period.

The PR24 DD estimated cost of carry at 7bps. By comparison, Ofgem and the CMA both estimated a 10bps allowance for cost of carry at RIIO-2 and PR19, respectively.

Both the KPMG and PR24 DD methods capture the impact of pre-financing expected for AMP8 with the difference between estimates primarily driven by the assumed pre-financing period and assumed pre-financing rate. When the PR24 DD analysis is updated to incorporate a 18-month pre-financing period and incorporate a 34bps uplift to the yields on iBoxx A/BBB 10+, the results become broadly consistent.

These estimates reflect the debt issuance profile implied by the PR24 DD. This includes: (1) refinancing debt from the PR24 DD Balance Sheet model; and (2) RCV-financing debt from the PR24 DD financial models, calculated by multiplying the difference between the FY25 and FY30 closing values by the notional gearing of 55%. For the KPMG method, cost of carry based on the debt issuance profile submitted in company BPs is also presented.

	Pre-financing requirement based on:	
	PR24 DD	Company BPs
KPMG methodology	12	14
Updated Ofwat methodology	13	N/A

Note: The pricing is based on 2m average for iBoxx and SONIA as of 30 June 2024. 3m SONIA rates are adjusted downward by 58bps to account for expected rate cuts not priced in. See detailed discussions in Appendix 2.

02

Cost of new debt

Ofwat's approach to CoD_{N} estimation

The benchmark index adjustment included in the PR24 FM reflected Ofwat's observation that during 2015 – 2022 companies had, on average, issued fixed-rate, GBP-denominated debt with a tenor of approximately 15 years, which was 5 years shorter than the A/BBB 10+ benchmark index.

This adjustment was removed in the PR24 DD based on the observation that issuances from companies with credit ratings in line with the notional company closely tracked the benchmark index from November 2022 to March 2023.

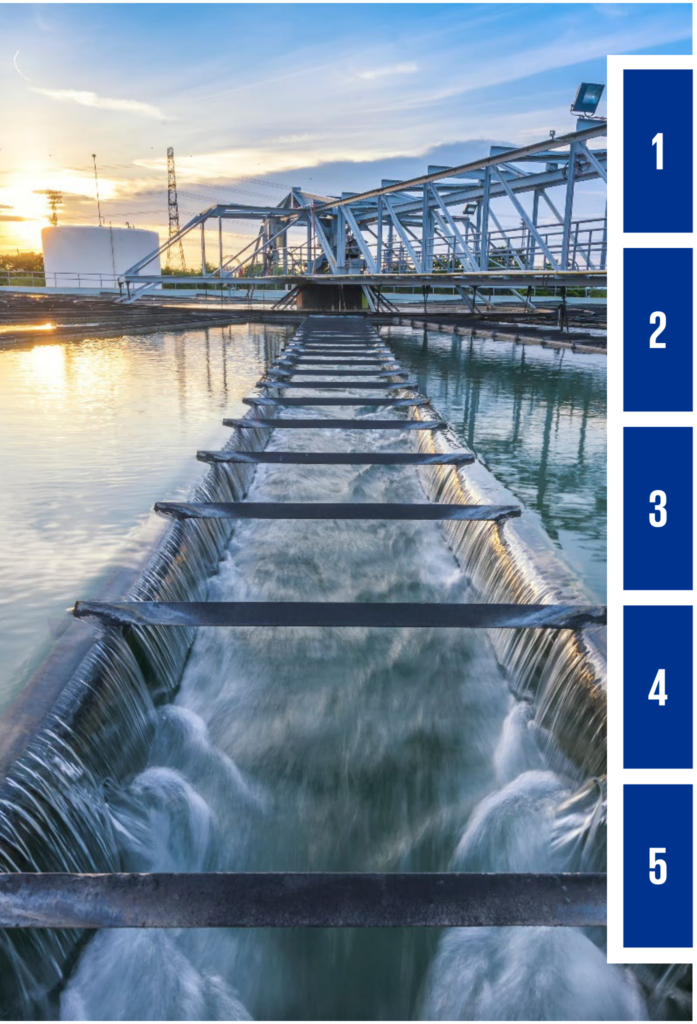
The updated analysis in the PR24 DD:

- Does not fully capture the evolution of the performance of water company issuances as it omits all issuances after March 2023.
- Is not on a like-for-like basis, i.e. it does not control for tenor and rating.
- Includes 16 debt instruments, 9 of which are private placements assumed to be issued at par. This is a departure from iBoxx index inclusion criteria[a] and private placements do not represent a like-for-like comparison to public issuance. It is unclear that it is appropriate to assume that these private placements are issued at par.
- Includes 2 bonds originally issued in EUR which is a departure from iBoxx inclusion criteria.
- Includes instruments with tenor at issue of less than 10 years which is not consistent with iBoxx index inclusion criteria and is a departure from the PR24 FM approach. Notably, in the FM Ofwat argued that by focusing on issuances with tenors longer than 10 years it was avoiding "*any impression that we are pushing water companies to issue at very short tenors*"[b].

Notes: (a) Markit (2024), Benchmark Index Guide.
(b) Ofwat (2022), PR24 FM, Appendix 11 – Allowed return on capital, section 4.3.5.

The PR24 DD estimates the CoD_{N} based on a 1-month average of the yields on iBoxx A/BBB 10+ index. Ofwat removed its 15bps benchmark index adjustment in the PR24 DD based on the performance of public bonds and private placements issued by water companies between November 2022 and March 2023.

The approach to the cost of new debt adopted by the CMA at PR19



1	During the PR19 appeal, the CMA carefully examined the yield-at-issue performance of water company bonds and determined that there was insufficient evidence that water company debt consistently outperformed the benchmark indices (iBoxx A/BBB) post-2000.
2	It concluded that there was not evidence of systematic outperformance of the benchmark index, citing the challenge of making exact comparisons between a small sample of company bonds and a broad index based on bond, tenor, and credit rating. The CMA referred to the analyses from KPMG and Ofwat which found a spread of 1bps and 6bps, respectively, for bonds issued at 5 years either side of the benchmark, when controlling for rating[(a)].
3	The CMA observed little evidence of sustained like-for-like outperformance of utility companies compared to the broader market, except during times of significant market stress, such as the Global Financial Crisis.[(b)]
4	It noted that factors contributing to past embedded debt outperformance (high rating, European Investment Bank debt, floating debt) are unlikely to drive systematic outperformance in the future and could not be relied upon to underpin an adjustment[(c)].
5	The CMA identified the issuance of shorter tenors than the benchmark as a potential reason for applying an adjustment but concluded that there was no substantive evidence to support this in practice[(d)].

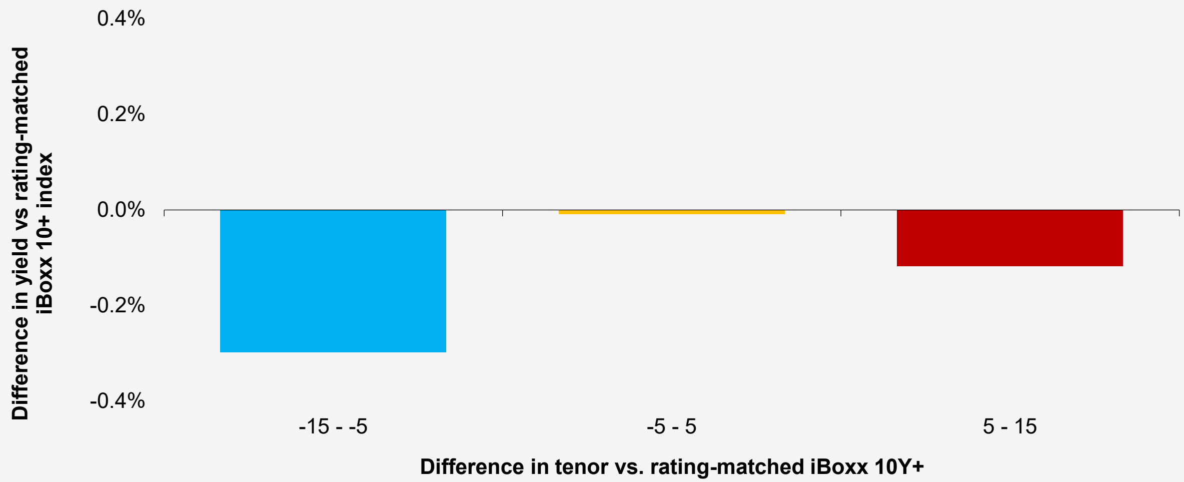
Notes: (a) CMA (2021), PR19 Final Determination, para. 9.750. (b) Ibid., para. 9.751. (c) Ibid., para. 9.824. (d) Ibid., para. 9.825.

Application of the CMA PR19 methodology to issuance up to 2024

- At PR19 the CMA cited KPMG analysis which found a spread of 1bps for bonds issued at 5 years either side of the benchmark, when controlling for rating[(a)].
- Extending this analysis to include issuances up to June 2024 yields comparable results, showing minimal outperformance for bonds issued within 5 years of the benchmark. As a result, the CMA's conclusion that there is insufficient evidence of consistent outperformance remains valid based on this analytical framework.

Note: (a) CMA (2021), PR19 Final Determination, para. 9.750.

Differences in water bond yields relative to the rating-matched iBoxx 10+ index by tenor bucket: Issuances since 2000



	-15 - -5	-5 - 5	5 - 15
# Bonds	34	29	12

Note: (a) There are only two bonds in the 15 – 50 bucket and no bonds in the -15 – -5 bucket. As such these buckets have been excluded.

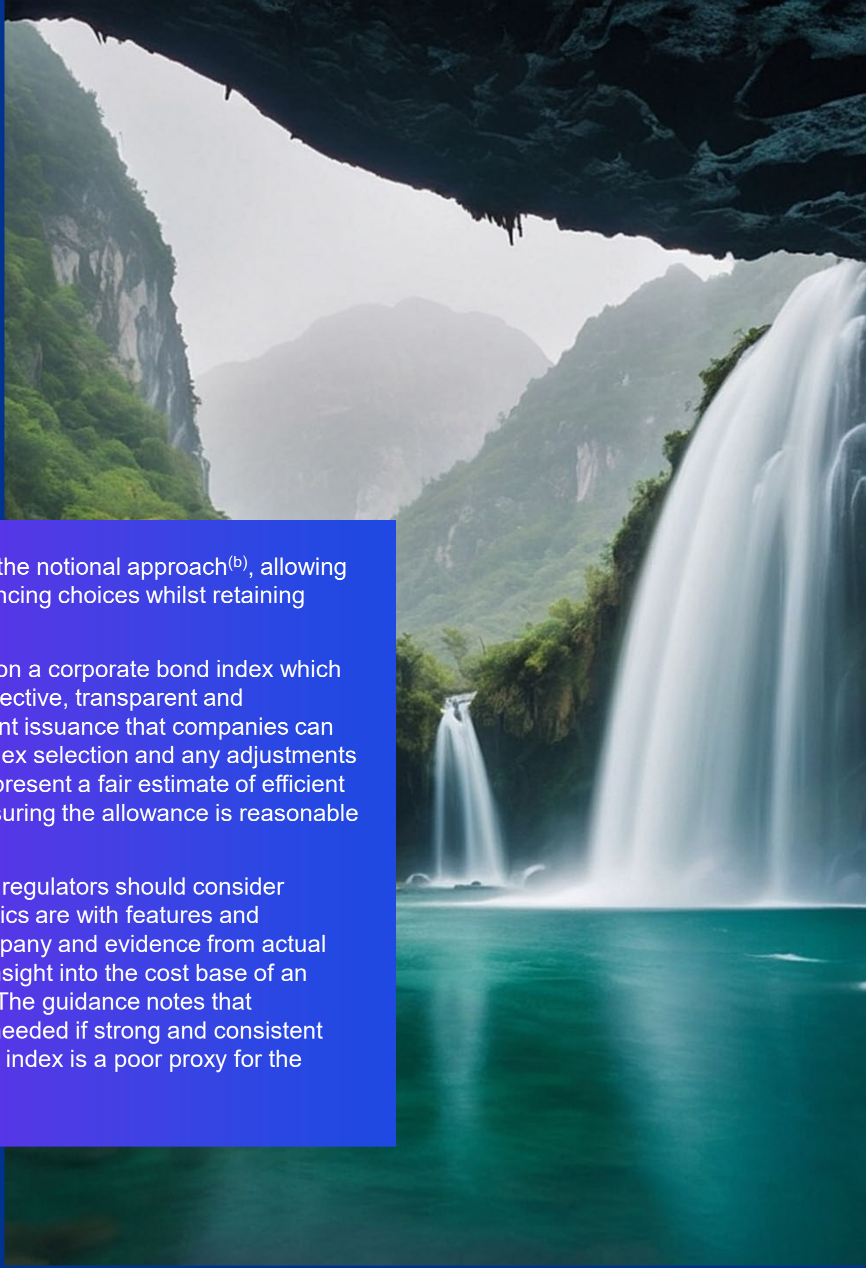
Source: KPMG analysis based on Refinitiv Datastream and Capital IQ data

Principles underpinning the estimation of the CoD_N allowance

From an economic perspective, financing costs are normal costs for a firm and are fully priced in an efficient market equilibrium. If prices do not reflect and allow the recovery of financing costs, the economic activity is not viable as investors would not be able to earn their required return.

When financing infrastructure, investors are generally unwilling and unable to bear material market risk from any significant deviations between revenues and costs of financing over time. This is due to (1) the asset-heavy nature of the industry, which implies significant capital employed, (2) long-term asset lives and hence investment horizons, and (3) limited flexibility when investing in fixed assets.

In this context, the CoD_N allowance should be a fair and achievable estimate of the cost of debt likely to be incurred by a notionally geared, efficient company. Ofwat's objective for PR24 is to set ***"a reasonable return which also implies good incentives to issue new debt prudently and efficiently"***[a].



The allowance is estimated using the notional approach[b], allowing companies to make their own financing choices whilst retaining incentives to issue debt efficiently.

The allowance for CoD_N is based on a corporate bond index which should, in principle, provide an objective, transparent and independent benchmark for efficient issuance that companies can target ex ante. The benchmark index selection and any adjustments to the benchmark index should represent a fair estimate of efficient borrowing costs for the sector, ensuring the allowance is reasonable and achievable.

According to the UKRN guidance, regulators should consider how aligned the index characteristics are with features and characteristics of the notional company and evidence from actual sector issuance (which provides insight into the cost base of an efficiently-run notional company). The guidance notes that adjustments to the index may be needed if strong and consistent evidence suggests the unadjusted index is a poor proxy for the notional company's debt cost[c].

Notes:
(a) Ofwat (2022), PR24 FM, Appendix 11 – Allowed return on capital, section 11.3.3.
(b) Ofwat (2016), Water 2020: consultation on the approach to the cost of debt for PR19, p. 16.
(c) UKRN (2023), Guidance for regulators on the methodology for setting the cost of capital, p. 32.

Principles underpinning the estimation of the CoD_N allowance (cont.)

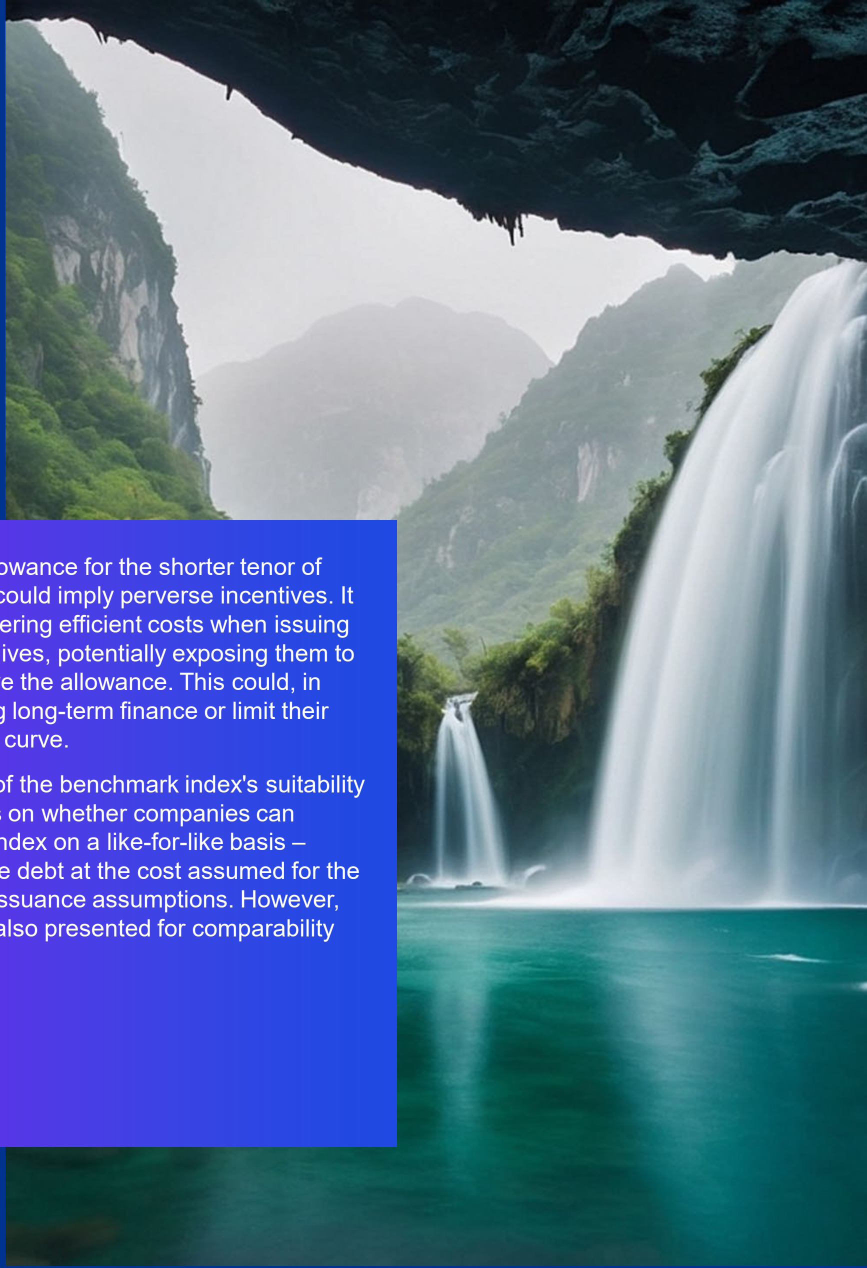
The assessment of whether the index is good proxy for the notional company's cost of debt should consider if water companies, on average, can issue debt at the rates implied by the benchmark index when issuing debt at the target credit rating assumed for the notional company and at a comparable tenor.

Evaluating performance on a like-for-like basis in terms of both tenor and rating ensures that the benchmark for the CoD_N is achievable in practice and does not expose customers to risks related to companies' financing decisions.

This is consistent with the approach adopted by the CMA which cited the finding of no like-for-like outperformance for water company debt relative to the benchmark index[a] as the basis for its decision to remove the outperformance wedge adjustment from CoD_N at PR19.

An approach which adjusts the allowance for the shorter tenor of recent water company issuances could imply perverse incentives. It may hinder companies from recovering efficient costs when issuing long-term debt aligned with asset lives, potentially exposing them to ex post losses if they fail to achieve the allowance. This could, in turn, deter companies from issuing long-term finance or limit their ability to issue across the maturity curve.

As a result, the Report's analysis of the benchmark index's suitability and achievability primarily focuses on whether companies can achieve the yields implied by the index on a like-for-like basis – specifically, whether they can issue debt at the cost assumed for the notional company under notional issuance assumptions. However, other performance measures are also presented for comparability with Ofwat's analysis.

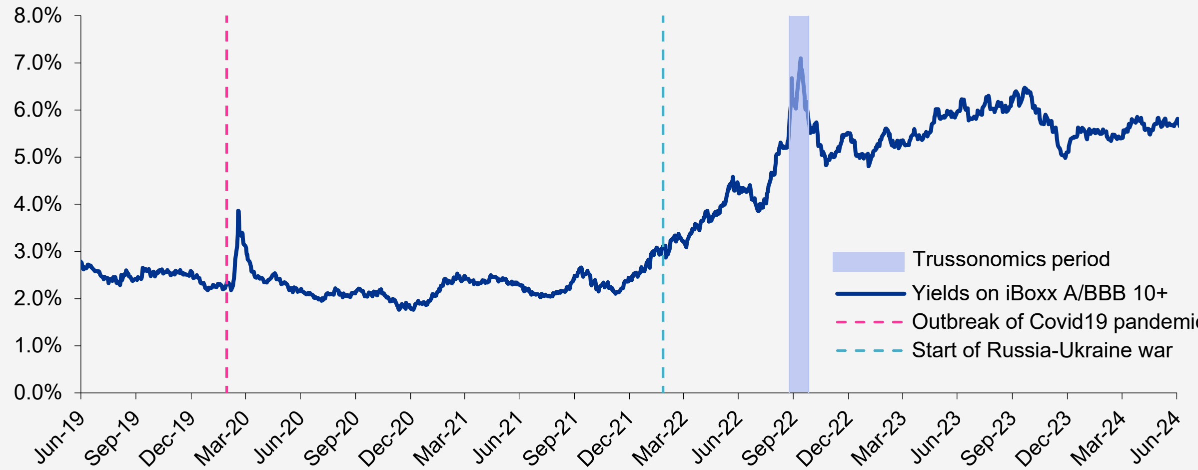


Note: (a) CMA (2021), PR19 Final Determination, para. 9.823.

Assessing achievability of the benchmark index in current market conditions

- The analysis of suitability and achievability of the cost of debt benchmark in the future relies on past issuance data. The relevance of historical performance to AMP8 depends on how well past drivers reflect expected future conditions. This assessment may be influenced by sector-specific factors, such as perceptions of sector risk and creditworthiness, alongside broader economic conditions. These factors are considered in turn below.
- AMP7 has seen a step change in the macroeconomic environment with a significant increase in interest rates from mid-2022 as well as significant market turbulence due to Covid-19, the Russia-Ukraine war, and Trussonomics. It will be important to assess whether the step change in market conditions has affected the performance of water company issuances.

Evolution of the yields on iBoxx A/BBB 10+



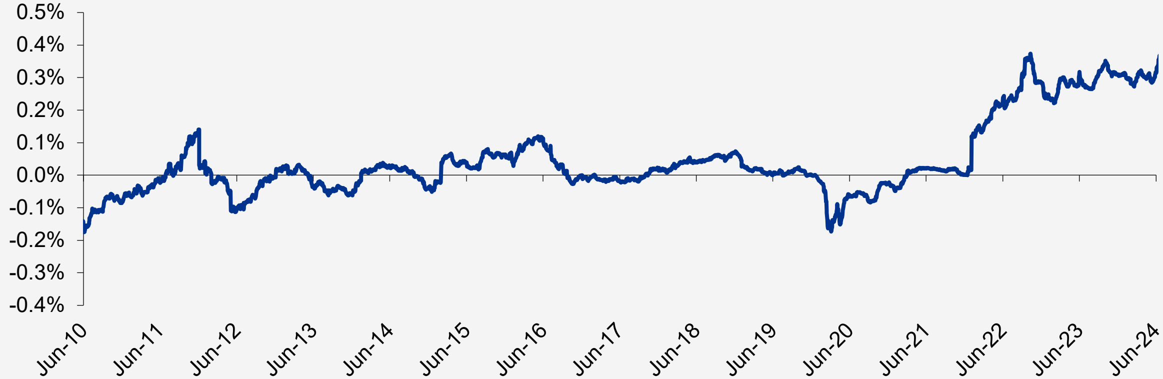
Source: KPMG analysis based on Refinitiv Datastream data

Assessing achievability of the benchmark index in current market conditions (cont.)

The CMA recognised[(a)] that utilities might temporarily outperform during periods of market turbulence due to the 'flight to safety' effect. As illustrated by the chart, the spread between iBoxx Utilities and A/BBB indices was negative during March 2020 – April 2021, at the height of the Covid-19 pandemic, likely due to flight to safefy effects.

Note: (a) CMA (2021), PR19 Final Determination, para. 9.751.

Evolution of the differential between iBoxx Utilities 10+ and iBoxx A/BBB



Source: KPMG analysis based on Refinitiv Datastream data

Flight to safety dynamics are typically temporary and cannot be assumed to persist for prolonged periods. Consistent with this, the negative spread observed during Covid has since reversed and is now significantly elevated relative to historical levels.

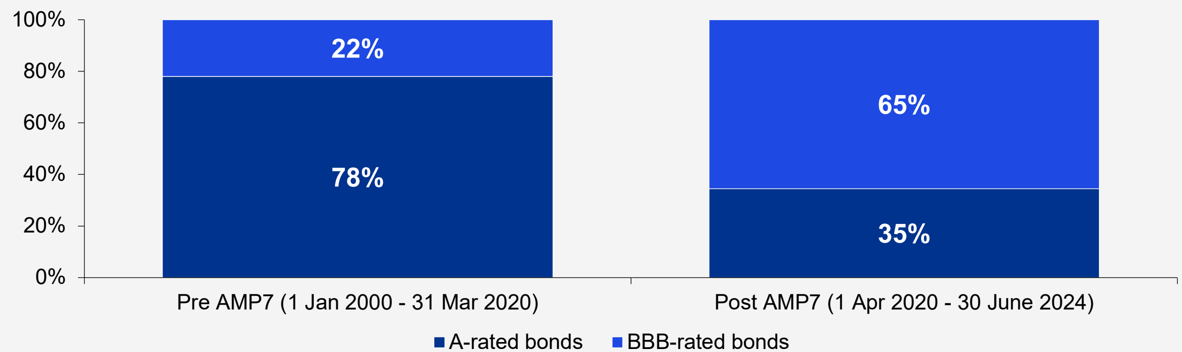
Higher levels of spread between the iBoxx Utilities and A/BBB post mid-2022 indices indicate that utilities are currently perceived to carry more credit risk relative to the broader market. The start of the analysis period for water company issuances in the PR24 DD (November 2022) broadly coincides with the onset of higher spreads for utilities and aligns with stabilisation of interest rates post Trussonomics.

Assessing achievability of the benchmark index in current market conditions (cont.)

The target rating for the notional company is Baa1/BBB+. Prior to AMP7, water companies issued a larger proportion of A-rated debt. However, over time, the average credit rating of water company debt has aligned more closely with the notional target. This trend is illustrated in the chart below, which shows the distribution of A-rated and BBB-rated water company bonds before and after AMP7 (proportions are based on the number of bonds).

As recognised by both Ofwat and the CMA at PR19, superior ratings (relative to the benchmark index) in previous price controls contributed to the performance of water sector issuances. However, the CMA considered it significantly less likely that future issuances would benefit from the same advantages. The average rating of AMP7 issuances indicates that (1) past outperformance driven by higher ratings is not relevant for assessing the suitability of the benchmark index at PR24 (2) the median company is issuing at Baa1 in AMP7, which should be taken into account through attaching weight to performance of Baa1 issuance in calibration of the benchmark index.

Percentage of A and BBB rated water company bonds pre and post AMP7



Source: KPMG analysis based on Bloomberg data

Overall, debt issuances post-November 2022 appear to be most reflective of the likely yield-at-issue performance in AMP8 and should be the primary focus in assessing the achievability of the benchmark index. This start date is consistent with the PR24 DD.

It will also be important to assess whether the rating of the benchmark index is achievable for the notional firm issuing in line with the target Baa1 rating.

Proposed approach and methodology

The Report assesses the performance of GBP-denominated, nominal, fixed-coupon, non-perpetual bonds against the yields on the benchmark index.

The following metrics are considered in the assessment of performance:

Metric	Description
Spread controlling for tenor and rating[(a)] (primary measure)	Represents the spread between the bond yield at issuance and the like-for-like yield on the interpolated iBoxx yield of the relevant rating.
Spread to iBoxx A/BBB 10+	Represents the spread between the bond yield at issuance and the yield on the PR24 DD benchmark index on the day of issuance, without controlling for tenor or rating.
Spread controlling for tenor	Represents the spread between the bond yield at issuance and the tenor-matched interpolated iBoxx A/BBB yield on the day of issuance.
Spread controlling for rating	Represents the spread between the bond yield at issuance and the rating-matched iBoxx 10+ yield on the day of issuance.

- The analysis focuses on bonds with tenor at issue of 10yrs+, which aligns with iBoxx 10+ inclusion criteria and the approach set out in PR24 FM.
- To enable performance assessment on a tenor-controlled basis, hypothetical iBoxx curves are constructed. These curves provide the yield that would prevail on hypothetical iBoxx indices, equivalent to the actual indices, had the actual iBoxx maintained a specific weighted average tenor.
- The proposed methodology is broadly consistent with the one adopted in the analysis developed by KPMG during the PR19 appeal, with some differences outlined below:
  - Callable bonds are included as they are also included in iBoxx indices
  - The threshold for the identification of outliers is set to +/- 1% to avoid distortions and maintain representativeness.
  - Debt held above the operating company level and unrated bonds are excluded, as they may not representative of debt issuance within the regulatory ringfence.

Notes: (a) The analysis controls for tenor based on Moody's rating for simplicity.
(b) To enable tenor-matched comparison debt tenor curves were constructed from all available iBoxx indices using a combination of Cubic-spline and Nelson-Siegel interpolation and extrapolation methods.

Empirical analysis of the performance of water company issuances

The table below sets out the performance of water company bonds relative to the iBoxx based on various metrics. Bonds issued after November 2022, consistent with the start date of the PR24 DD analysis, consistently underperform across all metrics. On a for-like basis and without controlling for either tenor or rating water company bonds underperformed the iBoxx index by 22 – 23bps.

Negative = outperformance (bps)	Median Tenor	Spread controlling for rating and tenor	Spread controlling for rating	Spread controlling for tenor	Spread to iBoxx A/BBB 10+
Average of issuances post 1 Nov. 2022	13.50	22.37	17.60	25.67	23.13

Source: KPMG analysis based on Refinitiv Datastream and Capital IQ data

An analysis of the effective rating of the iBoxx A/BBB 10+ index from 2016 to 2024, based on Markit's (i.e. the provider of iBoxx indices) index construction methodology, indicates that the effective rating of the A/BBB index is closer to A3 rather than Baa1[(a)].

This suggests that yields implied by the index are *lower* than those based on the target rating of the notional company (Baa1). This could partially explain the underperformance of water company issuances.

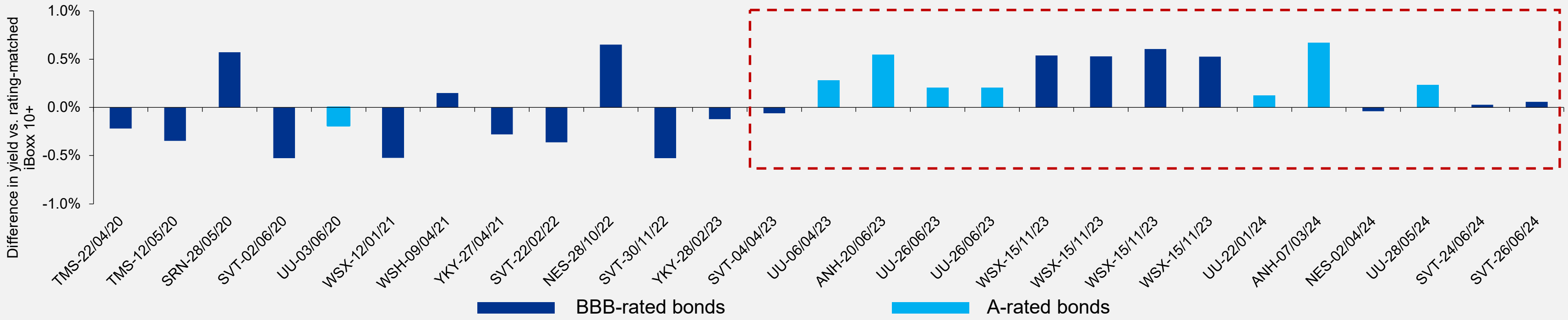
A-rated bonds issued by water companies were priced at a premium to the iBoxx A index and, in some instances, underperformed the iBoxx A/BBB index.

This is reflected in the chart on the next page, which shows a consistent trend of underperformance on a rating-controlled basis for both BBB and A-rated issuances, particularly from April 2023 onwards, as well as on average.

Notes: (a) The effective rating has been derived based on iBoxx Rating Methodology September 2022 as follows: (1) the list of constituents of the non-financials BBB index and their weightings in the index was downloaded on a semi-annual basis between 2016-2024 from Refinitiv Datastream (item LIBI4RRL), (2) bond ratings from Moody's, S&P and Fitch were downloaded from Bloomberg at each semi-annual date, (3) these ratings were assigned numerical values in accordance with the table on page 3 of iBoxx Rating Methodology September 2022, (4) the average numerical rating was calculated across the three agencies, (5) the effective rating was calculated based on the weighting and the numerical rating of each bond.

Empirical analysis of the performance of water company issuances (cont.)

Trend of AMP7 issuances (tenor 10+) yield difference to rating- and tenor-matched iBoxx



Source: KPMG analysis based on Refinitiv Datastream and Capital IQ data

The chart illustrates that there is a marked deterioration in performance on a like-for-like basis after April 2023. The same dynamic can be observed for all metrics, as set out in the table below. By excluding issuances post-March 2023, the analysis in the PR24 DD does not capture the significant decline in water bond performance, resulting in an overestimation of how achievable and reflective the iBoxx A/BBB 10+ index is of water company financing costs. To note the 2038 bond issued by SVT and the 2041 bond issued by SWL after the June 2024 cut-off date have like-for-like underperformance of 28bps and 71bps, respectively. These issuances imply a sustained and increasing deterioration in water bond performance and it will be important to capture this dynamic at the FD.

Negative = outperformance (bps)	Median Tenor	Spread controlling for rating and tenor	Spread controlling for rating	Spread controlling for tenor	Spread to iBoxx A/BBB 10+
Average of issuances post 1 April 2023	15.50	29.68	26.11	29.73	27.41

Source: KPMG analysis based on Refinitiv Datastream and Capital IQ data

Empirical analysis of the performance of water company issuances (cont.)

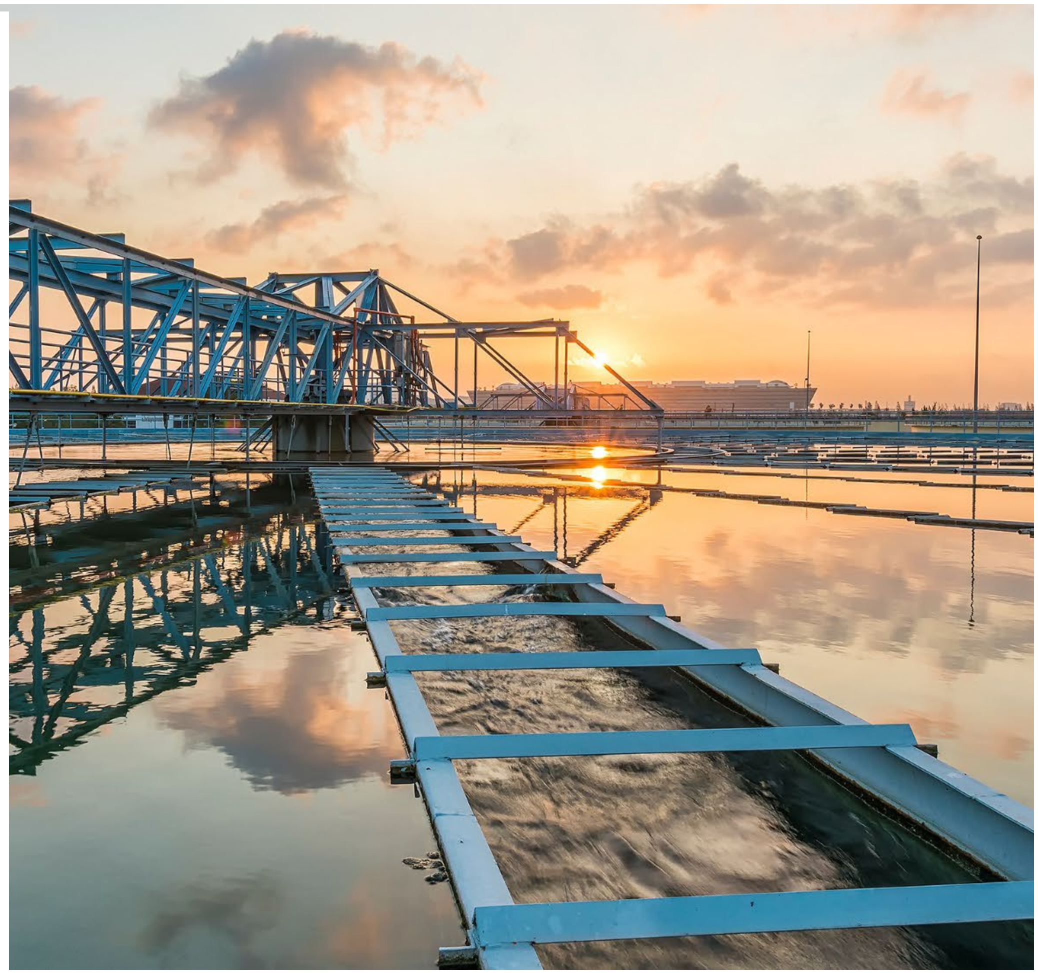
The sample of water company issuances considered thus far includes A-rated bonds, whereas the notional company is assumed to have a Baa1/BBB+ rating (consistent with sector issuance in AMP7 to date). As a result, when evaluating the reasonableness and achievability of the allowance, it is important to consider the performance of Baa1/BBB+ rated issuances relative to the benchmark index.

Negative = outperformance (bps)	Spread controlling for tenor	Spread to iBoxx A/BBB 10+
Average of issuances post 1 Nov. 2022, Baa1/BBB+ only	45.95	39.25

Source: KPMG analysis based on Refinitiv Datastream and Capital IQ data

Baa1/BBB+ rated issuances underperformed the benchmark index by approximately 46bps controlling for tenor and by 39bps when not controlling for tenor.

This indicates that water companies are not able to match the benchmark index under current market conditions when issuing at the target rating of Baa1.



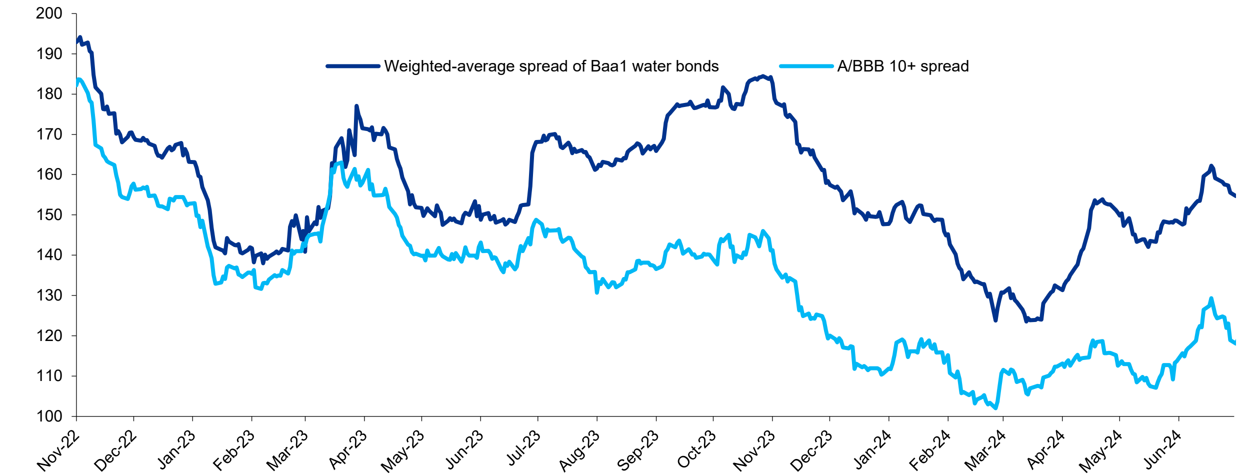
Empirical analysis of the performance of water company issuances in the secondary market

The secondary market spreads[a] on Baa1 rated water company bonds[b] have significantly increased relative to the spread on iBoxx A/BBB 10+.

Between November 2022 and March 2023, the spread difference was 9bps, increasing to 28bps from April 2023 to June 2024, and reaching 34bps in June 2024.

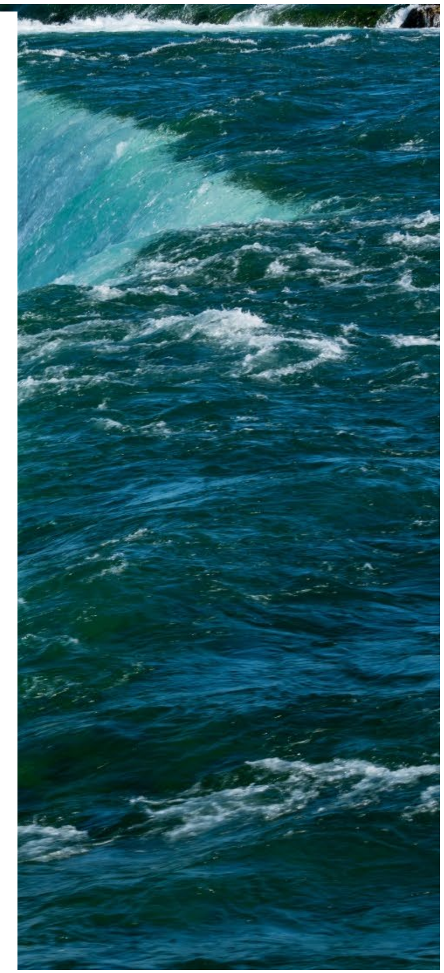
This material differential in secondary market spreads corroborates market perception of increased credit risk for the notional water company.

Evolution of the spreads for sample water company instruments included in the BBB 10+ iBoxx



Source: KPMG analysis based on Refinitiv Datastream data

Notes:
(a) Spreads relative to benchmark curve as per Refinitiv Datastream.
(b) The bonds considered are NES 2042, SVT 2042, SVT 2040, WSX 2036, and NES 2034, all of which are part of the iBoxx BBB index and hold a Baa1 rating from Moody's. The weighted average spread has been calculated using the current relative weightings of these bonds. Each of these bonds have been outstanding between 1 November 2022 and 30 June 2026. Other water company bonds in the BBB index have not bee included as they either were not outstanding during this full period or have a Moody's rating different from Baa1.



Implications of the results for setting the allowance for new debt at PR24 (cont.)

The findings of the analysis of the yield-at-issue performance of water bonds are as follows:

No outperformance when extending the CMA PR19 analysis:

The CMA's conclusion that there is no empirical evidence for debt issuances post 2000 to support an adjustment to the benchmark index for outperformance remains valid when including issuances up to June 2024.

The extended analysis shows minimal outperformance for bonds issued within five years of the benchmark, similar to the results considered during the appeal.

Underperformance against A/BBB Index during AMP7:

Issuances after November 2022, which are the most representative and relevant for estimating the allowance for PR24, underperform on all metrics against the A/BBB index, including like-for-like comparison and that without controlling for tenor or rating.

Baa1/BBB+ rated issuances specifically underperform the A/BBB 10+ index.

Factors contributing to underperformance may include increased perceived risk for the sector and a higher effective rating for the A/BBB index than the rating assumed for the notional company.

Incomplete analysis of performance in the PR24 DD:

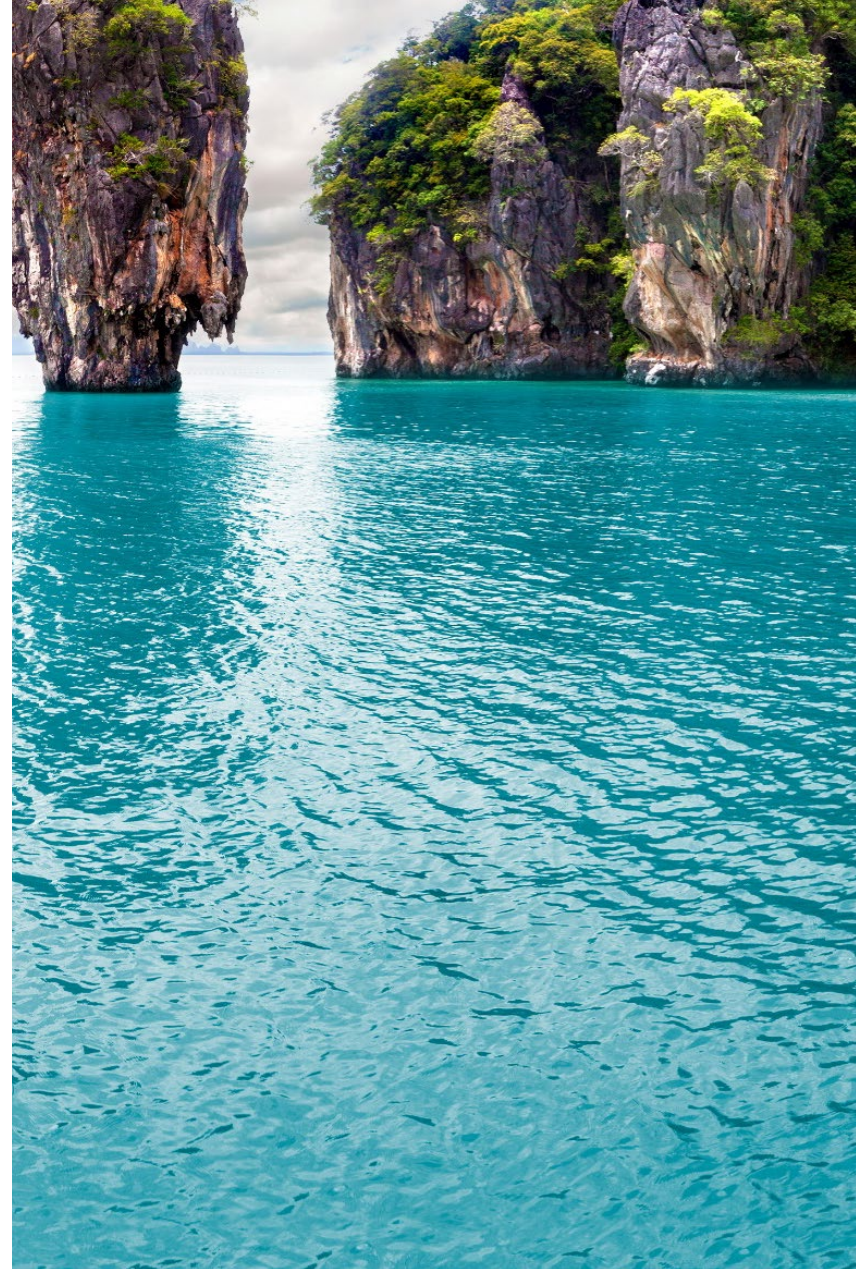
Whilst Ofwat has removed the benchmark index adjustment in the PR24 DD, the analysis in this Report indicates that this measure alone does not ensure the allowance is reasonable and achievable for the notional company. The exclusion of issuances post-March 2023 significantly understates the extent of underperformance of water company bonds.

Additionally, the departure from iBoxx inclusion criteria and the FM approach – such as including private placements, foreign currency bonds and instruments with tenors shorter than 10 years – may skew the results of the PR24 DD analysis.

The inclusion of shorter tenor instruments represents a departure from the approach applied at PR19 and PR24 FM. In the latter, Ofwat stated that by focusing on issuances with tenors longer than 10 years, it was avoiding "***any impression that we are pushing water companies to issue at very short tenors.***"

Notes: (a) Ofwat (2022), PR24 FM, Appendix 11 – Allowed return on capital, section 4.3.2.
(b) Ofgem (2022), RIIO-GD&T2 FD – Finance Annex, para. 2.18

Implications of the results for setting the allowance for new debt at PR24 (cont.)



The following adjustments are considered appropriate to the yields on the iBoxx A/BBB 10+ index to ensure the benchmark is reasonable and achievable for the notional company:

- **Lower bound: 22bps**, reflecting the like-for-like underperformance of all issuances post November 2022.
- **Upper bound: 46bps**, reflecting the underperformance of Baa1/BBB+ rated issuances post November 2022 when controlling for tenor.

The midpoint of this range is 34bps which is slightly below the spread of Baa1/BBB+ issuances relative to A/BBB 10+ index (39bps).

34bps is also consistent with the secondary market spreads of Baa1/BBB+ rated water company bonds from the BBB 10+ index during June 2024.

The omission of issuances after March 2023 is the key reason for the difference between this estimate and the PR24 DD's finding of a 5bps outperformance over the A/BBB 10+ index. Including issuances from April 2023 to the PR24 DD's data cut-off in March 2024 would have revealed significant underperformance across all measures.

This Report adopts a cut-off date of June 2024, excluding subsequent events from the quantitative analysis. The recent downgrade of Thames Water to sub-investment grade has resulted in removal of its bonds from the benchmark index. This has in turn reduced the yield on the A/BBB 10+ index by 14bps. All else equal, this increases the adjustment required to ensure the allowance remains achievable and the CoD_N policy is sustainable to 36 – 60bps.

Notes: (a) Ofwat (2022), PR24 FM, Appendix 11 – Allowed return on capital, section 4.3.2.
(b) Ofgem (2022), RIIO-GD&T2 FD – Finance Annex, para. 2.18

Implications of the results for setting the allowance for new debt at PR24 (cont.)

The comparative impact of the approach proposed in this Report has been assessed using the framework and criteria employed by Ofwat during its evaluation of the cost of debt policy at PR19[(a)].

Criteria	Evaluation
Ensures risks are allocated efficiently between companies and customers	The approach proposed in this Report aligns more closely with this criterion than the PR24 DD as it would not expose customers to adverse consequences of companies not being able to issue debt at assumed pricing due to an understated benchmark.
Promotes fairness and reflects the best interests of customers	The approach proposed in this Report approach aligns more closely with this criterion than PR24 DD as it is customer interest that the notional company is financeable and able to recover efficient costs on a mean expected basis.
Reflects an efficient cost of debt and provides an appropriate incentive to minimise long-term debt costs	The approach proposed in this Report aligns more closely with this criterion than the PR24 DD as it would allow a company issuing debt in line with notional assumptions to achieve the cost assumed for the notional company. The option maintains incentives to raise debt efficiently and on a long-term basis over multiple price review periods and reduce long-term debt costs.
Is robust to changing markets and financing arrangements	The approach proposed in this Report aligns more closely with this criterion than the PR24 DD as it takes into account the changing rating dynamics in the sector as well as the most recent market evidence around changes in the pricing of water company debt issuance compared to benchmark indices.
Is transparent and avoids undue complexity	The level of complexity of the approach proposed in this Report is similar to that applied in the FM – i.e. the CoD_N is based on a benchmark index with an adjustment.

Notes: (a) Ofwat (2016), Water 2020: consultation on the approach to the cost of debt for PR19, p. 16.
(b) It could be argued that the Utilities index is more sensitive to the tenor decisions of water companies. However, the effective maturity of the 10+ index has remained relatively stable since 2000, despite water companies issuing bonds at shorter tenors on average during certain periods.

Source: KPMG analysis

03

Basis risk management

Context

In the water sector, the RCV and revenues are indexed to outturn inflation, which means that both the RCV and the revenue that water companies can earn vary with outturn inflation.

Issuing index-linked debt (ILD) allows companies to match their liabilities (debt repayments) with the inflation-adjusted revenue they receive. Unlike fixed-rate debt whose repayments do not vary depending on outturn inflation, for ILD both the principal and interest payments are indexed to inflation. Issuing ILD reduces the risk that inflation will increase company costs (through higher interest payments on non-inflation-linked debt) without a corresponding increase in revenue. Consistent with this, the water sector has typically maintained just over 50% of its total debt in ILD form.

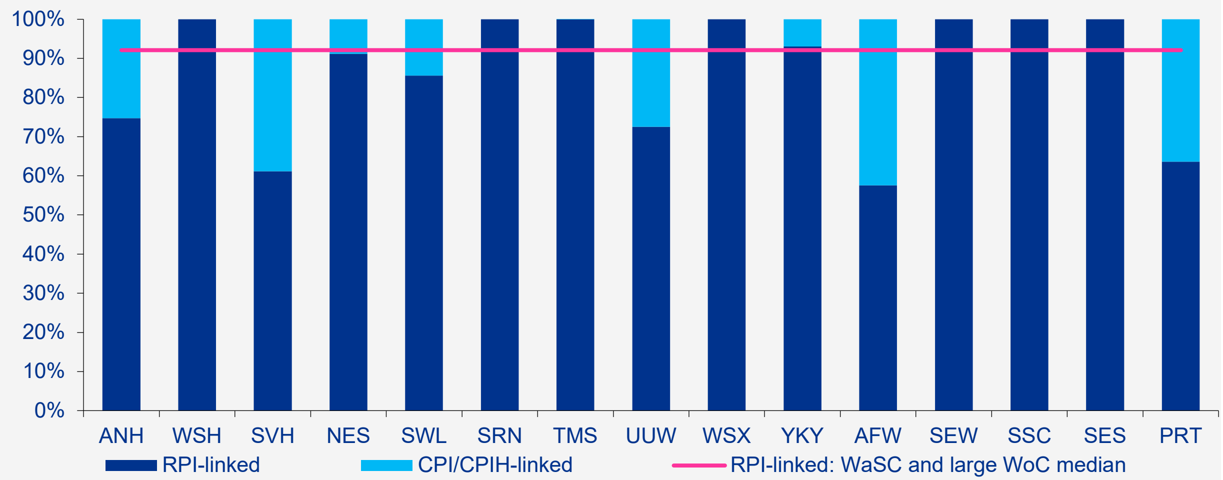
Prior to AMP7, the RCV was indexed to RPI, and companies issued RPI-linked debt to match their RPI-linked asset base. AMP8 will see the water sector transition to full CPIH indexation, replacing the 50% RPI and 50% CPIH indexation applied at the beginning of AMP7.

Embedded index-linked debt (ILD) in the sector is almost entirely RPI-linked. This is illustrated in the chart below which shows the composition of ILD for each company.

The decision to transition from RPI to CPIH indexation, accelerating the transition at 2030 (RPI Reform), is beyond the control of companies and could not have been predicted when company debt structures and hedging strategies were established across the last 20-30 years.

Additionally, given the substantial scale of capital programs projected for AMP8, the sector is expected to raise significant amounts of new debt. To maintain asset-liability matching, a proportion of this new debt should be issued on a CPIH-linked basis. However, the market for CPIH-linked financial instruments is highly limited, and while the CPI-linked market has developed in recent years, its ability to accommodate the additional supply required for AMP8 is uncertain.

Composition of index-linked debt



Source: KPMG analysis based on the data from Monitoring Financial Resilience 2023 report

Regulatory precedent on basis risk

The approach adopted in the PR24 FM and DD

01 In the PR24 DD, Ofwat maintained that an allowance for basis risk is neither necessary nor a fair allocation of risk between companies and customers[a]. It argued that, based on inflation since 1997, companies with the notional structure would have benefited from the PR24 assumptions of 2% CPIH and a 0.9% RPI-CPIH wedge[b].

02 In the FM[c] Ofwat noted that an allowance for basis risk had been provided at RIIO-2, however it did not intend to provide one for water as it was not convinced these costs would apply equally.

03 Ofwat considered that it had not been provided with any estimates of the scale of risk, the cost of insuring against it, or why the policy to transition to full CPIH indexation obliged companies to bear higher costs.

04 In the FM Ofwat additionally argued that the wedge implied by the then latest OBR forecasts and inflation swaps was lower than its ‘early view’ estimate of 90bps. If these lower values materialised in practice, this would result in gains for companies, thus limiting the benefit of insuring against basis risk.

05 Finally, Ofwat noted that by 2025, the sector will have had nearly a decade to plan a transition to CPIH indexation and that any transitional costs related to full CPIH indexation should be weighed against the benefits to equity investors from an inflation measure that reduces the volatility of the RCV.

The approach adopted in the RIIO-2 FDs and RIIO-3

01 At RIIO-2, price controls for energy networks were fully transitioned to CPIH indexation, unlike the partial indexation implemented for water at PR19.

02 Ofgem provided an allowance of 5bps for the issuance of new CPI/CPIH-linked debt and the management of basis risk between RPI-CPI/CPIH[d], recognising that its decision to switch from RPI to CPIH indexation would result in additional costs.

03 The incremental cost of new CPI/CPIH-linked debt was estimated based on the premium at issue for CPI debt (30bps). This was multiplied by the assumed proportion of index-linked debt and share of new debt implied by the length of the trailing average.

04 The cost of basis risk management was estimated based on swap charges (10 – 15bps). This was multiplied by the assumed proportion of index-linked debt and share of embedded debt implied by the length of the trailing average.

05 In the RIIO-3 Sector Specific Methodology Decision[c], Ofgem stated that the provision of the allowance in its DD will depend on whether (1) licensees generally hedge the associated risk in a manner the allowance methodology assumes and (2) if not generally hedged, whether basis risk constitutes a negative expected return for licensees.

Notes: (a) Ofwat (2024), PR24 DD, Aligning risk and return – Allowed return appendix, section 3.4.
(b) Ofwat (2024), PR24 DD, Aligning risk and return appendix, section 1.4.3.
(c) Ofwat (2022), PR24 FM, Appendix 11 – Allowed return on capital, section 4.5.2.
(d) Ofgem (2022), ED2 FD – Finance Annex, paras. 2.40 – 2.44.
(e) Ofgem (2024), RIIO-3 Sector Specific Methodology Decision – Finance Annex, para 2.83.

Risk implied by the exposure to inflation wedges

There is a material and volatile wedge between RPI and CPI, CPI and CPIH as well as RPI and CPIH.

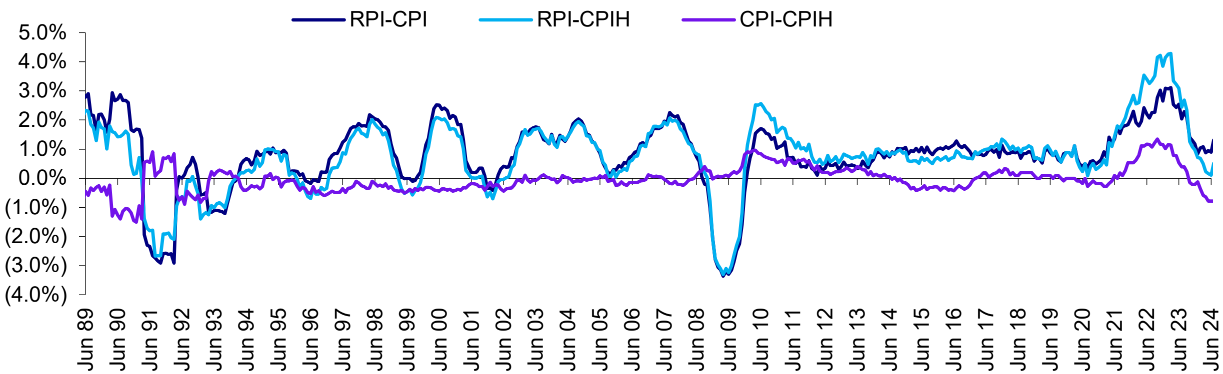
The latest forecasts imply that a material wedge is expected to persist during the period leading up to the 2030 RPI Reform:

- HMT's comparison of independent forecasts from May 2024 implies a wedge of 1.2% for 2028[(a)]
- OBR's forecasts from March 2024 imply a wedge of 0.9% [(b)] for 2028
- CPI and RPI-linked swap data for June 2024 implies an average wedge of 93bps to the end of 2030.

In the FM, Ofwat argued that central estimates of the wedge, based on official forecasts and inflation swaps, were below the 0.9% wedge at the time of publication. This suggested limited benefits from hedging against basis risk. However, based on latest data central estimates exceed the assumed 0.9% wedge.

Moreover, whilst it is assumed that the CPI-CPIH wedge is zero, in practice there might be a material difference between outturn values for these inflation measures (as set out on the next page).

Evolution of inflation wedges



Source: KPMG analysis based on ONS data

Risk implied by the exposure to inflation wedges (cont.)

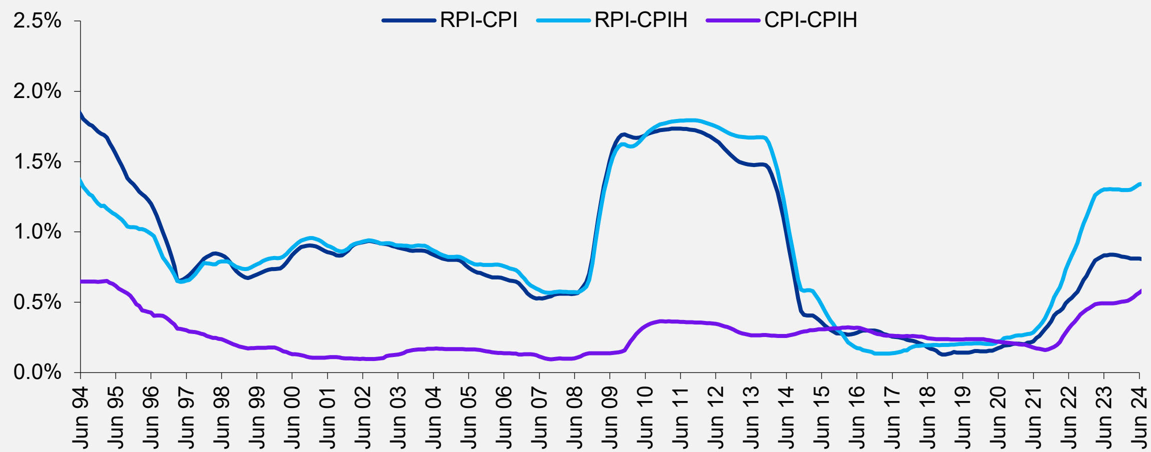
Historical data indicates considerable variability around the central estimate for each of these wedges. The volatility of the wedges has increased over time, particularly after 2021, indicating heightened basis risk.

This means that regardless of the central estimate of the RPI-CPIH adopted for PR24 – currently 90bps – there is a substantial risk of the actual outturn wedge across AMP8 deviating from this.

Variation around the P50 value

1988-2024	RPI-CPI	RPI-CPIH	CPI-CPIH
Average	0.82%	0.77%	-0.05%
P10[(c)]	-0.22%	-0.63%	-0.48%
P90[(c)]	2.15%	2.00%	0.56%
Degree of variation against central estimate	-1.04 to +1.33%	-1.40 to +1.22%	-0.43 to +0.61%

5-year average standard deviation of inflation wedges



Notes: (a) HMT (May 2024), Forecasts for the UK economy: a comparison of independent forecasts
(b) Ibid.
(c) P10 and P90 are terms used in probability and statistics to represent the 10th and 90th percentiles of a distribution, respectively. P10: The value below which 10% of the distribution falls. P90: The value above which 10% of the distribution falls.

Source: KPMG analysis based on ONS data

Translating the impact of the basis risk on RoRE variance to CoD

The effect of the basis risk exposure on the CoD is estimated by first translating the associated RoRE impact into beta terms. This beta value is then translated into the WACC and expressed as an equivalent change in the CoD.

The RoRE impact is estimated using the KPMG risk model[a], considering the financing RoRE range both with and without the basis risk exposure, while holding all other risk factors constant.

The resulting variance in the total RoRE range (the average of P10-P50 and P90-P50) is *higher* for a company with exposure to basis risk[b]. As inflation is a macroeconomic risk factor beyond companies' control, this increased variance is considered to be systematic.

In the PR24 DD Ofwat contends that the analysis of historical CPIH and RPI-CPIH wedge outturns does not indicate losses for companies in RoRE terms. However, Ofwat's analysis does not isolate the impact of the wedge, meaning it does not directly measure the effect of basis risk.

The increase in RoRE variance due to basis risk exposure is converted to an implied standard deviation of the notional company's return. Based on RoRE outputs from the KPMG risk model and assuming normally distributed returns, the standard deviation for a notional company with basis risk at PR24 is 0.54%, versus 0.51% without it, indicating a 1.06x increase in total risk exposure.

The scaled-up standard deviation is translated into an equity beta uplift based on the decomposition set out below. The decomposition implies that equity beta increases proportionally with the total risk exposure of a notional efficient company, assuming the company's correlation with the overall market as well as the volatility of market returns, remains constant. The assumption of a constant correlation holds when the total equity risk exposure is scaled up by a constant multiplier.

To evaluate whether a reduced correlation could offset the increase in the standard deviation of the company's return, a reverse stress test was conducted. The results indicate that the likelihood of such an offset is below 10%[c].

As a result, the notional equity beta should be uplifted by the same scaling factor of 1.06x, leading to an increase of 19bps in the CoE (based on the point estimate of ERP of 4.88% based on KPMG analysis[d]) and an implied rise of 9bps in the WACC. This translates to approximately 16bps on the CoD and is equivalent to 65bps on the cost of embedded index-linked debt.

Parameter	Basis risk Impact	
Notional equity beta (KPMG June 2024 cut-off)	0.687	A
Notional equity beta uplifted by a scaling factor of 1.06x	0.727	B
ERP (KPMG June 2024 cut-off)	4.88%	C
Increase in pre-tax CoE	19bps	D = C * (B-A)
Increase in WACC	9bps	E = D * (1 – 55%)
Implied increase in CoD	16bps	F = E/55%
Implied increase in cost of embedded ILD	65bps	G = F/(33% * 76%)[e]

$$\beta_i = \rho_{i,m} \frac{\sigma_i}{\sigma_m}$$

Where:

- $\rho_{i,m}$ is the correlation between the returns of a company and the market portfolio;
- σ_i is the standard deviation of a company's returns;
- σ_m is the standard deviation of the market portfolio's returns;

Notes: (c) $\rho_{i,m}$ (Pearson's correlation coefficient) can be rewritten as follows: $\rho_{i,m} = \frac{Covariance(i,m)}{\sigma_i * \sigma_m}$

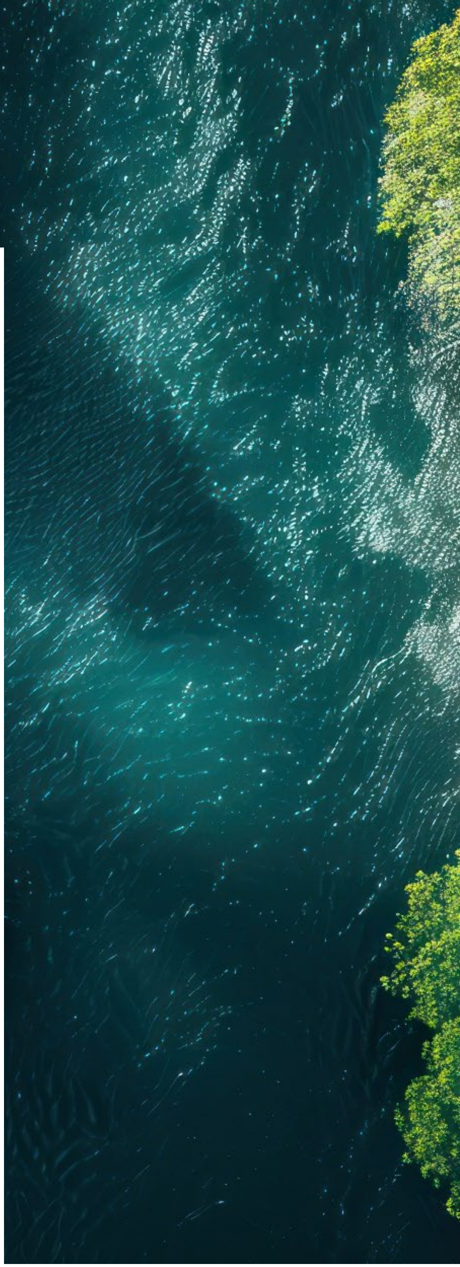
The analysis above suggests the financing risk associated with basis risk is 1.06 times greater than no such risk. Based on the decomposition of $\rho_{i,m}$, the impact of the scaled-up total equity risk exposure of the totex risk will cancel out on the upper and lower side of the formula, due to the fact that: $Covariance(1.06 * i, m) = 1.06 * Covariance(i, m)$, and $\sigma_{1.06*i} = 1.06 * \sigma_i$

Therefore, the Pearson's correlation coefficient can be assumed to be constant when the total equity risk exposure is scaled up by a constant scaling factor of 1.06.

Notes: (a) KPMG risk analysis assesses, based on the available empirical evidence and historical sector performance data, whether the DD parameters and mechanisms allow the notional company to earn base allowed return on a median expected basis. The stochastic risk model is constructed to simulate the notional company's risk exposure in RoRE terms by key risk drivers, accounting for risk mitigations purposed by Ofwat in PR24 DD.

(b) Please refer to Appendix 1 for detailed RoRE results.; (c) Please refer to Appendix 1 the results of the reverse stress test.; (d) KPMG (2024), Estimating the Cost of Equity for PR24; (e) Using notional company assumptions for share of embedded debt and proportion of ILD.

The implications of full CPIH indexation for regulatory policy



The decision to transition from an RPI- to a CPIH-based framework – including accelerated transition ahead of RPI Reform in 2030 – is beyond companies' control and could not have been anticipated when debt structures and hedging strategies were being established. The limited (1) depth of the CPIH market and (2) ability of the CPI market to absorb the new and increasing supply from issuers is also beyond water company control. Absent an allowance, companies will be exposed to additional risks and costs which are not priced in – arising from the specification of regulatory policy arising from accelerated transition to CPIH. The transition should be implemented in a manner that is NPV neutral and does not penalise and disadvantage companies due to exogenous factors outside their control.

Exposing companies to additional risks and costs from the transition would contravene the principles Ofwat set out for its implementation. For example, Ofwat noted that[a]:

- ***"We should move towards implementation of CPI, applying it to both prices and the RCV, but with careful regard to transitional issues".***
- ***"We will commit to ensuring that the impact of this is neutral to both company (nominal) revenues and customer bills in net present value terms... We see this commitment as being a critical part of our package and understand its importance. We therefore welcome views as to how we can best support the credibility of this commitment".***
- ***"We also stated that the choice of indexation method should not impact on the total (nominal) level of returns earned by investors".***

Ofwat has argued that there would be net benefits from a move to full CPIH indexation, given that CPIH is a less volatile measure of inflation. This reduction in volatility, according to Ofwat, eliminates the need for compensation for additional basis risk[b].

However, the analysis Ofwat cites to support this point acknowledges that the wedge between RPI and CPI offsets the reduction in volatility from moving away from RPI indexation. It notes that where the proportion of RPI-linked debt is substantial and indexation is fully switched to CPI, after accounting for the RPI-CPI mismatch, there is unlikely to be a net reduction in risk[c]. This is particularly relevant for PR24, given that RPI-linked debt constitutes a significant portion of the sector's portfolio and Ofwat is implementing a full transition. Furthermore, this analysis considers CPI as the alternative indexation measure, effectively assuming the same conclusions would hold if CPIH were used instead. In practice, there is a non-zero wedge between CPI and CPIH, which would introduce additional volatility.

Ofwat has also argued that the sector has had sufficient time to prepare for the full transition to CPIH. However, all index-linked debt issued by the notional company was assumed to be RPI-linked at PR19, and it was not clear that full transition would be implemented ahead of RPI reform. As a result, PR24 marks the first time that a significant proportion of CPIH-linked debt is assumed for the notional company. The sector has been issuing increasing amounts of CPI- and some CPIH-linked debt since 2017 in anticipation of the transition away from RPI indexation. However, the limited depth of the market for CPI- and CPIH-linked debt, relative to the scale of RPI-linked debt in company portfolios, has constrained the pace of transition away from RPI-linked debt.

Notes: (a) Ofwat (2015), Water 2020: Regulatory framework for wholesale markets and the 2019 price review
(b) Ofwat (2022), PR24 FM, Appendix 11 – Allowed return on capital, section 4.5.2 and Ofwat (2022), PR24 DM, Appendix 10 – Aligning risk and return, section 2
(c) Oxera (2016), Indexation of future price controls in the water sector, p. 68

Pricing evidence on hedging basis risk – bank questionnaires

In PR24 FM Ofwat highlighted that it had not been provided with any estimates of the cost of insuring against basis risk.

To inform the estimation of hedging costs, a questionnaire was distributed to seven leading banks that are key participants in the debt and swap market for the water sector. The questionnaire is designed to gather: (1) quantitative data on swap charges and the illiquidity premium associated with CPIH direct issuance; and (2) insights on market capacity to absorb the anticipated increase in supply from companies during AMP8.

Questionnaire responses on embedded ILD:

- For existing RPI-linked bonds, the optimal hedging strategy involves trading in basis swaps.
- Responses indicate that the CPIH swap market is still underdeveloped, meaning that basis swaps are almost exclusively available in the RPI-CPI market. As a result, companies are left exposed to the risk associated with the CPI-CPIH wedge.
- Bank quotes for basis swaps (RPI-CPI) average around 7bps for a 5-year swap, with a maximum of 12bps. A 5-year swap is deemed appropriate as there may not be a need to hedge this risk after the RPI Reform. As the quantification of basis risk exposure implies a 16bps impact on CoD, the 12bps estimate is proposed as the upper bound.

Questionnaire responses on new ILD:

For new issuances, water companies can manage basis risk in two ways: (1) by directly issuing CPIH or CPI bonds, with the latter potentially exposing them to the CPI-CPIH wedge; or (2) by issuing nominal bonds and entering into an inflation swap (fixed-to-CPI/CPIH).

- Responses indicate that although liquidity in the CPI bond market has improved over time, the market's capacity to absorb direct CPI issuance remains insufficient to accommodate all expected ILD issuances in the water sector during AMP8. Furthermore, the CPIH bond market is even less liquid, with some banks estimating an illiquidity premium of 9 – 13bps on CPIH bond issuance.
- With greater capacity in the swap market[(a)], the most effective way to issue new ILD that more closely aligns with the price control's indexation measure may be to raise nominal bonds and enter into CPI inflation swaps. Bank quotes for inflation swap charges are in the range of 58 – 62bps.

Bank quotes in the response to the questionnaire	Lower bound (bps)	Upper bound (bps)
Basis swap charges (RPI-CPI), 5-year tenor	7.0	12.0
Illiquidity premium on CPIH-linked	9.0	13.0
Swap charges on Fixed-to-CPI swap	58.0	62.0

Notes: (a) The explanation provided by one of the banks for this dynamic is as follows: Similar investors, such as pension funds and insurance companies, are active in both the index-linked bond and swap markets. These investors typically separate their investment activities into distinct mandates, such as equities, corporate debt, and government debt, while managing overarching liability hedges – like inflation and interest rate risk –at a central level. This separation means that liability hedging is handled independently from the management of corporate credit risk. Therefore, these institutional investors may opt for inflation swaps, which allow them to hedge inflation risk directly without introducing additional corporate credit risk. This results in greater demand for swaps as they effectively address the specific liability risks without overlapping with their corporate debt portfolios.

The estimates for basis risk pricing for PR24

The cost of basis risk management is estimated at 6bps across new and embedded debt, based on pricing evidence from banks.

- **For embedded debt, the range of 2 – 3bps reflects the cost of hedging this risk, cross-checked against by quantifying the additional volatility arising from basis risk, which translates into a 16bps adjustment. This significantly exceeds the cost of hedging through swaps. This cross-check, along with the potential market response to a significantly increased supply of ILD during AMP8, supports adopting 3bps as the estimate for pricing basis risk management on embedded debt.**
- **For new debt, the range of 1 – 5bps reflects the cost of issuing new CPI(H)-linked debt. 3bps is proposed as the point estimate.**

The pricing of basis risk is based on the proportion of ILD assumed for the notional company. However, in practice, the actual average ILD proportion differs significantly from the 33% notional assumption. Therefore, 6bps represents a conservative *de minimis* estimate.

Pricing of basis risk on embedded debt

	Basis of pricing	Estimate
Lower bound	The lower bound reflects the median cost of hedging the risk, based on information gathered from banks regarding basis swap charges.	7bps
Upper bound	The upper bound represents the maximum cost of hedging the risk based on bank surveys. This is corroborated by the quantification of the additional volatility arising from basis risk, which translates into a 16bps adjustment on CoD.	12bps
Overall range		7 – 12bps
Share of embedded debt		74%
ILD proportion		33%
Pricing of basis risk on embedded debt		2 – 3bps

Pricing of basis risk on new debt

	Basis of pricing	Estimate
Lower bound	The lower bound reflects the additional costs from issuing more illiquid CPIH-linked debt to maintain asset-liability matching.	9 – 13bps
Upper bound	The pricing is based on CPI inflation swap charge information gathered from banks. Survey responses indicate that the demand for inflation-linked bonds is limited relative to swaps and that there is virtually no market for CPIH swaps, suggesting that swapping nominal debt into CPI may be the most effective way of issuing CPI-linked debt.	58 – 62bps
Overall range		11 – 60bps
Share of new debt		26%
ILD proportion		33%
Pricing of basis risk on new debt		1 – 5bps

04

Cost of carry

Context

Cost of carry reflects the cost of issuing debt ahead of need (for example, pre-financing maturing debt, capital expenditures, working capital requirements).

This cost is calculated as the spread between CoD_N and the deposit rate earned on the cash proceeds from the debt issuance, over the duration of the pre-financing period.

Ofwat and the CMA at PR14

At PR14, Ofwat and the CMA estimated cash holding cost of 20bps.

Both Ofwat and the CMA included cash holding costs of c.0.20% in their assessment of actual costs[a].

This estimate was designed to reflect "*ongoing costs associated with complying with debt covenants / managing liquidity, the level of which may be influenced by the need to hold additional cash or retain draw-down facilities*"[b].

However, neither Ofwat not the CMA provided an uplift for the cost of carry for the notional company.

Ofgem RIIO-2

Ofgem estimated a 10bps cost of carry allowance at RIIO-2.

In the RIIO-2 FDs, Ofgem examined cash held by licensees to estimate cost of carry[e] (similar to the CMA's approach at PR19). Ofgem used group accounts where licensee level accounts held no cash.

The cost of carry was calculated by multiplying the cash balance, expressed as a percentage of net debt, by the 5-year average spread between the benchmark iBoxx GBP Utilities 10+ index and the cash deposit rate.

Ofwat and the CMA at PR19

At PR19 the CMA estimated the cost of carry at 10bps.

Ofwat did not provide estimate cost of carry in the PR19 FD.

During the PR19 CMA appeals, companies argued that a cost of carry allowance should be provided when including floating rate debt in the calculation of actual costs. This is because floating rate debt primarily corresponds to cash held on balance sheets[c].

The CMA included a 10bps cost of carry estimate in its embedded debt calculations which reflected floating debt[d].

Ofwat PR24 DD

Ofwat estimated the cost of carry to be 7bps[f].

Cost of carry is calculated based on the spread between the iBoxx A/BBB10+ index and the 3-month SONIA rate. The calculation assumes:

- A 6-month pre-financing period.
- A pre-financing requirement of 12%, expressed as a percentage of debt, to provide liquidity for 12 months for capital expenditure (beyond funds from operations) and to pre-finance maturing debt.
- That 50% of the refinancing requirement can be financed through revolving credit facilities (RCFs).

Ofwat calculated its iBoxx-SONIA spread based on data from 2020 to 2022. The regulator noted that the average spread has narrowed since January 2023 and will consider using this narrower spread for the FD.

Notes: (a) CMA (2015), Bristol Water plc determination, para. 10.100. Ofwat (2015), Ofwat's response to Bristol Water's Price Determination Statement of Case dated 11 March 2015, para. 310.
(b) CMA (2015), Bristol Water plc determination, para. 10.100
(c) CMA (2021), PR19 Final Determination, paras. 9.582 and 9.584.
(d) Ibid., para 9.606(a)(ii).
(e) See, for example, Ofgem (2021), RIIO-2 Final Determinations – Finance Annex (revised), para 2.23.
(e) The exact value and the calculation methodology are set out in the supplementary calculation published in August. The overall allowance for additional borrowing costs includes a new allowance for cost of carry and a decreased allowance for liquidity, resulting in a net 5bps increase in relative to the PR24 FM/.
(f) Ofwat (2024), PR24 DD, Aligning risk and return – Allowed return appendix, section 3.4.

Proposed approach and methodology

This Report estimates the cost of carry using three models: the PR24 DD model, the CMA/Ofgem model, and the KPMG model. The latter two represent top-down approaches for estimating the cost of carry, while the PR24 DD model is a bottom-up approach.

The CMA/Ofgem model, drawing on regulatory precedents from PR19 appeals and RIIO-2, calculates cost of carry as the product of the historical cash/net debt ratio and the spread between the iBoxx and SONIA indices.

The KPMG model estimates cost of carry based on the scale of pre-financing expected for AMP8.
An overview of the methodology is set out below.

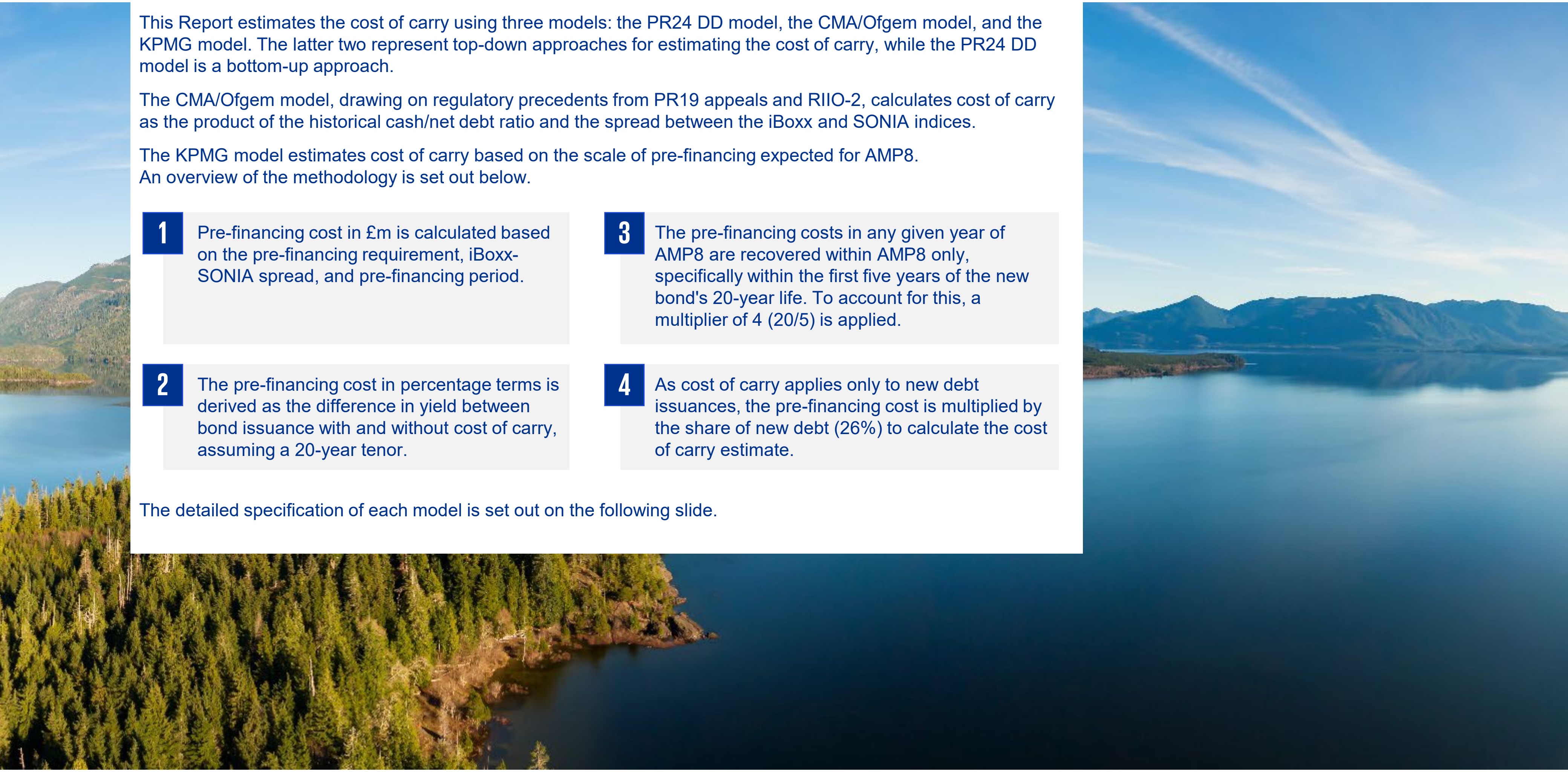
1 Pre-financing cost in £m is calculated based on the pre-financing requirement, iBoxx-SONIA spread, and pre-financing period.

2 The pre-financing cost in percentage terms is derived as the difference in yield between bond issuance with and without cost of carry, assuming a 20-year tenor.

3 The pre-financing costs in any given year of AMP8 are recovered within AMP8 only, specifically within the first five years of the new bond's 20-year life. To account for this, a multiplier of 4 (20/5) is applied.

4 As cost of carry applies only to new debt issuances, the pre-financing cost is multiplied by the share of new debt (26%) to calculate the cost of carry estimate.

The detailed specification of each model is set out on the following slide.



Proposed approach and methodology (cont.)

	Model specifications		
	Ofwat PR24 DD ('Ofwat model')	**CMA PR19 and Ofgem model ('CMA/Ofgem model')**	**KPMG AMP8 growth model ('KPMG model')**
Summary of model framework	Bottom-up modelling, based on refinancing and liquidity requirements for AMP8 capex and historical iBoxx-SONIA spread.	Top-down modelling, based on historical cash/net debt ratio, historical RCF facility size and forecast iBoxx-SONIA spread.	Top-down modelling, based on forecast AMP8 RCV growth, forecast RCF facility size (as a percentage of RCV) and forecast iBoxx-SONIA spread.
Period used for iBoxx-SONIA spread	Average of 2020 to 2022.	May-June 2024, updated for forward rate adjustments for SONIA overnight rates, where rate cuts have not be priced in due to short tenor.	
Total financing requirement across AMP8	12% on an annualised basis (6% refinancing and 6% capex liquidity).	N/A	26% on average across AMP8, consistent with the share of new debt assumption in PR24 DD.
Number of debt issuances during AMP8	N/A	N/A	5, 3.5, or 2.5, depending on the pre-financing period (i.e., 5Y/12m, 5Y/18m, or 5Y/24m).
Length of pre-financing period	6 months.	N/A	Primary assumption of 18 months, with sensitivities of 12 and 24 months considered.
Relevant benchmark for CoDN	iBoxx A/BBB 10+.	iBoxx A/BBB 10+ *plus* 34bps uplift (consistent with the assumption for CoD_N in this Report).	
Relevant benchmark for the return on cash and cash equivalents	3m Overnight Index Swap (OIS).	Weighted average SONIA across cash and cash equivalents, with cash linked to overnight SONIA and cash equivalents linked to 3m SONIA.	
Total amount of RCF	N/A	N/A	RCF as a percentage of RCV assumed ton be consistent with AMP7.
Availability of undrawn RCF for use for pre-financing	50% of the refinancing requirement (i.e. 6%).	N/A	50% of the refinancing requirement.
Companies included in analysis	WaSCs and large WoCs.	WaSCs and large WoCs.	WaSCs and large WoCs.

Analysis of and commentary on the Ofwat model

Parameter	Impact	Ofwat assumption	RAG[a]	KPMG commentary
Length of pre-financing period	Large	6 months	Red	This assumption is inconsistent with rating agency requirements and industry practices. For example, S&P requires corporate issuers to achieve "**adequate**" or "**strong**" liquidity assessment for BBB- rating and above. Achieving "**adequate**" requires liquidity sources to exceed uses by at least 1.2x over the next 12 months. Achieving "**Strong**" requires a minimum of 1.5x coverage over the next 12 months and 1.0x coverage for the subsequent 12 months (covering 24 months in total). Evidence from companies also supports longer pre-financing periods. Surveys conducted among water companies yielded seven responses, none indicating a pre-financing period shorter than 12 months. One company, for example, reported a 15-month liquidity policy, which it noted aligns with broader industry practices based on a recent benchmarking exercise. More generally, companies tend to adopt more prudent policies in the context of market volatility, increases in perceived credit risk of the sector and substantial investment programmes that increase required funding levels.
Average period for iBoxx-SONIA spread	Large	2020 to 2022. Ofwat noted that since January 2023 the average spread has narrowed, and that it will consider whether to adopt this narrower spread in the FD.	Amber	Ofwat has not acknowledged that the narrowing of the spread post-January 2023 is attributable to the difference in iBoxx and SONIA tenors. This difference means that rate cut expectations are reflected in iBoxx yields (with 10+ years to maturity) but not in SONIA rates. KPMG has estimated the forward rate adjustment due to this difference to be 58bps[b].

Notes: (a) RAG definition: Red – Ofwat assumption does not appear to be appropriate; Amber – Ofwat assumption does not, in principle, appear to be appropriate but it is recommended that Ofwat revisit the assumption for FD based on evidence submitted; Green – Ofwat assumption appears appropriate.

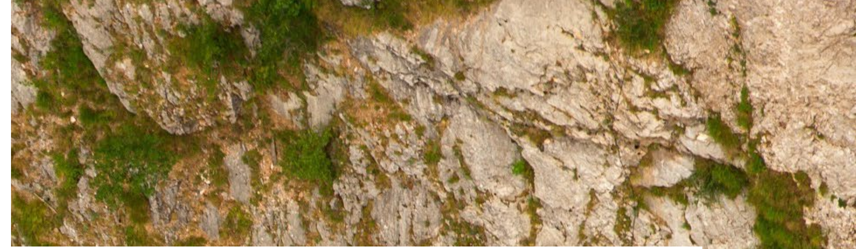
(b) See Appendix 2.

Analysis of and commentary on the Ofwat model (cont.)

Parameter	Impact	Ofwat assumption	RAG[a]	KPMG commentary
Total financing requirement over AMP8	Large	12% of total debt balance[b]		The total financing requirement would increase at the FD, if the Totex allowance and/or refinancing requirement is increased for one or more companies.
Portion of financing requirement met by utilising RCF	Large	50% (or 6% of total debt balance)		Ofwat appears to be assuming that 50% of the pre-financing requirement will be met using RCFs, although this is not confirmed explicitly. Some companies explained that they hold a certain proportion (33% – 50%) of their committed but undrawn RCF as permanent buffer for meeting unexpected cash needs.
Benchmark index for calculating iBoxx-SONIA spread	Large	iBoxx £ A/BBB 10+ index		The unadjusted yields understate the cost of borrowing for water companies. The evidence in the PR24 DD does not capture the full extent of water company underperformance.
OIS tenor	Small	3 months		While this represents a reasonable assumption for short-term deposits, cash at hand is likely to earn the overnight SONIA rate, which is generally lower than a 3-month rate.

Notes: (a) RAG definition: Red – Ofwat assumption does not appear to be appropriate; Amber – Ofwat assumption does not, in principle, appear to be appropriate but it is recommended that Ofwat revisit the assumption for FD based on evidence submitted; Green – Ofwat assumption appears appropriate.

(b) The financing requirement in the Ofwat model is annualised and hence is not like-for-like with the share of new debt, which reflects the cumulative new debt requirement across the AMP.



Cost of carry estimates for PR24

The tables below set out the pre-financing cost on total book debt for the three models based on primary assumptions and sensitivities.

These estimates reflect the debt issuance profile implied by the PR24 DD. This includes: (1) refinancing debt from the PR24 DD Balance Sheet model; and (2) RCV-financing debt from the PR24 DD financial models, calculated by multiplying the difference between the FY25 and FY30 closing values by the notional gearing of 55%. For the KPMG model, results based on the debt issuance profile submitted in company BPs are also presented.

The iBoxx-SONIA spread in each model is based on iBoxx A/BBB 10+ plus 34bps. The spread is calculated over (1) May-June 2024[(a)] and (2) 2020-2022[(b)].

Both the KPMG and updated Ofwat models capture the impact of pre-financing expected for AMP8. Assuming an 18-month pre-financing period, aligned with company policies and rating agency requirements, yields an estimated cost of carry of 12 – 14bps using the KPMG model. The updated Ofwat model, which now incorporates with an 18-month pre-financing period and appropriate new debt pricing, estimates a cost of carry of at least 13bps. Sensitivity analysis reveals that the assumed pre-financing period significantly impacts the results.

KPMG model results (bps)		Length of pre-financing period (months)		
		12	18	24
Source of issuance profile	PR24 DD	5.1	**11.6**	18.2
	BPs	7.9	**14.4**	21.1

Updated Ofwat model results (bps)		Length of pre-financing period (months)		
		12	18	24
Period used for iBoxx-SONIA spread	2020-22	15.7	**23.5**	31.3
	2024	8.8	**13.2**	17.7

The CMA/Ofgem model yields an estimate of 8 – 15bps, reflecting the appropriate pricing of CoD_N. However, by design, it does not account for expected pre-financing requirements for AMP8.

CMA/Ofgem model results (bps)	Period used for iBoxx-SONIA spread	
	2020-22	2024
Pre-financing cost	14.9	8.0

Notes: (a) 2m average for iBoxx and SONIA as of 30 June 2024. 3m SONIA rates are adjusted downward by 58bps to account for expected rate cuts not priced in. See detailed discussions in Appendix 2.
(b) Average iBoxx-SONIA spread between July 2020 and September 2022, before structural changes to the spread occurred.

Source: KPMG analysis

Cost of carry estimates for PR24 (cont.)

Cost of carry estimates based on the three models are as follows:

The KPMG model implies a cost of carry of 12 – 14bps, assuming

(1) an 18-month pre-financing period and

(2) a pre-financing cost based on iBoxx A/BBB 10+ plus 34bps. This is 5 – 7bps higher than the PR24 DD estimate.

The updated Ofwat model implies a cost of carry of at least 13bps, assuming (1) an 18-month pre-financing period and (2) a pre-financing cost based on iBoxx A/BBB 10+ plus 34bps. This is broadly in line with the lower bound of the results from the KPMG model.

The CMA/Ofgem model implies a cost of carry of 8 – 15bps, assuming a pre-financing cost based on iBoxx A/BBB 10+ plus 34bps. However, this model is unlikely to capture increases in pre-financing requirements driven by AMP8 capital programmes.

An estimate of 12 – 14bps based on the KPMG model is proposed in this Report.

05

Appendices

This appendix describes a three-step approach for translating the RoRE variance, arising from basis risk exposure in PR24, into changes in total risk exposure. This is expressed as the standard deviation of total return, a traditional measure of risk.

Appendix 1: Methodology for translating RoRE variance into standard deviation

Step 1

Simulate RoRE performance in terms of P10/P50/P90 for each risk driver using the KPMG risk model, under two scenarios: (1) with exposure to basis risk and (2) without exposure to basis risk.

Step 2

Calculate risk exposure for each risk factor

The standard deviation for each risk factor is derived by averaging the P10-P50 and P90-P50 ranges and dividing by 1.268[(a)].

This approach aligns with the CAPM assumption that returns are normally distributed, meaning they are symmetrically clustered around the mean. While there may be asymmetric downside risks in the expected performance of each risk factor under the PR24 DD regulatory framework, such risks are beyond the scope of this specific analysis.

Step 3

Aggregate the exposure to each factor into overall exposure for the firm

The standard deviation of each risk factor is aggregated to determine the total risk exposure for the notional company using the following formula:

$$\sigma_P^2 = \sum_{i=1}^{n} \omega_i^2 \, \sigma_i^2$$

$$\sigma_P = \sqrt{\sigma_P^2}$$

Where:

- σ_P is the total risk exposure measured as standard deviation
- σ_i is the risk exposure of each driver, e.g. Financing risk
- ω_i is the relative weight of each risk driver[(b)]

Notes: (a) This methodology assumes that performance is normally distributed, and thus that (1) P50, mean, and median values for each risk driver are equivalent and (2) the range of P90-P50 and P10-P50 should conceptually be the same and equal to 1.285 standard deviation (SD), where 1.285 is the critical value for the 10% confidence level in a normal distribution. Where the P90-P50 and P10-P50 ranges from the simulation differ, standard deviation is assumed to be the average of P90-P50 and P10-P50..

(b) The relative weight of each risk driver is derived as the proportion of its P90-P50/P10-P50 average variance to total RoRE variance. The same weights are applied to PR19 as derived from the KPMG risk model for PR24.

Appendix 1: Methodology for translating RoRE variance into standard deviation (cont.)

The tables below set out the RoRE outputs from the KPMG risk model for PR24, with and without exposure to basis risk, holding all other risk factors constant. P10 and P90 represent the downside and upside of the expected performance for each factor. The only difference between the tables is the simulated Financing RoRE range, with an average variance of P90-P50/P10-P50 at 1.52% in the presence of basis risk versus 1.18% without it.

The tables also set out the total risk exposure for a notional water company in PR24, measured as the weighted average of the standard deviations for each risk driver, both with and without exposure to basis risk. Keeping all risks constant except for Financing risk, the total risk exposure for a notional company with basis risk in PR24 is 0.54%, compared to 0.51% without basis risk. This indicates an increase in total risk by a scaling factor of 1.06x.

Incl. basis risk	Implied P10	Implied P50	Implied P90	Average of Variance	Standard Deviation of risk drivers (σ_i)	*Relative weight (ω_i)*	Implied risk variance ($\sigma_i^2 \omega_i^2$)	Implied total risk (σ_P)
Totex	-2.43%	-0.91%	0.42%	1.43%	1.11%	*22.02%*	0.00060%	
Retail	-1.55%	0.00%	1.55%	1.55%	1.21%	*23.96%*	0.00084%	
ODIs	-2.56%	-0.84%	0.37%	1.47%	1.14%	*22.64%*	0.00067%	
Financing	**-1.49%**	**0.05%**	**1.55%**	**1.52%**	**1.19%**	***23.49%***	**0.00078%**	
C-MeX	-0.33%	0.04%	0.48%	0.41%	0.32%	*6.26%*	0.00000%	
Revenue & other	-0.05%	-0.03%	0.00%	0.03%	0.02%	*0.39%*	0.00000%	
DPC	-0.16%	0.00%	0.00%	0.08%	0.06%	*1.24%*	0.00000%	
Total	**-8.57%**	**-1.69%**	**4.37%**	**6.47%**	**5.05%**	***100.00%***	**0.00289%**	**0.54%**

Source: KPMG risk model, extracted August 19, 2024.

Notes: In this report, the RoRE outputs are based on the "**Unmitigated rebased**" numbers in the club risk model, which is the scenario with full estimated risk exposure of the notional company under the PR24 DD regulatory regime, but removing the miscalibration risk, i.e. assuming that companies are able to improve their performance to the levels required in AMP8 to meet the submitted BP targets. The RoRE for each driver have been adjusted to be on additive basis, i.e. the total RoRE equals to the sum of the individual RoREs.

Appendix 1: Methodology for translating RoRE variance into standard deviation (cont.)

The tables below set out the RoRE outputs from the KPMG risk model for PR24, with and without exposure to basis risk, holding all other risk factors constant. P10 and P90 represent the downside and upside of the expected performance for each factor. The only difference between the tables is the simulated Financing RoRE range, with an average variance of P90-P50/P10-P50 at 1.52% in the presence of basis risk versus 1.18% without it.

The tables also set out the total risk exposure for a notional water company in PR24, measured as the weighted average of the standard deviations for each risk driver, both with and without exposure to basis risk. Keeping all risks constant except for Financing risk, the total risk exposure for a notional company with basis risk in PR24 is 0.54%, compared to 0.51% without basis risk. This indicates an increase in total risk by a scaling factor of 1.06x.

Excl. basis riskc	Implied P10	Implied P50	Implied P90	Average of Variance	Standard Deviation of risk drivers (σ_i)	*Relative weight (ω_i)*	Implied risk variance ($\sigma_i^2\omega_i^2$)	Implied total risk (σ_P)
Totex	-2.43%	-0.91%	0.42%	1.43%	1.11%	*22.02%*	0.00060%	
Retail	-1.55%	0.00%	1.55%	1.55%	1.21%	*23.96%*	0.00084%	
ODIs	-2.56%	-0.84%	0.37%	1.47%	1.14%	*22.64%*	0.00067%	
Financing	**-1.15%**	**0.03%**	**1.21%**	**1.18%**	**0.92%**	***23.49%***	**0.00047%**	
C-MeX	-0.33%	0.04%	0.48%	0.41%	0.32%	*6.26%*	0.00000%	
Revenue & other	-0.05%	-0.03%	0.00%	0.03%	0.02%	*0.39%*	0.00000%	
DPC	-0.16%	0.00%	0.00%	0.08%	0.06%	*1.24%*	0.00000%	
Total	**-8.23%**	**-1.71%**	**4.03%**	**6.13%**	**4.78%**	***100.00%***	**0.00258%**	**0.51%**

Source: KPMG risk model, extracted August 19, 2024.

Notes: In this report, the RoRE outputs are based on the "**Unmitigated rebased**" numbers in the club risk model, which is the scenario with full estimated risk exposure of the notional company under the PR24 DD regulatory regime, but removing the miscalibration risk, i.e. assuming that companies are able to improve their performance to the levels required in AMP8 to meet the submitted BP targets. The RoRE for each driver have been adjusted to be on additive basis, i.e. the total RoRE equals to the sum of the individual RoREs.

Appendix 1: Methodology for translating RoRE variance into standard deviation – reverse stress test on correlation

Accurately estimating the potential change in correlation resulting from the increased standard deviation of company returns due to basis risk exposure is challenging.

As such, a reverse stress test is conducted to assess the plausibility of a reduced correlation to offset the increased equity risk exposure. This involves calculating how much the correlation would need to decrease to keep the beta unchanged and evaluating whether such a decrease is realistic based on historical correlation trends. If the required correlation to offset the increased volatility is lower than the P10 of historical levels, it would indicate that maintaining a constant beta might be unrealistic. For completeness, the offsetting correlation is compared with 2Y, 5Y and 10Y windows with historical data since 2006.

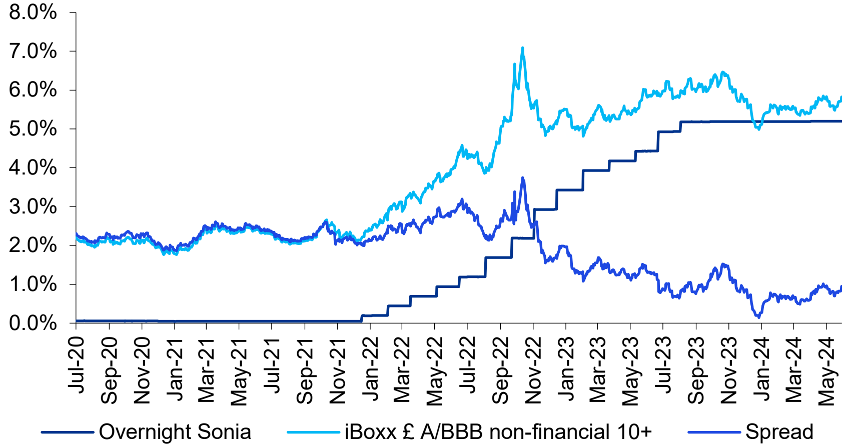
The results of the test are shown in the table below. Based on the scaled-up standard deviation in equity return, the likelihood of correlation decreasing enough to maintain beta unchanged is lower than 10% for the 5- and 10-year windows used for beta estimation in the PR24 DD. Therefore, the possibility of a lower correlation to completely offset the increase in equity return volatility is low, thus the equity beta is more likely to increase.

Estimation Window	2Y	5Y	10Y
Correlation as of 30 June 2024	0.36	0.42	0.44
Required correlation to offset the increased volatility	**0.34**	**0.40**	**0.41**
Historical correlation from Jan 2004 to 30 Jun 2024 (P10)	0.33	0.41	0.44
Historical correlation from 1 Oct 2014 to 30 Jun 2024 (P10)	**0.32**	**0.41**	**0.44**
Compared with Jan 2004 to 30 Jun 2024	Likelihood > 10%	Likelihood <10%	Likelihood <10%
Compared with 1 Oct 2014 to 30 Jun 2024	Likelihood >10%	Likelihood <10%	Likelihood <10%

Source: KPMG analysis.

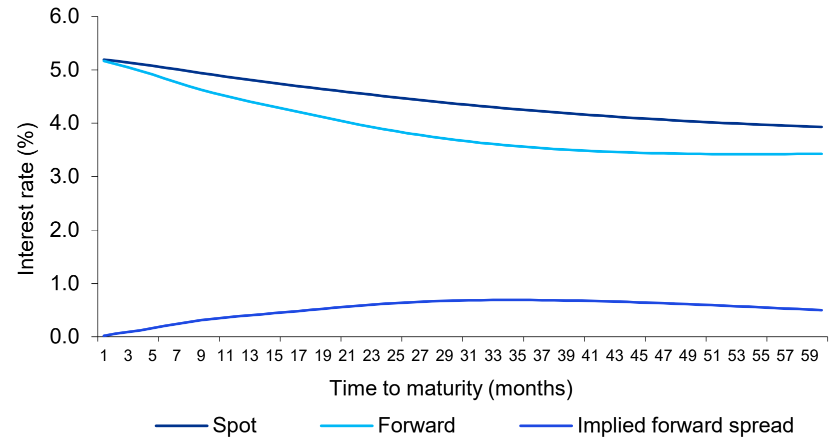
Appendix 2: Evolution of the spread between SONIA and iBoxx

Evolution of iBoxx (A/BBB 10+) and Sonia (overnight) spread



Source: Refinitiv Datastream and Bank of England

Implied forward spread on Sonia swaps (June 2024 average)



Source: KPMG analysis based on Bank of England data

Between July 2020 and September 2022, the spread between overnight SONIA and iBoxx A/BBB 10+ is typically 2-3%. A structural break is observed from November 2022 onwards, with the spread decreasing to 1.5% by January 2023 and to less than 1% throughout 2024. This spread is a key modelling input, reflecting the difference between the cost of financing and the return achievable on cash and cash equivalents. *Ceteris paribus*, a larger spread results in a higher cost of carry, and *vice versa*.

It is important to consider the implications of this for the spread that can reasonably be assumed to apply in AMP8. It is possible that the recent narrowing of the spread is a consequence of the iBoxx having built-in expectations of future base rate decreases, whereas the overnight SONIA – which by definition is a one-day rate – does not. Once base rate decreases have taken place, it is possible that the spread will widen once again. Comparing the forward curve of SONIA swap rates for June 2024 for maturities between 1 and 60 months indicates an implied fall in SONIA rates of approximately 58bps.

Appendix 3: important notice

This Report has been prepared by KPMG LLP (‘**KPMG**’, ‘**we**’ or ‘**our**’) for Water UK on the basis of an engagement contract dated 26 September 2023 and varied by an amendment and restatement agreement dated 16 August 2024 between Water UK and KPMG (together the **“Engagement Contract**”). Water UK commissioned the work to assist Water UK in its considerations regarding the Water Services Regulation Authority (“Ofwat”)’s PR24 Draft Determination on the cost of new debt and additional borrowing costs.

Water UK should note that our findings do not constitute recommendations as to whether or not Water UK should proceed with any particular course of action.

The findings expressed in this Report are (subject to the foregoing) those of KPMG and do not necessarily align with those of Water UK.

KPMG has not assisted Water UK in preparation of its separate response to the PR24 Draft Determination on cost of new debt and additional borrowing costs to which this Report relates. For the avoidance of doubt, it is Water UK’s sole responsibility to decide what should be included in their response or submission to Ofwat. KPMG has not made any decisions for Water UK or assumed any responsibility in respect of what Water UK decides, or has decided to, include in its response or submission.

This Report is for the benefit of Water UK only. This Report is not suitable to be relied on by any party wishing to acquire rights against KPMG (other than Water UK) for any purpose or in any context. Any party other than Water UK that obtains access to this Report or a copy and chooses to rely on this Report (or any part of it) does so at its own risk. To the fullest extent permitted by law, KPMG does not assume any responsibility or liability in respect of our work or this Report to any party other than Water UK.

The sector-wide market information in this Report reflects prevailing conditions as of the date of the Report, all of which are accordingly subject to change. Although we endeavour to provide accurate and timely information, there can be no guarantee that such information is accurate as of the date it is received or that it will continue to be accurate in the future. Information sources and source limitations are set out in this Report. We have satisfied ourselves, where possible, that the information presented in this Report is consistent with the information sources used, but we have not sought to establish the reliability or accuracy of the information sources by reference to other evidence. We relied upon and assumed without independent verification, the accuracy and completeness of information available from public sources and financial information platforms. KPMG does not accept any responsibility for the underlying data used in this Report.

The company-specific information in relation to water company debt is based on representations made to us by the management of each water company. We do not accept responsibility for such information which remains the responsibility of management. We relied upon and assumed without independent verification, the accuracy and completeness of the information. We have not sought to establish the reliability of the information by reference to other evidence. The company-specific information has been reviewed by the management of each water company.

This Report also contains or refers to questionnaire responses (“**Data**”) provided by banks (“**Third Parties**”). The Data was not prepared or supplied by the Third Parties in contemplation, or for the purpose, of Water UK’s or any other person’s interests or needs.

Appendix 3: important notice (cont.)

In respect of the Data: (i) no representation or warranty, either express or implied, is provided by any Third Party and no responsibility or liability, either express or implied, is taken by or accepted by any Third Party in relation to the accuracy, completeness, reasonableness or reliability of the Data or the assumptions upon which the Data was prepared, nor whether it is relevant or suitable for Water UK's or any other person's purposes; (ii) the Data is confidential in accordance with KPMG's contractual obligations to the Third Parties; (iii) no Third Party owes or accepts any duty, liability or responsibility to Water UK or any other person, whether in contract, as a fiduciary, in tort (including, without limitation, negligence and breach of statutory duty) or otherwise and the Third Parties shall not be liable to Water UK or any other person in respect of any loss, damage or expense in connection with the Data; and (iv) neither Water UK nor any other person may rely on the Data or any part of it and, if they do so rely on any of the Data for any purpose, they do so at their own risk.

Where our Report makes reference to 'KPMG Analysis' this indicates only that we have (where specified) undertaken certain analytical activities on the underlying data to arrive at the information presented. We do not accept responsibility for the underlying data.

This engagement is not an assurance engagement conducted in accordance with any generally accepted assurance standards and consequently no assurance opinion is expressed.

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CREATE: CRT157036A | August 2024

Annex 4 – KPMG Report on PR24 risk analysis for a notional company

28 August 2024

Private & confidential

Water Services Regulation Authority
Centre City Tower
7 Hill Street
Birmingham
B5 4UA

28 August 2024

Dear Director,

Report on PR24 risk analysis for a notional company in response to Ofwat's Draft Determinations

We attach a copy of the above confidential report dated 27 August 2024 the ("Final Report") prepared by KPMG LLP ("KPMG"). The Final Report was solely prepared for Affinity Water Limited, South East Water Limited, South Staffordshire Water plc, Anglian Water Services Limited, Southern Water Services Limited, Wessex Water Services Limited, Yorkshire Water Services Limited and Thames Water Utilities Limited (together, "the Companies").

KPMG has agreed that we may disclose the attached Final Report to you, on the basis set out in this letter, to enable you to verify that a report has been commissioned by us and issued by KPMG in connection with the estimation of risk for the PR24 price control, and to facilitate the discharge by you of your regulatory functions subject to the remaining paragraphs of this letter to which your attention is drawn. KPMG has also agreed that you may publish the Final Report (in full only) on your website pages.

KPMG's work was designed to meet our agreed requirements and the engagement activities were determined by our needs at the time. The Final Report should not be regarded as suitable to be used or relied on by any party other than us for any purpose or in any context.

In consenting to the disclosure of the Final Report to you, KPMG does not assume any responsibility to you in respect of its work for us or for the Final Report. To the fullest extent permitted by law, KPMG accepts no liability in respect of any such matters to you. If you rely on the Final Report or any part of any of them, you do so at your own risk.

Yours faithfully

Wessex Water Services Limited

PR24 risk analysis for a notional company

27 August 2024

Document Classification - KPMG Public

Contents

1 Important notice

This Report has been prepared by KPMG LLP ('KPMG', 'we' or 'our') for Affinity Water Limited, South East Water Limited, Anglian Water Services Limited, Southern Water Services Limited, Wessex Water Services Limited, Yorkshire Water Services Limited, Thames Water Utilities Limited, and South Staffordshire Water Plc ('group of companies') on the basis of an engagement contract dated 08 July 2024 between the group of companies and KPMG (the "Engagement Contract").

This Report is for the benefit of the group of companies only. It has not been designed to be of benefit to anyone except the group of companies. In preparing this Report we have not taken into account the interests, needs or circumstances of anyone apart from the group of companies, even though we may have been aware that others might read this Report. We have prepared this Report for the benefit of the group of companies alone.

This Report is not suitable to be relied on by any party wishing to acquire rights against KPMG (other than the group of companies) for any purpose or in any context. Any party other than the group of companies that obtains access to this Report or a copy and chooses to rely on this Report (or any part of it) does so at its own risk. To the fullest extent permitted by law, KPMG does not assume any responsibility or liability in respect of our work or this Report to any party other than the group of companies.

In particular, and without limiting the general statement above, since we have prepared this Report for the benefit of the group of companies alone, this Report has not been prepared for the benefit of any other person or organisation who might have an interest in the matters discussed in this Report, including for example other water companies or regulatory bodies.

Information in this Report is based upon publicly available information and reflects prevailing conditions as of the date of the Report, all of which are accordingly subject to change. Although we endeavour to provide accurate and timely information, there can be no guarantee that such information is accurate as of the date it is received or that it will continue to be accurate in the future. Information sources and source limitations are set out in the Report. We have satisfied ourselves, where possible, that the information presented in this Report is consistent with the information sources used, but we have not sought to establish the reliability or accuracy of the information sources by reference to other evidence. We relied upon and assumed without independent verification, the accuracy and completeness of information available from public and third-party sources. KPMG does not accept any responsibility for the underlying data used in this Report.

You should be aware that KPMG, including members of the engagement team, delivers other advisory services to individual companies who are within the group of companies. KPMG has not made any decisions for the group of companies, nor for any individual company within the group of companies, on any aspect of their responses to the Draft Determination. KPMG has not assumed any responsibility for what the group of companies, or any individual company within the group of companies, decides, or has decided, to include in its response(s).

This engagement is not an assurance engagement conducted in accordance with any generally accepted assurance standards and consequently no assurance opinion is expressed.

This Report should not be copied, referred to or disclosed, in whole or in part, without our prior written consent, except as specifically permitted in the Engagement Contract.

2 Introduction

Over the next twenty-five years, the water sector will need to deliver large-scale investment for customers and the environment. The sector will need to improve resilience and service levels, adapt to climate change, and work towards net zero emissions. This investment will need to be balanced against affordability constraints. With these goals spanning multiple price controls, continuous access to both debt and equity financing will be critical to ensure that these improvements can be delivered.

In order to attract investment into the sector, debt and equity investors need to earn a reasonable return that provides fair compensation for the risks associated with their investment. This requirement translates into two components. First, the base allowed return needs to reflect forward-looking risk exposure, and second, an efficient company needs to have a reasonable prospect of earning the base allowed return or, to put it differently, a notionally efficient company's expected return needs to equal the allowed return. This report predominantly considers whether the second component holds true given changes to regulatory risk protection mechanisms proposed in the Price Review 24 (PR24) Draft Determinations (DDs).

In the PR24 DDs, Ofwat stated: "*We have calibrated the risk and return package so that equity investors in an efficient company have a reasonable prospect of earning the base allowed return*", while maintaining financial incentives to outperform cost and performance targets and penalties in case of underperformance[1]. Several changes to the regulatory parameters and mechanisms were introduced at DDs to change risk allocation and reduce exposure for companies, namely: designing PC targets that sit between upper quartile and median of business plans, introducing Aggregate Sharing Mechanism (ASM) covering totex, lowering sharing rates for enhancement totex and introducing gated process for more complex projects, introducing energy cost indexation in the base cost and ex-ante labour cost indexation in the retail cost, shifting the C-Mex reward maximum from UKCSI maximum to upper quartile and others. Many of these changes improve the sector's ability to earn the base allowed return. Other changes to the regulatory framework at DDs appear to have the opposite impact on risk exposure, in particular: increase in the ODI rates, wider adoption of price control deliverables (PCD), significant totex efficiency challenges and the introduction of Delayed Delivery Cashflow Mechanism (DDCM).

This report aims to assess, based on the available empirical evidence and historical sector performance data, whether the DD parameters and mechanisms allow the notional company to earn base allowed return on a *median*[2] *expected basis*. This report explores whether additional changes to the calibration of regulatory parameters and mechanisms are required to ensure that the risk is mitigated at source and the notional company can expect to earn the base allowed return.

This report is structured as follows:

- Section 3 presents an executive summary of the key findings of the risk analysis conducted on the DD, the implications of the resulting risk on the PR24 package overall, and examples of regulatory mitigations and adjustments to the cost of capital to align risk and return.
- Section 4 provides further detail behind the simulated notional company's risk exposure in RoRE terms by key risk drivers. It also discusses potential regulatory mitigations and their relative effectiveness in supporting the notional company to achieve the allowed return on a median expected basis.

[1] Ofwat (2024), PR24 draft determinations: aligning risk and return appendix, p. 2.

[2] P50 or Median is the value occurring in the middle of a distribution, with 50% of the data set above and 50% below this point. It gives insight into central data tendencies and typical performance. Mean and Median are the same in a symmetrical, normal distribution but can be very different in asymmetric distributions.

- Section 5 summarises the key conclusions of the analysis and the wider implications for the water sector over the PR24 period.
- Section 6 Appendices provides additional detail on the main drivers of risk, methodology used to analyse risk, approach to notional company calibration and assessment of the risk associated with enhancement projects.

3 Executive summary

The risk analysis in this report has been developed through stochastic simulation of forward-looking performance, considering the water sector's performance in AMP7, performance stretch embedded in the business plan targets and implied in the DDs. The suitability of AMP6 performance data for simulating forward-looking risk in AMP8 is substantially limited due to no differentiation between base and enhancement totex, totex not reflecting the scale and complexity present in AMP8, performance commitment targets set at inconsistent levels, with significant differentiation by company, vastly different ODI rates creating different sets of financial incentives and risk exposures across companies, inconsistency of definitions for some ODIs with AMP8 definitions, and limited cross-sector standardised data.

Forward-looking performance was simulated for a theoretical notional company, based on median company by size among each population of water and sewerage companies (WaSCs) and water-only companies (WoCs) and defined as the first quartile performer in the sector.

Accurate specification of the notional company and its baseline performance is essential for producing meaningful return on regulated equity (RoRE) risk ranges. Performance that is realistically achievable by the top quartile companies in AMP7 to date could act as a benchmark, providing a useful cross-check that the definition of the notional company above is supported by the empirical data. Table 1 shows RoRE performance across each company in the sector in AMP7, with widespread underperformance.

Table 1: Summary sector reported RoRE (%) across the major categories of operational performance

	Co1	Co2	Co3	Co4	Co5	Co6	Co7	Co8	Co9	Co10	Co11	Co12	Co13	Co14	Co15	Co16	Co17	P50	P75
Cumulative totex	-1.6	-5.2	**-0.8**	-6.9	-1.0	-3.1	-1.1	-1.1	-2.0	-2.4	-1.4	**-0.3**	**-0.1**	**0.6**	-1.9	-2.6	-1.7	**-1.6**	**-0.9**
Cumulative ODIs	-0.5	-1.5	**-0.2**	-1.7	**1.1**	-0.5	-0.9	**0.4**	-0.7	**-0.1**	-0.7	-1.1	-1.2	-0.9	-0.4	-0.9	-1.2	**-0.7**	**-0.3**
Cumulative Retail	**-0.1**	**1.5**	-0.5	-0.9	**-0.2**	**0.0**	-0.9	-0.3	-1.1	-0.4	-0.5	-0.5	-0.3	-1.0	-2.6	-0.6	-1.1	**-0.5**	**-0.2**
Cumulative operational RoRE, FY21-FY24	-2.1	-5.2	**-1.3**	-11.0	**0.1**	-3.7	-3.5	**-0.9**	-3.8	-2.8	-2.6	-2.1	**-1.5**	-2.7	-5.1	-4.3	-3.9	**-2.8**	**-1.8**

Source: Annual Performance Reports, FY24; Bold figures highlight upper quartile performers in each category; Grey shading shows companies that performed at or above sector-median on each operational parameter.

During the first 4 years of the AMP7 price control period, the sector reported an average 330 basis points[3] operational underperformance against the baseline equity return, with the main contributors being the ODIs (-65b.p.), wholesale totex (-193b.p.) and retail (-56b.p.). The sector also reported a modest average financing outperformance of 56b.p.[4] driven by the difference between outturn and assumed inflation. Overall, the sector's performance was severely skewed towards underperformance and only a few top-performing companies earned the allowed return.

No company consistently achieved upper quartile performance across each wholesale totex, ODIs and retail, as demonstrated in Table 1. Companies which performed strongly on totex exhibited weaker than median performance on ODIs and retail, and *vice versa*. Only five companies performed at or above the median level on each parameter, highlighted in grey. This demonstrates the level of stretch implied by the combination of performance targets and base totex allowances in AMP7, with no company managing to meet targets and spend within cost allowances.

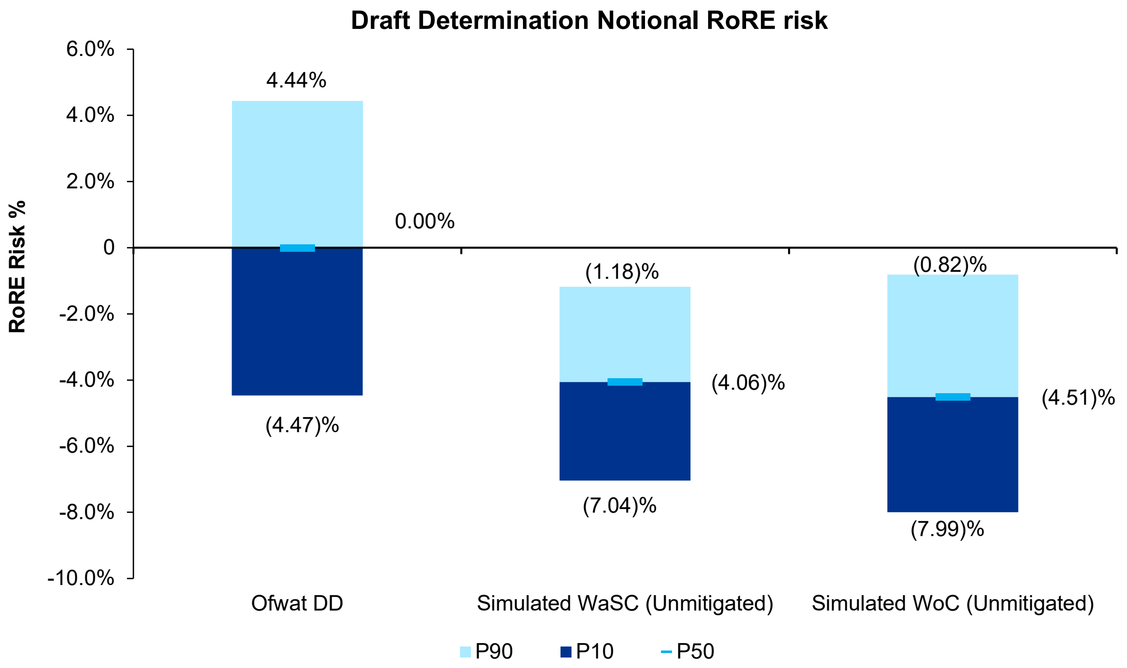
[3] Simple average of reported Total Operational Performance RoRE for FY21-FY24 as per industry APRs; actual return and notional regulated equity.

[4] Simple average of reported cost of debt performance plus simple average of reported hedging instruments for FY21-FY24 as per industry APRs; actual return and notional regulated equity.

It follows from the empirical data presented in Table 1 that a company achieving median[5] performance across all performance parameters in all years could be considered an upper quartile company with respect to overall performance achieved by its peers. This approach factors in the trade-offs between totex and ODI performance, given the limitations of the overall package. The calibration of the notional company based on median sector performance therefore reflects an achievable efficient company and is used in this report as the cornerstone of the risk simulations. Application of this specification, grounded in historical data, demonstrates that there is scope for regulatory miscalibration of performance achievable by the notional company in the DD.

Overall, consolidated analysis of the water sector's risk exposure suggests that the DDs imply a material imbalance between risk and return where the historical performance of the sector and the design of regulatory mechanisms are fully accounted for. Compared to the baseline equity return, there is a negative upside in the best-case scenario (P90)[6], a substantially negative risk exposure in the base-case scenario (P50) and a severe downside in the worst-case scenario (P10). Chart 1 presents simulated risk ranges and key components of risk for a notional WaSC, a notional WoC[7] and compares them to the view of risk in the DDs.

Chart 1: Simulated risk ranges for the notional company based on the PR24 DD[8]



[5] A median separates higher half of a data sample from the lower half and helps define the central tendency of a data array, which is particularly relevant for skewed, non-normal distributions, where mean could be significantly impacted by outliers.

[6] Best-case, base-case and worst-case scenarios are consistently referenced throughout this report as a substitution for the P90, P50 and P10, respectively. The P10, P50 and P90 are percentiles and show how the numbers are distributed in a sample. P50 is the value that features in a sample with an equal number of observations above and below. P10 and P90 are the tail ends and correspond to the 10 percent of lowest and highest values, respectively.

[7] The two different types of a notional company, a WaSC and a WoC have been considered in this report. This is because of significant structural differences between the two types that affect RoRE risk ranges. WaSCs have significantly larger asset base, operate two distinct business units – water and wastewater – and cover larger geographies. WoCs have smaller asset base, operate one distinct business unit – water – and cover smaller geographies. A WoC has higher operational gearing where base totex reflects a higher proportion of RCV than for a WaSC, which results in more negative risk outcomes.

[8] Risk ranges reflect all the risk mitigations proposed at the DDs across ODIs, totex, measures of experience, retail, DPC and Aggregate Sharing Mechanisms (ASMs) on ODIs and totex.

Table 2: RoRE risk ranges presented in the DDs versus those arrived at in this analysis (by component)

	Notional company per DD			Simulated notional WaSC			Simulated notional WoC		
	Worst-case	**Base-case**[9]	**Best-case**	**Worst-case**	**Base-case**	**Best-case**	**Worst-case**	**Base-case**	**Best-case**
Totex	-1.36%	0.00%	1.23%	-2.60%	-1.26%	0.11%	-3.27%	-1.43%	0.98%
Retail	-0.30%	0.00%	0.30%	-2.17%	-0.62%	0.92%	-2.17%	-0.62%	0.92%
Mex & ODI	-2.38%	0.00%	2.01%	-3.68%	-1.72%	0.08%	-3.94%	-2.04%	0.33%
Financing	-0.40%	0.00%	0.90%	-1.85%	-0.34%	1.19%	-1.88%	-0.33%	1.21%
Other	-0.05%	0.00%	0.00%	-0.21%	-0.03%	0.00%	-1.83%	-0.03%	0.00%
RoRE (additive)	-4.48%	0.00%	4.44%	-10.52%	-3.97%	2.30%	-13.08%	-4.46%	3.44%
RoRE (simulated)[10]	**n/a**	**n/a**	**n/a**	**-7.04%**	**-4.06%**	**-1.18%**	**-7.99%**	**-4.51%**	**-0.82%**

Source: KPMG analysis, APRs, DDs

There is a marked difference in the level of risk exposure across the worst-, base- and best-case scenarios between the results presented in the DDs and those arrived at in this analysis. This analysis shows that the outcomes are much poorer across all performance categories than is presented in the DDs.

Based on the detailed workings that were published on the 20 August 2024 by the regulator, it appears that the base-case (P50) risk exposure has not been quantified or analysed in any degree of detail in the DDs. Instead, an assumption was made that the expected return equals allowed return for the presentation purposes. There is also little evidence that historical sector data was used to inform the performance and risk ranges[11].

Despite greater risk variance[12] of the different performance components in this analysis versus the DDs, the total simulated risk variance is higher in the DDs because simple addition was applied to the components of risk, implying a correlation of 1. This analysis assumes that different components of risk are uncorrelated, resulting in the worst-case and best-case scenarios occurring only for some performance parameters while not occurring for others, producing a lower risk variance. The outcome of a simulated best-case scenario is lower than the simple addition of the individual best-case parameters and, similarly, simulated worst-case scenario is less negative than the simple addition of component parts. The overall exposure ranges from -1.18% to -7.04% for a notional WASC and from -0.82% to -7.99% for a notional WOC, which would erode the allowed return in all scenarios.

This level of risk could have an adverse impact on financeability and investability, challenging companies' ability to deliver service for customers and protect the environment. In the context of attracting capital necessary to maintain operations and deliver the investment programmes, risk exposure that is not commensurate with levels investors expect for a stable, predictable regulated utility could raise the return expectations of debt and equity investors and result in higher cost of infrastructure for customers.

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[9] In the DDs, there was no P50 base-case explicitly specified and it is assumed that the P50 was zero.

[10] Statistical analysis of the probabilistic outcomes relies on Monte Carlo simulations which produce random outcomes. The consolidated picture of such simulations heavily depends on the relationships between various components of risk or correlations. If one assumes that all the simulated risks have a correlation of 1, it implies that all risks happen simultaneously and result in the probabilistic outcomes being additive in case of symmetric distributions. This is an implicit approach adopted in the DDs, whereby the ranges of outcomes across totex, ODIs, measures of experience, retail and other parameters are being simply added together. In practice, this overstates both the worst- and best-case scenarios because different components of performance are not perfectly correlated. Statistically, it is more prudent to run the Monte-Carlo simulations assuming that different components of risk are uncorrelated, and while for some performance parameters the worst-case scenarios occur, for others they do not, resulting in a lower risk variance.

[11] Ofwat (2024), Risk and return models. Models can be found here.

[12] Variance is the difference between the worst- and best-case scenario (P10 and P90).

Key drivers of risk in AMP8

Notional company risk exposure can be decomposed into risk arising from the asymmetry of regulatory design and risk that the sector's performance targets, combined with cost allowances, are not achievable in practice. These risks are referred to as regulatory design and regulatory calibration throughout this report and they contribute c.160-190 b.p. and 200-230 b.p., of downside in the base-case scenario, respectively.

Table 3: Decomposition of notional company risk

		Risk arising from regulatory design			Implied risk arising from regulatory calibration			Notional Company		
		P10	P50	P90	P10	P50	P90	P10	P50	P90
WaSC	Totex	-2.44%	-0.92%	0.45%	-0.17%	-0.33%	-0.33%	-2.60%	-1.26%	0.11%
WaSC	Retail	-1.55%	0.00%	1.55%	-0.62%	-0.62%	-0.62%	-2.17%	-0.62%	0.92%
WaSC	DPC	-0.16%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.16%	0.00%	0.00%
WaSC	Mex & ODI	-2.90%	-0.80%	0.82%	-0.79%	-0.92%	-0.74%	-3.68%	-1.72%	0.08%
WaSC	Financing	-1.52%	0.03%	1.55%	-0.33%	-0.37%	-0.36%	-1.85%	-0.34%	1.19%
WaSC	Rev.	-0.05%	-0.03%	0.00%	0.00%	0.00%	0.00%	-0.05%	-0.03%	0.00%
WaSC	**RoRE (additive)**	-8.61%	-1.72%	4.36%	-1.91%	-2.25%	-2.06%	-10.52%	-3.97%	2.30%
WaSC	**Total RoRE (simulated)**	-5.01%	-1.93%	1.01%	-2.02%	-2.13%	-2.19%	-7.04%	-4.06%	-1.18%
WoC	Totex	-2.46%	0.27%	2.36%	-0.81%	-1.71%	-1.38%	-3.27%	-1.43%	0.98%
WoC	Retail	-1.55%	0.00%	1.55%	-0.62%	-0.62%	-0.62%	-2.17%	-0.62%	0.92%
WoC	DPC	-1.78%	0.00%	0.00%	0.00%	0.00%	0.00%	-1.78%	0.00%	0.00%
WoC	Mex & ODI	-3.63%	-1.46%	0.80%	-0.31%	-0.58%	-0.47%	-3.94%	-2.04%	0.33%
WoC	Financing	-1.50%	0.03%	1.54%	-0.37%	-0.36%	-0.33%	-1.88%	-0.33%	1.21%
WoC	Rev.	-0.05%	-0.03%	0.00%	0.00%	0.00%	0.00%	-0.05%	-0.03%	0.00%
WoC	**RoRE (additive)**	-10.97%	-1.19%	6.25%	-2.11%	-3.27%	-2.81%	-13.08%	-4.46%	3.44%
WoC	**Total RoRE (Simulated)**	-5.45%	-1.57%	2.19%	-2.54%	-2.95%	-3.01%	-7.99%	-4.51%	-0.82%

Source: KPMG analysis, APRs, DDs

Risks arising from the calibration of *regulatory parameters*

The regulatory calibration risk is based on the sector's observed performance in AMP7. Forward-looking risk includes the differences between expected performance of the notional company and the targets and allowances set out in the DD. There are several key areas where the calibration of regulatory parameters resulted in the downside risk exposure in the base-case scenario.

First, DD performance targets are set between median and upper quartile of the business plans (BPs) targets and assume that there is no risk associated with achieving the FY25 target performance[13]. A data-based approach suggests that there is substantial risk associated with the sector achieving FY25 target performance based on the performance in FY21-FY24. Furthermore, there is also risk associated with setting targets above the median level presented in BPs. Although the DDs suggest that the targets are set at a sector-median level[14], this does not appear to hold true for all performance commitments on closer examination. As demonstrated in the Table 4, DDs imply greater stretch than sector-median for water quality contacts, CRI, pollution incidents, internal and external sewer flooding, mains repairs and leakage. In addition to that, BP targets already imply a substantial improvement from the current level of performance for CRI, supply interruptions (Chart 2), pollution incidents, sewer flooding, leakage and water quality contacts, which requires adequate funding to be deliverable. In total, stretching PC targets in DD add 80 basis points of the downside exposure in the base-case scenario in RoRE terms, excluding any stretch in October 2023 BPs.

[13] Ofwat (2024), PR24 draft determinations: Delivering outcomes for customers and the environment, p. 3.

[14] Ofwat (2024), PR24 draft determinations: Aligning risk and return, p. 8.

Table 4: The level of stretch in selected performance commitments[15] (sector-median)

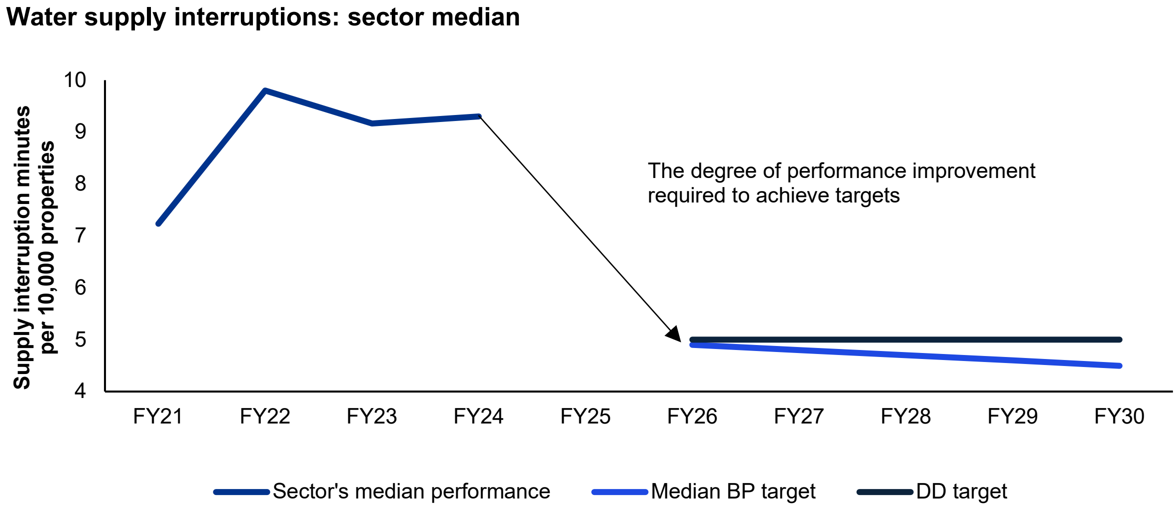
Outcome delivery incentive	Units	The level of stretch, % (in median terms, average of the period)		Performance in physical terms		
		BP targets vs. AMP7 perf.	DD targets vs. BP targets	AMP7 median	BP median	DD median
Leakage	*ML/km of mains/day*	18%	1%	7.4	6.1	6.0
Customer Contacts on Water Quality	*# Contacts/ 1,000 pop.*	12%	19%	1.0	0.9	0.7
Water Supply Interruptions	*Minutes / Property*	47%	-6%	8.9	4.7	5.0
CRI	*CRI Score*	57%	20%	2.9	1.3	1.0[16]
PCC	*l/person/day (3yr avg.)*	7%	1%	144.8	134.5	132.7
Mains Repairs	*# Repairs / 1000km mains*	2%	4%	131.8	129.4	123.8
Unplanned Outage	*(Non-outage - % peak week prod. capacity)*100*	0%	0%	98.4	98.0	97.7
Pollution Incidents	*Incidents / 10,000km of sewer*	33%	15%	28.1	18.9	16.0
Internal Sewer Flooding	*Properties / 10,000 connections*	29%	5%	1.8	1.3	1.2
Sewer Collapse	*Collapses / 1,000 km of sewer*	0%	0%	7.5	7.5	7.5
Discharge Compliance (WaSC)	*(% compliance) * 100*	1%	0%	98.9	100.0	100.0
External Sewer Flooding	*Properties / 10,000 connections*	19%	3%	19.4	15.7	15.3

Source: APRs, BPs, DDs

[15] These exclude new performance commitments due to limited and imperfect historical information: bathing water quality, operational greenhouse gases (water), operational greenhouse gases (wastewater), biodiversity, business demand, river water quality, and storm overflows.

[16] The level of deadband at FY30

Chart 2: Sector-median historical performance and targets for water supply interruptions



Source: APRs, BPs, DDs

It is appropriate to consider ODI performance in conjunction with base totex allowances, given the interlinkages between the level of spend and service. Considering the degree of performance improvement embedded in the DD targets versus the current sector performance and the degree of the exhibited overspend against base totex allowances in FY21-FY24, a substantial increase in funding is required to reduce the combined ODI and botex underperformance risk. DD base cost allowances exceed the PR19 allowances by 14% and the outturn cost by 3%[17]. The DD also includes energy indexation mechanism. Additionally, efficient leakage costs changed category and are allowed within enhancement spend.

Comparing this with the sector's overspend against the base totex allowances of c. 22% in FY21-FY24 (post timing adjustments) and considering the benefit of the energy indexation as well as the expected physical asset growth (approximated by the combined average population growth in the UK), the proposed increase in botex would still leave a funding gap in relation to FY21-FY24 performance levels, with performance improvements required in AMP8 significantly underfunded. Tables 4 and 5 present a high-level bridge between the sector performance on base totex in AMP7 and the increase in the AMP8 allowances proposed in DDs, whereby the adjusted underperformance was 19% versus the adjusted increase in the allowance of only 6%. The risk is simulated post sharing rates, so the RoRE exposure in the base-case represents half of the overspend.

Table 5 a, b: Sector median performance against base totex allowances in AMP7 and increase to the allowances as per DDs[18]

Sector performance vs. PR19 base totex allowances	
Reported performance	-18%
Timing adjustment	-4%
Benefit of energy indexation	3%
Final overspend against PR19 botex allowances (pre-RPE)	**-19%**

PR24 allowances vs PR19 botex allowances	
Increase before frontier shift	14%
Frontier shift adjustment (compounded over 5 years)	-5%
Growth in physical assets[19] (approximated by combined annual UK population growth in FY26-FY30)	-3%
Final increase in botex allowances vs. PR19 on a like-for-like basis (pre-RPE)	**6%**

Source: APRs, DDs, ONS (forecast of UK population growth)

[17] Ofwat (2024), PR24 draft determinations: Aligning risk and return, p. 9.

[18] Same price base (22/23) was used to calculate the changes in percentages for presentational purposes

[19] Larger assets require greater maintenance cost, therefore, base cost allowances should factor in the growing asset base

Enhancement spend is the second major area where the calibration of regulatory parameters resulted in downside risk exposure in the base-case scenario. This is because the enhancement programme in PR24 represents a step change in scale and complexity for the notional company and is not well captured by historical data[20]. Delivery of the enhancement programme involves construction and development activity which carries greater risk of delays and cost overruns than maintaining the existing asset base. The risk associated with delivering the PR24 enhancement programme is comparable with the risk of undertaking small to medium infrastructure projects of modest complexity.

For this analysis, the risk is simulated by using the empirical data from the KPMG infrastructure project database[21], which shows that projects comparable in size and complexity to those of the notional company are likely to be delivered late and at a cost exceeding the initial budget. The analysis incorporates the risk mitigations put in place at the DDs: a reduction to cost sharing rates on enhancement overall and even lower sharing rates on particularly large and complex projects, a gated process on key projects and a separate aggregate sharing mechanism for wholesale totex. While these mitigations address a significant component of enhancement risk at PR24, there remains a material cost gap in the base-case and a significant downside asymmetry. Table 6 presents the expected performance of the notional company against the original enhancement budget in the worst-, base- and best-case scenarios, after applying the mitigations proposed in the DDs. In RoRE terms, the gap is equivalent to 92 basis points downside in the base-case in combination with base totex before considering Price Control Deliverables (PCDs), the impact of which is assessed separately as part of the regulatory design.

Table 6: Expected performance of the notional company against the original enhancement spend budget (before the application of PCDs) %

Post-sharing enhancement cost performance	Units	Worst-case scenario (P10)	Base-case scenario (P50)	Best-case scenario (P90)
Notional WaSC enhancement cost underperformance	% Overrun on allowance	10.48%	2.72%	-1.39%
Notional WoC enhancement cost underperformance	% Overrun on allowance	8.27%	3.31%	-0.21%

Source: KPMG analysis based on the KPMG infrastructure project database

Finally, financing risk is the third major area where the calibration of regulatory parameters resulted in the downside risk exposure in the base-case scenario. As presented in Table 7, key contributors to the negative risk exposure in the base-case scenario is performance of the notional company against the allowances on embedded and new debt. This is because DD allowance for the cost of embedded debt is lower than the all-in cost of embedded debt for the median company in the sector. At the same time, the cost of new debt allowance, based on the iBoxx A/BBB indices, is significantly below the cost of new debt issuance achieved by water companies over the last 12 months. The regulator has signalled that it will consider refinements to its methodology and the latest market data in the Final Determinations (FDs), which could address the under-funding currently reflected in the financing risk range based on DDs.

[20] The mid-AMP reported performance is less helpful as it does not take account of the percentage of outputs delivered and can be materially impacted by re-profiling of spend during the AMP and also a shift of some investment into the following AMP.

[21] KPMG infrastructure project database includes publicly available major construction projects across different sectors completed in the last 30 years (see Appendix 6.10 for more detail). It was used for reference class forecasting, which is a method for estimating the future using similar past situations and their outcomes. Enhancement scale and complexity in AMP8 are not well proxied by historical sector data due to the step change in enhancement scale and complexity from previous AMPs. Consequently, a view from outside the water sector is required to appropriately calibrate the risk.

Table 7: Decomposition of financing risk[22]

Financing risk components	Worst-case scenario (P10)	Base-case scenario (P50)	Best-case scenario (P90)
CPIH variance	(1.16%)	--	1.16%
RPI-CPIH wedge variance	(0.31%)	(0.00%)	0.30%
CPI-CPIH wedge variance	(0.02%)	0.02%	0.07%
New debt performance	(0.14%)	(0.09%)	0.04%
Embedded debt performance	(0.62%)	(0.29%)	0.05%

Source: KPMG analysis, including historical sector cost of debt in relation to iBoxx A/BBB and cost of embedded debt allowance, simulations of the forward-looking inflation and interest rates

Risks arising from the *design of regulatory mechanisms*

There are several specific areas where the design of regulatory mechanisms has resulted in a negative RoRE risk exposure in the base-case scenario. These include penalty-only ODIs, proposed design of the C-Mex, absence of the retail cost indexation, imbalance of penalty and reward rates for the timing of delivery PCDs, regulatory discretion in the application of clawbacks to totex allowances under non-delivery PCDs and Delayed Delivery Cashflow Mechanism (DDCM).

Penalty-only ODIs such as serious pollution incidents, discharge permit compliance and compliance risk index (CRI) are inherently asymmetric due to no ability to earn a performance-related reward, and historical performance suggesting penalties in the base-case scenario. The deadband[23] for CRI of 1.0 by FY30 helps reduce risk but residual asymmetry remains given the presence of factors outside of companies' control such as pipework and fittings at customer properties. In addition to penalty-only ODIs, there is implicit asymmetry within some performance commitments where there is much greater scope for underperformance than outperformance, for example supply interruptions. While the collar of -1% RoRE limits extreme risk, it does not eliminate the asymmetry fully. The increase in ODI rates proposed in the DDs amplifies the financial impact of asymmetry across all scenarios. The calibration of the ODI rates at the DDs did not account for several material developments: first, a continuous increase in the stretch of the PC targets in AMP7 and AMP8 cause a different performance range from that indicated by the AMP6 data; second, changes in the ODI definitions over time causes an increase in risk[24]; and third, increasing frequency of severe weather events also causes greater performance risk than indicated by the AMP6 data. As a result, ODI rates are over-estimated and lead to a greater amount of regulated equity at risk than stated when forward-looking performance is considered.

The proposed design of the C-Mex mechanism, which now benchmarks water sector performance against the UKCSI all-sector average score[25] and uses payments in terms of a proportion of RoRE instead of based on allowed retail revenue, causes asymmetric risk exposure for the sector and a downside in the base-case scenario. The UKCSI average is very challenging as it includes customer service performance of organisations operating in highly competitive sectors such as leisure, banking and retail. In these sectors, greater resources are allocated to compete on levels of customer service than in regulated utilities. There is also a more frequent direct contact with customers which contributes to the ability to shape customer views. Based on the historical performance in PR19, only a few companies could achieve an outperformance payment, while the rest of the sector would remain within the underperformance territory. Chart 3 demonstrates that a median performer would not achieve UKCSI average score, based on the historical data, and hence would be in the penalty territory. This causes the base-case downside for the notional company.

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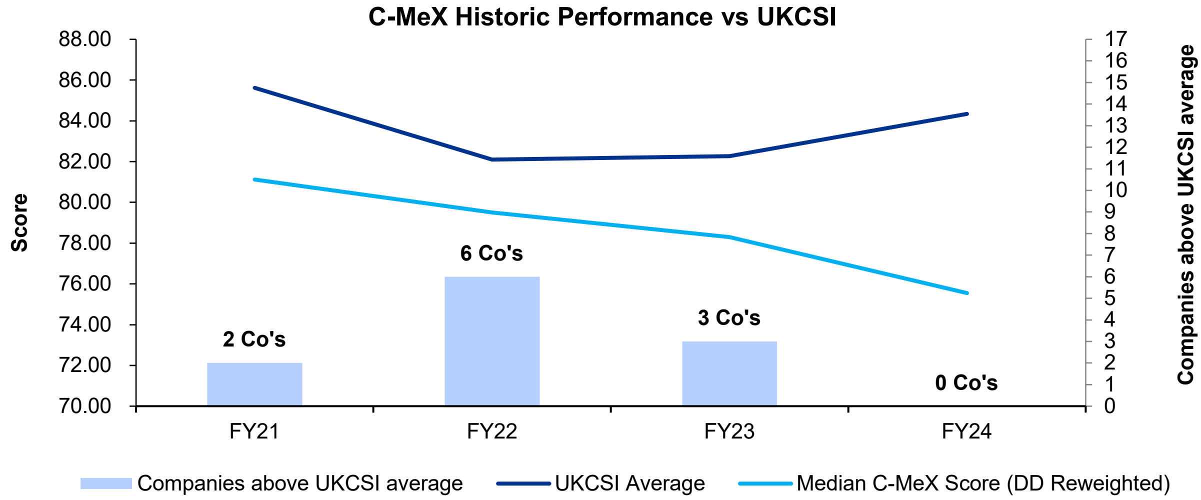
[22] This analysis does not consider where company specification characteristics like size and frequency of issuance may impact the achieved cost of debt and how that may differ from the allowed cost of debt. Should this risk be present, the financing risk ranges presented underestimate the risk.

[23] Deadbands are a range of performance around the PC where ODI payments do not apply; the CRI deadband level at FY26 is aligned with the current PR19 deadband levels (2.0 or 1.5), and then tightens to 1.0 by FY30.

[24] For example, named storms will no longer be excluded in counting pollution incidents in AMP8

[25] This is a change from the UKCSI all sector maximum proposed in the PR24 Final Methodology.

Chart 3: C-MeX historic performance vs UKCSI



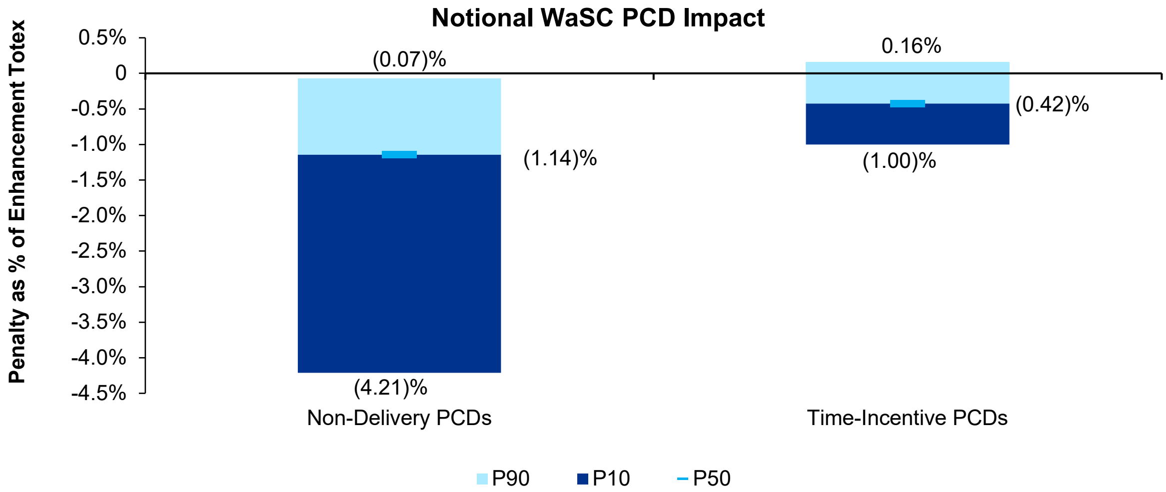
Source: UKCSI average: Ofwat UKCSI benchmark response, C-MeX: KPMG analysis of AMP7 C-MeX per APRs reweighted for DD weightings of CSS and CES

For retail performance the downside in the base-case is driven by treatment of inflation. The introduction of ex-ante indexation on labour costs at DDs has reduced but not eliminated the downside risk. In the absence of full cost indexation, the notional company is exposed to full inflation risk on components of costs excluding labour and to the risk that the outturn inflation rises above the ex-ante level embedded in the revenue allowances for labour costs. Historical data for the FY21-FY24 period demonstrates substantial sector-wide underperformance on retail (see Table 1) and includes the impact of the Covid-19 pandemic on bad debts, spike in inflation observed from 2022 to 2023 and a cost-of-living crisis. While some of these events may not recur in AMP8 (global pandemic), others are driven by the macroeconomic developments and may persist. These risks are captured in the forward-looking simulation, resulting in the negative exposure in the base-case scenario of 62 basis points.

Another significant contributor to the negative RoRE risk exposure in the base-case scenario due to the design of regulatory mechanisms is related to PCDs. The notional company is exposed to risk arising from both non-delivery and time incentive PCDs. PCDs cause exposure to asymmetric risk of late project delivery under non-delivery PCDs because these PCDs are designed to clawback an allowance if delivery is delayed into the next AMP by more than a few months. As is demonstrated by the empirical data in the KPMG infrastructure project database, on average 40% of projects are delayed[26], with the delay lasting from a few months to over a year. The risk arising from the non-delivery PCDs therefore exacerbates the already significant and asymmetric risk from enhancement spend. Performance on "time incentive PCDs" is expected to result in a loss in the base-case due to the calibration of penalty and reward rates. While the DDs propose that the relationship between the reward and penalty rates should be 1:4, empirical data suggests that the ratio is closer to 2:3.

[26] Additional support for the KPMG infrastructure project database results can be found in the US where 40% of the government's infrastructure projects are delayed: Chu A., White, A. & Basarkar, R., (2024, August 12), Delays hit 40% of Biden's major IRA manufacturing projects. *The Financial Times.* Article can be found here.

Chart 4: Asymmetric financial impact of PCDs, quantified as % of enhancement totex

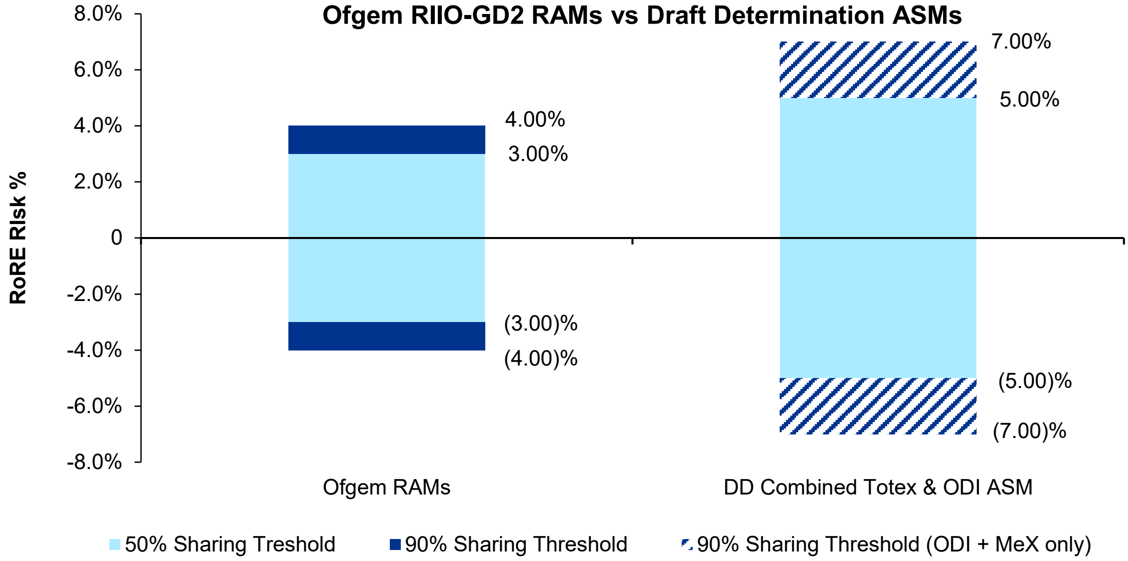


Source: KPMG analysis of PCD impact using data from KPMG infrastructure project database

The Delayed Delivery Cashflow Mechanism (DDCM) also increases the base-case risk due to unintended consequences for the financeability and deliverability. Due to the complex, dynamic and varied avenues the DDCM can take in impacting risk, it has not been simulated in the risk ranges presented. While it is designed to incentivise companies to deliver projects on time and in full by returning funding to customers where companies fail to deliver, it increases the scale of the regulatory discretion in relation to permitting clawed back spend and could cause funding shortfall in the middle of capital deliveries, which would cause greater financing risk exposure. A clawback could reduce cash flows when they are needed most, increasing financeability and deliverability pressures. Companies may opt to delay projects due to cash flow limitations, with project delays increasing the risk of statutory penalties. The new mechanism adds further complexity to the regulatory framework, appears to be duplicative in function and objective with the existing PCD mechanism and could introduce a perverse incentive for companies to deliver late.

Aggregate sharing mechanisms (ASM) for totex and ODIs are helpful in limiting the impact of very extreme out- and underperformance but the thresholds proposed in the DDs are such that they do not afford significant protection from plausible downsides. This contrasts with the return adjustment mechanisms (RAMs) in the energy sector, which result in significantly lower amount of regulatory equity at risk. The two sectors have a comparable equity return while the risk profile of the UK water has much more downside.

Chart 5: Ofgem RIIO-GD2 RAMs vs Draft Determination ASMs: cumulative thresholds



Source: Ofwat DDs, Ofgem RIIO-2

Stochastic simulation of negatively skewed probabilities

Statistical analysis of the probabilistic outcomes relies on Monte Carlo simulations which produce random outcomes. The consolidated picture of such simulations heavily depends on the relationship between various components of risk and on the shape of the probability distributions. For normal distributions, base-case results are additive while for asymmetric distributions base-case results are not just additive but also move towards the mean. As the distributions of the sector's performance in AMP7 were asymmetric to the downside for most parameters (PCs, totex) and as the design of the regulatory mechanisms also causes asymmetry in the case of PCDs, C-Mex and retail, the base-case outcome of fully simulated risk is more negative than the sum of the component parts. The negatively skewed distributions, therefore, represent a separate source of risk for the sector that needs to be considered.

Addressing notional company risk exposure

The identified risk represents a gap between expected and allowed return, which could be addressed by either regulatory mitigations at source, aiming up on the cost of capital or a combination of the two. UK regulatory practice favours addressing risks at source where possible. Mitigating risk at source can prevent customers from paying for risks that have not occurred while sufficiently protecting investors and attracting investment. Accordingly, the analysis considers an example of a suite of risk mitigations aimed at addressing specific risk drivers identified. It aims to demonstrate that it is possible to reduce the risk exposure to a level more commensurate with returns, deliverability and financeability. In this context, it would only be appropriate to aim up on the allowed return to cover any remaining asymmetry in risk exposure, after all regulatory risk mitigations have been applied.

Mitigations have been developed to best address key sources of risk in AMP8. Mitigations closer to the source of risk were prioritised, with an aim to reduce the risk exposure in the base-case. The resulting suite could be grouped into those addressing risk arising from the calibration of the notional company, and those addressing risk arising from the regulatory framework's design.

The first group of mitigations includes:

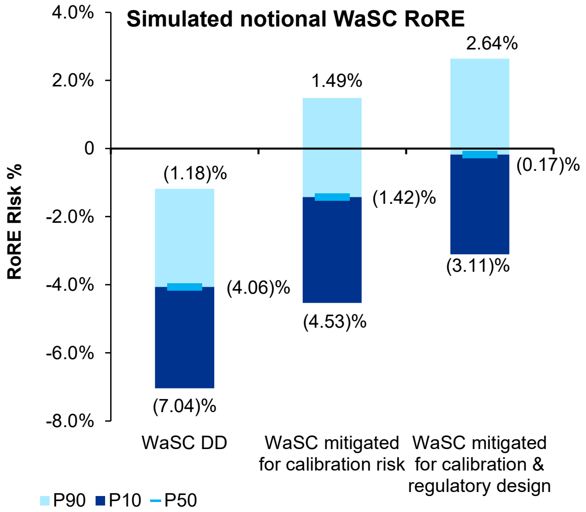
- Adjusting PC targets to consider outturn performance in AMP7 and providing sufficient funding of PC improvements in botex to bridge the gap between historical performance and AMP8 targets.
- Trueing up efficient enhancement costs after the finalisation of feasibility studies, planning permissions and design specifications via a specific reopener (this would reduce mis-budgeting risk) or/and providing additional allowances to reflect asymmetric downside skew in cost performance typical of complex projects or/and setting asymmetric sharing rates on enhancement projects to offset the asymmetric cost performance observed in infrastructure projects (sharing greater proportion of the underperformance with customers).
- Recalibrating the allowed cost of debt for new and embedded debt consistent with water sector's actual financing terms and forward performance expectations.

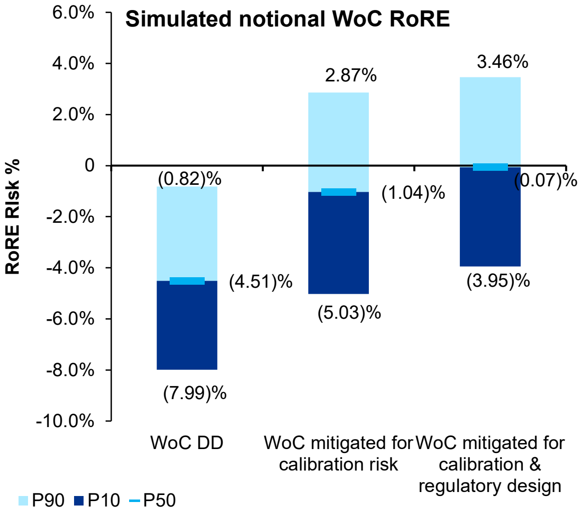
The second group of mitigations includes:

- Applying deadbands to penalty-only PCs to eliminate downside in the base-case (discharge permit compliance, serious pollution incidents) and adjusting the deadband for CRI.
- Reducing ODI rates to the level commensurate with business plans.
- Rebasing C-MeX target on water sector median instead of using the UKCSI average given the median water company underperformed the UKCSI average[27].
- Introducing a full indexation of retail costs to mitigate inflation risk.
- Modifying application of non-delivery PCDs to reduce regulatory discretion in application of allowance clawback for late delivery by allowing for at 12-18 months' grace period.
- Recalibrating time incentive PCD rates consistently with empirical data on construction delays.
- Redesigning the ODI aggregate sharing mechanism (ASM) and the totex ASM to more closely reflect the risk protecting features of RAMs implemented in the energy sector. This includes recalibrating the lower threshold for totex from 200b.p. to 150b.p. and adding the enhanced sharing threshold of 250b.p. Similarly, recalibrating the upper (enhanced sharing) threshold to 400b.p. of risk for ODIs. Taken together, lower threshold for ODIs and totex is 450b.p. and the upper threshold is 650b.p.
- Redesigning DDCM to completely eliminate the unintended consequences related to greater risk exposure, financeability and deliverability.

[27] Included in Ofwat's Consultation on the measures of experience performance commitments at PR24, the UKCSI cross sector average score was 82.9 out of 100 with only six of 17 water companies achieving this score in 2022 meaning the median company underperformed.

Chart 6 a, b: Unmitigated, partially mitigated and fully mitigated RoRE risk exposure



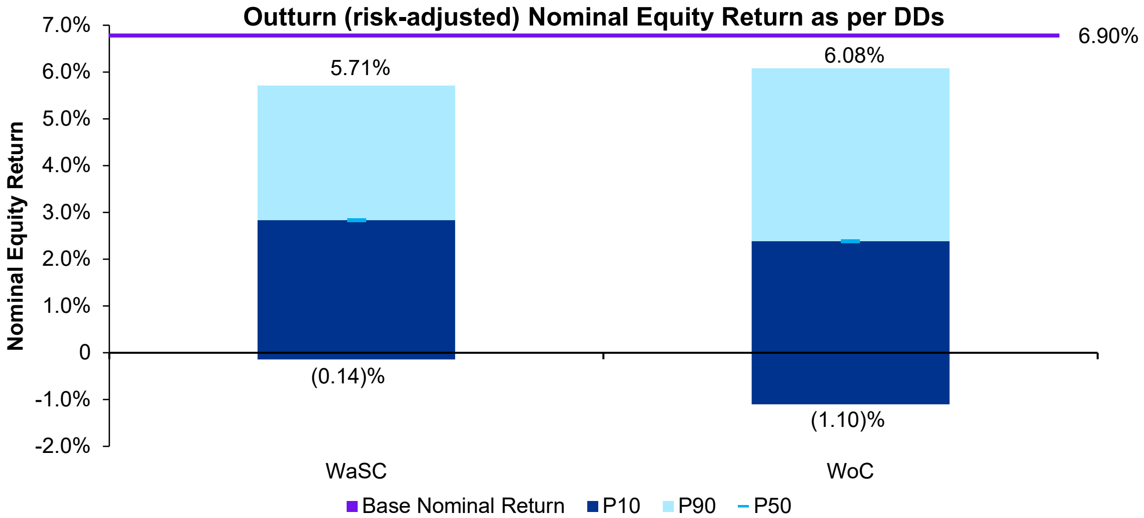


As demonstrated on Chart 6 a, b the application of the proposed mitigations reduces the risk at source and delivers the regulatory package consistent with an efficient notional company being able to earn a baseline return on a median-expected basis.

Key conclusions

This analysis considers that the notional company risk exposure under the DDs implies outturn equity return[28] substantially below the nominal allowed return in the base-case and below zero in the worst-case, as presented on Chart 7. Such risk exposure has a direct negative impact on both debt and equity financeability of the notional company, bringing into question the very deliverability of the AMP8 business plan and associated capital programmes.

Chart 7: Simulated risk-adjusted nominal equity return as per DDs



[28] The risk ranges simulated relied on real totex performance, real ODI rates applied to physical performance ranges, real cost of retendering and real RCV / regulated equity. The real elements of risk in the numerator of the ratio are offset by the real elements in the denominator and represent a conservative estimate of nominal performance over the nominal regulated equity. The ranges also relied on nominal retail profit performance and nominal financing performance. The ranges could be considered a conservative estimate of a nominal risk and have been compared to nominal allowed equity returns. The cash flow-based impact of risk (e.g., on financeability) would in effect be greater than is suggested in these ranges

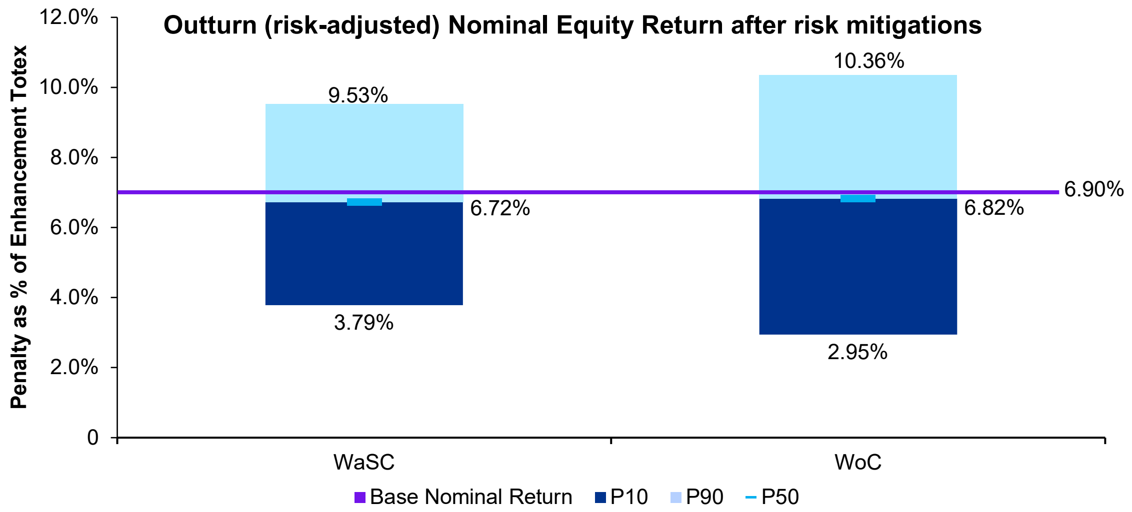
Alignment of risk and return is critical not only in the success of the upcoming price control but also in addressing the major sector's challenges over the next 25 years. These challenges include improving asset health and resilience in the face of climate change and population growth, achieving net zero, delivering better environmental outcomes and ensuring that a good standard of service is provided to the people of England & Wales at a reasonable cost. Without attracting capital to finance the required investment, these improvements can't be delivered.

In order to attract investment into the sector, debt and equity investors need to earn a reasonable return that provides fair compensation for the risks associated with their investment. It means that the base allowed return needs to reflect forward-looking risk exposure and that an efficient company needs to have a reasonable prospect of earning the base allowed return. While DDs state that this objective[29] is achieved, statistical and probabilistic analysis based on empirical data suggests that the notional company will fall significantly short of earning the base allowed return under the base-case.

When considering debt investability, Moody's Ratings has raised material concerns in its assessment of AMP8's impact on credit quality. In their sector analysis for the UK water sector, the agency noted that "risk of cost overruns or future underperformance has increased … [and] companies [are] at increased risk of incurring penalties."[30] Moody's is considering amending their rating methodology factor scores for the sector to reflect the changes to the regulatory framework as less stable and predictable and less likely to support investors earning the allowed return[31]. As a result, it may be more difficult for the companies to maintain existing credit ratings, which would cause higher borrowing costs but also regulatory dividend lock-ups, which, in turn, would increase the equity return required by investors given inability to receive cash yield for an indefinite period of time.

As demonstrated in this report, it is possible to redesign the PR24 regulatory package, including the calibration of allowances, performance targets and regulatory mechanisms in such a way that the risk exposure in the base-case approaches zero, and the package provides a reasonable upside of earning return above the allowed return in the best-case and reduces expected return (but not to zero) in the worst-case. A package offering such a risk exposure would indeed provide an efficient company with a reasonable prospect of earning the base allowed return, as presented on Chart 8.

Chart 8: Simulated nominal equity return after risk mitigations



[29] Ofwat (2024), PR24 draft determinations: Aligning risk and return, p. 2.

[30] Moody's Ratings (2024), Regulated Water Utilities – UK: Ofwat's draft determination increases sector risk, p. 1.

[31] Ibid. p. 11.

To attract debt and equity capital at an efficient cost and encourage confidence in the capital markets, risk exposure of the UK water sector needs to be commensurate with a stable and predictable industry with low volatility of returns. The volatility of returns in AMP7 caused adverse investor reaction across both debt and equity markets. It is in the best interest of consumers to restore investor confidence in the sector and reduce the cost of the infrastructure not just for one price period but for years to come.

4 Notional company RoRE ranges

Financeability and investability assessments consider the implications of aggregate risk where component risk drivers are simulated together. Key risks at PR24 include the scale and complexity of the capital programme, macro-economic uncertainty, increasing impact of climate change on company performance, calibration of the regulatory mechanisms and their overall application to the water sector. The analysis in this Report identifies significant increases in risk and risk asymmetry and considers levers to adjust regulatory calibration to address key drivers of risk at source.

Risk can be decomposed into two primary sources: risk arising from the regulatory framework's design and risk arising from the calibration of the notional company. The DDs recognise that there is a "*slight downward skew from overall operations*" but that this negative skew was mitigated in the PR24 framework by a "*slight upward skew from financing*."[32] While the results of the risk analysis included in this report agree there is a negative skew on operational risk, the quantum is significantly higher as it considers asymmetry arising from additional sources beyond the discharge permit compliance and serious pollutions incidents ODIs highlighted in the DDs.

To mitigate risk at source and capture the wide range of considerations needed to assess the most appropriate mitigations, a set of criteria has been developed. Potential combinations of regulatory mitigations are set out to reduce P50 risk and mitigate severe downside risk. Detailed specification of the mitigations could vary on a company-specific basis.

This section is structured as follows:

- Section 4.1 outlines the sources of risk and describes the high level methodology used to simulate risk over PR24 by risk driver.
- Section 4.2 presents the mitigations considered to address risk at source for a notional company. The mitigations have also been assessed against a set of objective criteria based on Ofwat's statutory duties.
- Section 4.3 presents a potential combination of mitigations and the resulting notional company risk to demonstrate the degree of risk mitigation at source.

[32] Ofwat (2024), PR24 draft determinations: Aligning risk and return appendix, p. 21.

4.1 Risk facing a Notional WaSC and WoC in AMP8

The analysis of the notional firm's risk exposure across AMP8, given the changing risk landscape, results in ranges that are wider than the DDs suggests, have a more negative base-case and more asymmetric to the downside. Tables 8,9 and Chart 9 present the key drivers of risk.

Table 8: Notional WaSC RoRE risk ranges: DDs vs Unmitigated range per this Report

Notional WaSC	DD risk ranges[33]			This report's resulting risk ranges		
	Worst-case	Base-case	Best-case	Worst-case	Base-case	Best-case
Totex	-1.58%	0.00%	1.58%	-4.77%	-1.88%	1.04%
Mex & ODI	-2.31%	-0.25%	1.81%	-3.68%	-1.72%	0.08%
Financing	-0.45%	0.23%	0.90%	-1.85%	-0.34%	1.19%
Other	0.00%	0.00%	0.00%	-0.21%	-0.03%	0.00%
RoRE	**-4.34%**	**-0.02%**	**4.29%**	**-10.52%**	**-3.97%**	**2.30%**

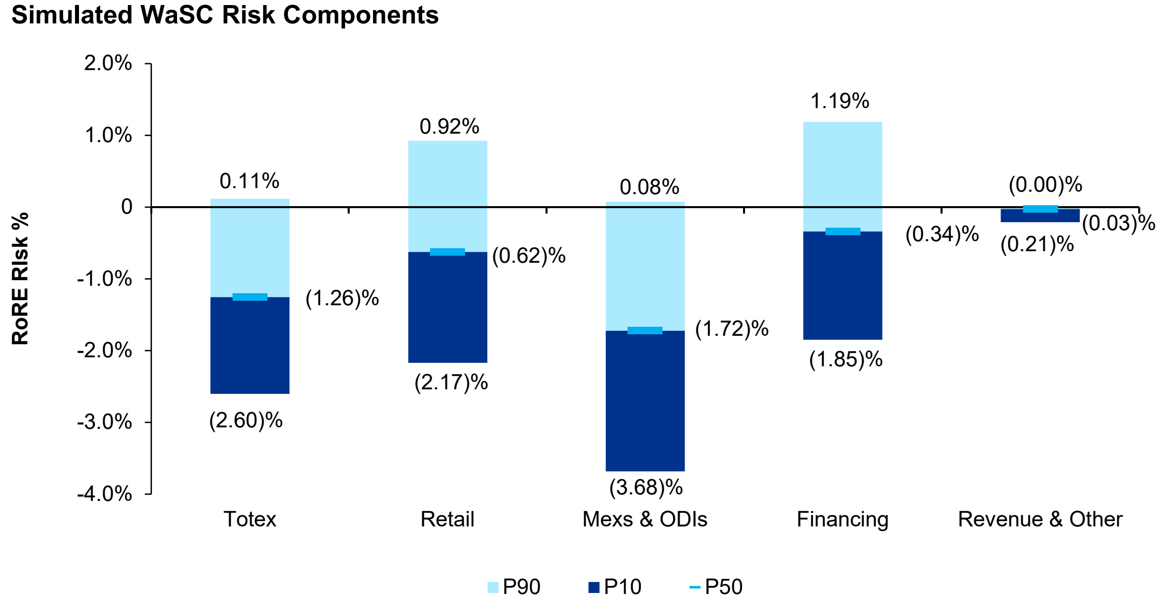
Table 9: Notional WoC RoRE risk ranges: DD vs Unmitigated range per this Report

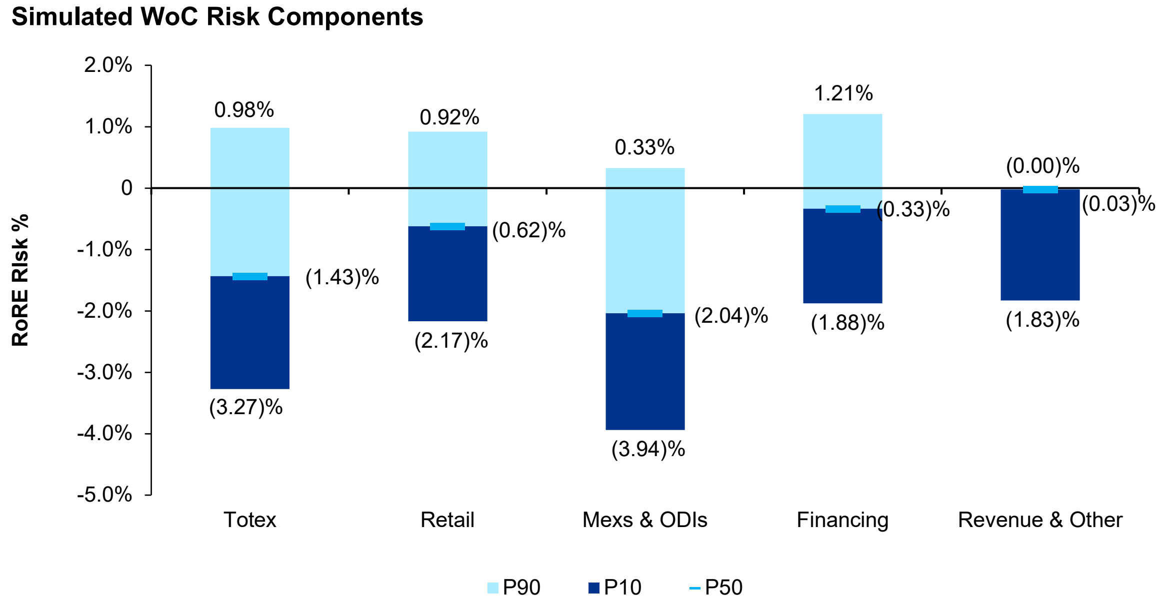
Notional WoC	DD risk ranges[34]			This report's resulting risk ranges		
	Worst-case	Base-case	Best-case	Worst-case	Base-case	Best-case
Totex	-1.29%	0.00%	1.29%	-5.44%	-2.06%	1.90%
Mex & ODI	-2.81%	-0.29%	2.24%	-3.94%	-2.04%	0.33%
Financing	-0.38%	0.26%	0.90%	-1.88%	-0.33%	1.21%
Other	0.00%	0.00%	0.00%	-1.83%	-0.03%	0.00%
RoRE	**-4.41%**	**0.01%**	**4.42%**	**-13.08%**	**-4.46%**	**3.44%**

[33] Ofwat (2024), PR24 draft determinations: Aligning risk and return appendix, p. 6.; the median WaSC risk range (based on width) was South West Water and for a like for like comparison the chart disregards the QAA reward.

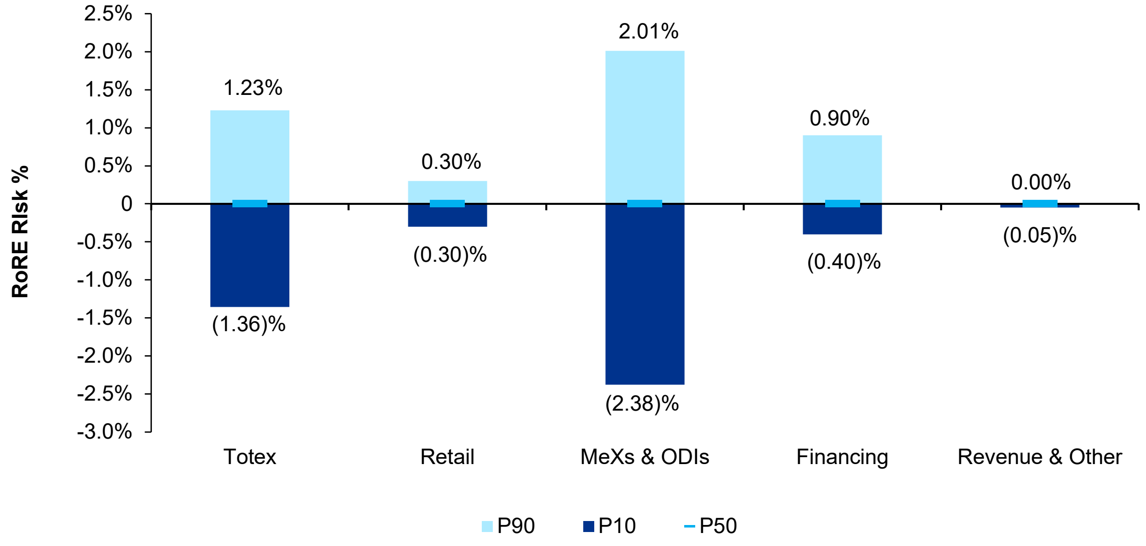
[34] Ofwat (2024), PR24 draft determinations: Aligning risk and return appendix, p. 6.; the median WoC risk range (based on width) was South East Water and for a like for like comparison the chart disregards the QAA reward.

Chart 9 a, b, c: Drivers of the notional company RoRE ranges: Simulated analysis vs DDs





Ofwat Draft Determination Component Risks



The results of the risk analysis set out in the DD and developed in this report are compared on a like for like basis. In the DD, separate components of risk were not simulated but instead were simply added together. While this approach is simpler and intuitive, it does not represent a meaningful view of potential returns available to investors. The risk analysis in this report has been simulated to capture the interrelationships between risk drivers accounting for the benefits of low correlated risk drivers. The resulting total risk ranges on a simulated basis therefore provide insight into potential returns available to investors given historical relationships between risk drivers. The table presents the risk ranges on an additive basis for comparison purposes only.

The risk analysis included in the DDs represents an “overall risk package [that] is broadly balanced.”[35] This conclusion is broadly supported by its WaSC and WoC risk ranges importantly because its negative base-case for Mex & ODI is offset by the base-case for financing. The DD acknowledges this offset between component risks that are asymmetric.[36] The risk analysis included in this report directionally agrees with the risk analysis included in the DDs that the Mex & ODI risk driver is negatively skewed, however the risk analysis in this report also points negative asymmetry from financing risk driver as well totex and other risk categories such as retail.

The differences between the risk analysis included in the DD’s estimate of risk and the risk ranges presented in this report are driven by methodological choices broken down in [Table 7] below. The subsequent sections provide further detail as to the rationale behind methodological choices in this risk analysis and how alternatives were considered.

[35] Ofwat (2024), PR24 draft determinations: Aligning risk and return appendix, p. 21.

[36] Ofwat (2024), PR24 draft determinations: Aligning risk and return appendix, p. 21.

Table 10: Differences in methodological approach to simulating risk

Risk driver	Methodology applied in the DD[37]	Methodology applied in this report
Historical data considered	• Apr 2015 – Mar 2020	• Generally, Apr 2020 – Mar 2024 with limited exceptions
Distribution types	• Normal distributions used for all risks	• Distribution type determined by a statistical fit test of the historical performance data[38]
Wholesale totex	• Considered totex as a whole in historical data • Calculated risk for time incentive PCDs based on WINEP delivery in 2020 – 2025 • No risk identified for non-delivery PCDs • No correlations specified	• Separated base totex from enhancement totex • Base totex performance simulated based on the FY21-FY24 sector-wide performance • Enhancement cost performance and delay risk based on the KPMG infrastructure project database[39] • Time delay and non-delivery PCDs based on delay performance modelled • Correlation between cost and delay performance based on empirical data from KPMG infrastructure project database
Retail	• Assumed a symmetrical range of +/- 0.30% at P90/P10	• Considered retail net profit over FY21-FY24 and simulated future performance based on the recent past
Mex	• Calculated risk on the maximum and minimum penalty possible with P50 set to nil	• Simulated based on reweighted historical scores as a difference from sector median to UKCSI • The analysis excludes BR-Mex
ODI	• Calculated each ODI generally setting P50 at no out- or under-performance and using historical data to calibrate the P10 and P90 • No correlations specified	• Simulated forward-looking performance for most ODIs based on a baseline of median AMP7 performance and median BP forecasts; used historical performance data to calibrate the P10 and P90 • Correlations specified based on industry performance data collected on a monthly frequency • Simulated PCC and Business Demand based on industry forecast data considering the impact of Covid-19 • The analysis excluded river water quality, bathing water quality, storm overflows, greenhouse gas emissions (for water and wastewater) due to lack of consistent historical data
Financing	• Calculated interest rate risk on new debt issuance based on sector debt issuances performance vs iBoxx A/BBB non-financial 10 year+ index and calibrated allowance to deduct • The analysis excluded embedded debt as a risk • Calculated forward looking CPIH risk based on 8 years of CPIH index data • Calculated forward looking basis risk where CPIH indexed RCV is hedging RPI linked debt in the sector based	• Simulated interest rate risk on new debt issuance based on sector debt issuances performance vs iBoxx A/BBB non-financial 10 year+ index • Simulated risk of embedded debt based on the sector's expected cost of debt performance on embedded debt vs allowance • Simulated forward looking CPIH risk based on 8 years of CPIH index data over a high and low inflation period applied to the notional company capital structure of 33% index-linked debt • Simulated forward looking basis risk where CPIH indexed RCV is hedging CPI linked and RPI linked

[37] Ofwat (2024), PR24 draft determinations: Aligning risk and return appendix, p. 7 - 21.

[38] See appendix 6.2 for detailed methodology for how the historical performance data influences the distribution type modelled.

[39] See appendix 6.10 for description of the projects included in the KPMG infrastructure project database.

Risk driver	Methodology applied in the DD[37]	Methodology applied in this report
	• The analysis excluded basis risk on CPI-CPIH wedge as a conservative assumption that all index-linked debt was RPI-linked and the wedge was historically higher for RPI-CPIH	debt in the sector based on 8 years of CPI and RPI indexes • Interrelationship between financing risks captured by time series analysis
Market based delivery	• The analysis excluded market based delivery as a risk driver	• Considered a broad range of risks that can arise from market based delivery for the appointee • Simulated ranges reflect the risk of a CAP defaulting and the cost of tendering • Number of schemes for the notional company based on sector median number of market based delivery schemes in PR24 DDs • Probability of default for a CAP based on default study of construction companies

One key difference is the choice of distribution type. Distribution types for each risk in this report were based on empirical data to capture the risk dynamics in the historical performance as closely as possible. The analysis employed statistical fit tests to objectively assess the most descriptive distribution for each risk balanced against simplicity by limiting the total number of different distributions included. This was done by identifying preferred distributions where two or more distributions had similar characteristics[40]. Many of the risks present in the water sector are asymmetric in nature and by assuming all risks are normally distributed, the DD risk analysis systematically understates the downside and overstates the upside. Most importantly, as described in the executive summary the base-case is also impacted and becomes more negative.

The selection of time period for historical performance was another point of difference. As discussed in the executive summary, the AMP7 historical data offers a number of advantages over AMP6 data. However, the resulting use of AMP7 data alone has several weaknesses. A sample containing only a portion of AMP7 used to simulate the entirety of AMP8 has an inherent inconsistency. This methodology may also embed idiosyncratic risks experienced in AMP7 like Covid-19, the Russian invasion of Ukraine, and others which may make AMP7 a less representative time period with which to simulate AMP8 performance. However, the advantages of using empirical, representative, sector-wide data sample outweigh the potential limitations.

Another key methodological difference is the specification of correlations. Because low correlations ultimately reduce the simulated risk ranges and high correlations increase the simulated risk ranges, the presence of correlations can materially impact the final outcome. Considering the KPMG infrastructure project database cost and delay performance, granular PC performance data by month and region in the UK, inflation index values and interest rate index values, the correlations identified and included in the simulation are:

- Enhancement cost performance and Enhancement delay risk; +0.51
- Leakage reductions and customer contacts on water quality; +0.20
- Leakage and mains repair; +0.40
- Water supply interruptions and mains repair; +0.21
- Total pollutions incident and serious pollutions incident; +0.19
- Total pollutions incident and external sewer flooding; +0.18
- External sewer flooding and internal sewer flooding; +0.55

[40] For a detailed description of the approach taken to selecting distributions and types of distribution refer to appendix 6.2.

- Cost of embedded debt and cost of new debt; +1.00
- CPIH inflation risk and RPI-CPIH wedge risk; +0.33
- CPIH inflation risk and CPI-CPIH wedge risk; +0.69
- RPI-CPIH wed risk and CPI-CPIH wedge risk; +0.35

Other risks are expected to have relationships but in the absence of empirical data to support the quantification of correlations, the analysis in this report conservatively assumes the correlations to be zero between all other performance parameters. For example, PC performance and base totex, retail profit and CPIH inflation, and PC performance and C-MeX are likely to have relationships that if captured could enhance the reliability of the simulated RoRE ranges. If these correlations, currently specified as zero in the model, are in reality highly positive, the simulated RoRE ranges would be wider. Conversely, if the correlations are highly negative, the simulated RoRE ranges would be narrower.

Each of the following sub-chapters expands on the key drivers of risk in greater detail and provides supporting analysis.

4.1.1 Totex

Risks driving enhancement totex and base totex are materially different and therefore should be considered separately. Base and enhancement performance risk are analysed independently of each other. However, the newly introduced totex aggregate sharing mechanism (ASM) considers the net whole totex risk and applies a sharing rate beyond +/-200b.p. of risk on AMP basis. This helps mitigate extreme downside risk in AMP8.

Enhancement totex

The scale and complexity of the capital programme at PR24 is unprecedented for the sector and drives a significant amount of risk in the notional company. This was well recognised by Ofwat and addressed to some degree in the DDs, however material enhancement totex risk remains and arises from both the design of the regulatory framework and calibration risk of regulatory parameters. There are two key risks included in simulation to capture the enhancement totex RORE ranges: cost performance and delay risk.

Firstly, cost performance risk inherent in construction projects in the infrastructure sector is driven by the following risk drivers: scope change, design change, input price changes and ex ante budget mis-forecasting risk. Scope changes and design changes also materially impact delay risk as well as the knock on impact of higher costs where cash flow shortages can lead to delays. Cost and delay performance is highly interrelated given the shared risk drivers between the two.

- **Scope changes** include when the purpose or objective of the project changes for example a storm tank build originally planned to have 50 Ml capacity increasing the requirement to 80 Ml capacity.
- **Design changes** include when the proposed solution changes either due to factors outside of management control or because of optioneering identifying a better solution, for example a storm tank originally planned as a concrete tank being converted to a nature based solution with the same capacity. This risk can materialise from feasibility assessments or planning permission that invalidate the original project design or voluntary changes due to more preferred alternatives being identified.
- **Input price changes** include supply chain shocks and commodity price volatility.
- **Ex ante budget mis-forecasting risk** includes incorrectly estimating the cost or amount of inputs needed holding constant the scope, design and market prices for inputs. An example of ex ante budget mis-forecasting can include relying on prior cost data that is no longer representative in the market at the time of estimation. A well-documented phenomenon, optimism bias, is a

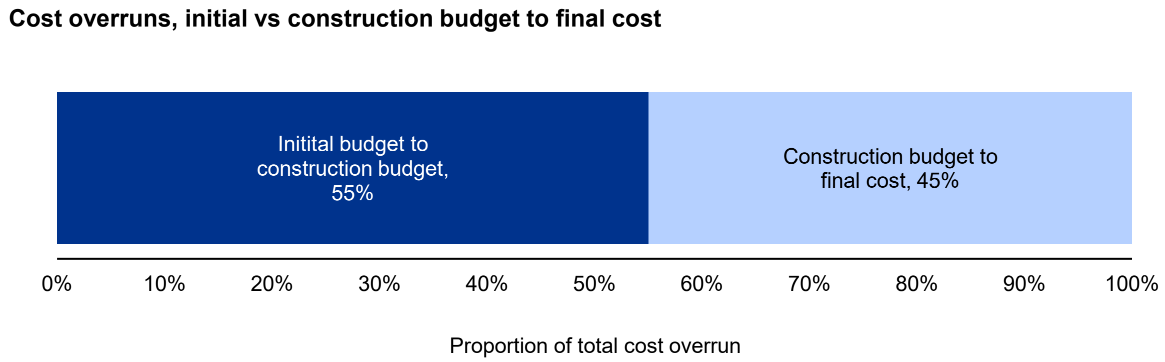
component of this risk where companies can underestimate the cost of delivering projects due to biases in decision making.

An efficient notional company is exposed to scope change, design change and input price changes. An efficient company can also be exposed to ex ante budget mis-forecasting where projects are higher in complexity or involve new or untested technology.

Overall, the regulatory framework addresses many components of enhancement cost performance risk. Market based delivery schemes for the larger and most complex schemes such as DPC reallocate the majority of cost performance risk to the competitive appointed provider (CAP), though this introduces other risk discussed in section 3.1.5. Significant cost performance risk is mitigated through sharing rates: 40:40 sharing rates introduced in the DDs for all enhancement schemes; and sharing rates of 25:25 in place for large, complex enhancement schemes, the gated allowance schemes and the industrial emissions directive (IED) schemes. Scope change is well mitigated through uncertainty mechanisms. Input price risk related to labour costs is now covered by a construction sector specific RPE true-up.

The gated allowances schemes have the added benefit of addressing design change in full, and some degree of input price risk and ex ante budget mis forecasting where allowances are awarded after the development phase and incorporate better information. Empirically, awarding allowances at the beginning of the construction phase like in the gated allowance schemes would result in material reduction in cost performance risk. The below graph demonstrates the degree of risk associated with the development phase of infrastructure projects by comparing the cost performance versus initial budget and the performance versus budget at tendering:

Chart 10: Breakdown of cost overruns between initial and construction budgets



Source: Analysis of KPMG infrastructure project database

Notwithstanding these mitigations, design change risk is present on all schemes except for the schemes with gated allowances and input price risk remains from supply chain shocks on key inputs like concrete and steel. The ex-ante budget mis-forecasting risk also persists but is significantly reduced where enhanced allowances are applied. The primary limitation of the mitigations included in the DD for enhancement risk is that enhanced sharing rates apply only to a limited number of schemes and all the schemes included are from WaSCs. No WoCs had enhancement schemes included in the enhanced sharing rates or gated allowance process.

The simulation also captures delay risk. Enhancement delay risk is not well mitigated by the regulatory framework and is translated into financial penalty by the PCD mechanisms and the DDCM. Allowance clawbacks and time penalties under these mechanisms introduces risk for a notionally efficient company. The DDs clarified the design of non-delivery PCDs to not apply clawbacks where "the length of late delivery is of a few months into 2030-35 period."[41] However, this is insufficient to remove all risk from non-delivery PCD. This excludes scenarios where projects are delayed beyond a few months into AMP9 but partially delivered. Many causes of delay are outside of management

[41] Ofwat (2024), PR24 draft determinations: Expenditure allowances, p. 176.

control such as scope and design changes and would be present in a notional company. Enhancement schemes where projects are partially delivered and delayed create the risk of clawbacks where allowances were already spent. This risk is reflected in the risk ranges presented.

Project characteristics including size, complexity and duration interact with the cost and delay performance. The methodology employed to simulate the enhancement totex risk utilised reference class forecasting and machine learning techniques to capture these dynamics based on the KPMG infrastructure project database[42]. By matching the empirical cost and delay performance to projects of similar characteristics the risk ranges are more reliably simulating potential outcomes.

Risk arising from the *calibration of enhancement allowances*

The empirical distribution of cost performance indicates that the distribution is negatively skewed meaning there were some projects that modestly underspent their initial budgets while many projects modestly overspent their initial budget and some that significantly overspent their initial budget. The database removed projects where scope changes were identified and the cost profile is reflective of risks not well managed by the regulatory framework. The resulting simulated cost performance after applying regulatory mitigations such as rates for a notional WaSC and notional WoC are:

Chart 11: Simulated notional WaSC enhancement totex cost performance excluding PCDs

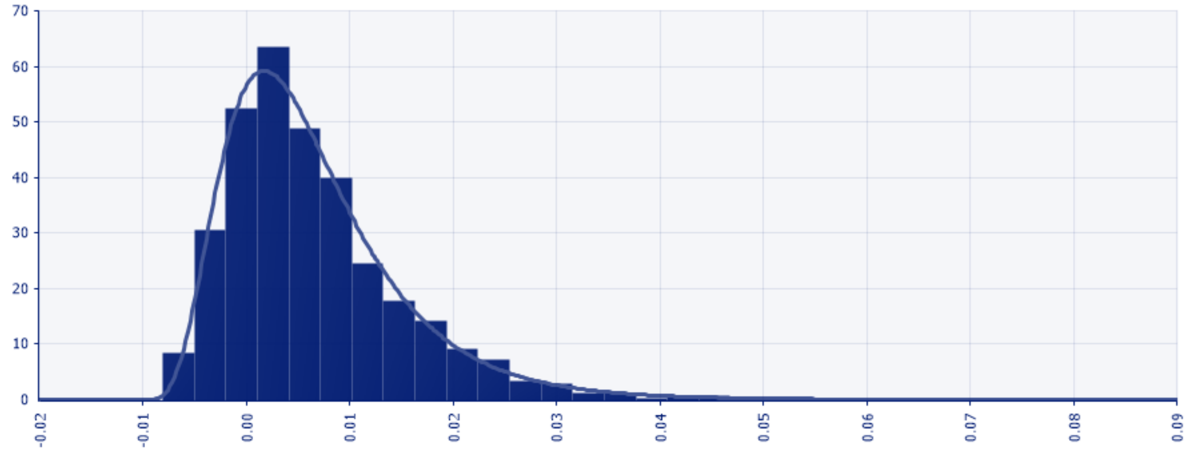
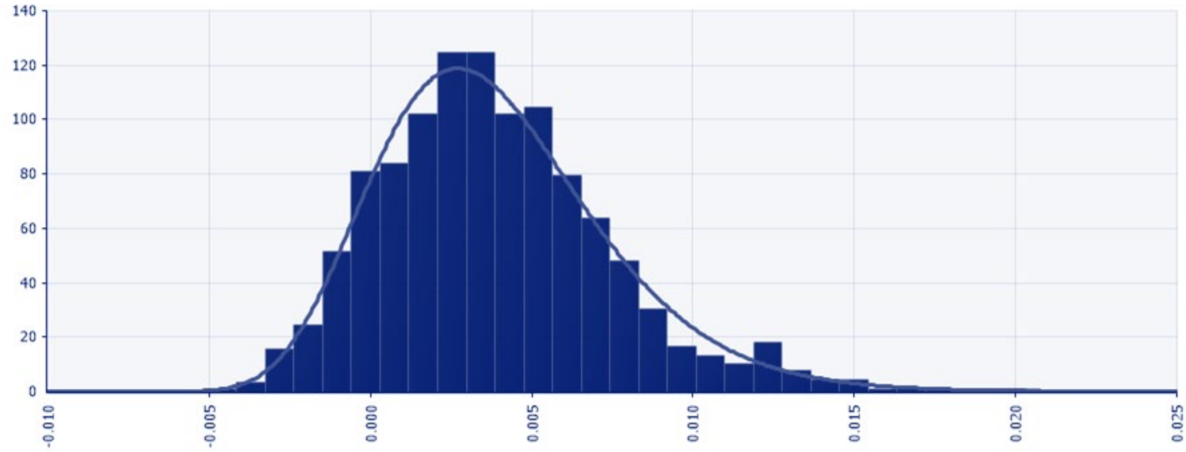


Chart 12: Simulated notional WoC enhancement totex cost performance excluding PCDs[43]



[42] For a detailed methodology on enhancement totex risk please see appendix 6.4.

[43] The distribution for notional WoC is materially less skewed due to the absence of the wastewater price control schemes. In particular WINEP environment given the larger size and complexity is a material driver of the difference in distributions.

The distributions indicate that if water sector enhancement schemes perform similar to projects in the KPMG infrastructure project database of similar size, complexity and duration absent further mitigations have inherently negatively skewed cost performance. If allowances are insufficient to cover the asymmetric nature of cost performance risk then the sector may underperform due to regulatory miscalibration.

Risk arising from the *regulatory design*

First, non-delivery (ND) PCDs are downside only and likely to be triggered, even by an efficient company. The sector has struggled to deliver the entire AMP programme within five years as seen in AMP6; spending related to AMP6 carryover went well into the second year of AMP7. Additionally, the underlying analysis used to calibrate the time incentive PCDs acknowledges that where schemes are late, they are "on average delivered one year late"[44] in setting reward and penalty rates for the time incentive (TI) PCD. The KPMG infrastructure project database finds that projects of similar size, duration and complexity to those in the water sector at AMP8 were delayed on average 20% beyond the initial delivery date. This means projects may be delayed well beyond the grace period permitted by Ofwat of a few months into the next price control. It is also unclear what constitutes a few months which in turn provides scope for regulatory discretion in the application of clawbacks. When considering the degree of carryover spend from AMP6, average scheme delay, and regulatory discretion it is likely that ND PCDs would be triggered in an efficient company on projects partially delivered and therefore form part of the risk ranges.

Second, the TI PCD is negatively skewed because the reward to penalty rate of 1:4 was set based on a non-representative sample of project delay performance. The underlying analysis used to calibrate the time incentive PCD relied on AMP7 WINEP schemes only. The stated intention of the regulatory design of TI PCDs was to set the penalty rates and reward rates on time incentives would net off to zero where companies delivered in line with 20% of schemes late and 80% of schemes on time, or 1:4. Many of the AMP7 WINEP schemes are low complexity and short duration projects. For example, within the WINEP programme, schemes included installing monitors at wastewater treatment works (42% of schemes) and investigations into the presence of monitors at wastewater treatment works (17% of schemes). The sample is not representative of AMP8 enhancement programme as the complexity is not reflective of the AMP8 programme. The KPMG infrastructure project database shows that projects of similar size, complexity, and duration to the AMP8 programme are late ~30% of the time and would require a lower penalty rate for an efficient company to achieve net zero penalties. Therefore, the penalty rate underestimates the degree of lateness an efficient company would deliver and is negatively skewed.

Qualitative assessment of the risk of delay

In addition to the quantification of risk relating to enhancement performance and the PCD mechanisms, the notional company is exposed to a variety of risks that would require considerable assumptions to estimate and are therefore best suited to a qualitative analysis to underscore that the quantitative models do not capture these risks. These factors compound the risk already quantified and therefore suggest the risk ranges may underestimate the true risk facing the notional company.

Direct negative financial outcomes of the risk of timing can primarily arise from multitude of factors, including the following.

- **Performance Commitments:** Delays in enhancement projects may worsen PC performance and result in ODI penalties. Where failure to complete an enhancement project would result in ODI impact, such as discharge permit compliance, the notional company would be exposed to: (1) direct financial penalties from Ofwat, (2) negative media attention and reputational damage, and (3) impact on C-MeX scores. Analysis performed for business plan submission using our data estimated a 3% multiplier impact whereby C-MeX scores are amplified by performance on ODIs, as estimated by the difference between the CES score before and after adjusting for the

[44] Ofwat (2024), PR24 draft determinations: Expenditure allowances, p. 173.

respondents who referenced ODI performance. Whilst this multiplier was derived using our data, it is likely a similar effect would hold true across the sector.

- **Regulatory Fines**: Fines may be issued by a regulator for failure to deliver a project in time that is associated with a statutory requirement. For example, WINEP schemes are required by the EA and failure to deliver would have negative affect on a company's EPA rating. The EA has recently been given unlimited powers to issue fines on companies not complying with EA regulation[45]. There have been 28 court courses and 21 enforcement notices issued by the EA to the water sector in AMP7 thus far[46]. Given the scale of the programmes in AMP8, expected challenges in delivery and expanded power, historical fines would underestimate the degree to which companies are exposed to over AMP8. Furthermore, the DWI is seeing expanded powers to directly impose fines on companies, where they are currently issued through courts.[47] In February 2024, Ofwat was granted new powers to act against water companies which provide poor customer service.[48]
- **Reputational damage with regulators and third parties:** Environmental Performance Assessment (EPA) rating which limits the enhancement solutions able to be proposed and may result in fines and poorer PC performance. Furthermore, the company is likely to experience decreased investor appetite, given a poor environmental record, exacerbated by depressed returns from penalties. Similarly, reputational damage may impact relationships with third parties which could make procurement, contracting and hiring more onerous.
- **Financing challenges**: Ability to raise finance as (1) investors continue to place increased value on a company's sustainability and environmental performance in allocating capital and calculating an interest rate, and (2) investor appetite decreases due to depressed returns from penalties.

Quantification of delay impact is therefore difficult to due to the multitude of direct and indirect factors, and it is likely the ranges adopted understate the true risk.

Base totex

The calibration of allowances through the stochastic cost models complimented by cost adjustment claims where company specific factors drive differences carries inherent risk of miscalibration.

Risk arising from the *calibration of base allowances*

In AMP7 most companies overspent their base allowances with material underperformance across the sector[49]. The base allowances set at the DD rejected cost adjustment claims equivalent to 84% of the total value requested by the sector as seen in the below table. While the base cost model changes resulted in increased base totex allowances, there is a gap between the sector's assessment of base totex allowances and the base allowances awarded at DDs. All companies submitted cost adjustment claims and a small proportion were awarded with four companies receiving no cost adjustment claims and one receiving a reduction in allowances as a result. Companies will need to reassess the adequacy of allowances at DDs given the degree of change from PR24 BPs and DDs and determine if the cost model has determined appropriate levels of funding required to deliver service improvements. The degree and scale of the rejected cost adjustment claims and AMP7 performance suggest there may be residual calibration risk.

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[45] DEFRA and the EA (2023), Unlimited penalties introduced for those who pollute environment. Press release can be found here.

[46] EA, Register of Enforcement Actions. Register can be found here.

[47] Plimmer, G. & Hollowood, E., (2023, September 28), England's drinking water watchdog seeks powers to directly impose fines. *The Financial Times*. Article can be found here.

[48] Ofwat (2024), Water companies face fines for poor customer service. Release can be found here.

[49] Analysis of water company Annual Performance Reports for financial year 2023/24 included AMP to date whole totex cost performance showed that material overspend has occurred in AMP7 and is primary driven by inefficiency as reported.

Table 11: Summary of cost adjustment claims at PR24 DD

Sector requested CACs vs Ofwat allowance			
Company	Value requested	Allowance	Rejection %
BRL	24	13	-46%
SEW	68	28	-59%
TMS	600	213	-65%
YKY	746	250	-66%
SRN	481	109	-77%
SES	84	19	-78%
UUW	596	61	-90%
SVE	898	90	-90%
ANH	972	51	-95%
WSX	829	19	-98%
AFW	46	0	-100%
NES	18	0	-100%
SSC	43	0	-100%
SWB	48	0	-100%
HDD	35	-1	-102%
Sector	**5,487**	**852**	**-84%**

Given the nature of cost models as relying on historical data to set allowances, it may underestimate cost drivers that are changing rapidly like extreme weather. For example, the Climate Change Committee recently published in their assessment of the UK's climate risk that "[t]he magnitude of risks is also increasing faster than earlier assessments predicted."[50]The report goes on to state that further changes are expected in the UK's climate[51]. The risks associated with climate change are both material and worsening[52]. Therefore, there is scope for underestimating the impact of severe weather and climate change on the cost performance of the water sector in PR24 and beyond, especially when considering the relationship between PC performance and base totex.

As the DD risk analysis does not consider the risk facing a notional WaSC and WoC separately, it does consider the different levels of operational gearing between a WaSC and WoC and therefore the risk exposure to base totex cost performance. The notional WoC is materially more exposed to base totex performance as it represents a higher proportion of RCV given the smaller size of a median WoC and the economies of scale achieved by a larger median sized WaSC. The correct calibration of base totex is of particular importance for a notional WoC.

4.1.2 Retail

The risk analysis included in the DDs focused on retail totex while this report focuses on retail profit. As the wholesale cost of equity represents what is available to investors net of retail profit performance, it is more meaningful when considering financeability and investability to rely on retail profit to simulate potential returns over AMP8. The risks to retail profit observed in AMP7 were driven by Covid-19 pandemic, higher than normal inflation and the cost of living crisis – the net result was lower revenues due to bad debts and higher costs due to inflation. While these events are unlikely to occur in the future, the risk analysis uses AMP7 data as an input and the base-case performance

[50] Climate Change Committee (2021), Independent Assessment of UK Climate Risk, p. 14.

[51] Climate Change Committee (2021), Independent Assessment of UK Climate Risk, p. 46.

[52] Climate Change Committee (2021), Independent Assessment of UK Climate Risk, p. 56.

likely overstates risk where a pandemic is not expected to occur. However, inflation risk remains a material risk, as do other risk drivers that increase bad debts like a recession or cost of living crisis. The unmitigated risk ranges for retail profit likely overstate the true risk in AMP8 however it is reasonable to expect inflation to occur in the base cost on retail costs and some negative performance expected.

Retail risk is driven by the design of the regulatory framework. The retail revenues are recovered from customers on a nominal basis over the AMP as opposed to wholesale revenues which is recovered on a real basis. This introduces inflation risk into the recovery of efficient costs and profit margin for the notional company's retail business. The DDs addressed a material component of the retail risk through an ex ante true up for inflation by forecasting the salary and wage inflation and building this into allowances and has increased the retail profit margin by 20 percentage points in the DDs. However, this only cover 45% of totex. The design of the recovery mechanism for the retail price control is structurally exposing investors to inflation risks.

4.1.3 Outcome Delivery Incentive

The notional company is exposed to risk on PCs due to both miscalibration and regulatory design.

Risk arising from the *calibration of PC targets*

The PC targets set out in the Draft Determination are not representative of a median performance. These PCLs include stretch above the targets submitted at October 2023 BP. This level of stretch is shown in Table 12 below.

Table 12: Comparison between PCLs per DD targets, BP submissions and AMP7 performance

		The level of stretch (in median terms, average of the period)		Performance in physical terms		
	Units	BP targets vs. AMP7 performance	DD targets vs. BP targets	AMP7 median	BP median	DD median
Leakage, ML/km of mains/day	*ML/km of mains/day*	18%	1%	7.4	6.1	6.0
Customer Contacts on Water Quality	*# Contacts/ 1,000 pop.*	12%	19%	1.0	0.9	0.7
Water Supply Interruptions	*Minutes / Property*	47%	-6%	8.9	4.7	5.0
CRI	*CRI Score*	57%	20%	2.9	1.3	1.0[53]
PCC	*l/person/day (3yr avg.)*	7%	1%	144.8	134.5	132.7
Mains Repairs	*# Repairs / 1000km mains*	2%	4%	131.8	129.4	123.8
Unplanned Outage	*(Non-outage - % peak week prod. capacity)*100*	0%	0%	98.4	98.0	97.7
Pollution Incidents	*Incidents / 10,000km of sewer*	33%	15%	28.1	18.9	16.0
Internal Sewer Flooding	*Properties / 10,000 connections*	29%	5%	1.8	1.3	1.2

53 The level of deadband at FY30.

		The level of stretch (in median terms, average of the period)		Performance in physical terms		
	Units	BP targets vs. AMP7 performance	DD targets vs. BP targets	AMP7 median	BP median	DD median
Sewer Collapse	*Collapses / 1,000 km of sewer*	0%	0%	7.5	7.5	7.5
Discharge Compliance (WaSC)	*(% compliance) * 100*	1%	0%	98.9	100.0	100.0
External Sewer Flooding	*Properties / 10,000 connections*	19%	3%	19.4	15.7	15.3

This report considers two potential drivers of calibration risk for PCLs and the above table suggests the notional company is exposed to both these risks across most ODIs.

1 **Starting point for AMP8 is unlikely to be achieved given current performance**. The starting assumption for the PCLs set in the Draft Determination are the PR19 targets[54], based on the rationale that improvements implied by AMP7 targets were funded in AMP7. However, sector median performance falls short of these target levels across many ODIs despite material overspend on base totex in AMP7. To achieve the PR19 targets in FY25, the notional company would need a step change in performance without which it would be exposed to systematic underperformance in AMP8 even if it achieved the rate improvement implied by the DD targets.

   The draft determination was released prior to FY24 performance reporting, which increases the risk that current performance is not accounted for the AMP8 targets.

2 **Trajectory of improvement expected in AMP8 too stretching based on historical evidence**. AMP7 provides an objective data point for realistic trajectories of improvement to PCLs. There is a risk the allowances in AMP8 do not facilitate the rate of improvement expected by the DD targets. Even under the assumption the allowances are sufficient, there is risk performance improvements are slowed by deliverability issues relating to, *inter alia*, supply chain issues, labour shortages, or climate change. As with the step change the enhancement programme, the whole water sector having to deliver significant performance improvements concurrently across their services places strain on external resources.

Risk arising from the *regulatory design*

The PR24 FM and Draft Determination include three ODIs which, based on the proposed target levels, are penalty only: CRI, Discharge Permit Compliance, and Serious Pollution incidents. The target levels for these ODIs across all companies are zero and thus no outperformance is achievable. This creates asymmetry in the regulatory framework, applying a negative skew to the P50 and asymmetry to the range between worst- and best-case scenario.

Moreover, these ODIs imply unlimited scope for penalty. Whilst companies should bear some risk where factors are within their control, exogenous circumstances such as extreme weather could impact performance on these ODIs and result in a penalty. Furthermore, median performance in AMP7 indicates baseline performance would fall short of the target levels:

[54] Ofwat (2024), PR24 draft determinations: Delivering outcomes for customers and the environment, p. 53.

Table 13: Median AMP7 performance on penalty-only ODIs

	Units	FY21	FY22	FY23	FY24
CRI	*CRI Score*	2.16	3.02	2.92	3.57
Discharge Compliance	*100 - % Compliance*	0.49%	1.68%	1.43%	0.97%
Serious Pollution Incidents	*No. incidents*	3	3	3	N/A

The DD addresses some of this risk through a decreasing deadband on CRI of 1.83 in FY26 to 1.00 in FY30. However, the level and trajectory of the deadband leaves residual risk when compared with AMP7 performance. Risk is also mitigated through the aggregate sharing mechanism on ODIs, however mitigations are limited due to the very high thresholds (+/- 3% and 5%) and that, unlike the Totex ASM, the impact is calculated annually.

4.1.4 Measures of Experience

In PR19, Customer Measures of Experience ("C-MeX") penalties/rewards were calculated relative to water sector performance only. The DD updated the benchmark for performance to be the UKCSI average[55]. Whilst the PR19 approach of relative performance results in no P50 risk for the notionally efficient company, comparison to the UKCSI average risks baseline underperformance as demonstrated by the historical performance of the water sector against UKCSI in Table 14.

Table 14: AMP7 C-Mex performance vs UKCSI Average

	FY21	FY22	FY23	FY24
UKCSI Average	85.62	82.10	82.27	84.34
Median C-MeX Score	81.12*	79.50*	78.29*	75.55*
Companies above UKCSI average	2	6	3	0

Reweighted for DD definition

The objective of using UKCSI average is to prevent companies receiving rewards from decreasing scores. This protects customers from poor service and incentivises the sector to improve scores. However, tougher C-MeX targets may amplify the impact of PC penalties and other fines where companies suffer financial consequences due to falling short of performance standards and for the resulting reputational impact.

Furthermore, in a competitive market consumers would only be influenced by intra-industry customer experience comparisons: a consumer would not rule out the best rated supermarket for customer service because in comparison to other industries the service is worse.

The Draft Determination includes some risk mitigating factors: (1) the re-weighting to 66.6% Customer Service Survey and 33.3% Customer Experience Survey, which puts more weight on customer views with whom companies have had director contract with and therefore provides companies the opportunity to mitigate some of the reputational risks through high quality customer engagement, and (2) the upper bound for reward being the UKCSI Upper Quartile in place of the UKCSI maximum, which increases reward payments above UKCSI average although the notional company would not be expected to benefit from this. Regarding the Customer Experience Survey, there is also potential for factors outside of customer service to impact the survey results. Because this survey targets the wider customer base without regard for whether there was a customer service contact, customers completing this survey may base their scores on other factors like media coverage or recent regulatory actions against the water sector. This would mean C-Mex scores could be influenced by factors other than customer service (i.e., storm overflow or pollution performance). Placing lower

[55] Ofwat (2024), PR24 draft determinations: Outcomes – Measure of experience performance commitments appendix, p. 14.

weight on this component of the score is helpful in keeping the score focused on customer service metrics.

Developer Measures of Experience (D-Mex) remains a relative comparison and thus the efficient notional company – as defined by sector median – is expected to have no out- or under-performance. However, as demonstrated in Table 15 there is asymmetry in the performance whereby downside performance represents a larger underperformance compared with the outperformance on the upside.

Table 15: AMP7 D-Mex performance

	FY21	FY22	FY23	FY24
Median	81.52	80.80	83.08	86.20
P10 Downside	65.89	72.59	75.36	78.33
P90 Upside	86.65	87.93	89.18	88.62
Downside underperformance	15.63	8.21	7.73	7.87
Upside outperformance	20.76	15.35	13.82	10.29

All reweighted for DD definition

The reweighting to 66.6% Developer satisfaction survey and 33.3% Levels of Service metrics puts more emphasis on stakeholders with whom water companies have interacted. As with C-MeX, this adds more weight to scores which companies can influence directly.

The analysis does not include BR-Mex as it is a new incentive for PR24 with no historical performance upon which analysis could performed.

4.1.5 Market Based Delivery

The direct procurement for customers (DPC) and specified infrastructure projects (SIPR) are relatively untested delivery routes introduced by Ofwat for delivering larger and more complex schemes. The structure of the mechanism utilise project finance to raise capital at a potentially higher level of gearing than the appointee or is isolated from some degree of the risk. The appointee is ultimately responsible for the performance of the assets and takes ownership of the assets in the long run. At PR24, Ofwat required companies to assess projects with over £200m whole life totex for suitability under DPC. The sector requested market based delivery in the Business Plan submissions for AMP8 for 33 schemes covering £14b in capital expenditure. The risk allocation between the competitive appointed provider (CAP), which constructs and operates the assets, and the appointee results in some residual risks held with the appointee based on the structure of the deliver route. Given the scale and the residual risk it is important to assess how this relatively new and untested delivery route can impact the appointee.

The analysis points to several different ways that projects delivered under other market delivery routes can impact the appointee based on the result of the design of the regulatory framework. The majority of schemes progressed in the sector are under DPC and the analysis reflects the risk allocation embedded in the DPC framework:

- **Delay and associated statutory penalty**: if the appointee is using other market delivery routes to deliver schemes to comply with statutory requirements like the WINEP programme, WRMP or DWI water quality standards, delays can result in fines and penalties. The CAP is only paid on commissioning of the assets and is well incentivised to deliver on time. However, based on the KPMG infrastructure project database the larger and more complex nature of the projects delivered under this delivery route may be more at risk of delay due to the risk inherent in large construction schemes. Regulators have wide latitude to assess fines and therefore can have a wide range of outcomes should delays be experienced.

- **Impact on credit ratings**: where the appointee retains some degree of risk, credit rating agencies may opt to fully consolidate the CAP into the appointee for purposes of rating assessment. Further analysis is required on a case by case basis to assess the degree of contractual risk transfer from the appointee to the CAP to determine how a rating agency would assess the impact. There are a wide range of outcomes given the bespoke nature of each scheme making the estimation of risk to a notional company challenging.
- **Operational performance**: the CAP is expected to bear the risk of performance; however, it is unlikely to bear the full risk given the difficulty in drafting a contract that covers all possible outcomes. Some appointees may opt to operate the assets themselves in some cases. Given vastly different types, timelines, and profiles of the DPC deliveries, it is not possible to reliably estimate this risk for the notional company
- **Retendering in the event of CAP default**: should the CAP default during the construction phase, the appointee may need to retender the construction contract and award a new CAP. The regulatory framework does not guarantee additional funding for the cost of retendering in the event of a CAP default.

Cost performance risk is fully transferred to the CAP under the Allowed Revenue Directive and offers material protection for the appointee. It is not included in the list as under the DPC programme this is not a risk borne by the appointee.

The delay risk, potential ratings impact, and operational performance risk are not included in the simulated risk ranges but are acknowledged as sources of risk for the appointee. A more bespoke analysis of each scheme should be undertaken to understand the full degree of risk conferred to the appointee and the CAP as well as the impact on overall risk ranges.

However, the risk of retendering in the event of a CAP default is included in the simulated risk ranges. Without an explicit guarantee of subsequent funding, the appointee could be unfunded for the retender costs. The appointee has the option to bring the scheme in-house in most cases in the event of a CAP default, however the appointee would likely bear less risk by retendering where the scheme is large, complex, construction phase is not complete and the appointee is already delivering a large programme. Therefore, the risk is considered in the simulation.

4.1.6 Financing risk

An efficient notional company expects to deliver the majority of its capital programme through debt financing and the correct calibration of efficient costs in the cost of debt allowance is a key driver of risk for the notional company. Risk arises from two key macroeconomic factors (1) non-inflationary interest rate risk and (2) inflationary rate risk.

Recent market volatility following the COVID-19 pandemic, the Russia-Ukraine war and “Trussonomics” highlights the importance of an appropriately set allowance. Increased volatility increases the risk to which the sector and its stakeholders are exposed.

Interest rate risk

Interest rate risk relates to the allowance for cost of embedded and cost of new debt, and the potential delta between these allowances and the debt costs a company is incurring and will reasonably be able to issue at.

Key contributors to the negative risk exposure in the base-case scenario is performance of the notional company against the allowances on embedded and new debt. This is because DD allowance for the cost of embedded debt is lower than the all-in cost of embedded debt for the median company in the sector. At the same time, the cost of new debt allowance, based on the iBoxx A/BBB indices, is significantly below the cost of new debt issuance achieved by water companies over the last 12 months. The regulator has signalled that it will consider refinements to its methodology and the latest market data in the Final Determinations (FDs), which could address the under-funding currently reflected in the financing risk range based on DDs.

Inflationary risk

Inflationary risk is present in the Draft Determination framework because the notional company is not fully protected against (1) deviations between the observed CPIH index and the assumed level, and (2) basis risk as a result of the efficient notional company having to issue index linked debt linked to non-CPIH benchmarks, i.e., resulting in an RPI-CPIH or CPI-CPIH "wedge", when income through RCV and customer bills are linked to CPIH.

- **CPIH inflation**: the actual observed CPIH index values may be higher than the long-term 2% CPIH assumption. PR24 FM and the Draft Determination provides some protection against deviations from the long-term assumption, however this is limited to +/- 1% as this is the level at which the governor of the Bank of England would be required to write a letter to the Chancellor[56]. However, historical series from April-2000 suggest CPIH variation can exceed this with a P10/P90 of 0.9%-4.0%.
- **RPI-CPIH wedge**: The notional capital structure assumes all index-linked debt to be linked to the CPIH index, however in practise a significant portion of RPI linked debt is present in the sector due to limited availability of CPIH linked debt in the market. The Draft Determination assumes am RPI-CPIH wedge of 0.90%, and therefore exposes the efficient notional firm to basis risk should the outturn wedge vary from this assumption. Historical data series from April-2000 indicates a P10 and P90 wedge of 2.08% and 0.05%. Deviation from the assumed 0.90% wedge is predominantly an embedded debt risk given legacy RPI-linked debt and derivatives were used to manage capital structure. The sector is increasingly issuing CPI-linked debt, in place of the scarcely available CPIH debt due to market illiquidity.
- **CPI-CPIH wedge**: The Draft Determination assumes that all non-CPIH index linked debt is linked to RPI as 3% of current debt is indexed to CPI[57]. However, due to the lack of liquidity in the CPIH market, new debt issuances are likely to be CPI linked and thus an efficient notional firm is exposed to the CPI-CPIH wedge which is not provided for in the Draft Determination. Historical data series from April-2000 indicates no wedge exists at the P50, however that a wedge of 0.68% and -0.30% is present at P10 and P90 – thus creating basis risk. Given the negative wedge at the P90, this range presents basis risk to both the efficient company and its customers.

The aforementioned five components of inflationary and non-inflation risk – embedded debt, new debt, CPIH variance, RPI-CPIH wedge, and CPI-CPIH wedge – are included in the simulation and suggest some degree of calibration risk from the cost of debt allowance included in the DD.

The assessment of financing risk for a notional WoC did not take into account company specific characteristics that may warrant a company specific adjustment. Should this risk be present WoC financing risk would be understated by the ranges presented, potentially materially.

4.2 Notional company mitigations

Without mitigations, analysis indicates notional company AMP8 performance (1) has a negative P50, suggesting the allowed return will not be earnt, (2) is asymmetric, with more scope for downside scenarios than upside scenarios, and (3) exhibits a high level of variance, with a wide range between best-case and worst-case scenarios.

A narrower RoRE range, with less downside asymmetry and P50 near zero, would significantly improve notional company attractiveness to investors, and, consequently, the notional company's ability to deliver its AMP8 capital programme. With this view, mitigations could be used to address the notional risk at source, whilst also ensuring sufficient incentive remains in the regulatory framework. This section explores the possible mitigations and determines an example suite that could be applied to the notional company.

[56] Ofwat (2024), PR24 draft determinations: Aligning Risk and Return Appendix, p. 16.

[57] Ibid, p. 18.

Mitigations to the risk identified in the Draft Determination can be decomposed into two categories:

1) Mitigations addressing risk relating to the calibration of the notional company,
2) Mitigations addressing risk relating to the asymmetry of regulatory mechanisms.

Mitigations which may address calibration of the notional company – e.g., changes to allowances or ODI targets – are indicative for the notional company, as a bottom-up assessment of efficient costs or feasible performance improvements is not possible given the synthetic nature of the notional company. This Report does not comment on the sufficiency of allowances or feasibility of targets for any specific company, instead it provides examples of potential effective mitigations.

4.2.1 Objective assessment criteria for mitigations

A consistent, non-discriminative framework for selecting mitigations ensures a systematic approach and consideration of the factors that are most relevant in the regulatory context, including – but not limited to – protecting customer interest and long-term operational and financial resilience.

The selected criteria are as follows:

1) Are the proposed mitigations in the best long-term interest of consumers?
2) Do the proposed mitigations sufficiently preserve the incentive properties of the price control?
3) Do the proposed mitigations address the risk at source?
4) Do the proposed mitigations allocate the risk to the parties best placed to manage it?
5) Are the proposed mitigations consistent with precedents in other RAV-regulated sectors?
6) Are the proposed mitigations helping to achieve a greater risk symmetry?

4.2.2 Possible suite of mitigations

Possible mitigations are shown in Table 16 and Table 17, addressing company calibration risk and regulatory design risk, respectively. These tables show the potential impacts these mitigations would have on (1) underperformance at P50, (2) risk asymmetry, (3) risk variance.

Table 16: Possible mitigations to address company calibration risk

Mitigation	Description	Shifting median upwards	Reducing asymmetry (downside vs. upside)	Reducing variance (range of upside / downside)
Appropriately fund improvements to PCs	Providing sufficient base allowance to ensure the required ODI improvements can be made will reduce the risk of base underperformance experienced in AMP7 and underperformance against ODI targets.	Yes	Yes	Yes
Enhancement project re-opener	When material design changes are required due to unforeseen circumstances at planning, a reopener would be triggered to reassess the efficient notional company's required allowance to deliver the scheme.	Yes	Yes	Yes
Asymmetric sharing rates on enhancement totex	The risk of overspend on the large and complex enhancement projects is high. Ofwat recognised this by reducing sharing rates to 40/40. However, cost outperformance is less likely than	Yes	Yes	Yes

Mitigation	Description	Shifting median upwards	Reducing asymmetry (downside vs. upside)	Reducing variance (range of upside / downside)
	underperformance, implying asymmetry which could be addressed through asymmetric sharing rates.			
Adjust glidepath of ODI targets based on AMP7	The ODI targets outlined in the DD include material stretch when compared with AMP7 performance and improvement trajectory. Targets could be adjusted to factor in (1) companies are unlikely hit FY25 targets which are the baseline for AMP8 targets, and (2) the viable rate of improvement in AMP8 given historical performance.[58]	Yes	Yes	Yes
Appropriately calibrated cost of debt allowance	The KPMG Cost of Debt report[59] demonstrates the allowance per the DD is not sufficient to cover median sector costs to which companies are exposed, and therefore companies will underperform without an uplift to the allowance. It also suggests companies are exposed to basis risk for which no allowance is given in the DD. This is a regulatory design risk but considered alongside CoD allowance for simplicity.	Yes	No	No

[58] See Table 4 which demonstrates the level of stretch in the PC targets in the Draft Determination.

[59] See KPMG August 2024 reports on the cost of debt at PR24, namely, 'Cost of Embedded Debt – analysis of and commentary on Ofwat's DD position' and 'Estimating the Cost of New Debt and Additional Borrowing Costs for PR24', for more detail on the calibration of the cost of debt allowance.

Table 17: Possible mitigations to address regulatory design risk

Mitigation	Description	Shifting median upwards	Reducing asymmetry (downside vs. upside)	Reducing variance (range of upside / downside)
Retail indexation	Indexation of the retail allowance protects companies against high inflation which could occur in AMP8 and was a driver of underperformance in AMP7.	Yes	No	No
Modified application of PCDs	PCDs are inherently asymmetric. Modifications to the PCDs mechanisms could, *inter alia:* • Permit a longer timeframe for delivering enhancement under Non-Delivery PCDs • Refine the reward : penalty ratio of Time-Incentive PCs • Offset other regulatory actions and fines issued to explicitly avoid duplication of penalties	Yes	Yes	Yes
Rebased C-MeX on sector	Water sector C-MeX scores have historically underperformed against UKCSI, the proposed target in the DD. Resultingly, comparison to UKCSI would incur baseline underperformance which could be remedied by using a sector median target consistent with D-MeX.	Yes	No	No
ODI caps, collars and deadbands	This mitigation would re-instate caps and collars for the common ODIs, and deadbands for penalty-only ODIs in AMP8.	Yes	Yes	Yes
Reduced ODI incentive strength	The incentive strength across all ODIs could be recalibrated via scaling down ODI rates, which would reduce RoRE risk. Ofwat's top-down approach to ODI rate setting is based on an explicitly defined regulated equity at risk for each ODI.	Yes	Yes	Yes
Redesigned Aggregate Sharing Mechanism (ASM)	The aggregate sharing mechanisms on Totex and ODIs could be redesigned by reducing the first threshold to 1.5% from 2% and adding a second 90% sharing threshold of 2.5%.	No	Yes	Yes
Return Adjustment Mechanisms (RAMs)	Return adjustment mechanisms protect customers and companies from extreme outcomes with sharing rates effective after +/-3% and enhanced sharing rate of 90% active after +/-4%. There is a precedent of using similar thresholds that encompass both ODIs and Totex in the energy sector.	No	Yes	Yes

4.2.3 Assessing possible mitigations against the criteria

The possible mitigations are compared against the criteria outlined in section 4.2.1 in Table 18.

Table 18: Assessment of possible mitigations against objective criteria

Mitigation	Consumer Interest	Preserve incentive properties	Target risk at source	Allocate risk appropriately	Consistent with precedents	Improves risk symmetry and variance
Appropriately fund improvements to PCs	✓	✓	✓	✓	✓	✓
Enhancement project allowance re-opener	✓	✓	✓	✓	✓	✓
Asymmetric sharing rates	⊙	✓	✓	✓	✓	✓
Adjust glidepath of ODI targets based on AMP7	⊙	✓	✓	✓	✓	✓
Appropriately calibrated cost of debt allowance	⊙	✓	✓	✓	✓	✓
Retail indexation	✓	✓	✓	✓	✓	✓
Modified application of PCDs	✓	⊙	✓	✓	⊙	✓
Rebased C-MeX on sector	✓	✓	✓	✓	✓	✓
ODI caps, collars and deadbands	✓	✓	✓	✓	✓	✓
Reduced ODI incentive strength	✓	⊙	✓	✓	✓	✓
Redesigned Aggregate Sharing Mechanism (ASM)	✓	⊙	⊙	✓	✓	✓
Return Adjustment Mechanisms (RAMs)	✓	⊙	⊙	✓	✓	✓
✓ **Consistent with criterion** ⊙ **Exhibits some degree of inconsistency with criterion**						

4.2.4 Determining key mitigations

The mitigations adopted in this analysis to address notional company risk are presented below. The analysis relies more heavily on mitigations that are highly effective at addressing underperformance at P50, risk asymmetry, risk variance, and compliance with objective criteria.

The following section presents other possible mitigations which materially align with the objective criteria set out in section 4.2.1 and could provide effect risk mitigation, but which are not applied to the notional company in this report due to other mitigations addressing the source of risk.

Mitigations addressing calibration risk

- **Appropriately fund improvements to PCs.** Appropriate base allowances to fund the PC improvement required to meet DD targets reduces the downside P50 and RoRE variance on (1) base totex implied by AMP7 underperformance, and (2) ODIs where targets are significantly stretching compared with current performance and adjusting targets would not be palatable – e.g., leakage, total pollution incidents and external sewer flooding.
- **Enhancement project re-opener.** It is common for infrastructure projects to overrun on costs due to uncertainties in planning budgets. The downside P50 is mitigated through the setting of an appropriate enhancement allowance, which is most practically achieved through a re-opener to assess efficient scheme costs similar to the RAPID scheme stage gates.
- **Adjust glidepath of ODI targets based on AMP7.** Adjusting the DD targets to reflect achievable levels of performance at the P50 mitigates downside P50 risk. Revised PCLs consider actual performance in AMP7 and therefore align with expected performance. The targets for leakage, total pollution incidents and external sewer flooding are not revised as these are mitigated through fully funding the required performance improvement. Where ODI underperformance is addressed through fully funding the required improvements or by reducing targets is dependent on stakeholder prioritisation between lower bills and improved performance.
- **Appropriately calibrated cost of debt allowance.** KPMG's Cost of Debt report demonstrates the median company cost of debt is higher than the allowed cost of embedded debt and that it cannot issue at the allowed cost of new debt. It also demonstrates basis risk exposure due to the RPI-CPIH and CPI-CPIH wedge. Financing underperformance therefore occurs, which is remedied through provision of sufficient allowances.

Mitigations addressing regulatory design risk

- **Retail indexation.** The sector materially underperformed against retail allowances in AMP7, significantly – but not exclusively – driven by high inflation. Without indexation of allowances in AMP8, companies would again be exposed to inflationary risk on retail costs. Note, the negative P50 on retail is assumed be fully mitigated by AMP8 indexation. This is a conservative assumption, and some residual risk may remain if historical underperformance was driven by other factors, however insufficient data exists to robustly assess this.
- **Modified application of PCDs.** PCDs are inherently asymmetric and both ND and TI PCD mechanisms generate asymmetric risk for companies. Analysis of the KPMG infrastructure project database suggests 40% of projects are delayed on average, which indicates a reward : penalty ratio of 2:3 is more appropriate than the 1:4 set out in the DD for TI PCDs.

  The DD indicates a delivery buffer of "a few months"[60] into AMP9 for ND PCDs. The regulatory discretion poses risk to companies which is mitigated by applying a 12-month delivery buffer, where no clawback would occur unless projects are a full year late.

[60] Ofwat (2024), PR24 draft determinations Expenditure allowances, p. 176.

- **Rebased C-MeX**. Water sector performance has historically been below UKCSI[61]. Adopting the UKCSI average as the target therefore creates deterministic underperformance for the water sector. This is mitigated by adopting a water sector median as the target, as is the approach for D-MeX.

- **ODI caps, collars, and deadbands.** There is a strong argument for these based on alignment to regulatory framework and regulatory precedent. Deadbands are applied to downside only ODIs – CRI, Discharge Permit Compliance, Serious Pollution Incidents – as deadbands eliminate the negative P50 and asymmetry in the RoRE range resultingly from these ODIs.

  Caps and collars help to limit variance in the RoRE range where possible outcomes for individual ODIs are very broad. Based on historical performance, caps and collars for Leakage and Water Supply Interruptions are applied to the Notional WoC.

- **Reduced ODI incentive strength.** The Draft Determination's top-down methodology based on specified regulated equity at risk and assumed performance ranges results in skewed regulated equity at risk across sector, and significantly more regulated equity at risk compared with Oct-23 Business Plan proposals. The performance ranges utilise historical data covering AMP6, which is a less comparable period given the points made previously. Additionally, the performance ranges do not adjust historical performance for changes in PC definitions for example the EA exemption for extreme weather events on total pollutions incidents being removed. Additionally, the use of the 0.6% of regulated equity threshold for the calibration of ODI rates appears unjustified and significantly increases the overall risk exposure in economic terms. However, excessive reductions in rates could impact incentive properties. The appropriate impact of rates is ultimately dependent on achievable ODI targets. In the example suite of mitigations, rates were scaled down by reducing the RoRE at risk for ODIs with very wide performance ranges – Notional WoC: Leakage and Customer Contacts, Notional WaSC: Pollution Incidents and External Sewer Flooding.

- **Redesigned ASMs.** A broader sharing mechanism is supported by regulatory precedent, the degree of P10 risk in the sector, and helps with stability of bills. The DD introduced an ASM for Totex and included Measures of Experience in the ODI ASM set out in PR24 FM. However, the efficacy of these mechanisms in reducing the risk range is limited by the Totex ASM having only a lower 50% sharing threshold and the ODI ASM having high thresholds. In aggregate, the 50% sharing threshold is 5% of Regulated Equity which is unlikely to provide sufficient protection to customers and companies should ODI targets and totex allowances be set at achievable levels. The ASMs are therefore redesigned as follows:

  - Totex ASM: Lower the 50% sharing threshold to +/- 1.5% RE and add a 90% sharing threshold at +/- 2.5% RE.

  - ODIs & Mexs ASM: Lower the 90% sharing threshold to +/- 4% RE.

  Whilst ASMs do not address the risk at source, they provide a helpful RoRE backstop which aids financeability and customer bill stability.

Other potential mitigations

The following mitigations are not applied in the example notional mitigation suite, however, could provide risk mitigation in place of other mitigations.

- **Asymmetric sharing rates on enhancement.** The Draft Determination reduced enhancement sharing rates to 40:40 reducing the company retained risk in recognition of the step change in size and complexity of the AMP8 enhancement programme. However, as cost underperformance is more likely than outperformance the risk is inherently asymmetric - which could be addressed through asymmetric sharing rates. Lowering retained risk on overruns reduces the incentive strength and increases the propensity for variation in customer bills. This mitigation is therefore

[61] Ofwat (2024), UKSCI benchmarks – response. Data available here. UKCSI average benchmark 85.62, 82.10, 82.27, 84.34 vs sector median of 81.12, 79.50, 78.29, 75.55 in FY21-FY24 respectively.

not applied as enhancement cost overrun risk is instead mitigated through the appropriate calibration of allowance through a re-opener.

- **Further application of caps and collars.** Whilst caps and collars can limit incentive once the cap/collar level is achieved, they reduce the RoRE range width and therefore provide certainty to customers and investors. In the example mitigation suite, ODI risk is mitigated through appropriate funding of PC improvements, revised targets, recalibrated ODI rates, and limited application of caps/collars/deadbands. Should these mechanisms not provide sufficient mitigation, additional caps and collars could be used to achieve appropriate levels of ODI risk.
- **RAMs.** With sufficient Totex allowances, ODI calibration, and ASM configuration, RAMs are not required. However, RAMs are supported by regulatory precedent with application by Ofgem in RIIO-GD2 and in place of ASMs, could provide similar protection to stakeholders. RAMs would also offer the benefit of restricting extreme performance on other risk components such as retail.
- **Tighter ASM thresholds.** If the full suite of Totex and ODI mitigations were not applied, tighter ASM thresholds would be required to achieve appropriate RoRE width and symmetry. A possible application could be +/- 1.5% and +/-2% thresholds for Totex and ODI ASMs to align the overall protection with the 3%/4% thresholds of RIIO-GD2.

Sector views

UK water companies engaged with the Club Risk project had opportunity to provide their views on mitigations. Their support is summarised in Table 19.

Table 19: Company support of mitigation types

Support level	Potential mitigation
General support	• Appropriately fund improvements to PCs • Enhancement project re-opener • Adjust glidepath of ODI targets based on AMP7 • Appropriately calibrated cost of debt allowance • Retail indexation • Rebased C-MeX on sector • ODI caps, collars and deadbands
Mixed support	• Modified application of PCDs • Reduced ODI incentive strength • Return Adjustment Mechanisms (RAMs)

4.3 Mitigated RoRE ranges

4.3.1 Mitigated aggregated RoRE

The suite of mitigations set out in Section 4.2.2 significantly reduce risk exposure for the notional WaSC and WoCs, by limiting negative exposure at P50, the asymmetry between upside and downside exposure and reducing the risk at P10 below the allowed return on equity. This means that equity investors in the notional water company could expect to earn a return close to the allowed cost of equity on a P50 basis and, in a “worst-case” P10 scenario, would still be able to earn a positive return.

Addressing miscalibration risk improves the P50 from (4.06%) to (1.42%) and (4.51%) to (1.04%) for the notional WaSC and WoC respectively. P50 further improves to (0.17%) and (0.07%) when applying mitigations addressing regulatory design risk. The downside P10 scenarios also increase to (3.11%) and (3.95%), crucially below the allowed return on equity.

Chart 13: WaSC RoRE risk through mitigations

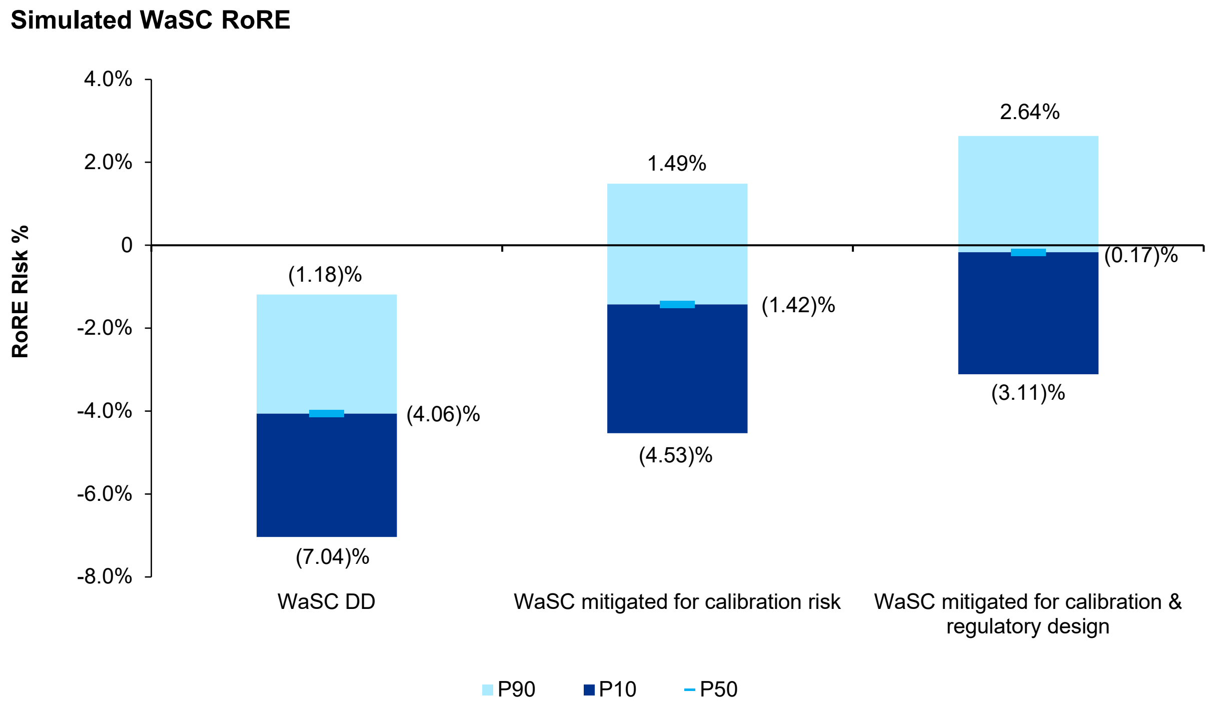
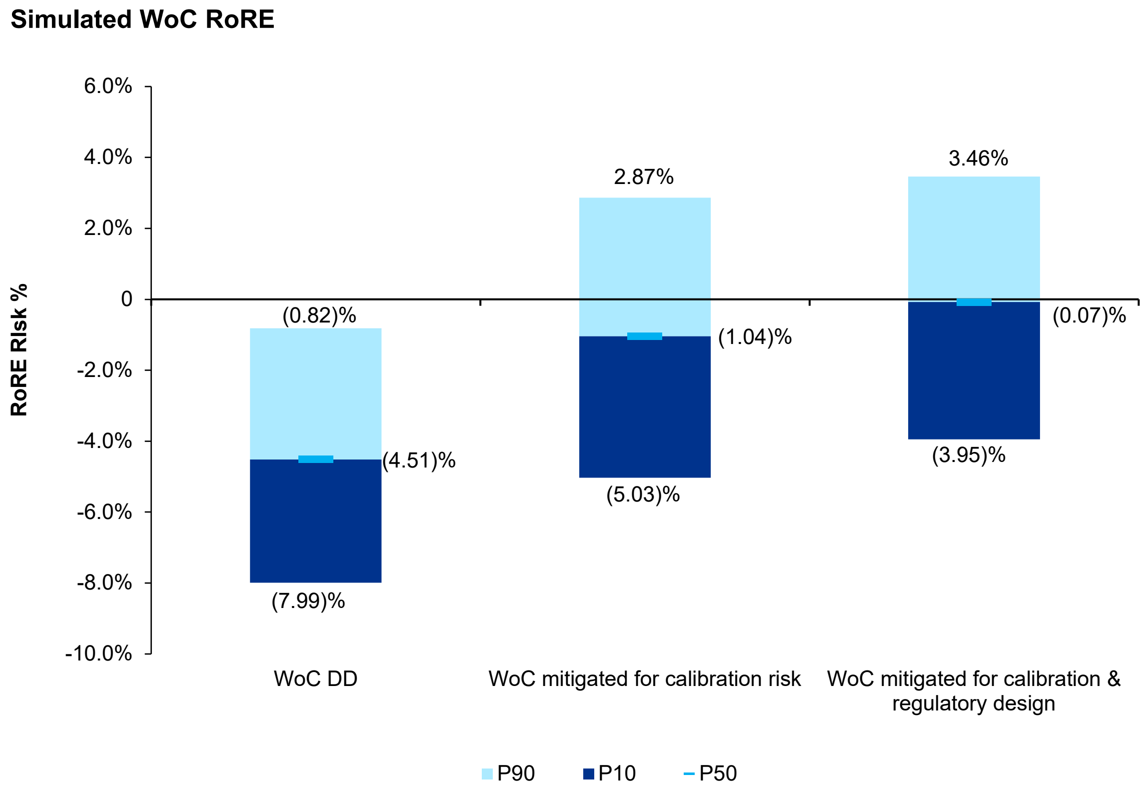


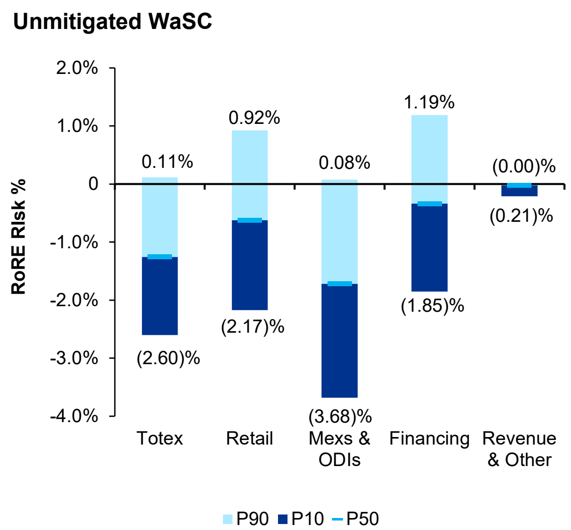
Chart 14: WoC RoRE risk through mitigations



4.3.2 Component level mitigations

The simulated components of risk for a mitigated and unmitigated WaSC and WoC are shown in Chart 15 and Chart 16.

Chart 15 a, b: WaSC components of risk: Unmitigated vs Mitigated



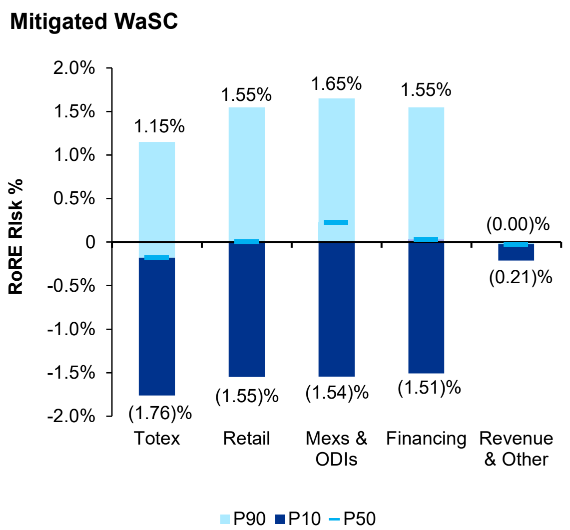


Chart 16 a, b: WoC components of risk: Unmitigated vs Mitigated

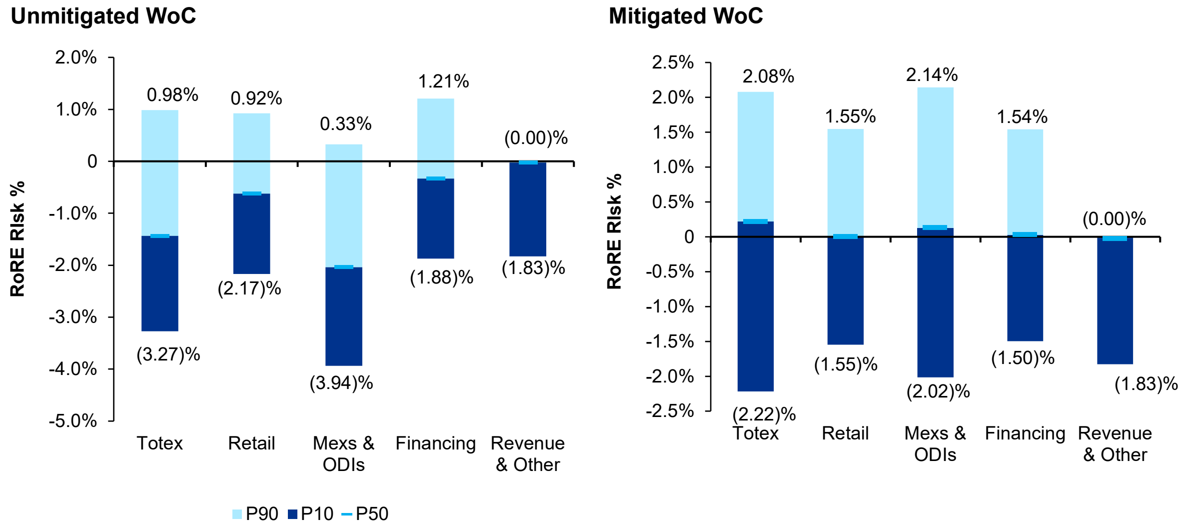


Chart 15 and Chart 16 present the risk exposure on each group of performance variables, the overall risk exposure, and the mitigations impacting each component, for the notional WaSC and WoC respectively.

It is important to note the relationship between risk components and the impact on overall RoRE. The overall RoRE range factors in the relationships between these components and thus the total range is not equivalent to the sum of the components. The combined additive range is not representative of the true overall risk but is shown below for comparability with the risk ranges presented in the DDs.

Analysis of historical performance indicates that performance distributions are downward asymmetric for elements of totex and numerous ODIs. As a result, aggregation of components with P50 = 0 through Monte Carlo can produce a non-zero P50. As a consequence of this statical relationship, to mitigate the P50 risk to near-zero some components require mitigation to the point of outperformance, as the case for ODI in the below table.

Table 20: WaSC unmitigated and mitigated risk ranges

Notional WaSC	Unmitigated			Mitigated			
	P10	P50	P90	P10	P50	P90	Mitigations
Totex	-2.60%	-1.26%	0.11%	-1.76%	-0.18%	1.15%	• Appropriate base funding improves P50 • Enhancement re-opener improves P50 • Modification of PCDs improves P10
Retail	-2.17%	-0.62%	0.92%	-1.55%	0.00%	1.55%	• Retail indexation improves P50
DPC	-0.16%	0	0	-0.16%	0	0	No change
Mex & ODI	-3.68%	-1.72%	0.08%	-1.54%	0.23%	1.65%	• Appropriate funding of PC improvements improves P50 • Adjust glidepath of ODI targets based on AMP7 improves P50 • Deadbands improve P50

							• Reduced ODI incentive strength improves P50 and reduces range • Redesigned ASM reduces range
Financing	-1.85%	-0.34%	1.19%	-1.51%	0.03%	1.55%	• P50 improved through sufficient embedded and new debt allowances and uplift for basis risk.
Rev.	-0.05%	-0.03%	0.00%	-0.05%	-0.03%	0.00%	No change
RoRE (additive)	-10.52%	-3.97%	2.30%	-6.57%	0.05%	5.89%	n/a
RoRE	**-7.04%**	**-4.06%**	**-1.18%**	**-3.11%**	**-0.17%**	**2.64%**	n/a

Table 21: WoC unmitigated and mitigated risk ranges

Notional WaSC	Unmitigated			Mitigated			
	P10	P50	P90	P10	P50	P90	Mitigations
Totex	-3.27%	-1.43%	0.98%	-2.22%	0.22%	2.08%	• Appropriate base funding improves P50 • Enhancement re-opener improves P50 • Modification of PCDs improves P10
Retail	-2.17%	-0.62%	0.92%	-1.55%	0.00%	1.55%	• Retail indexation improves P50
DPC	-1.78%	0	0	-1.78%	0	0	No change
Mex & ODI	-3.94%	-2.04%	0.33%	-2.02%	0.13%	2.14%	• Appropriate funding of PC improvements improves P50 • Adjust glidepath of ODI targets based on AMP7 improves P50 • Deadbands improve P50 • Caps and collars reduce range • Reduced ODI incentive strength improves P50 and reduces range • Redesigned ASM reduces range
Financing	-1.88%	-0.33%	1.21%	-1.50%	0.03%	1.54%	• P50 improved through sufficient embedded and new debt allowances and uplift for basis risk.
Rev.	-0.05%	-0.03%	0.00%	-0.05%	-0.03%	0.00%	No change
RoRE (additive)	-13.08%	-4.46%	3.44%	-9.11%	0.35%	7.31%	n/a
RoRE	**-7.99%**	**-4.51%**	**-0.82%**	**-3.95%**	**-0.07%**	**3.46%**	**n/a**

4.3.3 Significance of mitigations

The analysis indicates the risk exposure as a result of the Draft Determinations is materially skewed downward, with negative P50 and a P10 greater in magnitude than the allowed return. This risk can be separated into:

1) **Regulatory calibration of the notional company**. Analysis of historical performance suggests that the notional company calibration per the DDs is misaligned, and the allowances and

performance levels may not be achievable. It is crucial that the framework is representative of the true characteristics of the sector, and that an efficient firm would reasonably achieve the levels of performance expected.

2) **Regulatory design.** The regulatory framework includes mechanisms which create inherent downside risk. Whilst companies should be held to account for their performance, baseline asymmetry in the framework erodes the ability to offer the allowed return.

Without effective mitigations across both these categories, the level of risk would have material negative impacts on the notional company's:

- **Financeability.** The notional company would not be financeable with the risk allocation indicated by the analysis.
- **Investability.** The downside skew of risk ranges would result in the notional company being unable to attract equity investors through a sufficient rate of return.
- **Ability to deliver the AMP8 capital programme.** The AMP8 capital programme represents a step change in scale and therefore requiring additional capital from debt and equity investors. The inability to raise this finance would impact the deliverability of the proposed programme, which would ultimately harm customers by limiting the scope of service improvements.

The example suite of mitigations presented in Section 4.2.4 is not intended to be prescriptive. Instead, it demonstrates that targeted mitigations could materially improve the notional company's risk profile and therefore financeability and investability in AMP8. Crucially, the P50 risk is closer to zero and the P10 risk is smaller in magnitude than the allowed return – implying investor could access some small positive return in a P10 downside scenario.

P50 risk and asymmetry is not fully mitigated despite an extensive suite of mitigations. Full risk mitigation could be achieved through either:

1) Use of further mitigations. However, these may begin to distort the incentive properties of the framework.
2) Pricing in the residual risk into the cost of equity through an aiming up adjustment.

Asymmetry in risk exposure around the P50 is not fully consistent with the CAPM principles that returns are normally distributed, i.e., that they are clustered around the mean with a symmetric distribution. As a result, even with the risk mitigations, the incentive package would not constitute a 'fair bet' and would therefore warrant an adjustment to cost of equity to compensate for the downside risk asymmetry.

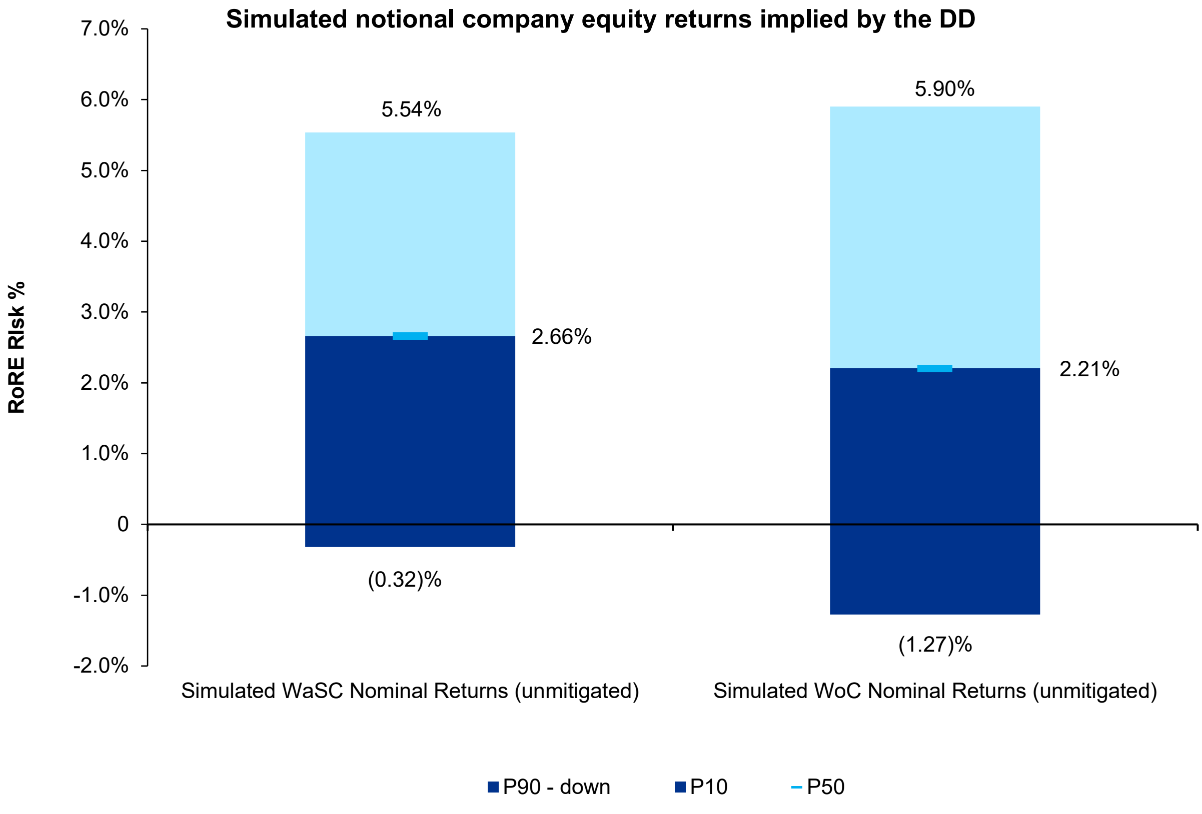
CAPM assumes that all possible future outcomes, including, in particular, downside risks with certain probabilities attached to them, are fully reflected in expected cashflows, i.e., that allowed cashflows already reflect all one-sided or asymmetric downside risks. Where this is not the case, the required returns will increase to compensate investors for these downside risks for the investment overall to constitute a 'fair bet'. These are typically captured through added premia to the required return.

Both corporate finance theory and regulatory precedent (such as CMA decisions for PR19 and SONI appeals, as well as Ofcom's implementation of the fair bet principle) suggest that presence of unremunerated and not-fully mitigated asymmetry is an important criterion for selection of a point estimate for the cost of equity. Asymmetry could also be captured via an asymmetric risk premium, which would ensure the notional company can attract the necessary new equity to fund its enhancement programme.

5 Conclusion

The risk analysis of a notional WaSC and WoC indicates that without mitigations, an efficient notional company would be: (1) unlikely to earn the allowed return on equity; and (2) in the worst-case scenario earn negative nominal returns. In the context of AMP8 where the sector will be seeking new equity and debt capital to deliver the capital programme, investability is of particular importance. An efficient notional company's ability to offer competitive returns given its level of risk is important to attracting this capital in globally competitive markets. Without sufficient capital, the sector will be unable to finance and consequently deliver the capital programme. Investment is needed to prevent deterioration in performance. The government and regulatory bodies have taken action to set tough environmental targets and tighten the standards and requirements related to the baseline expected performance. It will only be possible for the sector to rise to meet these challenges with a well-balanced risk and return profile. Therefore, a balanced risk and return package is in the customers' best interest as it would enable companies to finance and deliver against statutory objectives and improve service in AMP8.

Chart 17: Simulated nominal returns for unmitigated and mitigated WaSC



The balance of risk and return is an important element of the overall PR24 determinations in the context of the "focus on the long term"[62]. Improvement in asset health and resilience require a persistent and targeted effort over an extended period. If returns are not commensurate with the risk currently facing the sector, financing asset improvements may prove difficult and asset base may continue deteriorating while climate change and population growth persist. This could require even

[62] Ofwat (2021), PR24 and Beyond: Creating tomorrow, together, p. 13.

more risk mitigation or a higher cost of capital in future periods. Protecting customer interest today and in the long term involves taking action to balance risk and return at PR24.

The assessment of risk included in the DD: relied on AMP6 data; calculated performance ranges against the AMP8 framework; did not consider the interrelationships between risks; and simplified analysis by adding the resulting risk ranges together instead of randomly simulating them. The risk analysis presented in this paper: relied on AMP7 data; simulated performance against the AMP8 framework with empirically observed correlations; and produced a coherently simulated risk range. The differences between the results can be accounted for by these methodological differences.

It is possible to address risk at source to improve the probability an efficient notional company will be able to finance and deliver the AMP8 capital programme. The mitigations included in this analysis were selected based on their degree of effectiveness at addressing risk at source and consistency with a set of objective criteria. These key mitigations address risk arising from the calibration of performance targets and cost allowances in the AMP8 package as well as risk arising from the regulatory framework's design. Both sources of risk are important to consider in rebalancing risk and addressing risk at source.

The mitigations included in the report provide an example for how risk could be mitigated at source, with any residual risk subject to a separate consideration of a cost of equity uplift. There is a myriad of combinations of regulatory mitigations that can achieve the same outcome. The methodology for selecting mitigations based on the criteria objectively considers the relative advantages and disadvantages of each mitigation. The resulting package of mitigations included in this risk analysis do somewhat alter the incentive properties and in some cases increase customer bills and affordability pressures. However, the benefits to the long-term customer interest, effective risk mitigation at source and improved symmetry outweigh this potential disadvantages.

The regulatory framework presented at DDs would require material changes to improve the balance of risk and return. Moody's Ratings notes that FDs are "typically less onerous" than DDs, but that based on the DDs may "change … our view of the stability and supportiveness of the regime or companies' ability to recover costs and earn a fair return" and result in negative credit pressure on ratings[63]. This is particularly relevant when considering how much risk mitigation is needed and how much mitigation is required.

To arrive at a balanced and investable regulatory package, it may be necessary to consider both risk mitigations and the need for a cost of capital uplift. Where risk mitigations are insufficient to align investor expectations of earning the allowed return on equity, an adjustment to the cost of capital will be required. An aiming up adjustment to the cost of equity can be added to address negative base-case expected risk and where there is more downside risk than upside potential. Aiming up could be an important part of rebalancing of the risk package, given that asymmetric risk is not priced into beta and investors expect a 'fair bet'.

Overall, the regulatory framework can be an excellent tool for supporting the UK water sector to continue innovating to solve some of the greatest challenges facing society today. Addressing the imbalance of risk and return will allow the framework to continue being a source of strength for the sector in future by reducing the cost of privately financed essential infrastructure.

[63] Moody's (2024), Regulated Water Utilities – UK: Ofwat's draft determination increases sector risk, p. 1.

6 Appendices

6.1 Notional company specification and calibration

Appropriate specification of the notional company is important for producing meaningful RoRE risk ranges that are achievable in practice. It should reflect objective and realistic characteristics of an efficient water company that can achieve the set package of cost efficiencies and standards of service. Notional company characteristics and performance must be defined to be representative of the sector as a whole to support any conclusion on the appropriateness of the regulatory framework. Due to material divergences in sector characteristics between WaSCs and WoCs, this analysis presents two notional companies to best align the notional company characteristics to the sector. Notional company allowances, targets and rates are based on median of sector DDs. In general, the DDs set allowances and targets above the median of October 2023 Business Plans and rates were calibrated to put more equity at risk for smaller companies and less equity at risk for larger companies.

The notional company is used to verify the balance of risk and return of the regulatory framework and, more specifically, whether expected performance across costs and quality of service metrics of an efficiently run water company allows it to earn the allowed return on equity, as well as estimate the degree of upside and downside risk exposure. The calibration of the notional company’s baseline performance is particularly critical. This can be done by using the observed historical mean or median. A simulated distribution of performance around this baseline can then be applied based on historic distributions of performance.

The mean and median both have advantages and disadvantages and provide different views on risk. The mean is the point in a distribution which minimises the sum of the differences between the mean and all other points in the distribution. The mean is generally additive in nature when working with non-normal distributions and can be more intuitive. However, the mean is particularly sensitive to outliers. The median is the point in the distribution where half the observations are above, and half the observations are below: i.e., the middle of the distribution. It has the advantage of insensitivity to magnitude of outliers in the distribution. In a negatively asymmetric distribution, the mean is typically lower than the median due to the median being less sensitive to outliers. Because the mean is sensitive to outliers, analysis reliant on the mean may need to identify and remove these outliers which can be a subjective process. Therefore, the median is more objective and representative of an efficient notional company and as a result, the median is used as a basis for determining the notional company. Forward-looking operational performance is calibrated based on the median sector performance across totex, ODIs and retail. This approach allows the analysis to retain all observations and therefore avoids any potential distortions or required discretion in identifying and removing outlier companies.

While the notional company is efficient, it must also reflect realistic performance in the sector to produce meaningful ranges for inferring the appropriateness of a price control’s package of incentives. Ofwat’s duty to support water companies across a number of areas including carrying out their statutory functions, financing their operations, improving resilience in the long-term of the water supply and provision of wastewater services and efficiency apply to all companies. Where companies exhibit different characteristics outside of management control like size or number of business units, the regulatory framework must work for companies reflecting such characteristics. Within the water sector, there are two distinct groups of companies: WaSCs and WoCs. Relative to a WaSC, WoCs generally have smaller asset base by RCV, higher operational gearing defined as base totex relative to RCV and do not provide wastewater services. The notional company construct has been applied to both groups in this analysis to test the appropriateness of the package of incentives at PR24 on both types of companies.

The notional company is assumed to have pursued all available avenues of mitigating risk included in the PR24 FM. This includes Uncertainty Mechanisms for regulatory requirements that may change during AMP8 like WRMP, industrial emissions directive, land bank loss, outstanding WINEP requirements, DWI drinking water nutrient level changes, etc.

The below table outlines the calibration of the notional company across each of the main risk drivers:

Table 22: Notional company calibration by risk driver

Risk driver	Notional WaSC	Notional WoC
RCV	• Median RCV for water price control • Median RCV for wastewater price control	• Median RCV for water price control among WoCs
Base totex allowance	• Based on median relative proportion of water and wastewater base totex to water and wastewater RCV in AMP8	• Based on median relative proportion of water base totex to water RCV in AMP8
Enhancement totex allowance	• Total enhancement programme size based on median capital intensity of the water and wastewater enhancement programme relative to opening AMP8 water and wastewater RCV • Relative proportion of each enhancement totex category based on median proportions	• Total enhancement programme size based on median capital intensity of the water enhancement programme relative to opening AMP8 water RCV • Relative proportion of each enhancement totex category based on median proportions
Enhancement scheme duration and complexity	• Duration estimated of each enhancement scheme based on sector input and expert opinion • Complexity assessed based on a set of criteria included below	• Duration estimated of each enhancement scheme based on sector input and expert opinion • Complexity assessed based on a set of criteria included below
PCDs	• Enhancement totex subject to PCD both non-delivery and time incentive PCDs separately based on median proportion of enhancement totex subject to PCD by scheme • Clawback rate based on the allowance and proportion of enhancement totex subject to non-delivery PCDs • Time incentive rate based on enhancement totex subject to time incentive PCD and allowed WACC.	• Enhancement totex subject to PCD both non-delivery and time incentive PCDs separately based on median proportion of enhancement totex subject to PCD by scheme • Clawback rate based on the allowance and proportion of enhancement totex subject to non-delivery PCDs • Time incentive rate based on enhancement totex subject to time incentive PCD and allowed WACC.
Number of market delivery schemes	• Based on median number of schemes delivered by WaSCs	• Based on medina number of schemes delivered by WoCs
ODI targets, rates, caps, collars & deadbands	• Median of water ODIs and median of wastewater ODIs standardised as appropriate	• Median of water ODIs standardised as appropriate

Risk driver	Notional WaSC	Notional WoC
Retail profit	• Aligned to the 0.06% of RCV based on the retail margin adjustment in the WACC	
Capital structure	• Gearing of 55% made up 74% embedded debt and 26% new debt • Total debt made of 33% index-linked debt, of which 94% is RPI-linked, 6% CPI-linked – new ILD debt is assumed to be raised as CPI-linked in AMP8	

Enhancement scheme complexity is assessed under a framework that evaluates the following dimensions:

Social	Typically, projects are subject to scrutiny particularly when government or regulated monopolies funding is being spent. To mitigate this, the government has a series of departments which are accountable for spend from treasury while in regulated sectors, an independent regulator or authority monitors spend closely and evaluates value to customers. For projects with the lowest levels of complexity, a business case of some form will be required and approved.
Governance	Additional signoffs can be difficult to navigate given the number of public bodies which have been setup to protect certain elements of society. These can include Highways Agency, Environment Agency, Local Authorities, Gas/electricity/broadband suppliers, Canals and River Trust, Parishes etc. Additional consents can make projects difficult to construct and therefore are an indicator of complexity.
Novelty	Some projects can be first-of-a-kind, and some are carried out on a regular basis. Constructing a well-defined asset such as a new road can be easier than building a novel structure such as a football stadium. This is because there is additional design required and the supply chain may not be prepared.
Site	The condition of the site should also be considered when determining whether a project is complex or not. In particular, the location (urban or rural) and development on greenfield vs brownfield can have a significant impact on how difficult a project is.

Each criterion is assessed based on a scale of one to five. The composite score is then a simple average of the individual scores.

6.2 Methodology for selection of probability distributions ("fit test approach")

To simulate expected performance in AMP8, probability distributions must be selected which describe the shape of the range around baseline performance – as described in Section 6.1. Analysis of the AMP7 sector performance data established that most performance distributions were not normal nor symmetric. Resultingly, robust analysis must look to distributions which more appropriately describe the attributes of the underlying data, such as asymmetry.

To determine more representative distributions, a fit test was undertaken to select the most appropriate probability distribution, with the aim to preserve the features of historical data into the forward-looking simulation and reflect more accurately the upside and downside potential. This approach retains the shape of the empirically observed distributions and more appropriately simulates risk on an aggregate basis.

The alternative of using a normal distribution for all risk components – defined via a mean and a standard deviation – could allow outliers to skew results and therefore raise questions about outlier exclusion. Using the full sector performance data for simulating the forward-looking risk limits subjectivity and discretion, is more analytically robust, and more aligned with Ofwat's regulatory duty to ensure all licensees are financeable.

In general, the number of unique distributions was limited by utilising a single distribution type where other distributions were not materially different. This helps to simplify the analysis and makes the methodology easier to understand without reducing the degree of accuracy. Several different distribution types were required based on the results of the fit tests and the criteria outlined in the main body of the report. The key distributions selected as inputs to the risk analysis are described below:

- **Inverse Gaussian Distribution**, also called the Wald or normal-inverse Gaussian, is a member of the exponential distribution family with a single mode and long tail. The distribution is used to model non-negative, positively skewed data and has a wide variety of applications in business, survival analysis, finance, medicine, and even in labour dispute resolution. The distribution's tail decreases slowly compared to the normal distribution. Therefore, it's suitable for simulating phenomena where there is a greater likelihood of getting extremely large values compared to the normal distribution. Most distributions were fit to an exponential distribution type and in most of these cases the Inverse Gaussian was used to capture the degree of skew.
- **PERT distribution,** also called the beta distribution, is a bounded distribution defined typically by the minimum, maximum and mode. The PERT distribution has direct applications in risk analysis especially when simulating uncertain variables or limited observations. It is similar to the triangular distribution type but is curve on both sides instead of a straight line. It is an intuitive tool to model risk and is easy to understand given the direct relationship between input parameters and observed data.
- **Exponential distribution** is another member of the exponential distribution family and declines exponentially from its maximum point towards zero. It is similar to the Inverse Gaussian and can be used where the P10 and P50 are very close together. Given their similarity, the Inverse Gaussian distribution was used where possible and exponential distribution was used only where the P10 and P50 were too close to define an Inverse Gaussian distribution.
- **Normal distribution** is a well-known distribution commonly used in social sciences. It is defined by the mean and standard deviation and importantly is symmetrical with limited tail risk compared to the other distributions included in the analysis.
- **Discrete distributions including Binomial and Poisson** model outcomes where there are only two outcomes and are based on the chance of achieving one outcome over the other.
  - **Binomial distributions** are often used in credit analysis and default simulations based on a probability of default. It is best used when a distinct event can only occur once in a set time frame, such as default.

- **Poisson distributions** are used to model the number of times a binary event may occur over a time period and more appropriate where the modelled event can occur more than once in the time period, like serious pollution incidents.

The below table shows which distribution was applied to each risk based on the criteria outlined in the report:

Table 23: Selected distributions for each risk component

PC	Distribution type	Continuous / Discrete
Net profit margin	Normal	Continuous
Base totex	Inverse Gaussian	Continuous
Enhancement totex	Inverse Gaussian	Continuous
DPC	Binomial	Discrete
C-MeX	PERT	Continuous
D-MeX	PERT	Continuous
Leakage	Inverse Gaussian	Continuous
Customer contacts on water quality	Normal	Continuous
Water supply interruptions	Inverse Gaussian	Continuous
CRI	Inverse Gaussian	Continuous
Mains repairs	Inverse Gaussian	Continuous
Per capita consumption	Normal	Continuous
Unplanned outage	Normal	Continuous
Total pollution incidents	Inverse Gaussian	Continuous
Internal sewer flooding	Inverse Gaussian	Continuous
Sewer collapse	Inverse Gaussian	Continuous
Discharge permit compliance (WaSC)	PERT	Continuous
External sewer flooding	PERT	Continuous
Serious pollution incidents (WaSC)[(a)]	Inverse Gaussian	Continuous
Serious pollution incidents (WoC)	Poisson	Discrete
Cost of embedded debt	Normal	Continuous
Cost of new debt	Inverse Gaussian	Continuous
CPIH variation	Normal	Continuous
CPI-CPIH wedge	Normal	Continuous
RPI-CPIH wedge	Normal	Continuous

Note: (a) The serious pollution incidents were standardised similarly to total pollution incidents for the purposes of simulating performance and therefore a continuous distribution type was used.

6.3 Methodology for simulating base totex risk

The simulation relies on the sector's observed performance from allowances by water and wastewater price controls adjusted for a number of changes in the AMP8 framework. The adjustments to historical performance are to create a more reliable dataset reflective of risk expected in AMP8. These adjustments to observed AMP7 performance versus allowances includes:

- **Variance due to timing**: this is a self-reported and unaudited figure included in company APRs to decompose the driver of totex performance. The variation due to timing is not reported for base totex specifically and is assumed to proportionally impact the base and enhancement totex based on the proportion of total totex.

- **Energy RPEs**: the DDs introduced a material risk mitigation of an ex post true up for outturn energy costs inflation. One of the major risk drivers in AMP7 on base totex was inflation and therefore AMP7 underperformance is not predictive of AMP8 performance. To remove the impact of energy cost inflation from AMP7 data, AMP7 allowances were adjusted upwards. The amount was estimated by the difference in the proportion of energy costs in botex between AMP7 and AMP6, assuming it was entirely driven by high inflation of power costs.
- **Changes to the cost models**: the DD base cost allowances are higher than in AMP7. The full like-for-like impact of this change could be assessed by taking the full 14% increase in allowances (before frontier shift) and reducing this by population growth (3% compounded over 5 years) and frontier shift (5% compounded over 5 years), arriving at the 6% net like-for-like increase in allowances. While this is a simplification and further analysis of the cost models in warranted, it is the best approximation available. The resulting adjustment was used to improve historical AMP7 performance to be more reflective of performance under the DD allowances.

The historical performance against adjusted allowances feeds into the simulation to produce the reported notional WaSC and WoC results.

6.4 Methodology for simulating enhancement totex risk

The simulation relies on the KPMG infrastructure project database data – a collection of infrastructure projects for which data is available publicly – to set the baseline and performance distribution for cost performance versus initial budget and delay risk. More information about the database can be found in appendix 6.10.

Given the relationship between project characteristics and risk, the methodology must account for differences in project characteristics. To compare projects in the AMP8 capital programme to the projects in the database, the projects were grouped based on their characteristics: initial budget, planned duration, and complexity. The projects in the database's complexity and value were calculated on a consistent basis to the AMP8 projects using the complexity assessment and converting project value based on the World Bank purchasing power parity to 31 December 2022 GBP equivalent.

To eliminate subjectivity associated with matching the projects in AMP8 to the projects in the database with similar characteristics, the analysis relies on the K-means clustering machine learning algorithm to assign projects within the database to groups, from which statistics on cost overrun and delay can be determined. An expectation for cost overrun and delays can then be informed by the database cluster most relevant to the characteristics of the AMP8 project. The algorithm uses the following configuration:

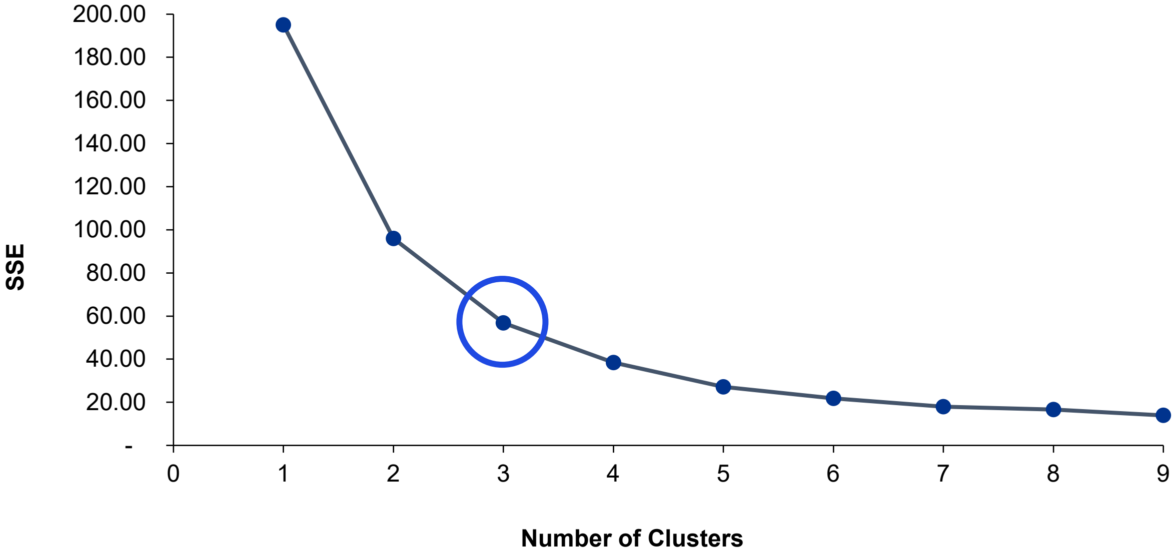
- **Clustering variables**: Initial budget, planned project duration, project complexity.
- **Number of clusters, K**: Three

The clustering variables are standardised to eliminate differences in scale and ensure the algorithm places equal weight on each parameter.

Application of the K-means clustering algorithm is sensitive to K, the number of clusters. To ensure the use of the most appropriate number of clusters, the analysis tests an array of cluster sizes and used the Elbow Method[64] as a guide.

[64] Umargono, E., & Suseno, J. & Gunawan, S.K. (2020), K-Means Clustering Optimization Using the Elbow Method and Early Centroid Determination Based on Mean and Median Formula. Paper can be found here.

Chart 178: K means optimal cluster number - elbow method

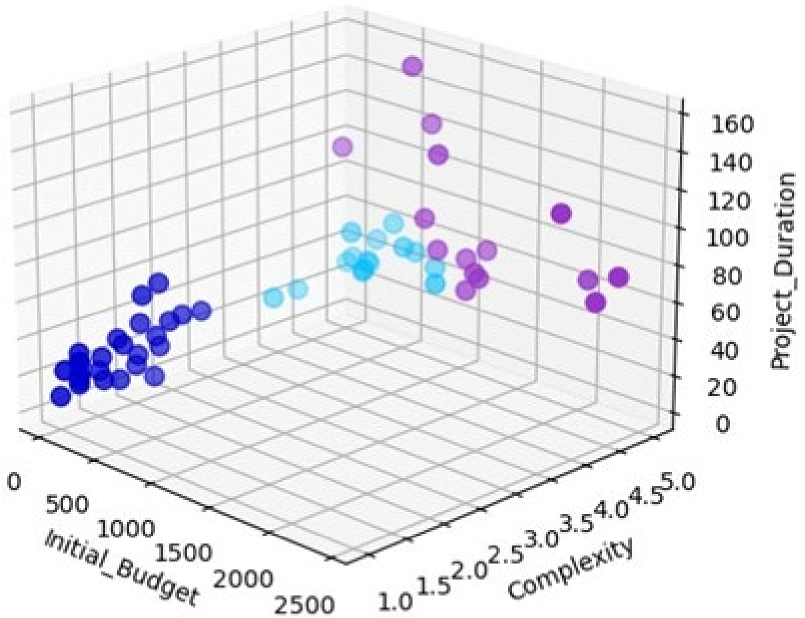


The elbow method dictates that the “kink” or “elbow” in the graph plotting sum of square error, SSE, against number of clusters is the optimal number of clusters. This technique helps quantify the benefit of adding an additional cluster. The inflection point in the graph represents a natural optimisation between the explanatory power of the algorithm and the risk of over-fitting resulting in a small number of projects per cluster.

For the projects in the database, the elbow could be interpreted as occurring at 2, 3 or 4 clusters. Additional clusters increase the accuracy of the analysis, as it places stricter conditions on the likeness of data points allocated to the same clusters, however, increases the computational cost of the clustering and may reduce the number of data points in each cluster and therefore the robustness of the cost and delay statistics. Three clusters are determined to give the most appropriate groupings for application to the notional company’s enhancement performance in AMP8 and ensured sufficient sample population in each cluster.

The results of the algorithm are represented below on the three-dimensional graph. Each database project is plotted across the three variables used in the clustering algorithm: initial budget, complexity, and project duration. Each project is coloured to represent the assigned cluster:

Chart 19: Infrastructure project database clustering



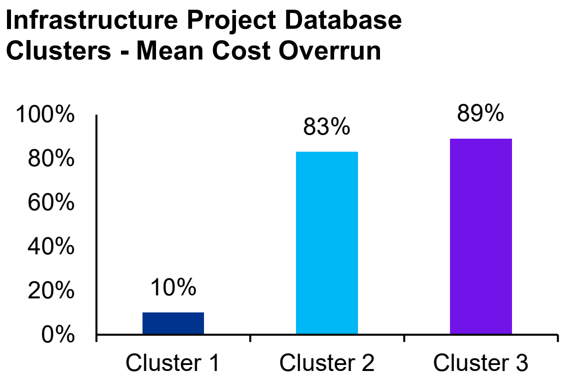
The clusters have the following attributes:

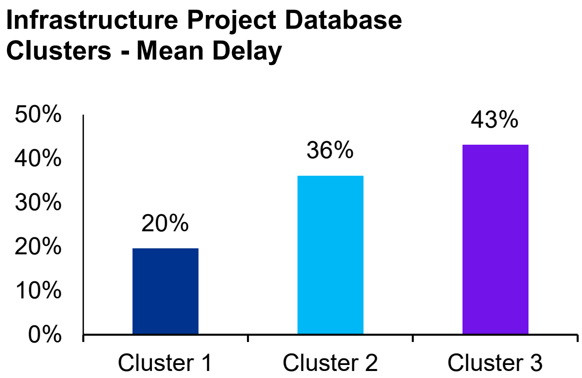
Table 24: Project database cluster characteristics

Cluster	Colour	Population	Average Initial Budget	Average Duration	Average Complexity
Cluster 1	**Navy**	27	£36m	24 months	1.7
Cluster 2	**Blue**	14	£433m	43 months	4.6
Cluster 3	**Purple**	15	£1371m	83 months	4.7

The project performance is also graphed below for comparison purposes:

Chart 20 a, b: Infrastructure project cluster performance against budget (cost, duration)





This analysis demonstrates that projects with similar characteristics to any of the three clusters are, on average, subject to cost overruns and delays - even those of lower scale and complexity. Additionally, projects requiring larger investment and over longer time frames are exposed to greater risk. Consequently, undertaking larger enhancement projects in AMP8 exposes the notional company to greater risk of cost overruns and delays.

Cost associated with extended timelines such as paying for additional use of contractors and machinery is also captured by the cost performance in the database. Cost overrun risk arising from project delays is inherent in the cost overrun calculated from the infrastructure project database.

Each enhancement spend category per CW3 and CWW3 are assigned one of the three clusters from the KPMG infrastructure project database by statistically optimising the cluster allocation[65]. Once the number of schemes within categories are considered, all enhancement categories are allocated to cluster 1. Whilst this is the least complex and best performing cluster from the KPMG infrastructure project database, it notably still has expected cost and timely delivery underperformance.

The statistics of the cost performance for the assigned cluster is used to simulate cost overrun for each enhancement category, with delay statistics facilitating simulation of PCD impact. The analysis uses Monte Carlo simulations with the following inputs to simulate the impact of the regulatory framework:

- A sharing rate of 40:40 for all enhancement totex across each price control and applying enhanced sharing rates of 25:25 based on the schemes in the gated allowance delivery mechanism and the large and complex projects delivery mechanism.
- Correlation between cost performance and time delay is set based on the empirical correlation calculated in the database of +0.51. Logically, a positive result is expected where the common risk drivers like design change can drive both, and delays often cause cost overrun where teams are paid for longer period of time. The degree of allowance clawback under Non-Delivery PCDs is set equal to the proportion of the delay applied to the original allowance estimate.[66]
- Correlations between the cost overrun between enhancement projects and delay between projects are set to nil, meaning performance in one category is unrelated to another's performance. This is a risk conservative assumption in the absence of empirical evidence and is appropriate given water companies may have delivery benefits not captured by the database statistics, such as having delivered similar projects in the past and relying on the same resources to deliver in future.
- Non-delivery PCDs are triggered when projects are delivered more than 3 months late into AMP9 in recognition of the flexibility allowed by the DD. Allowances are clawed back based on the degree of delay as a proxy for scope delivered. If a 60-month project is 12 months late, the clawback would be based on 83% of the scope being delivered (60 months / (60 months initial estimate + 12 months late)).
- Time incentive PCDs are calculated based on the degree of project delivered late. Using the prior example 83% of the project was delivered on time and receives the reward rate while 17% of the project was late and receives the penalty rate.

Relying on a public projects data has its limitations: it is not fully aligned with the risk of delivering water and wastewater infrastructure projects. While matching projects based on their size, duration and complexity helps to manage the data limitations, it cannot be completely eliminated without changing the underlying dataset.

To mitigate some of these limitations, the results are cross checked to industry reports on cost overruns and delays. BCG's International Major Infrastructure Projects Benchmarking Review[67] found average cost overruns of 15% and 31% on UK social infrastructure and UK transport projects respectively. Schedule delays were 5% and 22% respectively. Other reports, such as "Costing of Infrastructure Projects" by the IMF[68] and "Reducing the gap between cost estimates and outturns for

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[65] Each enhancement case assigned to the cluster to minimise the sum of squares between the three attributes of the enhancement category and the cluster average.

[66] For example, a delay of 20% would result in a project being 100%/120% complete at the end of the planned duration. Assuming linearity of delivery progress, 83% of the project (100/120) is delivered and therefore 17% not delivered. 17% of the allowance is therefore return as part of the Non-Delivery PCD mechanism.

[67] BCG (2021), International Major Infrastructure Projects Benchmarking Review. Report can be found here.

[68] IMF (2019), Costing of Infrastructure Projects. Report can be found here.

major infrastructure projects and programmes” by the ICE[69] indicate higher cost overruns across transport and infrastructure between 20%-80%.

The aggregate sharing mechanism is applied to the net wholesale totex consistent with the DDs.

[69] Institution of civil engineers (2019), Reducing the gap between cost estimates and outturns for major infrastructure projects and programmes. Report can be found here.

6.5 Methodology for simulating retail profit risk

Retail profit performance for the risk analysis is based on the AMP7 performance of total retail profit achieved relative to the retail margin adjustment removed from the WACC. Retail controls are set as average revenue controls, on the basis of retail costs plus a net margin that covers retail earnings before interest and tax. At PR19, a household retail net margin of 1.0% was allowed. To reflect that, appointee allowed return was adjusted downwards to remove the impact of the allowed retail margin. Expressed as a percentage of RCV, Ofwat's estimate of the retail margin adjustment was 0.04% at PR19. The retail margin adjustment can therefore act as a proxy allowance for retail profit as the appointee must meet the retail profit to earn the full cost of capital.

Historical performance is adjusted to reflect that Ofwat has increased allowances based on ex ante salary and benefits inflation in the retail totex allowances. The historical allowances are adjusted upward to account for the reduced inflation risk by referring to the ex-ante estimate of salary and benefits inflation at the time of PR19 and adding this to historical allowances. Performance is recalculated using higher allowances.

Recalculated performance is simulated over the increased retail profit in AMP8 of 0.06%. This results in the downside in the worst and base-case. The limitations to simulating AMP8 retail profit performance using AMP7 data are acknowledged. While bad debts influenced by the Covid-19 pandemic may not re-occur, high inflation and cost of living crisis may persist given the macroeconomic volatility.

6.6 Methodology for simulating market delivery route risk

Due to the industry-wide increase in required investment, utilizing market-based delivery is necessary for delivering the required asset improvements and increasing whole-system resilience. However, market-based delivery creates exposure to various types of risk. Table 25 details the elements of risk, who bears the risk and whether it was quantified it in this analysis.

Table 25: Risks associated with market-based delivery

Area of Risk	CAP*	*Notional co.	Detail	Quantified
Costs			100% of cost risk remains with a CAP[70] under fixed price contracts or a proportion is shared with customer under target cost contracts (pass through via the revenue directive)	No
Delay and associated statutory penalties			The CAP is expected to bear most of this risk. The notional company would bear residual exposure to the delay risk and be exposed to the risk of associated statutory penalties. The CAP will only be paid upon the delivery of the asset, so it is strongly incentivised to deliver timely. However, our expectation is that delays will be likely due to supply chain constraints.	No
Impact on rating			Ratings agencies' treatment of market-based delivery for key credit metrics may expose the water company to elements of risk	No
CAP default			The notional company may have to re-tender and be exposed to the associated delays in delivery	Yes
Operational performanc e			CAP is expected to bear most of this risk, subject to a cap. In reality, it will be very difficult to draft the contract in such a way that it covers every possible implication from an operational perspective	No

Note: orange indicates the party bearing the risk.

[70] Competitively Appointed Provider.

The only risk that was quantified in this analysis is related to the default of a CAP because of the difficulty associated with quantifying other sources of risk. Analysis to quantify this exposure in RoRE terms relies on the following evidence:

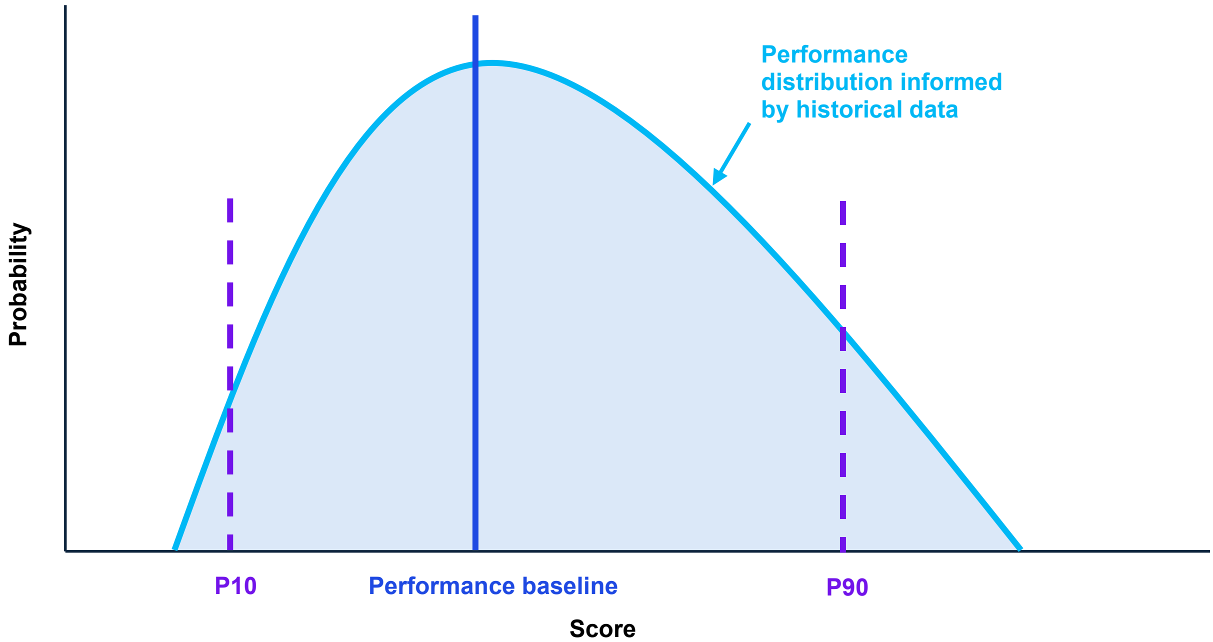
1. **Probability of default** – Moody's Construction Sector Annual Default Rates from 1980-2022 provides data to estimate the probability of a CAP defaulting in a AMP8[71]. In any given 5-year period, Moody's Construction Sector Annual Default Rates average default rate for a CAP is 15.03%.
2. **Cost to retender** – A bottom-up estimation of DPC development costs, focusing on the time and resources required for pre-tender and tender activities of a notional DPC project. This approach enables the development of specific DPC tender cost estimates across eight key activities, in line with Ofwat guidance and industry practices[72]. These activities encompass regulatory engagement, governance, commercial and legal planning, procurement, and market engagement. Detailed workplans for each activity outline the necessary full-time equivalents (FTEs) and their associated costs, categorised into SW internal, technical advisor, financial advisor, and Legal advisor, with day rates estimated for each category. The cumulative result of this analysis is a final tender cost of £5.16m. This figure of £5.16m represents the assumed value-at-risk, in the event of a CAP default necessitating retendering.

As the range of outcomes when considering CAP default are either (1) CAP default, or (2) no default, the problem is binary in nature[73]. Therefore, a binomial distribution is most appropriate when estimating CAP default risk. The simulation inputs are the probability of a CAP defaulting over a five year period and where a default occurs the cost to retender is used as the penalty in the simulation.

6.7 Methodology for simulating measures of experience risk

The simulation relies on observed measure of experience scores, reweighted to match the AMP8 definitions, to determine (1) an expected baseline for notional company performance, and (2) the appropriate distribution of performance around this baseline. This is represented diagrammatically below:

Chart 21: Probability distribution for simulated measures of experience performance



[71] Moody's (2023), Annual default study: Corporate default rate will rise in 2023 and peak in early 2024. Report can be found here.

[72] Ofwat (2019), Anglian Water: Direct procurement for customers detailed actions. Publication can be found here.

[73] When considering DPC default risk, each trial is independent and has only two possible outcomes.

Financial outcomes for C-Mex are calculated relative to the 2022 UKCSI average score for all years in AMP7, and calculated relative to the annual sector median for D-Mex.

The DD introduced new reward and penalty rates based on regulated equity instead of residential retail revenues and developer services revenues. The update to rates is reflected based on the calculated maximum and minimum scores observed that would earn the full reward or penalty. For C-Mex this is the upper quartile and minimum UKCSI score for 2022, and for D-Mex it is the annual maximum and minimum score.

The notional company baseline performance for C-Mex is negative because the median company underperformed the UKCSI in 2022. The D-Mex baseline performance is zero penalty or reward, as by definition the P50 performance for the calibrated notional company is the sector median, which is also the target. The same methodology applies to the notional WaSC and notional WoC.

6.8 Approach to simulating ODI risk

ODI simulations adopt a similar approach to Measures of Experience: adopting a performance baseline and a statistical distribution around that baseline.

- **Performance baseline.** The simulations capture performance risk and potential calibration risk by setting a baseline expected performance different from the median DD targets. The baseline for each PC is the median of the average AMP7 physical performance averaged with the median BP forecast. PCs are standardised wherever possible to remove the impact of different size networks or companies and how this impacts performance. The baseline reflects the average of AMP7 performance and BP forecasts because the BPs may have embedded a material degree of stretch for the median company. Companies were incentivised to build ambitious forecasts and may have been overly optimistic or not appropriately considered the potential impact of changing risk dynamics like extreme weather. In some cases, company forecasts in 2024/25 were revised by Ofwat in setting the DD targets, building in further stretch to PCLs by improving the baseline.
- **Performance distributions.** Performance simulations for each PC are based on the observed distribution of performance versus target over the first four years of AMP7. For water PCs these were assessed for the sector as a whole and applies equally to the notional WaSC and notional WoC. For serious pollutions incident the risk profile is materially different given a WoC does not operate a wastewater network and has limited ways it could commit a serious pollution incident. Therefore, this PC was separated between the WaSC and WoC performance in AMP7. The distribution shapes are maintained, and performance simulated around the baseline.

The resulting simulated physical performance is compared to DD median targets and rates, including enhanced thresholds and enhanced rates, to calculate the notional company's financial impact.

Generally, the methodology laid out in the previous paragraphs is followed for the common PCs with sufficient data available. The below table explains where methodology diverges for a subset of PCs. Some PCs were not modelled due to the lack of historical performance versus an ex ante target.

Table 26: Rationale behind each method of ODI data selection

ODI	Rationale
Method 1:	Simulated as a per cent deviation from upper quartile targets in AMP7
Pre-existing Common ODIs (excl. CRI)	Sufficient data available
Method 2:	Physical performance simulated where targets are zero
Compliance risk index (CRI)	The target was zero and therefore the AMP7 deviation could not be modelled as a per cent deviation from zero.
Serious pollution incidents	Ex-ante proxy target assumed at zero given there is no permissible level of serious pollution.

ODI	Rationale
Alternative targets:	Performance against AMP7 ex ante targets does not represent AMP8 expectations
PCC & Business demand	The Covid-19 pandemic had significant impact on PCC and Business Demand performance. Resultingly, and as the AMP7 targets were set prior to the pandemic, AMP7 performance is unlikely to represent expected AMP8 performance. To simulate ranges, PCC and Business Demand targets were replaced with updated forecasts reflecting the impact of Covid-19 prepared after the pandemic. This is a proxy for capturing risk on these metrics and while there are limitations, is favourable to excluding these ODIs which have historically carried material risk for the sector.
Excluded:	Not simulated
Discharge permit compliance (WoC)	As Ofwat has introduced this ODI for WoCs for the first time in PR24, there is no historical data on WoC discharge permit compliance with ex ante targets. Given the material differences between WaSC discharge permits and WoC discharge permits, this ODI could not be simulated based on WaSC performance and was therefore excluded.
River water quality	The risk associated with this PC is effectively WINEP P-removal scheme delivery risk. There is insufficient data to reliably model the risk of non-delivery for WINEP removal schemes.
Storm overflows	No ex-ante targets were present and therefore cannot be analysed according to the methodology.
Bathing water quality	There is no comparable data equivalent to the proposed required for PC reporting.
GHG emissions (water and wastewater)	Targets are set specific on a company-specific basis. There is no robust method for determining notional company targets and mis-forecasting risk of GHG emissions, which is a key driver of the risk associated with this ODI.
Biodiversity	The PC is based on a novel assessment methodology for biodiversity and therefore does not have an appropriate historical comparator.

The simulation also considers the regulatory mitigations applied to the incentives to limit risk for a notional company. Based on the DDs, the follow were included in the unmitigated notional company simulations reflecting the DD protections:

- Aggregate sharing mechanism: for net reward or penalties that fall between +/-3.0% and +/-5.0% water or wastewater regulated equity a sharing rate of 50% is applied; beyond +/-5.0% water or wastewater regulated equity a sharing rate of 90% is applied. This also includes measures of experience apportioned based on the split of RCV between water and wastewater for a WaSC or entirely to water for a WoC.
- Asset health caps and collars for mains repairs, unplanned outage and sewer collapse a cap and a collar of +/-0.50% apply.
- Compliance risk index deadband set at 1.83 on a glidepath to 1.00 over AMP8 consistent with DDs.
- Water supply interruptions collar set at -1.00%.
- Business demand cap and collar set at +/- 0.50%.

The impacts of mitigations in the DD on ODIs not modelled – caps and collars on Bathing Water Quality, Storm Overflows, and River Water Quality – are not captured as the underlying risk is also omitted.

For a notional WoC, ODI rate calibration resulted in materially higher regulated equity at risk before considering the impact of the caps and collars than for a notional WaSC. This is because the ODI rates published in Ofwat's top-down models were calibrated based on median water company characteristics without separating WaSCs and WoCs.

WoCs have fewer ODIs resulting in greater risk concentration, especially if positive correlations are present.

Correlations are included based on company provided data (performance by month and, where available, region). These data provide greater insight into underlying relationships between PCs which is not visible at an annual aggregated basis. The results for four companies are assessed individually and the results, presented below, take the median of each relationship. Where only one company identified a relationship between two PCs the relationship is not included. The risk of including spurious relationships is mitigated through (1) a materiality threshold of +/-0.15, whereby relationships below this in magnitude were omitted, and (2) confirmation of a logical explanation for observed relationships from operational teams. The relationships identified are listed below with a brief description of the operational explanation:

- **Leakage reductions and customer contacts on water quality; +0.20**
  Where leaks in the network are repaired, this can involve flushing pipes. This displaces sediment in the network and increases the chances of sediment in customer taps. Customer contacts regarding cloudy appearance of drinking water is included the customer contacts on water quality PC.

- **Leakage and mains repair; +0.40**
  By definition, a mains burst results in leakage and would trigger a mains repair and this relationship exhibits a particularly strong correlation. There are a number of common risk drivers that cause bigger leaks like burst mains and smaller leaks throughout the network, for example ground temperature dropping below freezing. When water freezes it expands and can create breaks in the network ranging in size from a smaller pipe to a mains burst. Other extreme weather events like a freeze thaw and named storms are also common risk drivers.

- **Water supply interruptions and mains repair; +0.21**
  A mains burst is a more severe leakage event which can leave the network depleted and customers without water, especially if there is only one main servicing a particular customer. Leakage is not related to water supply interruptions despite a strong relationship with mains repair because leakage is also driven by small leaks in the network which have very little to no impact on supply interruptions.

- **Total pollutions incident and serious pollutions incident; +0.19**
  By definition all serious pollutions incidents are included in the serious pollutions incident PC performance. Serious pollution incidents exclude category 3 pollutions incidents and the majority of the PC performance for total pollutions incidents is driven by category 3 incidents. A small positive correlation therefore tracks with the duplication of the PC performance counting against both PCs while total pollutions includes other incidents.

- **Total pollutions incident and external sewer flooding; +0.18**
  Both PCs are driven by rainfall and the network being overwhelmed. The common risk driver of precipitation explains the small positive relationship.

- **External sewer flooding and internal sewer flooding; +0.55**
  Sewer flooding PCs are both strongly associated with rainfall and wastewater network capacity. This results in a stronger positive relationship as there are common explanatory risk factors.

6.9 Approach to simulating financing risk

Finance risk has five risk drivers considered in this analysis: three inflationary and two non-inflationary. Inflationary risks include CPIH risk on fixed rate debt, RPI-CPIH wedge risk on embedded RPI-linked debt, CPI-CPIH wedge risk on embedded and new CPI-linked debt. Non-inflationary risk includes real interest rate risk on embedded and new debt.

Inflationary risk

CPIH variation is simulated based on variation of outturn CPIH to the long-term 2.00% assumption included in the calculation of real allowances for debt. Where CPIH deviates from the long-term assumption, the notional company is exposed to variation in nominal allowances received to cover nominal fixed rate debt costs. The DD considers CPIH risk based on a +/-1.00% shock to the long-term assumption. Historical observed variations in inflation imply this range of outcomes does not sufficiently reflect forward looking risk.

The methodology considers historical variation in CPIH inflation index since 2015 separated into two time periods based on an observed structural break. The first time period is March 2015 – November 2021 and was characterised by lower than target inflation. The second period was November 2021 – July 2023 and was characterised by higher than target inflation. CPIH is impacted by a multitude of macroeconomic factors, and therefore has historically had periods of lower volatility and higher volatility dependent on domestic and global events. It is therefore important to consider separate “low volatility” and “high volatility” scenarios – without this separation the variation and thus risk may be overstated.

Using empirically observed CPIH volatility, P10, P50 and P90 observations (worst-case, base-case and best-case in the analysis) is translated into RoRE using Ofwat’s approach and the notional company capital structured defined previously:

$$Inflation\ variation\ \times Proportion\ of\ ILD\ \times \left(\frac{Notional\ Gearing}{1 - Notional\ Gearing}\right) \times (1 - Tax\ rate)$$

The basis risk on index-linked debt is simulated based on data going back to April 2000 to July 2023 for CPIH, RPI and CPI using time series analysis. The observed wedges for RPI-CPIH and CPI-CPIH are then calculated on the results on the AMP8 time series simulated. To maintain consistency with the observed empirical dataset in terms of the relationships between CPIH and the two calculated wedges, the correlations below were included:

- CPIH inflation risk and RPI-CPIH wedge risk; +0.33
- CPIH inflation risk and CPI-CPIH wedge risk; +0.69
- RPI-CPIH wed risk and CPI-CPIH wedge risk; +0.35

Non-inflationary risks

Real interest rate risk for new debt risk was simulated based on the empirical sector debt issuances in AMP7 up to August 2023 compared to the iBoxx A/BBB non-financials 10+ years index average. The resulting observed P10, P50 and P90 observations (worst-case, base-case and best-case in the analysis) are used to simulate performance in AMP8. The results are translated into RoRE based on the notional company capital structure defined in Appendix 6.1 - Notional company specification and calibration.

Real interest rate risk on embedded debt was simulated based on the empirical sector embedded cost compared to how Ofwat determines the allowance. Deviation of an efficient notional company’s cost of financing from allowances can occur for a number of reasons including timing of issuance, frequency, treasury policy. The resulting observed P10, P50 and P90 observations (worst-case, base-case and best-case in the analysis) are used to simulate performance in AMP8. The results are translated into RoRE based on the notional company capital structured defined in Appendix 6.1 - Notional company specification and calibration.

For simplicity, simulation of financing risk does not differentiate between the notional WaSC and WoC. This means that the simulation does not consider the unique circumstances of individual WoCs, for example whether, as a small company issuing below benchmark size debt or an infrequent issuer that issues benchmark size debt. These would be expected to increase the financing risk for a WoC with these characteristics and should be considered on a company specific basis.

6.10 Infrastructure projects database

The projects in the KPMG infrastructure project database are summarised by the following attributes: country, sector, complexity, £m budgeted cost at initial planning, planned duration. As the planned enhancement for PR24 is at the initial stage, only those projects where initial budget data was available are included. Project costs are translated into GBP and adjusted using the World Bank's purchasing power parity conversion factor to allow comparison at a 31 December 2022 GBP equivalent position.

The below tables summarise the attributes of the projects in the database used in the Phase 1 work.

Table 2726: Summary of the third-party project database

Country	Project count
UK	31
US	5
Australia	4
Germany	4
Hong Kong	3
Sweden	2
Netherlands	2
Japan	2
France	2
Greece	1
Ireland	1

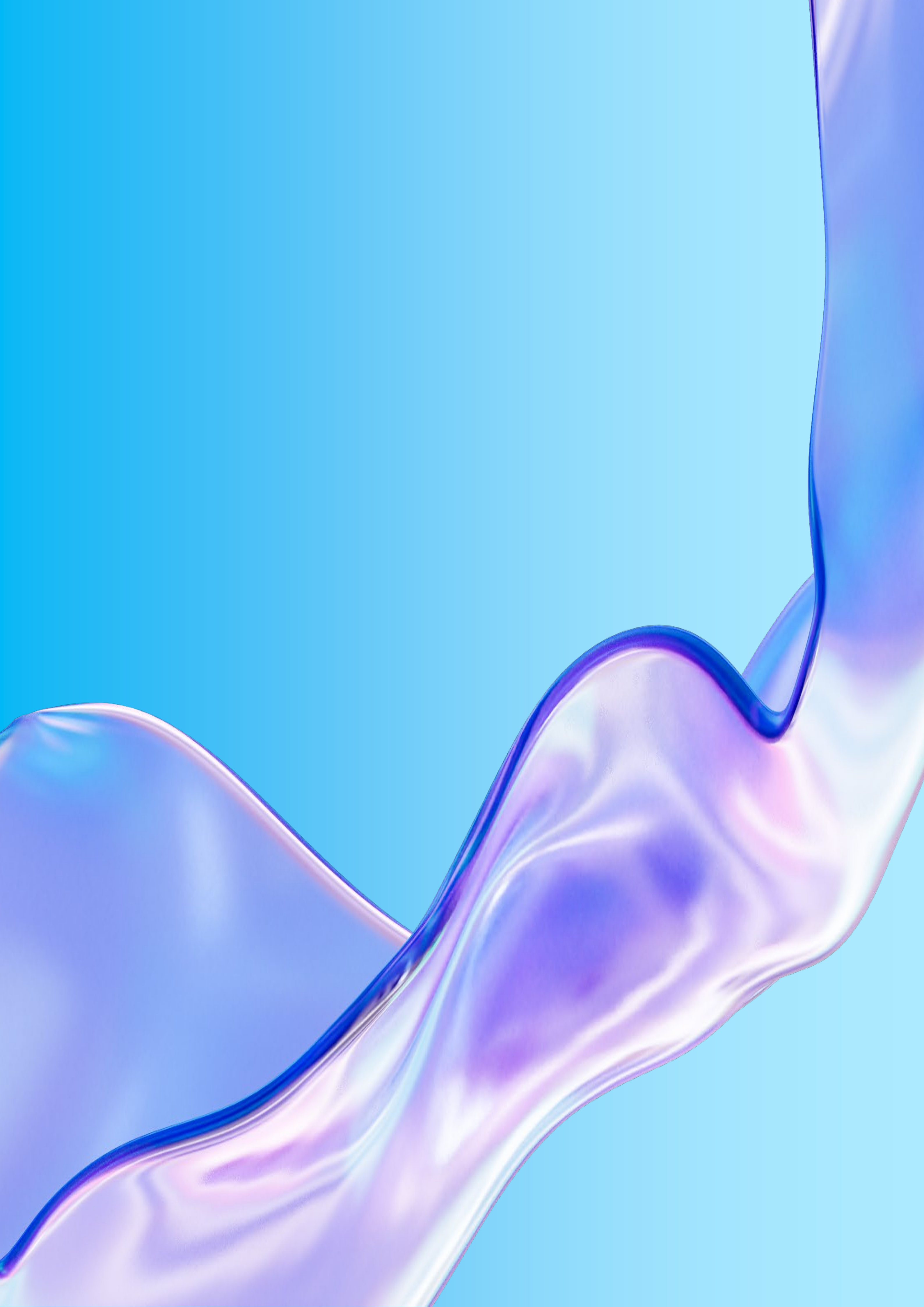
Sector	Project count
Rail	19
Water / Wastewater	12
Road	8
Social	6
Aviation	4
Energy	2
Transport	2
Rail and road	1
Healthcare	1
Education	1
Industrial	1

Complexity	Project count
1.0 - 2.0	16
2.0 - 3.0	11
3.0 - 4.0	1
4.0 - 5.0	21
5	8

Initial Budget	Project count
< £25m	14
£25m - £100m	12
£100m - £250	6
£250 - £500	6
£500+	19

Planned Duration	Project count
< 6 months	1
0.5 - 2 years	11
2 - 4 years	22
4 – 6 years	16
6+ years	7

Source: KPMG infrastructure project database



Annex 5 – EI Report on Appropriate level of notional gearing in water

APPROPRIATE LEVEL OF NOTIONAL GEARING IN THE WATER INDUSTRY

A report for Wessex Water

PR24 Draft Determination Representations | 22 August 2024

In its PR24 Draft Determinations, Ofwat has confirmed its intention to lower notional gearing to 55%, as an indication of the efficient capital structure in the water industry. This note, prepared to support Wessex Water's representations, summarises: (i) a review of the literature on the existence of efficient capital structures; and (ii) the results of our econometric analysis which provides a more robust basis to help Ofwat identify the efficient level of notional gearing in the water industry. Our analysis indicates that the efficient level of notional gearing for an average water company is around 66%.

1 Context

In its PR24 Draft Determinations (DDs), Ofwat has confirmed its intention to lower notional gearing to 55% at PR24,[1] relative to 60% at PR19[2] and 62.5% at PR14.[3] The regulator has made various statements that suggest it sees notional gearing as both a 'signalling mechanism' to encourage more equity into the industry; and that it is now viewing (at least to some degree) notional gearing as being an indication of efficient capital structure.

> *"The notional gearing level is an important signal to companies and investors about the prudent level of risk within capital structures, reflecting that companies need to raise significant amounts of finance to meet their obligations and deliver their investment programmes"*[4] [emphasis added].

> *"It [notional gearing] sets out a view about the prudent level of risk within the capital structure, reflecting that companies need to... deliver their investment programmes, and these investments should be financed efficiently"*[5] *[emphasis added].*

[1] *'PR24 draft determinations: Aligning risk and return appendix.' Ofwat (July 2024); page 15.*
[2] *'PR24 draft determinations: Aligning risk and return appendix.' Ofwat (July 2024); page 15.*
[3] *'PR14 Review.' Ofwat (January 2022); page 68.*
[4] *'PR24 draft determinations: Aligning risk and return appendix.' Ofwat (July 2024); page 23.*
[5] *'PR24 draft determinations: Aligning risk and return.' Ofwat (July 2024); page 14.*

Related to the above, when undertaking its financeability assessment, Ofwat's approach has been to assume 'equity solutions', once gearing reaches 57.5%, through reduced dividend yields and new equity injections.

2 Overview of relevant theory on efficient capital structures

The seminal Modigliani-Miller theorem (1958)[6] sets out the conditions under which the value and weighted average cost of capital (WACC) of a firm are unaffected by its capital structure. These conditions are that:

- capital markets are perfectly efficient;
- there are zero taxes;
- there are zero bankruptcy costs; and
- there are zero agency costs.

The intuition for the theorem is that equity and debt investors are able to buy and sell bonds and stocks freely, such that any difference in value between two firms (identical in all respects save for capital structure) would be arbitraged away, leaving overall firm value unaffected by capital structure. The above conditions are required for arbitrage to eliminate differences in firm value in full.

However, because the above conditions do not apply in the real world, finance theory tells us that *strict* capital structure / value neutrality does not hold. A range of alternative theories have thus developed to provide a basis for companies' actual choices over capital structures, which we summarise below.

- Trade-off theory proposes that firms have a single optimal capital structure, where the WACC is minimised (Fama & French, 2002)[7].
- Signalling theory is based on the notion that firms use gearing as a positive signal to the market (Ross, 1977)[8].
- Pecking order theory suggests that firms follow an established hierarchy when raising finance, reflecting the relative costs associated with debt and equity (Myers, 1984)[9].
- Market timing theory indicates that managers' decisions over whether to issue debt or equity are determined by a motivation to exploit fluctuations in market prices over time (Baker and Wurgler, 2002)[10].

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6 *'The cost of capital, corporation finance and the theory of investment'. Miller, M., & Modigliani, F. The American Economic Review (1958); pages 261-297.*

7 *'Testing trade-off and pecking order predictions about dividends and debt.' Fama, E., & French, K. (2002). The Review of Financial Studies, 15(1), (2002); pages 1-33.*

8 *'The Determination of Financial Structure: The Incentive-Signalling Approach.' Ross, S. A. The Bell Journal of Economics, 8(1), (1970); pages 23-40.*

9 *'The capital structure puzzle.' Myers, S. The Journal of Finance, 39(3), (1984); pages 574-592.*

10 *'Market Timing and Capital Structure.' Malcolm Baker and Jeffrey Wurgler. Journal of Finance (2002).*

Furthermore, there is extensive empirical evidence both that efficient capital structures exist and that they differ across industries. Kayo and Kimura (2011) summarise the relevant academic literature as *"suggest[ing] the existence of an optimal level of leverage."*[11] At a high level, the literature indicates differential efficient gearing across industries, with studies identifying systematic variation in gearing across industries alongside robust explanatory variables for that variation.

Our own comparative analysis of gearing across industries in the UK, based on the same dataset as we use for our econometric analysis described below, shows that there are material and systematic differences in gearing across industries and within industries.[12]

3 Our assessment of the efficient level of notional gearing for water

3A. Overview of our approach

Our approach to deriving econometric models for identifying efficient gearing is based on our literature review, as outlined above. We start with a generalised model specification, incorporating the range of factors identified in our literature review, before focusing on a more parsimonious model. It is important for a regression model to be parsimonious (and ideally should neither overfit, nor underfit, the dataset). As such, the model should only include explanatory variables that contribute sufficient explanatory power to the specification. Having established a generalised model founded on *all* the potential drivers identified in capital structure literature, we therefore derive a specialised regression model. This removes variables that are not statistically significant in our generalised model, and thus are unlikely to have any strong explanatory power, in addition to those that lack intuitive justification.

3B. Our generalised and specific models

Our analysis uses data from the Fame database, which provides financial data on companies within the UK. We used data from the 10-year period 2013-2023 and removed all observations with missing values for any of the variables. We truncated relevant variables,[13] and removed outliers by excluding the 2% extremes of financial ratios.[14] The resulting dataset has 104,119 observations across 20,130 companies. Here we measure gearing as the ratio of net debt to capital employed.

Our models perform well overall:

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11 '<u>Hierarchical determinants of capital structure.</u>' Kayo and Kimura. Journal of Banking & Finance (2011).

12 This holds for each of our three alternative measures of gearing: (i) total debt / capital employed; (ii) net debt / capital employed (which aligns with the calculation of gearing for regulatory purposes in the water sector); and (iii) long-term debt / capital employed.

13 We remove any observations with capital intensity or deprecation rate below 0%, or asset tangibility above 100%, on the basis that these may be data entry errors. Where gearing is below 0%, we set gearing to 0%.

14 Asset tangibility; capital intensity; profitability; liquidity; and gearing. For variables without an upper or lower bound, we remove 1% in each tail. For truncated variables, we remove 2% on each tail.

- The variables analysed generally have a statistically significant relationship with the level of gearing.
- The explanatory variables generally have the expected signs. Capital intensity; asset tangibility; asset life; corporation tax; and the dummy for large firms are all found to be *positively* correlated with gearing, as expected under theory. Profitability; liquidity; firm age; the dummy for small firms and the pandemic years, are all found to be *negatively* correlated with gearing. These are all in line with expectations, based on our literature review.
- The model's R^2 is 0.41, meaning that the variables explain 41% of the variation in gearing. This indicates that the model has a high level of explanatory power.

3C. Predicting efficient capital structures in the UK water industry

Our regression model can be used to predict the efficient level of gearing for the water sector in the UK. Because the model takes into account the relationship between gearing and the underlying drivers of companies' capital structure choices across the economy, it can provide an estimate of the efficient level of gearing in the water sector (that does not solely rely on observing water companies' actual gearing choices).

This analysis indicates a range for an average UK water company's efficient level of gearing being between 58% and 70%, with a point estimate of 66%. For so long as the regulatory method is based on applying a 'single' gearing level for all water companies, this range may be considered a good indication for the notional (efficient) gearing for use in the WACC and under financeability assessment.

Annex 6 – EI Report on Asset Growth and Systematic Risk

AUGUST 2024

IMPACT OF CAPITAL INVESTMENT ON SYSTEMATIC RISK

REPORT FOR AFFINITY WATER AND WESSEX WATER

Commercially confidential

CONTENTS

EXECUTIVE SUMMARY

THE LEVEL OF SYSTEMATIC RISK AT PR24 WILL BE HIGHER THAN IN THE PAST, DUE TO A MATERIAL INCREASE IN CAPITAL INVESTMENT (RELATIVE TO HISOTIRCAL LEVELS). THE RETURN FOR INVESTORS IS, HOWEVER, CALCULATED USING BACKWARDS-LOOKING DATA.

The need for a fair rate of return for investors

- Providing equity investors with a fair rate of return, commensurate with the level of systematic risk in the sector, is a cornerstone of Ofwat's financeability duty (and is also critical to the consumer duty).
- Without a fair rate of return, the sector will not attract the significant new equity investment required at PR24.

The changing nature of companies' activities

- Companies are materially increasing capital investment at PR24. This is to: respond to statutory requirements; meet customer needs; and address historical underfunding.
- The increase in investment is associated with a change in the mix of activities undertaken by companies (including increased asset construction). This results in an increase in systematic risk exposure.

The backwards-looking nature of beta analysis

- Equity investors are compensated for the level of systematic risk they face through the beta parameter in the capital asset pricing model (CAPM).
- The methodology for estimating beta focuses on backwards-looking analysis of historical data on share price volatility.

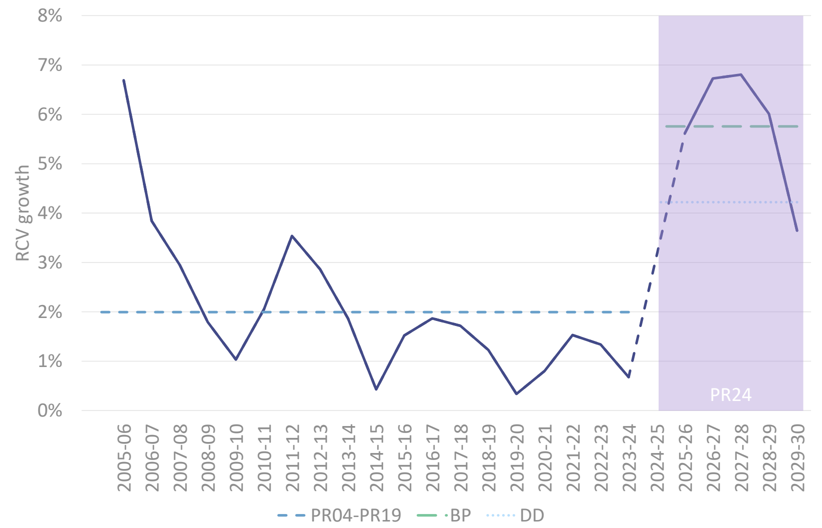
There is a need to ensure the view of systematic risk at PR24 is forward-looking.

PR24 WILL SEE ASSET GROWTH AT A HIGHER RATE THAN IN THE RECENT PAST.

- At PR24, water companies propose capital programmes that are materially different from the past. Both the type and the scale of capital investment will change significantly, as companies aim to improve their environmental performance.
- While *both* the type and scale of capital investment may affect the level of systematic risk companies face, this report is concerned with the effect of scale alone.
- The adjacent figure shows RCV growth since 2005-06. This is calculated as the percentage movement in RCV in each year, from opening RCV (including indexation) to closing RCV.
- Water companies' proposed RCV growth at PR24 represents a step change that is unprecedented in recent history.
  - From PR04 to PR19, RCV growth across the industry was on average 2.0% (and lower in PR14 and PR19).
  - Industry RCV growth in company business plans is on average 5.8% across PR24 (shown as BP in the adjacent graph) and is 4.2% in draft determinations, (DD in the adjacent graph).

Estimating beta solely using backwards-looking historical data *may* have been appropriate in previous price controls, but it is not sufficient to rely on at PR24.

Figure 1: Industry RCV growth since PR04 vs PR24 business plans



Source: Economic Insight analysis of Ofwat data and PR24 business plan data tables

WE DEVELOP A FORWARD-LOOKING VIEW BY ISOLATING THE EFFECT OF CAPITAL INVESTMENT (ASSET GROWTH) ON SYSTEMATIC RISK.

Econometric beta analysis

- **Fundamental beta analysis** isolates the effects of different sources of risk on companies' overall systematic risk, as measured by beta.
- In particular, it can measure the relationship between asset growth and the level of systematic risk.
- This estimation approach therefore addresses Ofwat's concerns regarding comparator methods for quantifying a beta adjustment.

Asset growth increases systematic risk

- We find **a significant positive relationship between asset growth rates and bet**a in FTSE 100/350 companies.
- Our results suggest that an increase in asset growth of 1 percentage point is associated with an increase in beta of close to 0.01.

A forward-looking view of beta

- This estimate of the relationship between asset growth rates and beta allows us to quantify the expected increase in systematic risk at PR24, based on companies' planned RCV growth.
- **This analysis implies an increase in asset beta of 0.019–0.033** above the level implied by historical data.

BACKGROUND AND CONTEXT

OFWAT'S FINANCEABILITY DUTY REQUIRES IT TO ENSURE THAT EFFICIENT COMPANIES CAN SECURE REASONABLE RETURNS ON THEIR CAPITAL, WHICH INCLUDES SETTING AN APPROPRIATE COST OF EQUITY AND, RELATEDLY, BETA.

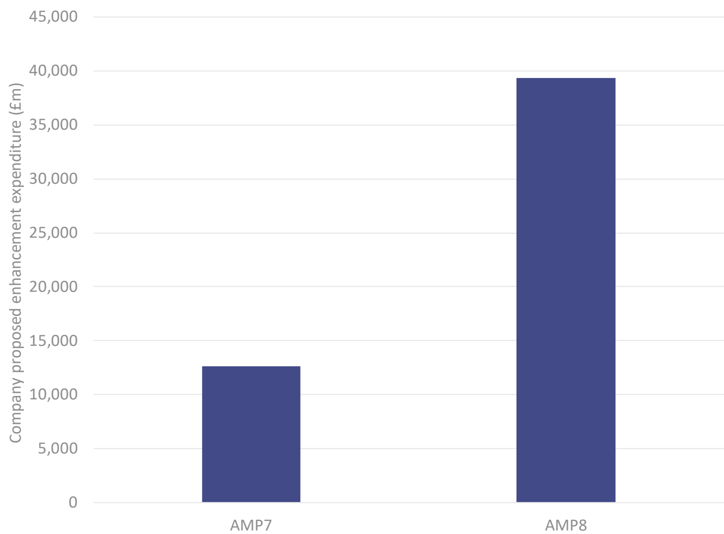
- Financeability duties require regulators to ensure that efficient regulated companies can attract and retain the investment required to run capital-intensive businesses. Under the Water Industry Act 1991, Ofwat has a statutory duty to *"secure that [water companies] are able (in particular, by securing reasonable returns on their capital) to finance the proper carrying out of [their statutory] functions"*.*
- Relatedly, Ofwat has a statutory duty to protect the interests of consumers. To meet consumer needs in the long run, sufficient investment in water infrastructure is critical, which in turn requires efficient companies to be able to attract and retain equity.
- The ability of companies to secure a reasonable return on capital is crucial to their ability to attract and retain equity investment, as well as their ability to service their debt. Furthermore, the allowed cost of equity is an important input to determining companies' revenue allowances.
- The role of equity in companies' capital structure is to bear the brunt of the risk that companies face. This includes both: (i) idiosyncratic risk, which is company-specific and which investors can mitigate by holding a balanced portfolio; alongside (ii) systematic risk, which is non-diversifiable because it is correlated with other risks across the economy.
- For companies to be able to attract and retain equity, equity investors must be able to earn a return that is commensurate with the level of systematic risk. In setting the allowed cost of equity, systematic risk is accounted for in the parameter beta, with a higher beta indicating higher systematic risk - and therefore, a higher allowance for equity costs.
- It follows that determining an appropriate level for beta is itself a critical step in ensuring the financeability and consumer duties are met.

**'Water Industry Act.'* *(1991); Section 2.*

A STRIKING FEATURE OF COMPANY PLANS AT PR24 IS THE LARGE INCREASE IN PROPOSED EXPENDITURE AND, WITHIN THAT, CAPITAL INVESTMENT.

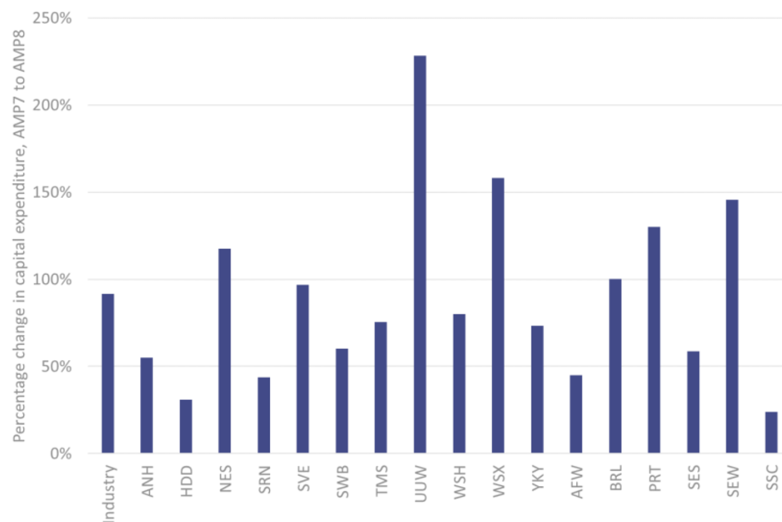
Companies' business plans include material increases in totex at PR24, relative to AMP7. While higher maintenance expenditure accounts for a material amount, the most significant portion comprises higher enhancement expenditure, with most companies proposing large increases compared to PR19. **As a consequence, the sector will see significant asset growth over the period, with potentially important implications for the level of systematic risk that companies in the sector face.**

Figure 2: Business plan enhancement expenditure in AMP8 vs AMP7 (whole industry)



Source: Economic Insight analysis of PR24 business plans

Figure 3: Percentage change in capital expenditure in AMP8 vs AMP7

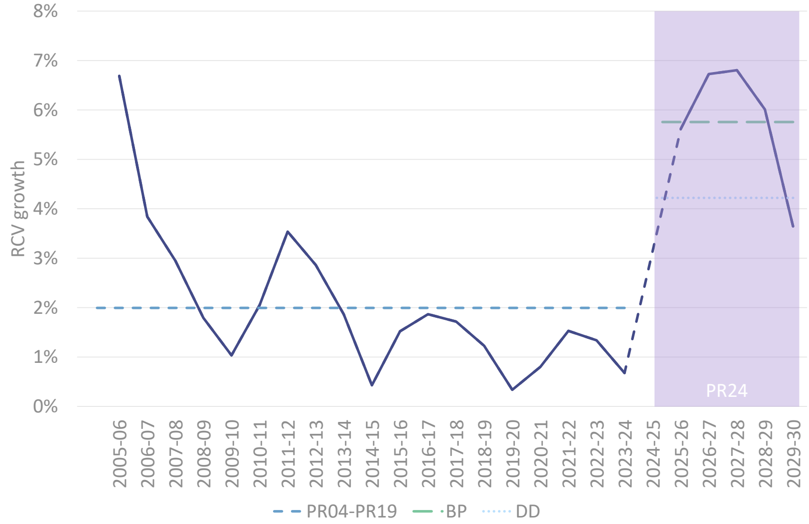


Source: Economic Insight analysis of PR24 business plans
Note: Figures to 2023/24 are actual expenditure; figures from 2024/25 to 2029/30 are forecast efficient expenditure

THE LARGE INCREASE IN CAPITAL EXPENDITURE IS REFLECTED IN SIGNIFICANT ASSET GROWTH, WITH RCV's PROJECTED TO RISE SIGNIFICANTLY RELATIVE TO HISTORICAL PATTERNS.

- The adjacent figure shows industry percentage RCV growth (real) from 2005–06 to 2022–23, and *projected* RCV growth (as per companies' business plans) over 2025–26 to 2029–30.
- Real RCV growth is calculated as the percentage change in RCV in each year, from opening RCV (including indexation) to closing RCV. It therefore reflects the net impact of RCV additions and depreciation / RCV run off in each year.
- RCV growth planned at PR24, at 5.8% in company business plans (and 4.2% in draft determinations), is substantially higher than at any point in PR14 or PR09. From PR04 to PR19, RCV growth across the industry was, on average, 2.0% (and lower in PR14 and PR19). Indeed, it has only been at a comparable level to PR24 business plan levels during a single year of PR04 (2005-06).

Figure 4: Industry RCV growth since PR04 vs PR24 business plans (real)



Source: Economic Insight analysis of Ofwat data and PR24 business plan data tables

THEORY AND PREVIOUS EMPIRICAL STUDIES SUGGEST THAT LARGE INCREASES IN CAPITAL INVESTMENT (ASSET GROWTH) MAY BE ASSOCIATED WITH HIGHER SYSTEMATIC RISK.

- The primary purpose of this report is to provide a *quantitative assessment* of the relationship between increases in capital investment and beta. As such, we do not consider the theoretical basis for a relationship between capital investment and systematic risk in detail here.
- Nonetheless, briefly, we note that theory and prior empirical studies identify two main reasons why systematic risk may increase with greater capex.
  - First, because the increase in investment is likely to be associated with **a change in the mix of activities being undertaken.** Some activities are exposed to higher systematic risk than others. If the mix that a firm undertakes varies to include a greater proportion of such activities, then the firms' overall systematic risk exposure rises. In practice, the main relevant change in mix at PR24 is likely to be a material increase in higher-risk asset construction and asset maintenance activities, relative to historical levels.
  - Second, being a fixed cost, an increase in capital investment tends **to increase a firms' operating leverage** (the ratio of fixed to variable costs) if it is not matched by a similar increase in variable costs. A higher proportion of fixed costs makes a company's returns more volatile, because its profit will vary more with volumes than they otherwise would (even if all other drivers of systematic risk are identical). For example, holding all else equal in response to a decrease in volume (and, in turn, revenue), a company with a high proportion of fixed costs will not be able to reduce its costs as much as a company for which fixed costs are less significant.

THE BACKWARDS-LOOKING NATURE OF BETA ESTIMATION RISKS OMITTING THE IMPACT OF INCREASED CAPEX AND OFWAT IS NOT CURRENTLY MINDED TO MAKE AN ADJUSTMENT TO ITS APPROACH.

- When estimating betas for regulatory price setting purposes, it is standard practice to estimate them over historical time periods on a backwards-looking basis.
- This is for good reasons, including that:
  - it is conducive to regulatory stability and predictability;
  - it is transparent and, being based on observable data, removes a degree of subjectivity that arises if one departs from a historical estimation method; and
  - one would expect historical betas, to some degree, to reflect investors' expectation of forward-looking risk (the extent to which this holds may depend in part on the beta estimation window).
- The drawback of a strictly historical approach to beta estimation, however, is that it is unlikely to fully reflect any material change in systematic risk that will arise on a forward-looking basis.

- In its PR24 DDs, Ofwat recognised the principle that the large-scale increase in capital investment (and related change in mix of activities) may increase systematic risk, stating: *"a mix of more complex and uncertain activities for PR24 could potentially increase systematic risk".**
- However, at this time Ofwat is minded to retain its historical approach to beta estimation and not to make an adjustment for forward-looking risk. This is for three main reasons:
  - Firstly, whilst accepting the 'in principle' point that higher capex may increase systematic risk, Ofwat was **not convinced that the relevant theory applies in the case of the water sector** (effectively because the regulatory framework itself shields companies from the identified risks).
  - Secondly, because Ofwat was **not satisfied that any of the evidence presented by companies to quantify the impact on beta was sufficiently robust** to warrant an adjustment.
  - Thirdly, Ofwat was concerned that an adjustment would **set a precedent,** whereby it would also be required to consider downwards adjustments to beta if capital intensity or complexity are lower in future price controls.

**'PR24 draft determinations. Aligning risk and return – Allowed return appendix.' Ofwat (July 2024); page 41.*

WE CONSIDER OFWAT'S REASONING VALID, AND SO IN THIS REPORT, FOCUS ON DEVELOPING ALTERNATIVE EMPIRICAL ANALYSIS OF THE IMPACT OF INCREASED INVESETMENT ON BETA.

- In our view, there is some validity to all three of Ofwat's reasons for not making a forward-looking adjustment to beta in its DDs. In practice, we think a more nuanced consideration of the theory and evidence would be beneficial for the final determinations.
- On Ofwat's first point (applicability of theory), we agree it is important to consider what systematic risks water companies are likely exposed to in reality, given how the regulatory model functions. However, whilst we consider the regulatory model *mitigates* some of the relevant sources of systematic risk arising from an increase in investment, *they do not remove it* (and in some instances, any mitigation effect is likely modest). Thus, in our view, water companies *are* exposed to higher systematic risk arising from both: (i) greater and more varied construction activity; and (ii) higher operational leverage. Relatedly, we therefore think it an overstatement to suggest that there is either:
  - on one hand, <u>no</u> (or a very limited) increase in systematic risk arising from these factors at PR24; or
  - on the other hand, that water companies are <u>fully exposed</u> to these risks.
- In the Annex to this report, we expand on our reasoning and evidence as to how (and to what extent) the regulatory regime impacts systematic risk exposure in practice.
- On Ofwat's second point, we also agree that there are limitations with the empirical evidence and analysis presented by companies to date. Indeed, the primary purpose of this paper is to address this concern by developing an alternative empirical method that is CAPM-consistent. That said, we note that no method is perfect and (as with beta estimation itself) all are subject to measurement error. Thus, the weight one attaches to this concern should be considered in the context of the consequences of failing to address the 'in principle' point and the impact of that on customers. In the subsequent slides, we expand on Ofwat's concerns regarding the existing empirical methods and share our own observations on them.
- Finally, on Ofwat's third point, we also agree that applying a forward-looking adjustment may raise the prospect of having to consider the issue at future price controls (i.e. making downward adjustments when capital intensity falls). However, in practice, we think this depends on the extent to which the increase in investment at PR24 reflects: (i) reoccurring factors that cause investment to fluctuate across price controls; and / or (ii) a one-off adjustment to correct for historical underinvestment / meet new requirements. In our view, the key point is to carefully consider this distinction, so as to avoid: (a) <u>overstating</u> any uplift to beta; or (b) setting a <u>precedent</u> that (rightly) concerns Ofwat. We discuss this issue further when presenting our results.

EMPIRICAL ANALYSIS PROVIDED BY COMPANIES TO DATE HAS (MAINLY) FOCUSED ON HOW COMPARATOR COMPANIES MIGHT INFORM AN ADJUSTMENT TO BETA AT PR24.

- Companies, and their advisors, provided a range of empirical analyses to Ofwat as part of their PR24 Business Plan submissions, seeking to quantify the impact of increased capital investment on systematic risk (including quantifying a beta adjustment). Most of these methods (but not all) were a form of 'comparator' analysis, whereby companies sought to: (a) identify comparators that undertook a 'higher mix' of investment / construction; and then (b) draw inferences as to the beta uplift from those. The main evidence provided to Ofwat was as follows:

- KPMG identified National Grid's regulated gas and electricity business as a potential comparator. KPMG made the point that National Grid (NG) had seen RAV growth in the past (2014-21) that was more reflective of water companies' plans for AMP8. KPMG estimated an unlevered beta of 0.36 for NG, which is higher than KPMG's backwards-looking estimate for listed water companies (0.32) over the same period. KPMG therefore advocated placing 'some' weight on the NG beta, recommending: *"a beta based on a weighted portfolio of water companies and NG may be the minimum required to appropriately price this forward-looking systematic risk exposure given that the scale of investment."**

- KPMG also provided evidence on betas from the construction sector, commenting that: *"The requirements and challenges of these firms in delivering infrastructure projects could closely align with those faced by water companies."*
  - Focusing on construction firms specialising in infrastructure investment, for 2010-2020, KPMG estimated an unlevered beta of 0.62.
  - KPMG then calculated a weighted average of a 'pure play' business as usual water beta, and the (higher) construction beta (with the weight for construction based on net RCV arising from enhancement spend). This gave a beta of 0.33. KPMG suggests this analysis is best used as a 'cross check'.**

**'Estimating the Cost of Equity for PR24.' KPMG (2023); pages 94–95.*
***'Estimating the Cost of Equity for PR24.' KPMG (2023); pages. 96–97.*

WHILE EVIDENCE FROM WIDER COMPARATORS MAY HELP INFORM FORWARD-LOOKING RISK, WE AGREE WITH OFWAT THAT IT ALSO HAS LIMITATIONS.

- Evidence from wider (non-pure-play water) comparators *may* be a helpful way to inform us as to how forward-looking risk may differ from the past. It might, therefore, be a useful method for considering the potential need for, and extent of, a beta adjustment at PR24 to reflect the large increase in capital programmes. However, we agree with Ofwat that this evidence has some limitations.
- In its DD's, Ofwat's main reason for not relying on this evidence was that: *"placing weight on non pure-play water stocks is… liable to introduce beta risk from completely unrelated sources (e.g. differences in regulatory framework)".** Similarly, Ofwat also states: *"differences in risk are not limited to capex intensity, so placing weight on these betas could result in investors being compensated for risks (such as demand risk for construction companies) which are almost non-existent in the water sector". ***
- Specifically in relation to NG, Ofwat notes the company: *"is governed by a different regulatory framework, has non-network (e.g. generation) activities within its portfolio, and has material US operations".**** In relation to construction companies, Ofwat does not think this is a *"reliable way of capturing any potential risk from the PR24 capex programme".*****
- We agree with the central thrust of Ofwat's concern. Namely, when one draws on comparators to inform in impact of an increase in capex-related systematic risk, one cannot know to what extent differences in beta across said comparators arise due to capital intensity or other factors, which are not relevant to the primary issue (capital programmes) of concern at PR24.
- With the above issue in mind, the primary aim of this report is to provide additional empirical evidence, using a method that: (a) isolates the impact of investment on systematic risk, so as to address the 'pollutant' limitation of comparator methods; and (b) is consistent with retaining the CAPM.

**'PR24 draft determinations. Aligning risk and return – Allowed return appendix.' Ofwat (July 2024); page 40.*
***'PR24 draft determinations. Aligning risk and return – Allowed return appendix.' Ofwat (July 2024); page 47.*
****'PR24 draft determinations. Aligning risk and return – Allowed return appendix.' Ofwat (July 2024); page 50.*
*****'PR24 draft determinations. Aligning risk and return – Allowed return appendix.' Ofwat (July 2024); page 50.*

AN EMPIRICAL METHOD TO ISOLATE THE IMPACT OF CAPEX ON SYSTEMATIC RISK

TO ADDRESS THE LIMITATIONS OF COMPARATOR APPROACHES, WE HAVE DEVELOPED AN ALTERNATIVE METHOD, WHICH USES ECONOMETRICS TO ISOLATE THE IMPACT OF AN INCREASE IN CAPEX ON BETA.

- We have developed a methodology for adjusting backwards-looking historical (water company) beta estimates, using an econometric method that addresses the limitations of comparator approaches.
- Our method takes as its starting point pure-play water company betas, using historical data (thus, going with the grain of existing regulatory methods).
- We then undertake an econometric analysis, whereby for a cross section of FTSE 100/350 companies, we regress their betas against variables relating to alternative sources of systematic risk. These include a variable to reflect differences in capex (in practice, we use asset growth), but also a range of controls, intended to ‘strip out’ other factors affecting differences in systematic risk across firms (thus, addressing the ‘pollutant’ concern that arises when using comparator methods).
- We then take our pure-play historical water beta and adjust it to reflect the estimated beta impact of increased asset growth, as established in our econometrics.

Start from backwards-looking pure play water company beta, using historical data

↓

Identify main sources of differences in systematic risk across industries

↓

Use econometric analysis to identify the impact of each factor on beta (separately isolating the impact of asset growth)

↓

Combine historical water beta with econometric analysis to generate a forward-looking beta that only captures the impact of the PR24 capital programme

ECONOMETRIC ANALYSIS OF THE SOURCES OF RISK CAN OVERCOME SOME OF THE LIMITATIONS OF COMPARATOR APPROACHES.

In our view, our econometric methodology has three main advantages, relative to the comparator approach.

- **The method can disentangle the effects of (i) the underlying driver of risk that is expected to change – asset growth – and (ii) other sources of risk that may differ between water companies and wider comparators.** This ensures that the adjustment applied to historical pure-play water company betas is a fair reflection of the expected change in systematic risk in the water industry (due to the capital programme) and is not distorted by potentially unobserved (and irrelevant) differences in the characteristics or activities of the comparators.

- **The method can be applied even where good comparators are difficult to find.** As outlined in the previous point, the method strips out the effect of differences in companies' activities other than the source of risk in question. Consequently, it does not rely on finding a comparator with a risk profile that is similar to the water industry's in every other respect. Instead, the method offers a way to take into account valuable evidence from the wider economy that would be overlooked by a comparator approach.

- **The method is consistent with using the CAPM to set the allowed cost of equity.** Limitations of the CAPM in setting the allowed return on equity are increasingly recognised. Consequently, there has been some debate as to whether alternative methods (including using multi-factor models) might be preferable. In some cases, such alternative methods may themselves address some of the issues discussed in this report (e.g. multi-factor models can, by definition, 'factor in' multiple drivers of risk). However, the method we propose here allows one to set aside the wider debate as to the relative merits (or otherwise) of the CAPM. Put simply, it allows Ofwat to retain the existing CAPM approach, whilst also addressing the important consideration of whether, and to what extent, the capital programme may affect systematic risk over PR24.

ECONOMETRIC ANALYSIS OF THE RELATIONSHIP BETWEEN BETA AND FUNDAMENTAL SOURCES OF RISK.

- The type of analysis we have undertaken is referred to as **'fundamental beta analysis',** as it relates beta to underlying economic fundamentals. That is, the analysis isolates the effects of fundamental sources of risk – such as asset growth – on companies' overall systematic risk (as measured by beta).
- Our starting point is a model with the following form, where i is an individual company and t denotes a time period covering five years:

$$\beta_{i,t} = \alpha_i + \gamma \times \text{asset growth}_{i,t} + \delta \times \text{controls}_{i,t} + \varepsilon_{i,t}.$$

- There is significant variation in companies' systematic risk levels, and the underlying drivers thereof are difficult to measure. The control variables included in the model are therefore unlikely to account for all of the differences in beta across companies that are not attributable to asset growth. To remove the confounding effect of any remaining unobserved heterogeneity that is not captured by the control variables, we use a first-difference approach.
- Taking first differences yields:

$$\Delta\,\beta_{i,t} = \gamma \times \Delta \text{ asset growth}_{i,t} + \delta \times \Delta \text{ controls}_{i,t} + \epsilon_{i,t},$$

where $\Delta\, x_{i,t} = (x_{i,t} - x_{i,t-1})$ and $\epsilon_{i,t} = (\varepsilon_{i,t} - \varepsilon_{i,t-1})$.

- To measure the dependent variable in this model, we first estimate equity betas by regressing a company's daily total returns on the market index's daily total returns over the relevant five-year period. We then de-lever this estimate, using enterprise value (EV) gearing to arrive at unlevered betas:

$$\text{unlevered } \beta_{i,t} = (1 - \text{EV gearing}_{i,t}) \times \text{equity } \beta_{i,t}.$$

- Asset growth is measured as the geometric mean of the company's nominal annual asset growth rate over the relevant five-year period.
- We estimate this first-difference model using OLS with robust standard errors clustered on companies.

WE INCLUDE A RANGE OF CONTROLS BASED ON ACCOUNTING METRICS IDENTIFIED IN THE ECONOMICS LITERATURE AS BEING RELEVANT DRIVERS (OR PROXIES FOR DRIVERS) OF SYSTEMATIC RISK.

- Our approach to selecting appropriate control variables is informed by the academic literature. We include measures of dividend payout, liquidity, asset size and earnings variability, in line with those proposed by Beaver, Kettler & Scholes (1970).
- We do not add leverage as a separate control variable, as we instead account for its effect on systematic risk by using unlevered beta as the dependent variable.

Table 1: Risk measures proposed in the academic literature

VARIABLE	RATIONALE
Dividend payout	Firms with greater volatility of earnings will tend to pay out a lower percentage of expected earnings.
Growth	Incremental earnings over and above a firm's usual level may be riskier than 'normal' earnings.
Leverage	In line with Modigliani-Miller, equity holders' earnings become more volatile as the use of debt financing increases.
Liquidity	Liquid current assets can be viewed as facing only inflation risk and so have a less volatile return than non-current assets. On the other hand, riskier companies may choose to hold more liquid assets.
Size	If individual asset returns are less than perfectly correlated, the rate of return for larger firms will have a lower variance than the rate of return for smaller firms.
Earnings variability	A measure of overall variability in earnings, including both systematic and non-systematic variation.
Earnings covariability	A measure of systematic earnings variability defined in a similar manner to equity beta, sometimes referred to as 'accounting beta'.

Source: Beaver, Kettler & Scholes (1970) "The Association between Market Determined and Accounting Determined Risk Measures", The Accounting Review 45(4), pp. 654–682

APPLYING A FORWARD-LOOKING ADJUSTMENT TO HISTORICAL BETA ESTIMATES

WE ESTIMATE THE MODEL USING LSEG EIKON DATA ON NON-FINANCIAL FTSE 100 COMPANIES.

- We use data from LSEG (formerly Refinitiv) Eikon, a financial database. For the estimation of beta, the 'Total Return' on companies' shares – a measure accounting for both movements in the share price and dividends paid – is regressed on the return on the FTSE 100 Total Return Index. Other variables used in the model are calculated using Eikon data, as set out in the adjacent table.
- For consistency, all variables are calculated over the same time period used to estimate beta. In each instance, this is a period covering five of the respective company's financial years. Based on data availability, we include two five-year periods covering FY2013–FY2017 and FY2018–FY2022.
- We include companies that are current constituents of the FTSE 100. We exclude financial institutions (20 companies), as the nature of asset growth for these companies is likely to be different to non-financials, and their underlying sources of risk (and the relationship with beta) are unlikely to be sufficiently comparable to those of other companies in the sample.
- For a further 33 companies, there is insufficient data available to calculate all required variables in both periods. This yields a sample of 47 companies.

Table 2: Definition of variables in terms of Eikon data

VARIABLE	DEFINITION	EIKON DATA ITEMS USED
Asset growth	$\left(\frac{\text{total assets}_{T-5}}{\text{total assets}_{T}}\right)^{1/5} - 1$	• 'Total Assets, Reported'
Dividend payout	$\frac{\sum_{\tau=T-4}^{T} \text{dividends paid}_\tau}{\sum_{\tau=T-4}^{T} \text{income to common}_\tau}$	• 'Cash Dividend Paid, Common, Discrete' • 'Income Avail to Cmn Shareholders Incl Extra'
Liquidity	$\frac{1}{5}\sum_{\tau=T-4}^{T} \frac{\text{current assets}_\tau}{\text{current liabilities}_\tau}$	• 'Total Current Assets' • 'Total Current Liabilities'
Size	$\log\left(\frac{1}{5}\sum_{\tau=T-4}^{T} \text{total assets}_\tau\right)$	• 'Total Assets, Reported', in £m
Earnings variability	$\sqrt{\frac{1}{5}\sum_{\tau=T-4}^{T}\left(\frac{E}{P_\tau} - \overline{\frac{E}{P}}\right)^2}$, where: $\frac{E}{P_\tau} = \frac{\text{income to common}_\tau}{\text{share price}_{\tau-1} \times \text{shares}_{\tau-1}}$	• 'Income Avail to Cmn Shareholders Incl Extra' • 'Hist Fscl Period Price Close (fin cur)' • 'Total Common Shares Outstanding'
EV gearing	$\frac{1}{5}\sum_{\tau=T-4}^{T} \text{net debt/EV}_\tau$	• 'Historic Net Debt/EV'

Note: τ denotes financial years, with T being the last FY included in a time period. Variable definitions for asset growth, dividend payout, liquidity, asset size and earnings variability follow Beaver, Kettler & Scholes (1970) "The Association between Market Determined and Accounting Determined Risk Measures", The Accounting Review 45(4), pp. 654–682.

THE SIGNIFICANT POSITIVE RELATIONSHIP BETWEEN ASSET GROWTH AND SYSTEMATIC RISK INDICATES A NEED TO ADJUST HISTORICAL BETA ESTIMATES UPWARDS, WHERE ASSET GROWTH IS EXPECTED TO INCREASE MATERIALLY.

- **We find that there is a statistically significant and positive relationship between asset growth and beta.** The coefficient on asset growth is statistically significant at 1%. Other things equal, an increase in a company's nominal asset growth rate of 1 percentage points is associated with a 0.0087 increase in its unlevered beta.
- The model explains a material proportion of variation in the dependent variable, with its R^2 being 32%.
- In relation to the other model coefficients:
  - The coefficient on asset growth is statistically significant and has the expected positive sign, meaning that higher asset growth is associated with higher systematic risk.
  - The coefficient on dividend payout is statistically significant and has the expected negative sign.
  - The coefficient on liquidity is statistically significant and has a positive sign. As set out above, higher risk companies may choose to hold more liquid assets.
  - The coefficient on size is positive, but is not statistically significant.

Table 3: Regression results

Model	FTSE 100 non-financials
Asset growth	0.866*** (0.278)
Dividend payout	−0.006*** (0.001)
Liquidity	0.207*** (0.073)
Size	0.041 (0.048)
Earnings variability	0.457** (0.196)
Observations	47
R^2	0.316

*Standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01*

DIFFERENT MODEL SPECIFICATIONS ALSO SHOW A SIGNIFICANT POSITIVE RELATIONSHIP BETWEEN ASSET GROWTH AND SYSTEMATIC RISK

- As a robustness check, we estimate the relationship between asset growth and beta in three alternative model specifications:
    i. dropping the control variables from the model;
    ii. including a broader sample of FTSE 350 companies; and
    iii. using an arithmetic, rather than geometric, average to measure of asset growth.
- Our finding of a statistically significant and positive relationship between asset growth and beta is robust to these changes in model specification.

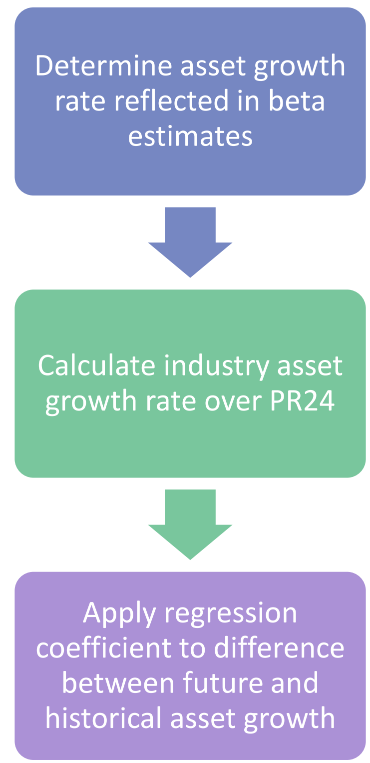
Table 4: Regression results – robustness checks

Model	FTSE 100 non-financials	FTSE 350 non-financials	FTSE 100 non-financials (arithmetic average asset growth measure)
Asset growth	0.851*** (0.229)	0.616*** (0.189)	0.579** (0.218)
Dividend payout	—	−0.007* (0.004)	−0.006*** (0.002)
Liquidity	—	0.008 (0.018)	0.190*** (0.070)
Asset size	—	0.068 (0.045)	0.042 (0.050)
Earnings variability	—	0.870*** (0.262)	0.399* (0.212)
Observations	52	76	47
R^2	0.177	0.259	0.292

*Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$*

TO TRANSLATE THE RESULTS OF OUR ECONOMETRIC MODEL INTO AN IMPACT ON BETA AT PR24, WE EXAMINE EVIDENCE ON THE LEVEL OF ASSET GROWTH AND PR24 VERSUS HISTORICAL LEVELS OF ASSET GROWTH.

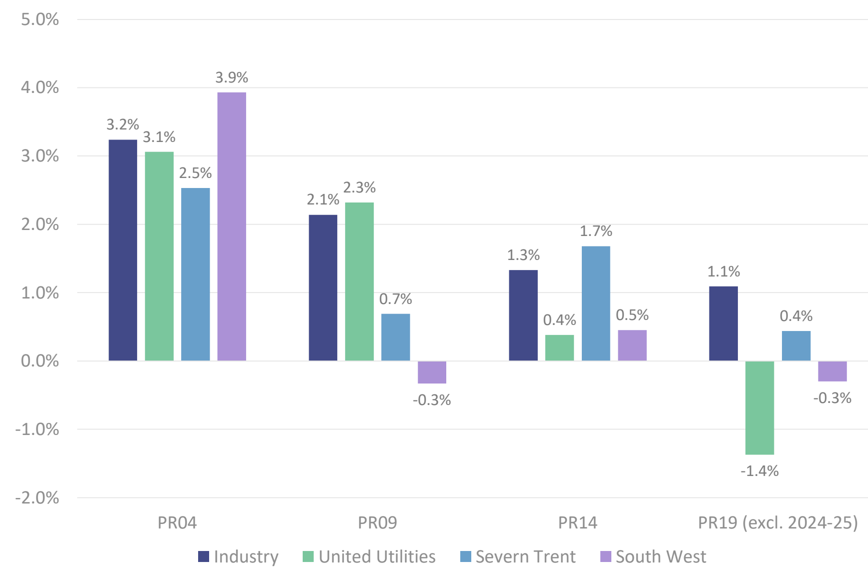
- To determine the implication of our findings for PR24, we first calculate the historical asset growth rate, reflecting a business-as-usual scenario. To do so, as we explain in the subsequent slide, we focus on industry data over a 19-year period from PR04 to the most recent financial year.
- We then calculate asset growth rates for the industry over PR24. This is based on an analysis of companies' business plans and Ofwat's draft determinations.
- Finally, we determine the impact of asset growth on beta at PR24 by applying the coefficient from our econometric model to the difference between future and historical asset growth.



TO ISOLATE THE STEP CHANGE IN INVESTMENT AT PR24, WE HAVE ANALYSED HISTORICAL RCV GROWTH OVER A LONG TIMEFRAME.

- We considered whether to calculate asset growth over the same timeframe as used when estimating beta. There is a risk, however, that doing so would overstate the impact of asset growth on beta. This is because the period since PR14 may represent the bottom of the asset renewal cycle. As we show in the adjacent figure, historical RCV growth was materially higher in PR04 and PR09 than in PR14 and PR19.
- We therefore focus on the 19-year period from PR04 to the most recent financial year. Taking a long-term average avoids measuring changes in reoccurring factors that cause asset growth to fluctuate across price controls, and which would be anticipated by equity investors and therefore be reflected in the historical pricing data used to estimate beta.
- The timeframe is also broadly similar to assumed asset lives in the sector and should therefore capture peaks and troughs over the investment cycle.
- This means that comparing planned asset growth over PR24 with the historical average over a long timeframe will capture asset growth in excess of the 'business-as-usual' asset growth rate. Put another way, this addresses Ofwat's (valid) concern regarding the potential precedent set by any adjustment at this time.

Figure 5: Historical RCV growth since PR04

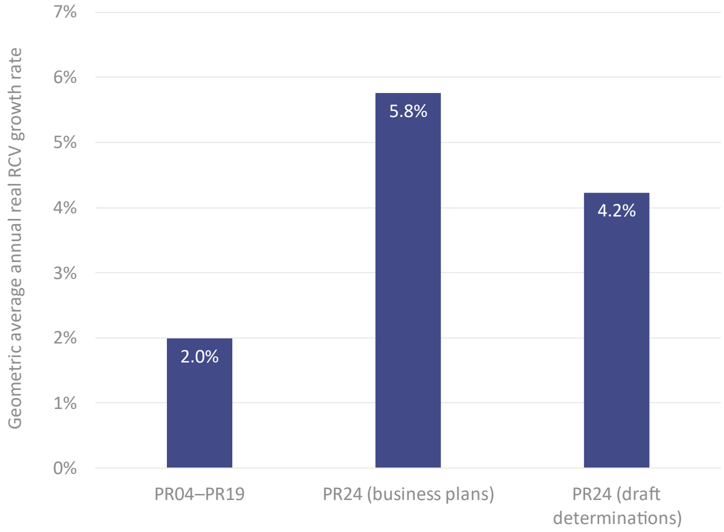


Source: Economic Insight analysis of industry RCV data

OUR ANALYSIS IMPLIES THAT HISTORICAL BETA ESTIMATES SHOULD BE UPLIFTED BY 0.019–0.033 TO REFLECT HIGHER SYSTEMATIC RISK AT PR24.

- From 2005–06 to 2023–24, the industry had an average annual rate of real asset growth of 2.0%. Annual real asset growth set out in business plans is 5.8% across PR24; the draft determinations imply a rate of 4.2%.
- This means that planned annual asset growth will be 2.2%–3.8% higher than in the 'business-as-usual' scenario, based on the historical long-term average.
- Our econometric model implies an increase in beta of 0.0087 for every 1% increase in annual asset growth. This indicates an uplift of 0.019–0.033 across the industry for forward-looking risk.
- KPMG estimated a backwards-looking unlevered beta range of 0.29–0.33 for PR24; Ofwat's draft determinations use a range of 0.26–0.29. Together with the forward-looking uplift calculated above, **this implies an unlevered beta in the range of 0.28–0.35.**

Figure 6: Historical RCV growth (2005–06 to 2023–24) and planned RCV growth at PR24



Source: Economic Insight analysis of industry RCV data

ANNEX A: OVERVIEW OF RELEVANT THEORY

A NUANCED UNDERSTANDING OF SOURCES OF SYSTEMATIC RISK IS REQUIRED IN ORDER TO PROPERLY ADDRESS OFWAT'S CONCERNS REGARDING THEORY.

- As noted in the main body of this report, one of the three reasons identified by Ofwat in its DDs for not making an upwards beta adjustment was due to the regulator not being convinced the relevant theory (as to why beta may be higher at PR24) applies to regulated water companies.
- The scope of this report is focused on the empirical estimation of the relationship between beta and investment, rather than the theory that may explain *why* there is one. Nonetheless, in this annex we briefly expand on why we consider that it would be an overstatement to suggest that there is no theoretical basis to suppose this relationship exists for water companies.
- Focusing on the *'change in mix of activities'* theory, water companies will undertake materially more construction at PR24, relative to the past. This gives rise to two main potential types of risk:
  - (a) delay and delivery risks (which have cost impacts, due to for example, materials storage costs, incurring labour costs for longer etc.); and
  - (b) cost risks (the risk that construction costs vary over time, resulting in variation in company cash flows).
- To determine the extent of systematic risk that arises for water companies under either channel (a) or (b) above, it is necessary to
  - firstly, identify and consider the individual sources of systematic risk at a granular level; and then
  - secondly, assess its relevance to water companies, including by taking into account any mitigating (or accentuating) impacts of the regulatory framework.

THERE EXISTS A BODY OF HIGH-QUALITY STUDIES THAT ALLOW PRECISELY THIS DETAILED UNDERSTANDING OF RISK SOURCES TO BE DEVELOPED.

- It is beyond the scope of this report to address the preceding in detail. However, to indicate what could be done, we note there is a considerable existing theoretical and empirical literature that surveys the main sources of construction delay and cost risk. For example, Xie et al. (2022) identifies 65 common sources of construction cost risk, categorised by: 'project macro' risks; 'project management' risks; and 'stakeholder' risks.*

- Examples of individual risk sources identified by Xie within the above categories include sources that are both idiosyncratic (for example, inadequate cost management and relationship with the labour force) and sources that are systematic (exchange rate movements; input cost variation; interest rates etc.). It is therefore feasible, by drawing on this type of literature, to build up quite a detailed understanding of the specific sources of systematic risk that arise, and which (in principle) apply to water companies. Our preliminary review suggests that a material proportion of delay / delivery and cost related risk sources for construction are systematic in nature and do apply to water companies.

- Following from the above, one then needs to consider the key elements of the regulatory framework that may affect the exposure of regulated companies to the identified risk sources. For example: cost sharing rates; the aggregate sharing mechanism; real price effects; DPC; and PCDs etc. Our preliminary review suggests some elements of regulation do mitigate certain risk sources for water companies (e.g. new real price effects mechanisms for energy and 'materials plant and equipment costs' will somewhat mitigate construction systematic cost risk arising from input cost variation). Other mechanisms will increase systematic risk exposure (e.g. PCDs). However, we have not considered this in detail and here are just illustrating the steps required to thoroughly understand this issue.

- We should further emphasise that the key issue regarding any mitigating / accentuating effects of regulation is changes in the regulatory framework at PR24 relative to the past (because the existing regulatory framework impacts are already captured in the historical beta). Our preliminary review suggests that the overall impact of changes to regulation at PR24 is unlikely to have any large net mitigating effect on exposure to the risk sources identified, and PCDs may result in a net increase in exposure (but this requires more analysis).

'Critical Factors Influencing Cost Overrun in Construction Projects: A Fuzzy Synthetic Evaluation.' *Wenwen Xie, Binchao Deng, Yilin Yin Xindong Lv and Zhenhua Deng. Buildings (2022).*

ANNEX B: CIRCUMSTANCES IN WHICH BACKWARDS-LOOKING BETA ESTIMATES CAN BE INACCURATE

DESPITE THE EVIDENT NEED FOR A FORWARD-LOOKING VIEW OF RISK, THERE ARE SEVERAL IMPEDIMENTS TO ACHIEVING SUCH A VIEW IN PRACTICE.

Lack of agreed method for incorporating forward-looking risk

- The use of backwards-looking historical share price data is 'bedded in', and its use makes a great deal of sense when the overall level of risk is stable.
- The sector lacks an agreed method for adjusting for different levels of future systematic risk.

Difficulty disentangling backwards- and forward-looking views of risk

- Historical share price data may capture some, but not all, of the anticipated future risk in the sector.
- More recent historical price data may partly reflect the impact of new information about the changing nature of activities in the sector.

Historical data catches up with changes in risk (eventually)

- Historical data may eventually capture the effects of changes in risk, albeit with a lag, assuming the approach to estimating beta is fully consistent across price controls.
- Use of long-run data could also mitigate the impact of cyclical changes in risk profiles.

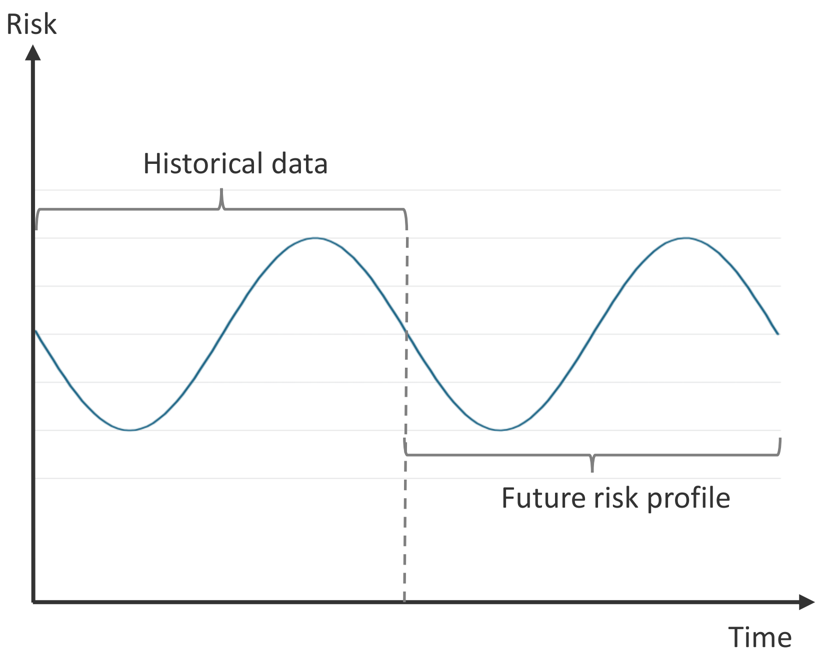
Difficulties with the comparability of other sectors

- Data on beta in other sectors may provide a useful indicator of the impact of higher risk – e.g. construction firm betas may be informative about construction risk.
- However, it is very difficult to ensure betas from other sectors are comparable with the sector of interest.

USE OF BACKWARDS-LOOKING HISTORICAL DATA TO ESTIMATE BETA WILL BE RELIABLE IF MARKET PRICING DURING THE ESTIMATION PERIOD REFLECTED FUTURE RISK.

- The level of systematic risk that companies face varies over time. In addition to external factors such as input costs and regulation, risk varies as companies engage in cycles of asset renewal and enhancement.
- Market pricing at any point in time reflects expectations of future risk. As such, the use of historical data can be accurate when, as in the adjacent figure, these cycles of asset renewal and enhancement are expected to be broadly similar to historical levels.
- The use of backwards-looking historical data is, however, problematic when future risk levels lie outside the historical range of variation. As we show in the next slide, this is the case for PR24.

Figure 7: Stylised example of variation in risk over time

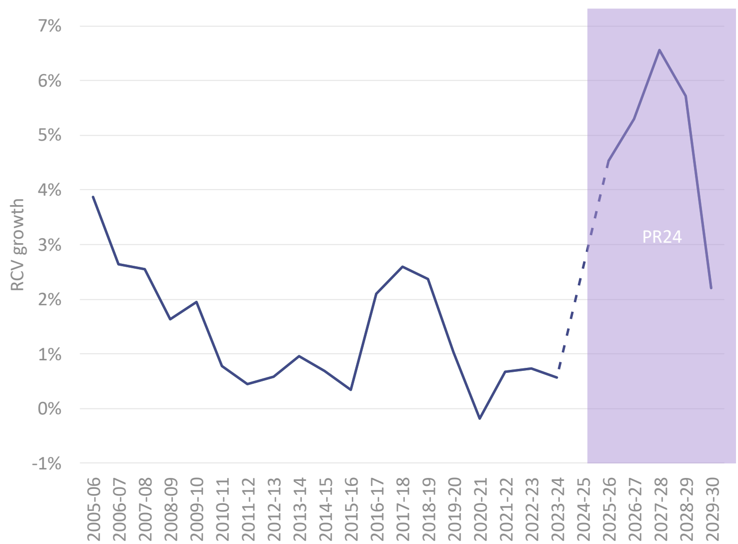


Source: Economic Insight

LISTED WATER COMPANIES SHOW A SIMILAR PATTERN TO THE INDUSTRY AS A WHOLE, WITH RCV GROWTH AT PR24 SIGNIFICANTLY HIGHER THAN HISTORICAL LEVELS.

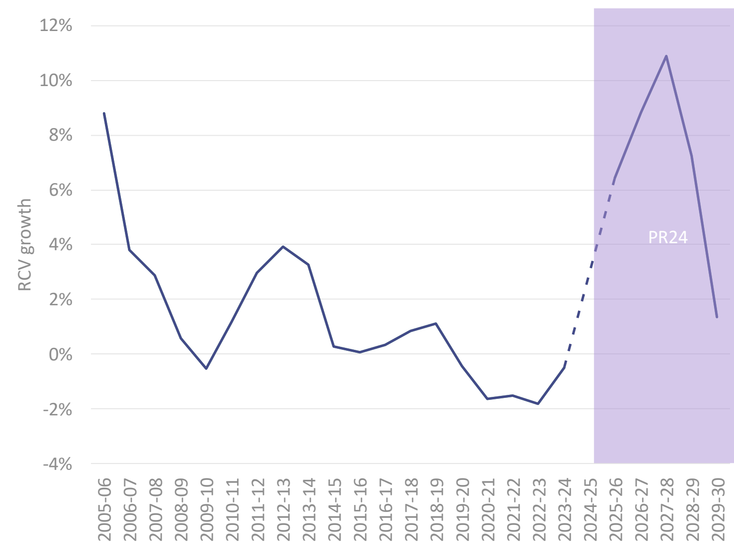
- Listed water companies (Severn Trent and United Utilities) are the main source of evidence on historical beta. As the two figures below show, the same pattern of asset growth observed for the whole industry also applies to Severn Trent and United Utilities. Consequently, backwards-looking estimates based on these two companies are unlikely to provide an accurate reflection of companies' full risk profiles.

Figure 8: SVT RCV growth since PR04 vs PR24 business plans



Source: Economic Insight analysis of Ofwat data and PR24 business plan data tables

Figure 9: UUW RCV growth since PR04 vs PR24 business plans



Source: Economic Insight analysis of Ofwat data and PR24 business plan data tables

Although a backwards-looking approach to beta was adequate for PR19 and PR14, it is unlikely to be sufficient for PR24.

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Annex 7 – FE Report on Considerations for the CoE at PR24

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ADDITIONAL CONSIDERATIONS FOR THE PR24 ALLOWED RETURN ON EQUITY

A REPORT PREPARED FOR WESSEX

25 APRIL 2024

Contents

frontier economics

frontier economics

Executive Summary

1 Ofwat is currently undertaking the 2024 price review (PR24) with the Final Determination (FD) due in December 2024. The determinations will consider the information provided by companies in their respective business plans.

2 What is clear from the plans submitted is that major new investments are required across the water and wastewater value chain. This is in response to multiple challenges faced by the sector, including resilience to climate change and meeting environmental standards.[1]

3 What is also clear is that investments made in the next five-year period[2] are an essential part of long-term (25-year) delivery strategies to meet the challenges the sector faces. Ofwat recognises this saying that, "*Funding will support efficient enhancement investment, both in the short and long term.*"[3] This means that the next five years are far from 'business as usual' for the sector, as companies strive to transform the value chain and improve outcomes, facilitated by a step-change in investment.

4 Investors therefore have a key role to play in the next five-year period. Significant sums of capital are required to make the investments set out in long-term plans a reality. However, capital cannot be transformed into assets if the sector cannot attract that capital in the first place. It is the challenge of attracting and retaining capital in the sector that this report provides a fresh perspective on.[4]

5 In this report we focus on the topic of attracting and retaining *equity capital* – but note that attracting all types of capital is essential for the sector to deliver on investment plans.

6 The work presented in this report was initially developed in response to Ofgem's Sector Specific Methodology Consultation (SSMC) for the RIIO-3 process. The analysis was therefore developed through late 2023 and early 2024. However, there are common challenges across sectors which mean the outputs are relevant for water networks as well as energy networks. We have therefore set out the implications from that work for Ofwat at the earliest opportunity following its completion.

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1 Water UK estimates that PR24 business plans set out £96bn of investment between 2025 and 2030. This represents a 63% increase, in real terms, on the expenditure allowed by Ofwat in the current five year period.

2 The next five-year period running from April 2025 to March 2030 is often referred to as "AMP8" (Asset Management Period 8).

3 Ofwat (2022), "Our final methodology for PR24: foreword and executive summary", pg.7.

4 Further detail on sector-specific and market context is provided in Section 2.

What is the challenge?

7 In the past two years capital market conditions have changed substantially. In response to a variety of global shocks, the period of accommodative macroeconomic policy has ended. There has been an abrupt rise in interest rates and the cost of borrowing – gilt yields have increased by c.3.5% over a short space of time. It is arguable that this was not fully factored into the PR24 Final Methodology, particularly where the allowed rate of return was discussed.[5]

8 The PR24 DD and FD will be taken in a very different environment to the equivalent at PR19. Allowances which reflected the era of low interest rates and required returns in the past will now have to be adapted to reflect the new conditions in financial markets. The challenge is to how adapt allowances proportionally to current market conditions.

9 In addition, it is not just water networks which have growing capital requirements. This challenge is arriving at a time when infrastructure investors have many competing opportunities (projects, companies and geographies) for deploying capital. This is driven by countries all over the world seeking rapid progress towards a decarbonised future – enabled, in many instances, by infrastructure investments. The financing costs faced by the water sector will reflect the competition for capital from other investment opportunities in these market conditions.

10 As the cost of equity cannot be directly observed, a range of tools are needed to assess what the new capital market environment means for the cost of equity. We consider it is important to review evidence produced by a range of tools – and note that this is consistent with UKRN guidance on the cost of capital.[6] Drawing upon a range of sources is a key way to ensure the allowed rate of return is set in a way that encourages long-term equity investment.

11 We present two tools for understanding the relationship between capital market conditions and the cost of equity. Both draw upon capital market data to support developing an appropriate allowed return on equity for PR24.

(a) **A cross-check derived from hybrid bonds** – as the name suggests, these are securities that combine debt and equity characteristics. But, as traded bonds, there is market information on the yields of these securities. This means those yields can be analysed to infer required equity returns. This

5 At the time the final methodology was being prepared, there was greater uncertainty around how persistent rate rises could be – the data cut-off used was September 2022.

6 The UKRN guidance says, "*The CAPM is a model of required returns; there is inherently some degree of parameter uncertainty. It is therefore important to sense check the resulting point estimate where there is evidence to do so.*" UKRN guidance for regulators on the methodology for setting the cost of capital, page 26.

cross-check provides a clear link from capital market conditions through to the equity returns that utilities investors are likely to require. It also helps to test whether the difference between the cost of equity and cost of new debt is consistent within reasonable bounds of the CAPM logic. As far as we are aware this evidence source and cross-check has not been discussed in the context of PR24.

(b) **The relationship between total market returns (TMR) and gilt yields** – we have explored what the academic literature tells us about the relationship between forward looking estimates of TMR and the yields on index-linked gilts (ILGs). We then follow this literature to develop our own model of the relationship, finding that this can be used to calibrate a "TMR Glider" i.e. an assessment of what market evidence tells us about the appropriate level of TMR implied by market movements in gilts (used to proxy the risk-free rate (RFR)).

12 In both cases we have developed these new sources of evidence in response to the persistence of capital market conditions at a level significantly different to PR19. Arguably even at PR24 Final Methodology, markets already started to show material changes (relative to the conditions during PR19, which had persisted for around a decade at that point), although it was then unclear how significant the changes would ultimately become and quite how enduring this would prove to be. The persistence of this change has now become more evident in the past two years – meaning the need to carefully consider this issue has grown. We set out our key findings from each evidence source below.

A hybrid bond cross-check on the cost of equity

13 We have developed a new cross-check on the cost of equity. This cross-check is based on ensuring that the cost of equity lies sufficiently far above the long-term return on senior investment-grade debt. This condition derives from the relative risk profile of debt and equity.

14 Senior debt implies lower risk and better recovery prospects: senior debt is paid first and it is paid a contractually stipulated sum, with contractual protections available as a backup. In contrast, holders of equity are paid last, and act as residual claimants on the business with no guarantee they receive anything, in particular in times of financial distress. Because of this marked difference in risk, it would be irrational for investors to opt for equity if equity returns are not sufficiently above the rates that could be earned from providing senior debt instead.

15 Given the large gap in relative risk between senior conventional debt and equity, comparing unadjusted yields on senior debt to equity returns would only provide a limited cross-check on equity returns, i.e. a test that we would typically expect to

be easily passed.. A meaningful cross-check must reflect the incremental return that equity requires over debt.

16 We find that hybrid bonds, which are closer to equity in nature, provide a more meaningful point of comparison.[7] Since the yield on these hybrid bonds is directly observable, with an appropriate assumption on the proportion of equity like feature of the hybrid bond, an expected return on equity can be implied from a relatively simple formula. If the allowed equity return is set below the level implied by of the yields of hybrid bonds, then risks to attracting sufficient equity capital are greater.

17 Specifically, we use hybrid bonds issued by regulated UK utility networks companies as the basis of the cross-check.[8] This provides an output which is relevant for PR24 given the similarities in regulation between water networks and the other utility networks. To provide further confidence that results from the hybrid bond cross-check are applicable to the water sector we have undertaken a range of sector-specific analysis. Most notably, we have used a recent direct market quote on a potential hybrid bond issuance for Severn Trent, and found very similar results to our original analysis. Concluding that the outputs from the cross-check are relevant and appropriate to apply to water company cost of equity.

18 Drawing on recent capital market data, evidence from hybrid bonds indicates that the cost of equity should fall in the range 5.8% to 8.4% (CPIH deflated), with a central estimate of 6.6%.[9] This compares with an 'early central view' allowed return on equity from the PR24 methodology of 4.14%.

19 Our view is that a cost of equity set below this range would heighten equity financing risks at PR24 and is therefore a cross-check we would encourage Ofwat to carefully consider.

The relationship between total market returns and gilt yields

20 UK regulatory practice over the past decade or more has been to move TMR down to reflect prevailing market conditions. As interest rates and yields on government bonds fell over much of the last decade, UK regulators responded by lowering their estimates of TMR used to determine the allowed cost of equity. This movement was not one-for-one, i.e. regulators moved TMR by a proportion of the fall in yields

---

7 Hybrid bonds can be of very long tenor – covering multiple decades, making it more similar to the perpetual nature of equity. These securities can also have debt like qualities, including periodic coupon payments, however, in certain circumstances there can be a higher degree of flexibility over when these are paid. Hybrid bonds also sit between senior debt and ordinary shares in a company structure, being eligible for payments prior to equity-holders, but after senior debt-holders.

8 NGG Finance (a part of the wider National Grid group of companies) issues hybrid securities. Therefore, they provide a specific figure that reflects risk for regulated network businesses.

9 Expressed in CPIH-deflated terms; using data to the end of February 2024.

on government bonds. This “stable but not fixed” policy has been endorsed by the UK Regulators Network (UKRN).[10]

21 The low interest rate environment has now reversed. The deeply negative real interest rates that caused regulators to lower their estimates of TMR over the last decade are no longer observed. On the contrary, real interest rates are now materially positive. Available evidence points to materially positive real rates persisting.

22 By the same logic that caused estimates of TMR to fall at PR19, it is now time for regulators to increase TMR for PR24 (instead of further decreasing as set out in Ofwat’s PR24 FM). As for the size of the appropriate increase, we have explored what the academic literature tells us about the relationship between short run, forward-looking estimates of TMR and yields on index-linked gilts (ILGs). Mirroring the UKRN guidance, we find that the literature finds such a relationship, and confirms that this is not one-for-one, i.e. TMR is stable but not fixed.

23 We then follow the academic literature to develop our own model. In line with the approach taken in the academic literature, we begin by using a Dividend Discount Model (DDM) to estimate a ‘market-based’ measure of nominal required TMR.[11] In accordance with what we have found in the literature, we analyse the relationship between these estimates of TMR and yields on government bonds (in particular 20-year nominal gilt yields, which are often used as a proxy for the RFR.

24 We posit that this relationship can be used to calibrate a TMR Glider, i.e. an assessment of what market evidence tells us about the appropriate level of TMR implied by market movements given the observable level of yields on 20 year gilts used to proxy RFR.

25 Our assessment is that the Glider we estimate is able to explain past regulatory TMR decisions, given each regulator’s assessment of RFR, reasonably well. The implication of this is that past regulatory decisions have indeed responded to interest rate developments. On this basis, we think that the Glider provides useful guidance and insight on how the TMR can be set for future price controls.

26 We have considered what the Glider would imply for current and future regulatory decisions. On the basis of prevailing gilt yields, all Glider specifications predict a

10 UKRN (2023) UKRN guidance for regulators on the methodology for setting the cost of capital, p19.

11 In fact, we note that Ofwat had considered DDM evidence in the past, when setting the allowed TMR. See for example: Ofwat (2019) PR19 Final Determinations, Allowed return on capital technical appendix. In this case, however, we are not suggesting to use the DDM outputs directly. Rather, we note that the academic literature suggests that the DDM can capture short-term investor expectations, and we posit that this information can be used to calibrate a TMR Glider to facilitate regulatory decision making, as we explain in our approach (and also in more detail in the chapter outlining our Glider approach and results).

current TMR above 7.5%, in the range of 7.55%-7.86%.[12] Given that interest rates at prevailing levels have not been observed for more than ten years, and the 'stable but not fixed' regulatory construct that has emerged, it is perhaps not surprising that the predicted TMR is considerably higher than observed in the most recent decisions.

27 Overall, we consider that this TMR Glider provides a way to adapt TMR estimates in the cost of equity to market conditions while maintaining consistency with regulatory best practice – we therefore encourage Ofwat to consider this evidence the making cost of equity allowances for PR24.

What next?

28 This report provides two specific tools which can be used by Ofwat to help calibrate the appropriate cost of equity for PR24. These tools have been developed so that the regulatory framework is able to adapt to the challenges posed by the new capital market environment which has emerged.

29 Both tools are able to capture the impact of this new environment as their inputs are directly sourced from capital markets. This means they are transparent, simple to apply, and they are also tailored to the UK regulatory landscape.

(a) The outputs from the hybrid bond cross-check on the current cost of equity show a need to revise upwards the CAPM inputs used at PR19 to calculate the cost of equity. Without revision there are heightened risks to the sector in terms of the equity capital is able to raise.

(b) The TMR Glider provides a guide for how the TMR CAPM input can be revised in a proportional manner that is consistent with regulatory guidance and the wider capital market environment.

30 We note that there are other CAPM inputs which may also require revision in order to reach an appropriate cost of equity PR24 – such as beta. But those other inputs are beyond the scope of this report.

31 We invite further engagement with Ofwat on the tools set out in this report and the fresh perspectives they provide for the PR24 cost of equity.

[12] CPIH-deflated terms. We have considered three different specifications which are discussed in this report.

1 Introduction

32 Frontier Economics has been commissioned by a group of water companies to explore the relationship between capital market conditions and allowed equity return at the PR24. This report supports Wessex Water for its submission to Ofwat on additional considerations for the cost of equity in PR24. The work presented in this report was initially developed in response to Ofgem's Sector Specific Methodology Consultation (SSMC) for the RIIO-3 process. The analysis was therefore developed through late 2023 and early 2024. However, there are common challenges across sectors which mean the outputs are relevant for water networks as well as energy networks. We have therefore set out the implications from that work for Ofwat at the earliest opportunity following its completion.

33 At a time when the water sector is going to require substantial investment, it is critical that equity capital can be attracted, at competitive costs, to the level required. Capital raised and invested during the next five year period is key for ensuring companies can deliver their long term strategies.

34 The specific challenge this report considers is how the allowed equity return should adapt to capital market conditions which have changed substantially since PR19. As the price control process has progressed it has become clear that conditions markedly different to PR19 are likely to persist into the next price control period. The need to carefully consider this issue has therefore grown.

35 In this report we provide two new perspectives on the relationship between capital markets and the cost of equity. In other words, these are perspectives, which, to our knowledge, have not been explored in the price review to date. These are:

- A new cross-check on the cost of equity based on hybrid bonds; and
- A TMR Glider – which provides an assessment of what market evidence tells us about the appropriate level of TMR.

36 The tools developed in this report demonstrate the need for CAPM inputs applied during the era of low interest rates and required returns to be revised significantly. We are not arguing that CAPM should be disregarded or that an entirely new methodology should be used to set the allowance. Rather we recommend Ofwat to take into account these relevant factors while exercising its regulatory judgement. We invite Ofwat to engage with the findings of this report and consider them when setting the allowed equity return for PR24.

37 The remainder of this report provides a full exposition of the points made in the Executive Summary, and is structured as follows:

- In Section 2 we set out the capital market and sector-specific context and the need for additional considerations when setting the PR24 cost of equity.

- In Section 3 we set out the hybrid bond cross-check on the cost of equity we have developed.
- In Section 4 we set out the history of TMR allowances and market conditions.
- In Section 5 we set out the TMR Glider we have developed.
- Section 6 concludes with the overall implications for the PR24 cost of equity.
- The annexes provide the further detail, to aid review of our work.

2 Context and the need for additional considerations when setting the PR24 cost of equity

38 In this section we:

- Outline the changes in market conditions that have occurred. We show that these have been significant, and that the deeply negative interest rate environment has come to an abrupt end.
- Outline sector-specific PR24 context on the scale of investment and financing.
- Conclude the section by setting out the implications for the PR24 cost of equity if market conditions are not adequately reflected.

2.1 Macroeconomic context

2.1.1 Interest rate expectations at PR19

39 The final determination for PR19 was published in December 2019. At the time, there had been a prolonged period of extremely accommodative monetary policy since the Global Financial Crisis (GFC). This low interest rate period was projected to continue. This is illustrated in Table 1 below, which sets out the market projected path for the Bank of England base rate at the time.

40 As shown in the table, the market anticipated the base rate remaining at 0.5% for the foreseeable future. There was no indication that upward interest rates pressure would be a feature of the next regulatory cycle.

Table 1 Base rate market expectations from November 2019

Month	Dec 2019	Dec 2020	Dec 2021	Dec 2022
Base rate	0.7%	0.5%	0.5%	0.5%

Source: Bank of England, November 2019 Monetary Policy Report
Note: Base rate projection rounded to 1dp

41 This view of the macroeconomy was consistent with the earlier view of Ofwat at the time the PR19 methodology was being developed. Ofwat stated that:

> 42 *"The latest medium-term forecasts for the UK economy support the view that prospects for future growth will remain weak, decreasing the*

> *probability that interest rates and returns will normalise to the higher rates seen in the last few decades."*[13]

43 Ofwat's decisions on the cost of equity were taken with the macroeconomic backdrop in mind. And it is clear that this supported their thinking when making allowances. Ofwat stated that:

> 44 *"low interest rates will be accompanied by low equity returns in coming years."*[14]

45 As such, at the time of the PR19 decision, there was no expectation of any imminent departure from the era of very low interest rates. Even at the time of the CMA's PR19 final determination, for those companies that appealed, the was a continued expectation that low interest rates would persist years ahead.[15]

2.1.2 The abrupt end of the era of low interest rates

46 The interest rate environment at PR24 is now fundamentally different. It is clear that the monetary policy environment has abruptly changed, in response to major global shocks that have affected both real and financial markets. The base rate rose sharply from 0.25% at the start of 2022 to 5.25% today (see Figure 1). There is no indication of a near-term return to the period of extremely accommodative monetary policy.[16]

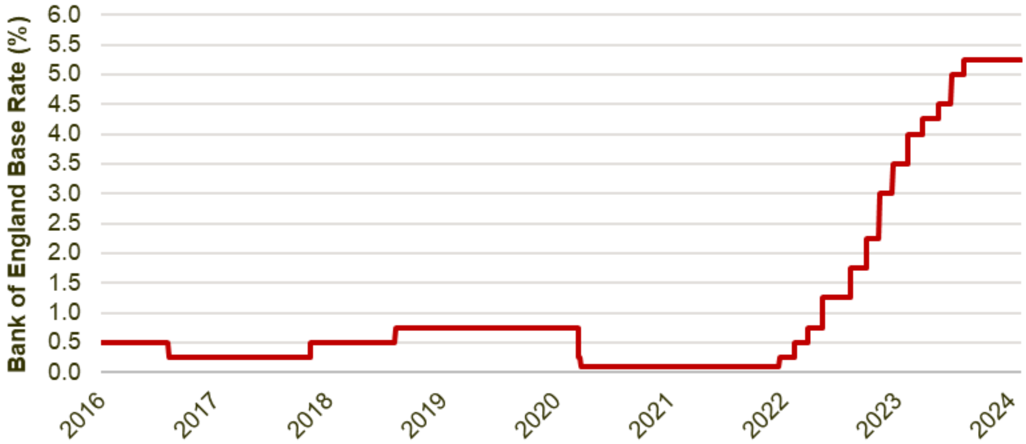
[13] Ofwat (2017), "Delivering Water 2020: Our methodology for the 2019 price review; Appendix 12: Aligning risk and return; section 5.4.

[14] Ofwat (2017), "Delivering Water 2020: Our methodology for the 2019 price review; Appendix 12: Aligning risk and return; section 5.4.

[15] See, for example, Table 1.A and Chart 2.6 in the BoE Monetary Policy Report February 2021.

[16] See, for example, Table 1.A and Chart 2.6 in the BoE Monetary Policy Report February 2024.

Figure 1 Bank of England base rate



Source: Bank of England

47 Since PR19, long-term gilt yields have also moved upwards by around 3.5 percentage points – a substantial increase over a relatively short period of time.

48 Together, this shows that PR24 decisions cannot be made with the same mindset as PR19, as the market outlook has fundamentally changed. However, we note that Ofwat's early view resulted in a lower allowed equity return for PR24 than for PR19. It is clear to us that there is a need to re-assess what Ofwat considered to be appropriate at its PR24 FM.

2.2 Investment and financing challenges going into PR24

49 Alongside the macro-economic situation described above, the water sector is heading into the PR24 price control facing a substantial increase in its investment programme. The water company business plans for the period 2025 to 2030, submitted in October 2023, implied spending requirements of £96 billion on delivering water and wastewater services. This represents a 63% increase, in real terms, on the expenditure allowed by Ofwat in the current five year period.

50 More specifically, that expenditure total includes £41 billion on enhancement schemes, compared to £11 billion allowed by Ofwat for 2020 to 2025. This represents a 271% increase. It includes £11 billion to upgrade the wastewater system to reduce sewage spills and the construction of up to ten new reservoirs to improve water supply resilience in the face of climate change.[17]

51 The scale of the investment programme implies the need for significant new financing over the period 2025 to 2030. This will consist of both new equity and

[17] Source: Water UK; https://www.water.org.uk/investing-future/pr24

new debt finance. Most of the companies in the sector propose some level of equity injection during the PR24 period. In addition, all companies propose a level of dividend yield that is materially below the long-term level implied by the cost of equity, providing a further source of equity injection into the companies.

52 Ofwat is in the process of assessing these business plan proposals and will publish its determinations later this year. Nevertheless, given the underlying drivers for investment in the sector it is inevitable that the final determination will include a significant increase in investment, with the associated implications for new financing.

2.3 Implications for setting an appropriate allowed equity return at PR24

53 The water sector needs to undergo a period of significant transformation to meet environmental and resilience goals.

54 The success of meeting these challenges will depend crucially on maintaining efficient ongoing access to capital markets, to raise and retain funding at efficient cost from both debt and equity investors. Without the ability to raise and retain capital in this way, it will not be possible to deliver the large scale investment needed.

55 What is also clear is that investments made in the next five-year period[18] are an essential part of long-term (25-year) delivery strategies to meet the challenges the sector faces. Ofwat recognises this saying that, "*Funding will support efficient enhancement investment, both in the short and long term.*"[19] This means that the next five years are far from "business as usual" for the sector, as companies strive to transform the value chain and improve outcomes, facilitated by a step-change in investment.

56 Investors therefore have a key role to play – both in the next five-years and beyond. Significant sums of capital are required to make the investments set out in long-term plans a reality. However, capital cannot be transformed into assets if the sector cannot attract that capital in the first place. An open approach to engagement has the potential to buttress investor confidence, by making it clear what investors can expect.

57 In the PR24 methodology Ofwat has signalled that they expected the balance of financing to change relative to past regulatory cycles. Its view is that a 55% level of gearing is appropriate for a notional company, a reduction from 60% at PR19.

18 The next five-year period running from April 2025 to March 2030 is often referred to as "AMP8" (Asset Management Period 8).

19 Ofwat (2022), "Our final methodology for PR24: foreword and executive summary", pg.7.

This demonstrates greater scope Ofwat sees for equity in the sector going forward, and therefore emphasises the importance of setting an appropriate allowed return on equity to ensure that the required financing is forthcoming.

58 It is the allowed return on equity – and the impact of changing capital market conditions on that allowance – that we focus on in this report. Given the role of equity in financing the sector's investments, we believe that the hybrid bond cross-check to the cost of equity set out in Section 3 requires careful consideration. By considering all available evidence, including this cross-check, there is a greater likelihood of striking an appropriate balance between customers and investors.

3 Hybrid bond cross-check

59 This part of the report outlines the details of our hybrid bond cross-check methodology. It covers:

- The context – explaining the rationale for hybrid debt as a cross-check;
- The methodology we have used to estimate the cost of equity cross-check;
- Results of the cost of equity cross-check; and
- How we have ensured the findings are applicable to the water sector.

60 In Annex A we provide further details on sensitivity tests on the key assumptions, and additional robustness tests supporting the methodology.

3.1 Context

61 The risk and return principles in corporate finance requires that the expected return on equity lies sufficiently far above the long-term return on senior investment-grade debt of the same entity. This condition derives from their relative risk profile. Senior debt implies lower risk and better recovery prospects. It is paid first and it is paid a contractually stipulated sum. In contrast, holders of equity are paid last, and act as residual claimants on the business with no guarantee they receive anything, particularly in times of financial distress. Because of this difference in risk, it would be irrational for investors to opt for equity if expected returns were similar to or below the expected returns on senior debt.

62 Therefore, the relevant question is how much higher should equity returns be, relative to debt. Given the large gap in relative risk between senior conventional debt and equity, the unadjusted yield on senior debt would only provide a limited cross-check on equity returns, i.e. a test that we would typically expect to be easily passed (although Ofwat's early view can be considered to not even pass this test in places).[20]

63 To provide stronger, more suitable cross-check we have considered securities that are somewhat debt like, but more similar to equity, for which yield information is available. Specifically, we focus on hybrid bonds to infer required equity returns.

64 Hybrid bonds, as the name suggests, are securities that combine debt and equity characteristics. For example, hybrid bonds can be of very long tenor – covering multiple decades, making them more similar to the perpetual nature of equity.

20 Ofwat's early view of the allowed return on equity is 3.67% - 4.60%, with a central estimate of 4.14%, all figures in CPIH-real. Using a CPIH assumption of 2%, this translates approximately to 5.74% - 6.69% nominal, with a central estimate of 6.22%. At the end of February 2024, the iBoxx £ Non-Financial BBB 10Y+ recorded a nominal yield of 5.86%. If this was the relevant benchmark, the low end of Ofwat's early view on the allowed return of equity fails this check of relative risk and return between debt and equity.

These securities can also have debt-like qualities, including periodic coupon payments. But, importantly, in certain circumstances there can be a higher degree of flexibility over when these are paid.[21] Hybrid bonds also sit between senior debt and ordinary shares in a company structure, being eligible for payments prior to equity-holders, but after senior debt-holders.

65 Since the yield on these hybrid bonds is directly observable, with an appropriate assumption on the proportion of equity-like feature of the hybrid bond, an expected return on equity can be implied from a relatively simple formula. If the allowed equity return is set below the level implied by of the yields of hybrid bonds, then a rational investor would not invest in equity capital.

3.2 Hybrid debt

66 Our work is focused on hybrid bonds issued by GB utilities. The table below provides an overview of the available securities. They are issued by NGG Finance Plc, a financing subsidiary of National Grid Plc, and by SSE Plc. We have not identified any hybrid bonds issued by water companies which are currently outstanding. However, we review in detail the applicability of analysis based on hybrid bonds issued by these other GB Utilities in Section 3.5.

Table 2 Hybrid bonds for GB utilities

Issuer	Issue date	Maturity date	Amount
NGG Finance Plc	Mar 2013	Jun 2073	£1,000m
NGG Finance Plc	Sep 2019	Dec 2079	€500m
NGG Finance Plc	Sep 2019	Sep 2082	€750m
SSE Plc	July 2020	Perpetual	£600m
SSE Plc	July 2020	Perpetual	€500m
SSE Plc	April 2022	Perpetual	€1,000m

Source: Fitch, Bloomberg

Note: Our analysis excludes SSE bonds that have been superseded by more recent hybrid bonds

67 These hybrid bonds present the following characteristics:

- Subordination: Hybrid debt-holders receive payment after senior debt-holders but before ordinary shareholders;
- Extended tenors: All bonds have a maturity of more than 60 years at issuance;

[21] Coupons payments can sometimes be deferred. This flexibility over payments is closer to the nature of dividend payments on equity.

- Deferrable coupons: The coupons attached to these bonds are deferrable;
- Call dates: Periodic call dates are incorporated into the structure of all bonds, with the specifics varying by security;
- 50% equity attributes: Rating agencies designate these hybrid bonds as 50% equity-like and 50% debt-like from an analytical standpoint;[22] and
- All the bonds listed above were issued during the period when the RIIO framework (which has similarities to the model adopt by Ofwat since PR14) was operational and are currently traded.

3.3 Inferring the right level of equity returns from hybrid debt

68 We use the hybrid bond data to estimate the implied cost of equity. Assuming the allocation of securities between debt and equity stands at 50%, the spread between the expected return on hybrid bonds and conventional senior debt would fall at the midpoint between equity and senior debt costs. This approach enables us to sense check the allowed cost of equity.

3.4 Methodology and results based on available traded hybrid debt

69 This section summarises the methodology that estimates the hybrid bond cross-check, including the selection of bonds, and the approach to computing the cost of equity in nominal and real terms.

70 Our method for deducing equity returns from hybrid bonds involves the following steps:

- We estimate the spread between expected returns of hybrid bonds and senior debt;
- Assuming 50% equity-like characteristics in hybrid bonds, we calculate additional returns from equity attributes; and
- We calculate the cost of equity by adding senior debt returns to the extra returns from equity attributes.[23]

3.4.1 Selection of hybrid bonds

71 Our approach to selecting hybrid bonds is guided by two key considerations.

- **We focus on the yield to next call date at issuance.**

[22] The details of analytical treatment can vary between agencies.

[23] The spread between debt and hybrids is assumed to reflect the 50% equity-like characteristics of hybrid bonds. Hence, the extra returns of 100% equity compared to debt can be inferred as twice this spread, i.e. Equity returns = Debt yield + 2 x Spread hybrid to debt.

- A call date refers to the date when the issuer can repay the bond for a predetermined call price before its maturity.[24] Hybrid bonds can have multiple call dates. The issuer's decision to exercise the call is influenced by market conditions. For instance, in periods of declining interest rates, the issuer may choose to call the bond to avoid paying interest above the prevailing rate.
- The 'yield to next call date' refers to the estimated annualised rate of return if the hybrid bond is called by the issuer on its next available call date. This can differ from the 'yield to maturity', which provides an estimate over a more extended period. Since call options can imply that the yield of hybrid bonds behaves more like shorter-tenor debt as capital market conditions change, the yield-to-maturity of these bonds may not provide useful insights. Therefore, we look at the yield-to-next-call at the issue date in our cross-check analysis.

- **We prioritise hybrid bonds issued by GB utilities.** We select hybrid bonds secured by GB utilities to ensure we reflect regulatory and operational risk of regulated networks. As a result, the returns from these bonds will accurately mirror the unique risks associated with companies of a similar nature. In Section 3.5 we also discuss how we have ensured the results from the cross-check are applicable to water networks in particular.

72 Table 3 provides a list of hybrid bonds issued by GB utilities, with the tenor to next call date at issue.

24 At a par or at a premium, depending on the terms stipulated at issuance.

Table 3 List of hybrid bonds for GB utilities

Issuer name	Issue date	Maturity date	Next call date	Tenor (years to call at issue date)
NGG Finance Plc	Mar 2013	Jun 2073	18/06/2025	12.3
NGG Finance Plc	Sep 2019	Dec 2079	05/09/2024	5.0
NGG Finance Plc	Sep 2019	Sep 2082	05/06/2027	7.8
SSE Plc	July 2020	Perpetual	16/04/2026	5.8
SSE Plc	July 2020	Perpetual	14/07/2026	6.8
SSE Plc	Apr 2022	Perpetual	21/01/2028	5.8

Source: National Grid, SSE, Bloomberg
Note: The next call dates listed are all first call dates

73 Among the options, we examine the evidence from the **NGG Finance Plc June 2073 hybrid** (NGG 2073 hybrid). This choice is driven by its longest years to call at issue date, extending beyond a decade (see Table 3).[25] This date maximises the remaining tenor and thereby allows us to measure long-term return expectations. Selecting a security denominated in sterling further avoids currency exchange complications.[26]

74 We place less emphasis on the SSE Plc bonds as SSE has a greater share of activities outside of regulated networks (for example, generation activity), however we do sense check our results against SSE securities in Annex A.2. We find similar, logically ordered outcomes

3.4.2 Measuring the spread of expected returns relative to senior debt

75 We assess the hybrid bond yield spread against a well-known market cost of debt benchmark, the iBoxx £ Utilities index. Specifically, we compare against average of the iBoxx £ 10-15Y Utilities index, which provides a comparable tenor to the NGG 2073 hybrid at issuance.[27] **By comparing the yield of the hybrid bond (5.65%) to that of the iBoxx benchmark (4.14%) as of 18 March 2013, we estimate a spread equal to 151bps at issue**.

25 The liquidity of this bond is also comparable with other conventional corporate bonds as measured by bid-ask spread, and we also find that yield data for this bond changes on a daily basis.

26 At the time of writing this report, we did not find any traded hybrid bonds issued by regulated water networks in England and Wales but have used information specific to water companies in Section 3.5 to ensure applicability.

27 Ofwat (2022) PR24 Final Methodology, Appendix 11, page 58. The NGG 2073 hybrid has a tenor of 12.3 years to the first call at issue, which is broadly consistent with an average tenor of the selected iBoxx index.

76 This spread could be applied to the current long-term iBoxx value, providing an estimate for the yield on a long-tenor hybrid bond in current market conditions. However, when determining the spread that will be applied to the present iBoxx, we consider the relatively higher risk profile of hybrid debt. Hence, we estimate the 'expected return' on the hybrid bond, factoring in the potential for the bond to not deliver the promised cash flows, that is, the default risk.[28] By estimating expected return on the bond, the outputs are more consistent with the expected cost of equity that the spread will imply.[29]

77 We follow the methodology outlined in the UKRN cost of equity study (2018)[30] to estimate the expected returns. This approach uses historical default rate data by credit rating bands and incorporates recovery rate assumptions to determine a downward adjustment to the yield figure.[31]

78 Table 4 displays the results. The spread between the expected return on the NGG 2073 hybrid (5.50%) and the corresponding iBoxx indices at the time of issue (4.14%) is estimated at 136bps.[32] This figure is estimated using expected returns to avoid capturing the default risk premium in the yield.

Table 4 Spread of selected hybrid bond relative to benchmark

Hybrid bond	Yield to next call at issue date	Expected return	Selected index	iBoxx yield at issue date	Yield spread at issue date	Expected return spread at issue date
	(1)	(2)		(3)	(1 - 3)	(2 - 3)
NGG Finance Plc, 2073	5.65%	5.50%	iBoxx £ Utilities 10-15Y	4.14%	1.51%	**1.36%**

Source: Bloomberg, Frontier calculations

Note: The expected return adjustment is based on the 2018 UKRN cost of equity study

79 Our estimate uses the spread at issue, effectively assuming that the spread has remained relatively stable since the bond's issuance. While the spread will have fluctuated since issuance, not least to reflect different levels of business risks at

28 We do not adjust the iBoxx Utilities index since it holds an investment-grade status, indicating a lower default risk and potentially higher recovery rates for constituents. This makes our estimate more conservative as the gap between expected return and yield is narrower than it would have been had we carried out a similar adjustment on the senior debt.

29 The CMA recently highlighted the importance of this adjustment in the Heathrow appeal, FD 6.262 page 212.

30 UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK regulators', Appendix H.

31 We assume a recovery rate of 80% for the purposes of this adjustment. Our sensitivity analysis shows this spread changes by approximately 10bps for every 10 percentage point change in the recovery rate.

32 A risk of default for an 80% recovery rate and credit rating of BBB- results in a downward of 15bps.

any given time, we cannot accurately disentangle that effect from the general market credit spread conditions. Our approach has the advantage of avoiding the complexity of estimating a meaningful yield to maturity for a security as it approaches a potential call date. However, to ensure that this assumption does not drive the result, we conduct sensitivity analysis looking at historic time-varying spread to construct a range of spreads (see Annex A1).

80 We also consider the spread of other hybrid bonds, using the same methodology set out in Table 4 as a sensitivity. As we discussed earlier, we focus our analysis on the NGG June 2073 bond, as our assessment reveals that it has more favourable characteristics over the available alternatives. However, to ensure the robustness of our analysis, we repeat the calculations in Table 4 on the remaining bonds set out in Table 3.[33]

81 This analysis reveals an average expected return spread of 1.30% for the other National Grid bonds, with a range of 1.08% to 1.53%. Our main results in Table 4 lie towards the centre of this range – suggesting the result is robust to the selection of other bonds. For SSE bonds, the equivalent average spread is 1.93%. We place less weight on this figure given SSE's involvement in other activities such as generation. However, the spread being greater than National Grid equivalent is logical given SSE's significant ownership of non-regulated businesses e.g. generation. This is also in consistent with SSE having a higher beta than National Grid.

3.4.3 Estimating the implied cost of equity

82 Hybrid bonds exhibit characteristics that fall between traditional equity and debt securities, making them a hybrid financial product. Rating agencies typically assign these securities a 50% weight to both equity and debt attributes. To estimate the equivalent returns on equity, we evaluate the spread considering that it is influenced by the equity attributes of the hybrid bonds.

83 In essence, our goal is to calculate the cost of equity by determining the additional returns associated with the percentage of equity-like features in hybrid bonds. The greater the resemblance to equity, the smaller the difference between hybrid and equity returns. This is set out in the following formula:

$$Cost\ of\ equity_t = avg(iBoxx\ Utilities\ yield)_t + \frac{Hybrid\ bond\ spread\ to\ iBoxx}{\%\ equity\ like}$$

84 Where:

33 Note that we matched the benchmark iBoxx index to the currency and tenor of the hybrid security in question. Full details are set out in Appendix A.2.

- The ‘iBoxx Utilities yield’ represents the average yield of the iBoxx £ Utilities 10Y+ index over the last recent year;
- The ‘hybrid bond spread to iBoxx’ remains constant at 136bps, aligning with the expected returns on the hybrid bond at the time of issuance relative to the iBoxx £ indices’ yields on the issue date; and
- The ‘% equity-like’ stands for the percentage of equity-like characteristics, assumed at 50%. We set out our sensitivity analysis on this assumption in Annex A1.

85 We estimate the expected long-term returns on senior debt by taking the average of the iBoxx Utilities 10Y+ indices over the last recent year.[34] We take the yields from the latest calendar year, facilitating comparability and replicability of our analysis, and average them to obtain a robust estimate. We note this is different from Ofwat’s approach of using one-month average for estimating the cost of new debt. A year timeframe allows us to reflect the near-term future outlook and minimise the impact of short-term fluctuations in debt market rates. We conduct sensitivity tests to assess the reliability of this estimate, establishing a reasonable range for potential iBoxx values (see Annex A1).

3.4.4 Results of the hybrid bond cross-check

86 This section outlines the results of the cross-check using hybrid debt according to the methodology set out in the previous subsections.

87 The table below summarises the outputs for the long-term cost of equity estimate. Our point estimate of the expected returns on equity implied from hybrid debt evidence lies at 8.8% in nominal terms (6.6% in real CPIH terms).

Table 5 Results of the cost of equity cross-check

Value	Estimate
Hybrid bond spread (adjusted for default risk, at issue)	+136bps
iBoxx £ Utilities10Y+ (1Y average)	6.04%
Higher returns on equity (based on 50% equity-like)	+272bps
Nominal cost of equity	**8.76%**
Real cost of equity (CPIH deflated)	**6.63%**

Source: Frontier calculations

Note: Analysis as of 29 February 2024. We consider a 2% inflation assumption to derive CPIH-real cost of equity.

34 As of 29 February 2024.

88 To provide further comfort around these results, we have undertaken a set of sensitivity tests on the key assumptions of the analysis, summarised below. The details of these sensitivity checks are included in Annex A1.

89 Although the details are not discussed here, the results from those checks are shown in Table 6. As shown, the sensitivities are used to derive a range around the central CPIH real cost of equity of 6.6%. Overall, this results in a low end of the range from the cross-check of 5.8%, and a high end of the range from the cross-check of 8.4%. We note that our point estimate is closer to the lower end than the upper end – this simply reflects the non-symmetric outputs from the sensitivity analysis.[35]

90 Our range reflects plausible high and low scenarios of hybrid spread, equity-like proportions and iBoxx yields, although the lower and higher bounds of our range do not represent the lowest and highest outcome of all of the scenarios compounded, which would have produced implausibly low and high values. Instead, they represent average lower and higher bounds of these scenarios.

Table 6 Summary of sensitivity checks on key assumptions

Summary results	Low	High
Sensitivity on historical hybrid-iBoxx spread	7.8%	10.1%
Sensitivity on the percentage of equity-like	7.9%	11.5%
Sensitivity on iBoxx averaging	8.2%	10.1%
Nominal cost of equity	7.9%	10.6%
Real cost of equity (CPIH deflated)	**5.8%**	**8.4%**
Real cost of equity (CPIH deflated) – point estimate		**6.6%**

Source: Frontier calculations

Note: Results for the cost of equity are obtained by averaging the low and high values of each sensitivity respectively. We consider a 2% inflation assumption to derive CPIH-real cost of equity.

91 As shown in the table above, we conducted three sensitivity tests on our results

(a) ***Sensitivity on the historical hybrid-iBoxx spread***.

(i) An assumption in our analysis is that the hybrid spread to iBoxx has remained constant over time. We have adopted this approach as spread figure is associated with a long-term hybrid bond yield at issue – making

[35] For example, on equity likeness, dividing a constant spread value by different percentage equity-like leads to this results.

it an appropriate observation to use when checking long-term equity returns. It also aids simplicity.

(ii) Nevertheless, we test the sensitivity of our analysis in response to the hybrid spread volatility over time by constructing a range around the 10th and 90th percentile.[36] We obtain a spread between 86bps and 201bps, resulting in nominal equity returns between 7.8% and 10.1%. Applying the CPIH assumption of 2.0% produces a CPIH deflated range of 5.6% to 7.9%. Our main analysis output lies towards the centre of this sensitivity range.

(b) ***Sensitivity on the percentage of equity-like***.

(i) In our main analysis, we have taken the assumption that hybrid bonds stand at the midpoint between debt and equity, specifically, we assume 50% equity-likeness from an analytical perspective. However, we test sensitivities ranging from 75% to 25%.

(ii) This sensitivity tests produces a range of 7.9% to 11.5% (equivalent to 5.7% to 9.3% in real terms). Although the lower end of this range aligns closely with the prior sensitivity, the upper limit exhibits a significant increase in magnitude. This is not surprising since in the upper case a larger multiplier is applied to the hybrid spread to imply the equity premium.

(c) ***Sensitivity on iBoxx averaging***.

(i) In estimating the cost of equity cross-checks from hybrid debt, we considered the average value of the iBoxx £ Utilities 10Y+ during the latest year.[37] This average window, in our view, captures the outlook for debt market in the near future reasonably well whilst smoothing out short-term volatilities on market rates.

(ii) However, we have conducted sensitivity scenarios on the iBoxx yield, and assessed how different dates and 'milestones' in the hybrid bond's trading history could influence the final value.

(iii) When we average across these periods, we find that the iBoxx values range from 5.4% to 7.4%. Consequently, the nominal cost of equity falls between 8.2% to 10.1%, which translates to 6.0% to 8.0% in real terms cost of equity. This aligns with the sensitivities observed in the previous sections.

36 Using traded yield data whereas the main outputs are based on yield at issue data.

37 As of 29 February 2024.

92 In conclusion, our results are a point estimate for the implied cost of equity for 6.6% CPIH-real, within a range of 5.8% - 8.4% CPIH-real.[38]

3.5 Ensuring the findings are applicable to the water sector

93 The results presented above are derived from the NGG bond explained above. However, they are not sourced from water companies in England and Wales. In this section we demonstrate that the results are applicable to the water sector, and therefore can be applied in the context of the PR24 cost of equity. We ensure this in two ways:

- By comparing the characteristics of the networks being considered – both qualitatively and quantitatively; and
- By assessing information on quoted spreads for newly issued water sector hybrid bonds.

94 We discuss each in turn below.

3.5.1 Comparing the characteristics of the networks being considered

95 As set out in Section 3.4, the central result for the cross-check is based on a hybrid bond issued by National Grid. One way to explore relevance for the water sector is to qualitatively compare water companies to National Grid. We consider that, in the context of the hybrid bond analysis, there are several similarities between National Grid and water companies which mean the results are relevant for the water sector cost of equity, these are:

- **Long-lived network assets** – both types of company manage a large network of assets that provide an essential service. A key characteristic of those networks in both cases is long-lived assets.
- **RCV based regulatory models** – both types of network are regulated through a RCV (or RAV to use Ofgem's terminology) model. Both earn a return on capital linked to the RCV value, and have a component of revenue linked to the depreciation of that RCV value.
- **Revenue model** – both types of network operate under a regulator model of allowed revenues, which involve an assessment of efficient costs (totex) and a system of rewards and penalties linked to outcomes.
- **Use of water company data by Ofgem** – when assessing the cost of equity, Ofgem directly considers evidence on the beta of listed water companies (Severn Trent, Pennon and United Utilities) alongside that of National Grid.

38 As noted above, our point estimate is closer to the lower end than the upper end – this simply reflects the non-symmetric outputs from the sensitivity analysis

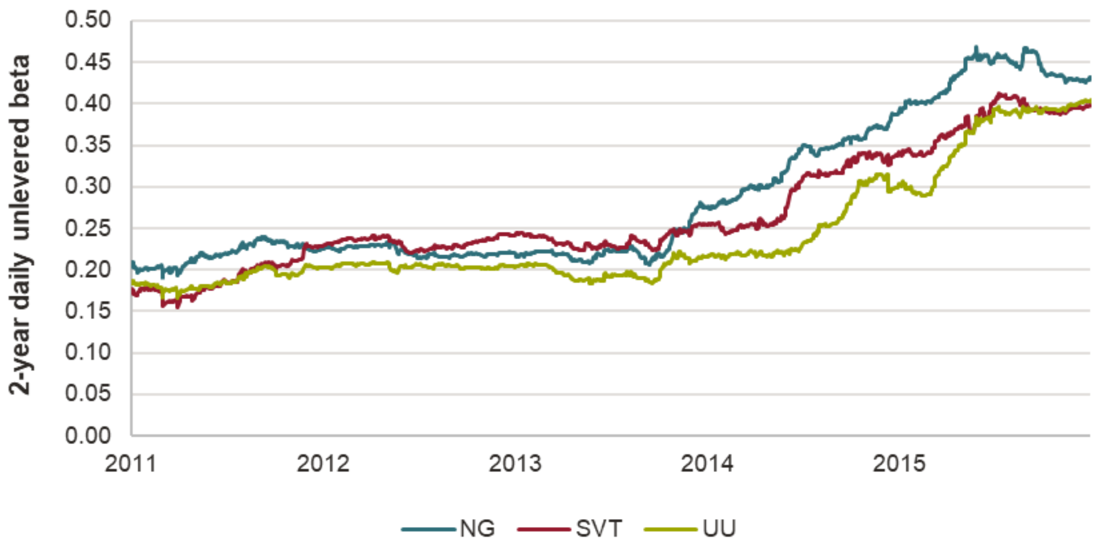
Therefore, Ofgem considers these data points to have sufficient similarity to the networks they regulate to inform its cost of equity allowance.

96 Given these shared characteristics, we consider the results from the cross-check can be utilised in the context of PR24, but have also considered other quantitative data points too.

97 The quantitative data points we consider are focused on how comparable the National Grid was to water companies at the time the NGG 2073 hybrid bond was issued (March 2013). Specifically, by focusing on unlevered beta and gearing estimates from the time, we can ensure there is no large differences in relative risk not being accounted for.

98 Firstly, comparing unlevered beta estimates at the time, we find that there are no large differences. In fact, as shown in Figure 2 below, the unlevered betas for National Grid and two listed water companies were very similar to each other in 2013, with the outputs showed minimal dispersion, between 0.20 and 0.25 at that time.[39]

Figure 2 Beta comparison to water companies



Source: Frontier analysis, Bloomberg
Note: Unlevered betas shown using 2-years of daily data

99 Secondly, comparing gearing levels at the time, we find that the gearing level (measured by net debt to enterprise value) of National Grid was actually lower than the two water companies around 2013.[40] This suggests, given similarities in

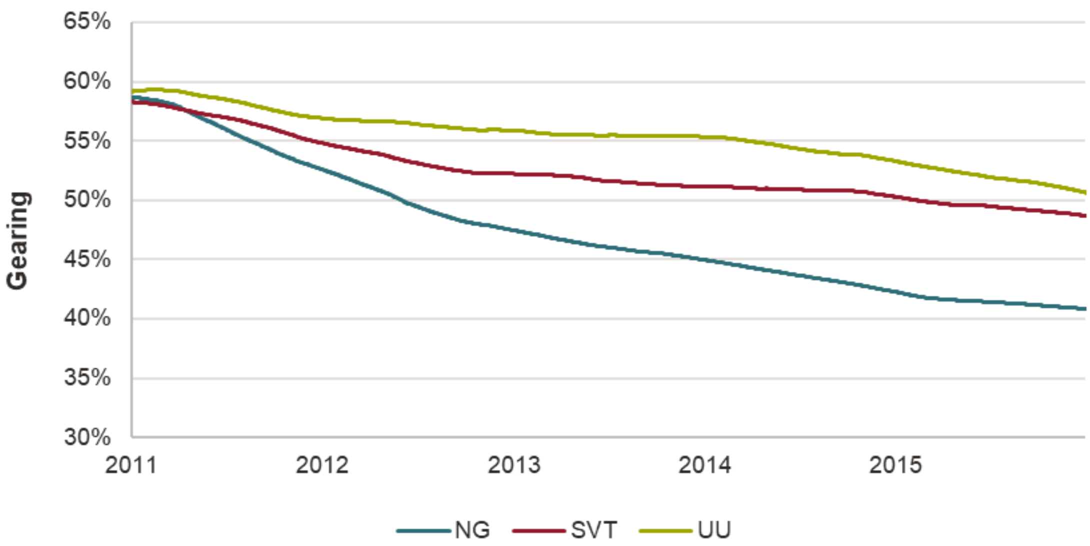
[39] Given Pennon's previous holding of waste business assets we do not include this in this analysis.

[40] We focus on Enterprise Value rather than RCV/RAV since this is more reflective of an investor's outlook.

unlevered beta, an equity beta for National Grid which happened to be lower than water companies at that particular moment in time. Arguably this implies that the inputs to the cross-check were reflecting risks lower than those present in water network at that time.

100 In addition, we note that around the time of issuance the enterprise value gearing level of National Grid was around 45%. This is significantly lower than Ofwat's PR24 methodology gearing level of 55%.[41]

Figure 3 Gearing comparison to water companies



Source: Frontier analysis, Bloomberg

Note: Enterprise value based gearing, averaged daily over a 2-year rolling period

101 We consider this evidence supports the use of the cross-check in a water sector context. And again, the points of comparison set out above may even suggest that the cross-check is calibrated in a relatively cautious manner.

3.5.2 Quoted spreads for potential water sector hybrid bonds

102 Even though there is currently no hybrid bond issued by water companies, we have considered relevant evidence from new issuance quotes recently provided by financial advisors on behalf of water companies which should reflect market conditions reasonably well. Specifically, Severn Trent have provided us with data on the spread of a new sterling denominated hybrid bond above their senior bonds. This data is from a hybrid bond issuance quote obtained from its investment bank in early 2024.

41 Measured on an RCV basis.

103 The information provided showed that the spread of the new hybrid issuance above senior bonds varied in a range of 155bps to 170bps. Hybrid bonds with a longer number of years to next call (e.g. around 10 years) were at the higher end of the range.[42]

104 Therefore, the higher end of this 155bps to 170bps range is arguably most comparable with the NGG 2073 hybrid bond used in Section 3.4, as this hybrid had around 12 years to the first call date when it was issued.

105 As set out earlier in this section, the spread of the NGG 2073 hybrid bond[43] above the iBoxx Utilities equivalent at issue was 151bps. It is this input to the cross-check methodology that the quote shared by Severn Trent should be compared to.[44] Therefore, we find that this quote for a water hybrid bond is of a very similar magnitude to the inputs used in the cross-check – with the NGG spread sitting just below the quoted new issue range.

106 We consider this is further evidence that the values we have used to estimate the hybrid bond cross-check are suitable in the PR24 context. Indeed, the evidence shows that our assumptions may actually on the cautious side relative to recent market conditions reflected in the quote, which extended to 170bps at longer tenors.

3.6 Conclusion on hybrid bond cross-check

107 Overall, we find the hybrid bond cross-check developed in this section can be applied reasonably well in the PR24 context.[45] It provides a direct reading of the capital market conditions, to which Ofwat should have regard if it were to set a price control package that can successfully attract and retain equity capital for PR24. Our analysis shows a range for the implied cost of equity of 5.8% - 8.4% CPIH-real. Within that range, our central estimate for the implied cost of equity is 6.6%. This compares with an 'early central view' allowed return on equity from the PR24 methodology of 4.14% – a figure which lies outside the cross-check range. This could be due to the CAPM parameters used by Ofwat in its early is to skewed to the downside given that they are mostly based on long-term historic averages

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42 Our understanding is that this information relates to the hybrid bond being issued by the opco, and that there is an assumption that the hybrid bonds would receive 50% equity credit (noting that details of that treatment can differ between rating agencies).

43 Also sterling denominated.

44 There is a very minor difference in that the spread for the NGG hybrid was to the iBoxx Utilities, whereas the quote is to Severn Trent senior bonds. However, Severn Trent Water Limited has a credit rating of BBB+/Baa1, meaning any difference will be minor.

45 Some data suggests the cross-check outputs may be cautious.

and the capital markets are currently higher than those levels. We will see an example of this in the next part of this paper where we discuss the TMR.

108 This range has been developed through extensive sensitivity analysis and robustness checks, the details of which are set out in Annex A. Our view is that an allowed return on equity below this range may fail to adequately reflect the new capital market reality – and therefore would be associated with heightened equity financing risks.

4 The process of lowering TMR allowances

109 In helping to understand how regulators can and should adapt the allowed equity return to the current high interest rate environment, we explore how regulators have in the past adapted the allowed equity returns downwards as a response to the previously low interest rate environment. Among other things, the parameter that reflected this regulatory practice the most clearly is the TMR.

110 In this section, we outline how regulators responding proactively to the interest rate environment has been the norm for a considerable amount of time. Namely, we illustrate how the TMR input to the cost of equity has actively been lowered since the Global Financial Crisis (GFC) in response to very low interest rates.

4.1 The process that led to lower allowances for TMR

111 Looking back at past regulatory determinations up to the early 2010s, regulators generally followed established practice (at the time) for determining TMR. This involved placing almost all weight on long-run historical ex post equity market returns, with other approaches mentioned almost as an aside. At that time, historical equity market returns sourced from the Dimson, Marsh and Staunton (DMS) Credit Suisse Global Investment Returns Yearbook dataset supported estimates of TMR above 7% (adjusted for inflation).[46] This focus on a long history of evidence was aimed at promoting a stable framework for remunerating invested equity capital. Most regulators followed broadly this approach and the approach was well understood.

112 However, following the GFC, yields on ILGs started to fall as central banks changed policy to protect their economies, and they kept falling. Regulators in other geographies that adopt a fixed equity risk premium (ERP) model saw their cost of equity allowances decrease automatically as interest rates fell.[47] But in the UK, with its hitherto ‘fixed’ TMR model, there was no similar automatic lowering of TMR and/or cost of equity, just a second order effect on the cost of equity arising from the decrease of RFR.[48] Regulators needed to find other ways to lower TMR.

113 The consensus approach to TMR which had previously prevailed was therefore tested, arguably to the point where in the last round of price controls, it broke. As interest rates continued to fall regulators responded by placing greater weight on approaches that had previously played a much more limited role (or no role at all) in regulatory determinations. Historical ex post approaches to assessing market

46 It still does, although the inflation index DMS uses has evolved over time.

47 Many European regulators assume that the ERP is fixed, and then calculate TMR based on this fixed ERP plus a contemporaneous estimate of RFR based on a trailing average of government bond yields.

48 Where the equity beta is less than one.

returns were revisited, and reasons were found to develop lower measures. Averaging methods for ex post returns were also revisited, and regulators started to place less weight on measures that were high, and more on those that were low.

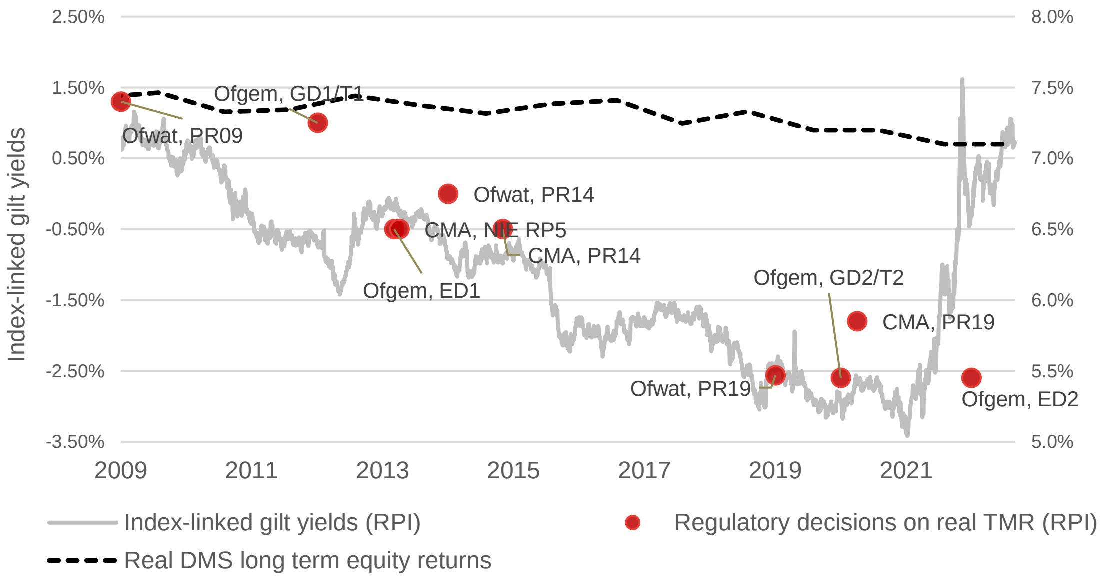
114 As part of this, fresh attention was paid to historical ex ante methods, for example by the CMA as part of its redetermination of PR19. These are expected to produce lower estimates of TMR than historical ex post methods, because they are based on subjective decompositions of historical returns, and a subjective assessment of which aspects of these decompositions are repeatable (and should be included in estimates of TMR) or likely to be one off (and should be excluded from estimates of TMR). By setting aside some proportion of achieved historical returns, it follows that a lower estimate of TMR will result.

115 The recent history of regulatory TMR decisions is illustrated alongside other key evidence in Figure 4 below.

- The dotted red line (right-hand scale) shows the underlying evidence on real long-term equity returns as published by DMS. The estimated long run level has fluctuated in a narrow range roughly between 7.1% and 7.3% (in real terms according to DMS's definition of inflation for the UK), i.e. it has barely changed.
- The grey line (left-hand scale) shows yields on 20-year government ILGs (an often used proxy for RFR), RPI-real.
- The red dots show regulatory decisions on the estimated TMR (also right-hand scale) in the same period, all converted to RPI-real terms for comparison purposes.[49]

[49] We note that some of the TMR decisions were expressed in CPI or CPIH-real (PR19 Ofwat, PR19 CMA, GD2/T2 Ofgem, and ED2 Ofgem). Where this was the case, the UKRN expressed these in RPI-real terms using a RPI/CPI wedge of 1%. Please see: UKRN (2023) Cost of Capital – Annual Update Report, Table 7. Accessible here: https://ukrn.org.uk/app/uploads/2023/08/2023-UKRN-Annual-Cost-of-Capital-Report_080823_minor-editorial-corrections-1.pdf

Figure 4 Long run TMR as estimated by DMS, Regulatory decisions on TMR and yields on 20 year ILGs



Source: Bank of England, DMS, Frontier Economics, UKRN

116 It is clear from this chart that regulators have lowered their estimate of TMR over time in response to the fall in gilt yields. In fact, regulators were explicit that they lowered TMR *because* of their perception of wider market evidence, in particular the change in interest rates.

117 Below we delve further into the linkage between interest rates and TMR by stepping through the timeline described above in more depth.

4.2 Further detail on the links between interest rates and TMR

118 The process of lowering returns began with the Competition Commission's redetermination of NIE Networks RP5 price control (March 2014).[50] The CC lowered its prior standing assumption that TMR was 7% (RPI-real) to an allowance of 6.5% (RPI-real) for RP5. The CC could not have been clearer *why* it was lowering its expectation of TMR – no material changes have occurred to the long run evidence at the time of its decision compared to a similar decision on Bristol

[50] Accessed here: https://assets.publishing.service.gov.uk/media/535a5768ed915d0fdb000003/NIE_Final_determination.pdf

Water[51] a few years back, but its assessment of prevailing wider market conditions had.

> *"A forward-looking expectation of a return on the market of 7 per cent does not appear credible to us, **given economic conditions** observed since the credit crunch in 2008 and lowered expectations of returns."*[52] [emphasis added]

119 Ofgem then followed suit. First, in response to the emerging findings of the CC in respect of NIE, Ofgem issued a stand-alone consultation to revisit how it would set the cost of equity for RIIO-ED1. This led to Ofgem following the CC down, for the same reason.

> *"We therefore consider that there are a number of factors pointing towards a lower cost of equity for DNOs, in large part **reflecting current market conditions** as analysed by the CC. Our analysis and advice highlight alternative **interpretations of current market conditions**, although they point our assessment of the cost of equity in the same downwards direction.*
>
> *As a result, we are changing our methodology **to give greater weight to the influence of current market conditions** in relation to the equity market return, specifically in relation to our assessment of its separate components."*[53] [emphasis added]

120 Around the same time as Ofgem's consultation on equity market returns, Ofwat released its 'risk and reward guidance' for its upcoming PR14 price control, within which Ofwat estimated a TMR range of 6.25% to 6.75% (RPI terms). This *was* a large reduction from the 7.4% TMR that featured in its PR09 decision. A key reason Ofwat selected this new range was that:

> *"monetary policy and investor appetite have **significantly reduced Government and corporate bond yields** and put downward pressure on returns across most asset classes"* [54] [emphasis added]

121 This reasoning continued through to RIIO-2, when Ofgem again lowered its estimate of TMR. Ofgem's new estimate was 6.5% but this was on a CPI-real basis – equivalent to approximately 5.5% on an RPI-real basis. Ofgem's decision was prompted by the recommendations of the controversial and much debated 2018 UKRN paper on cost of capital, but also resulted from Ofgem's assessment

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51 CC (2010). Bristol Water plc, Appendix N.

52 CC (2014), Northern Ireland Electricity Limited price determination, para. 13.146.

53 Ofgem (2014), Decision on our methodology for assessing the equity market return for the purpose of setting RIIO-ED1 price controls, p. 4.

54 Ofwat (2014), Setting price controls for 2015-20 – risk and reward guidance, p.14

of then-prevailing wider capital market conditions. For example, Ofgem relied on information from investment managers' forecasts at the time, and other forward-looking measures, to lower its TMR estimate.

> *"We note that each of these [investment managers] forecasts is significantly lower than the 8-9% nominal TMR range we derive from inflating the UKRN Study by forecast CPI. These are in line with lower forward-looking measures and further reinforce the recommendation to reduce the long-term TMR range."*[55]

122 Again, at a broadly similar time, Ofwat produced the final methodology for PR19. There was an extensive discussion of TMR and wider market conditions within the final methodology. Again, there was clear evidence of a link between equity returns and interest rates, with Ofwat saying:

> *"Our draft methodology proposals, together with supporting analysis by PwC, set out evidence from recent market data that **the extended period of low interest rates has reduced returns required by UK equity investors** to below long-run historical averages of realised returns."*[56] [emphasis added]

123 Going on to note that:

> *"PwC argued that, while some of these factors may unwind over time, any unwinding is likely to be gradual and that low long-term interest rates are likely to persist for the foreseeable future. **They are therefore relevant to our efforts to forecast Total Market Return** over the period 2020-25."*[57] [emphasis added]

124 Ultimately, this culminated with Ofwat concluding that:

> *"We consider that **reflecting recent market conditions in our point estimate of TMR is a continuation of past practice**, which we see as necessary to uphold our statutory duties for financing functions as well as customers. We interpret our financing duty as a duty to secure that an efficient company is able to finance its functions, in particular by securing reasonable returns on its capital. An approach to setting TMR which failed to reflect market evidence on likely financing costs would not effectively support this duty…*

55 Ofgem (2018), RIIO-2 Sector Specific Methodology Consultation: Finance Annex, para 3.78.

56 Ofwat (2017), "Delivering Water 2020: Our methodology for the 2019 price review; Appendix 12: Aligning risk and return; section 5.4.

57 Ofwat (2017), "Delivering Water 2020: Our methodology for the 2019 price review; Appendix 12: Aligning risk and return; section 5.4.

> *… Recent evidence that required equity returns have fallen below their long-term average, together with expectations of weak productivity growth and **subdued interest rate rises**, imply that relying too heavily on long term averages is likely to overstate actual TMR in 2020-25."*[58] [emphasis added]

125 As such, while the basis for the downward shift in TMR allowances has sometimes appeared subjective or opaque, it is evident that regulators have lowered TMR explicitly *because* of their assessment of wider market evidence, including in particular falls in interest rates and reductions in yields on ILGs.

4.3 What now?

126 As illustrated above, UK regulatory practice has over the past decade or more been, de facto, to move TMR down to reflect prevailing market conditions. As interest rates and yields on government bonds fell over much of the last decade, UK regulators responded by lowering their estimates of TMR used to determine the allowed cost of equity.

127 This movement was not one-for-one, i.e. they moved TMR by a proportion of the fall in yields on the government bonds. This "stable but not fixed" policy has been explicitly endorsed by the UKRN.[59]

> *"There is significant alignment amongst regulators in the overall approach to the TMR/ERP, namely that in recent determinations UK regulators assume greater stability in the TMR and therefore estimate it directly from historical equity returns data. In the interests of maintaining consistency across sectors and also across time, continuing with this approach remains preferable. This approach does not imply that regulators should simply pick the same fixed value for the TMR in each decision for all time, but that the TMR would be relatively less variable than the underlying RFR. This would support greater stability in the cost of equity allowances over time. This policy choice seems appropriate in the wider context of the aspiration for greater predictability and transparency in the regulators' methodologies for estimating the allowed rate of return, and one that is fair to investors and customers over time."*

128 Interest rates have now reversed. The very low, deeply negative real interest rates that caused regulators to lower their estimates of TMR over the last decade are no longer observed. On the contrary, interest rates are now materially positive. Available evidence points to materially positive rates persisting.

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58 Ofwat (2017), "Delivering Water 2020: Our methodology for the 2019 price review; Appendix 12: Aligning risk and return; section 5.4.

59 UKRN (2023), UKRN guidance for regulators on the methodology for setting the cost of capital, p. 19.

129 By the same logic that caused estimates of TMR to fall, it is now time for regulators to increase TMR. Section 5 explores how the regulatory TMR should adapt to current market conditions, and proposes a solution.

130 To develop a solution we have explored what the academic literature tells us about the relationship between forward looking estimates of TMR and the yields on index-linked gilts (ILGs). We then follow this literature to develop our own model of the relationship, finding that this can be used to calibrate a 'TMR Glider' i.e. an assessment of what market evidence tells us about the appropriate level of TMR implied by market movements in gilts (used to proxy the RFR).

131 Our view is that TMR not responding to these steep increases in interest rates runs the risk that investors might conclude that 'stable but not fixed' applies only when interest rates are falling, but not when they are rising. This could be detrimental to investor confidence.

5 The relationship between TMR and RFR

132 In this section we step through the TMR Glider we have developed, setting out our estimation and checks against past regulatory decisions. Supporting analytical details can be found in Annex B.

5.1 Developing a TMR Glider

5.1.1 Overview

133 Below we set out the steps we have followed to develop our TMR Glider at a high level. The full detail underlying our methodology is set out in the TMR Glider Annex.

134 Our process can be summarised as follows.

- **Step 1, understanding the relationship between TMR and gilt yields**: we have explored the evidence on the relationship between TMR and interest rates. Our review of the academic literature has shown evidence of this relationship, although we note that different studies report different levels of responsiveness. This is inevitable as studies cover different markets and time periods do not all rely on the same measures of interest rates. Given this, we do not propose to simply adopt the academic literature directly to develop a TMR Glider which is relevant to Ofwat's regulatory context.

- **Step 2, developing a DDM model to estimate short run forward-looking TMR**: the literature we have reviewed suggests that the relevant relationship is between the measure of the RFR as proxied by the yield on safe government assets, and the forward-looking *required equity return*. This is also the relationship of interest for our purposes. We have followed the academic literature and have developed an equity cash flow Dividend Discount Model (DDM) to estimate required returns on a forward-looking basis. We note that this approach has also been adopted by the Bank of England.[60] Owing to data availability constraints, we produce results for the UK market for the period 2006-2023.

- **Step 3, estimating the relationship between DDM-derived TMR and 20-year gilt rates**: we identify the line of best fit between required TMR and yields on 20-year gilts commonly used to proxy the RFR. We have explored a range of potential specifications and time periods, and we have conducted sensitivity analyses to gauge whether and how to account for periods of high financial market volatility that may be outliers. Inevitably, our estimates of the

60 See for example: An improved model for understanding equity prices (2017), Will Dixon & Alex Ratten, Q2 2017 Bank of England Quarterly Bulletin https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/2017/an-improved-model-for-understanding-equity-prices.pdf

relationship between TMR and nominal gilts is somewhat sensitive to these choices, but not unduly so, i.e. similar conclusions would emerge from all the specifications we have considered.[61]

135 More detail on each of these steps are set out in the following subsections. As a final step, we evaluate whether the relationship we have developed leads to a Glider that is capable of explaining past TMR decisions taken by regulators; this will be covered in Section 5.2.

5.1.2 Understanding the relationship between TMR and ILG yields as a proxy for RFR – the academic evidence

136 The academic literature reveals that there is evidence of a relationship between TMR and government bond yields, which are usually used in the regulatory context to set the RFR. However, we are not able to directly rely on the findings from the academic studies, given that they relate to different markets and time periods. We do not consider that it would be appropriate to rely on these models 'out of sample' to inform the cost of equity in the context of upcoming GB price controls.

137 Nevertheless, our review of the literature has shown that there is a fairly consistent approach to investigating the relationship between expected total market returns and RFRs. This involves first estimating the expected or required TMR via an equity cash flow model such as the dividend discount model.[62] The required TMR values derived from the DDM model can then be used to evaluate whether a relationship can be specified between the required equity market return and the prevailing RFR at the time. We have adopted this approach in our analysis.

138 Details on the academic evidence revealed is set out in Annex B1.

5.1.3 Estimating the required equity return using a DDM

139 In line with the approach set out in the literature, we have developed a Dividend Discount Model (DDM) to estimate a TMR timeseries for the UK from 2006 to 2023.[63] We note that our approach closely mirrors that adopted by PwC in their

61 One question that might be asked is, why not just use DDM estimates of TMR directly to test regulatory decisions? Why fit a relationship to build a Glider? In our view, there would be risks associated with using 'spot' DDM estimates directly in a regulatory context. DDM estimates are volatile, and reliance on them for regulatory purposes would result in a regime where returns may vary materially from period to period. Neither customers nor investors would value such a regime. It would also be out of line with the UKRN guidance set out above, as a regime based on DDM would not deliver stable TMR. However, DDM remains a valid model for constructing expectations on forward-looking required returns, and can serve as a sound foundation for this analysis.

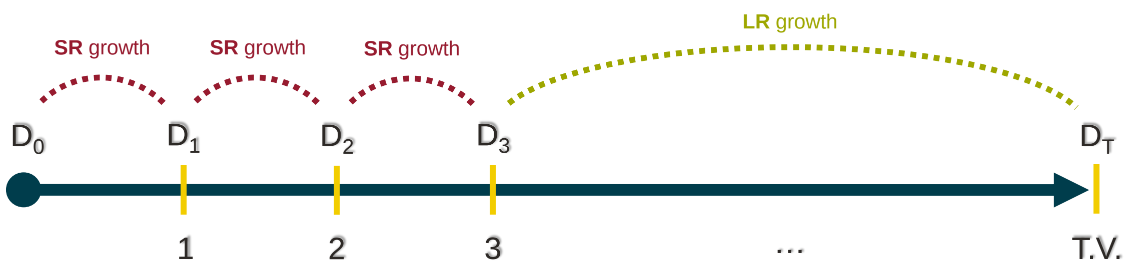
62 In addition to the academic literature investigating the relationship between ERP/TMR and the RFR, the Bank of England have a set of papers using DDM to estimate TMR over time. These papers also support our use of DDM to estimate required returns to equity. We summarise the findings of these papers in Annex A.

63 The data we have used in the DDM model is outlined in Annex B.

study for Ofwat, described above. We also note that in PR19, Ofwat considered DDM evidence when setting the regulatory total market return.[64] However, as we set out in Section 5.1.1, we do not propose using DDM evidence directly, to support a stable regulatory regime.

140 We have also adopted a two-stage growth DDM model. This requires an assumption of a short-run growth rate for the first three periods and a long-run growth rate used in perpetuity thereafter, as illustrated below. The short term growth assumption uses dividend forward rates sourced from Bloomberg. The long term growth rate is the IMF's nominal GDP long-run growth forecast. Our DDM also takes account of share buybacks as part of our assessment of the cash flows that will accrue to equity holders. We consider that accounting for buybacks more accurately reflects the overall cash return for investors, and note that this matches the approach adopted by PwC.[65]

Figure 5 Growth assumptions required to operationalise the DDM model



Source: Frontier internal

141 Using these assumptions, we are able to construct a stream of *expected* equity cash flows for the period 2006-2023. We note that data availability prevents us from extending the analysis back further. The present value of expected equity cash flows are then equated with the level of the FTSE All Share[66] at any given

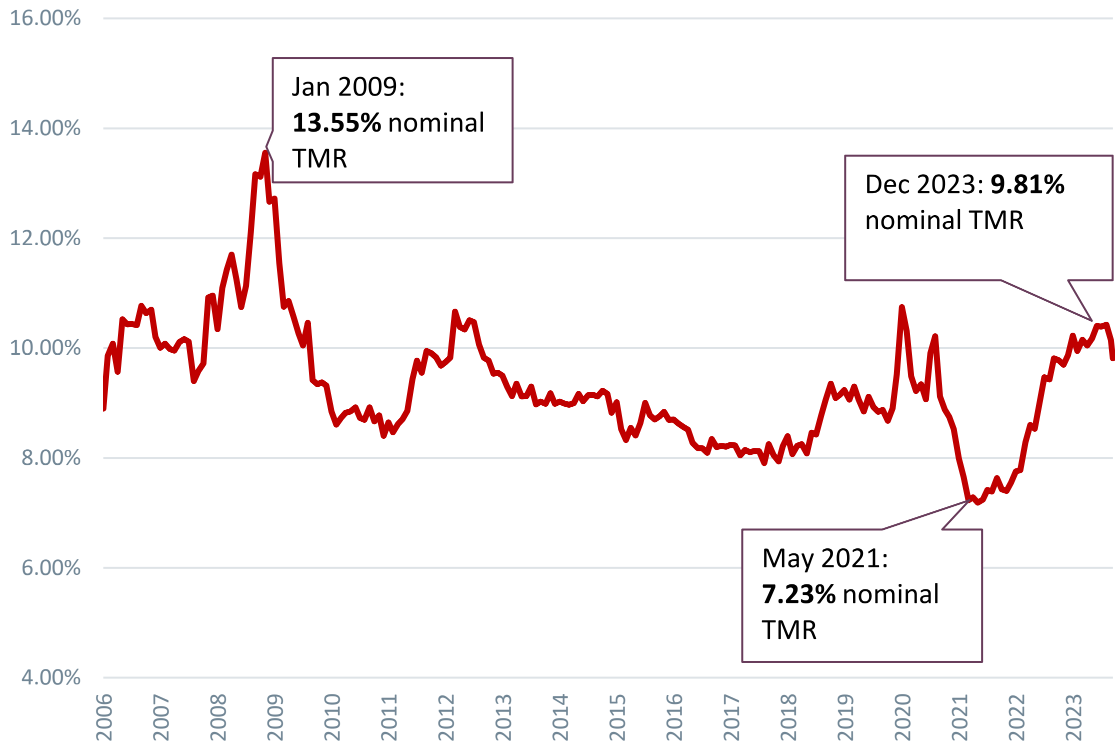
64 See for example: Ofwat (2019) PR19 Final Determinations, Allowed return on capital technical appendix.

65 We have explored a range of further specifications in the course of this work. We find that different specifications make only minor differences to the resulting TMR. For the reasons provided in the main body of this report, we consider that our chosen approach is the most robust and reasonable.

66 More details on the datasets used are given in Annex B. We test the underlying data assumptions for robustness on several dimensions. We use FTSE 100 data rather than the FTSE All Share Index, and find results to be similar. We use quarterly rather than monthly data, and again we find the results to be similar. We use actual dividends data rather than analyst dividend estimates, and we find the results are more robust across the specifications with the estimated data.

point in this time window, to infer the *required* equity return on the FTSE All Share.[67] The model output is illustrated in the figure below.

Figure 6 Estimated TMR from DDM modelling



Source: *Frontier Economics DDM Model output*

Note: *Our preferred specification uses analyst dividend yields and buyback yields to capture shareholder returns, dividend 3Y forward expectations for short-run growth and IMF nominal long-run GDP growth forecasts for long-run growth.*

142 The pattern of this chart fits most of the macro events that one would expect to have affected the TMR over the time period. For example, the height of the global financial crisis saw the peak of the TMR, followed by a second (albeit lower) high during the Eurozone sovereign debt crisis. Further down, the Covid-19 market turbulence marked another high market premium point, while the continued loosening of monetary policy meant that once the market recovered from the Covid-19 shock the TMR was at its lowest in recent history in line with the lowest RFR in recent history. The Ukraine war and the ensuing interest rate hikes by the Bank of England contribute to the recent peak of the TMR, with risk premium and RFR increasing simultaneously.

67 See **Error! Reference source not found.** of this report for a full explanation of the DDM model.

143 We have compared our above DDM TMR output against the output of a similar exercise undertaken by the Bank of England. The results of this comparison can be found in Annex B. We consider this comparison broadly supportive of our DDM approach and findings.

5.1.4 Estimating the relationship between TMR and the RFR

144 Our final step is to evaluate the relationship between the forward-looking required equity return and contemporaneous 20-year gilt yields, i.e. to estimate the observed change in TMR given changes in bond yields.

145 To do this, we identify the line of best fit between required equity returns (TMR) and 20-year gilt yields as a proxy for RFR. More specifically, we estimate the slope (β) and intercept (α) of this line of best fit, per the following equation:

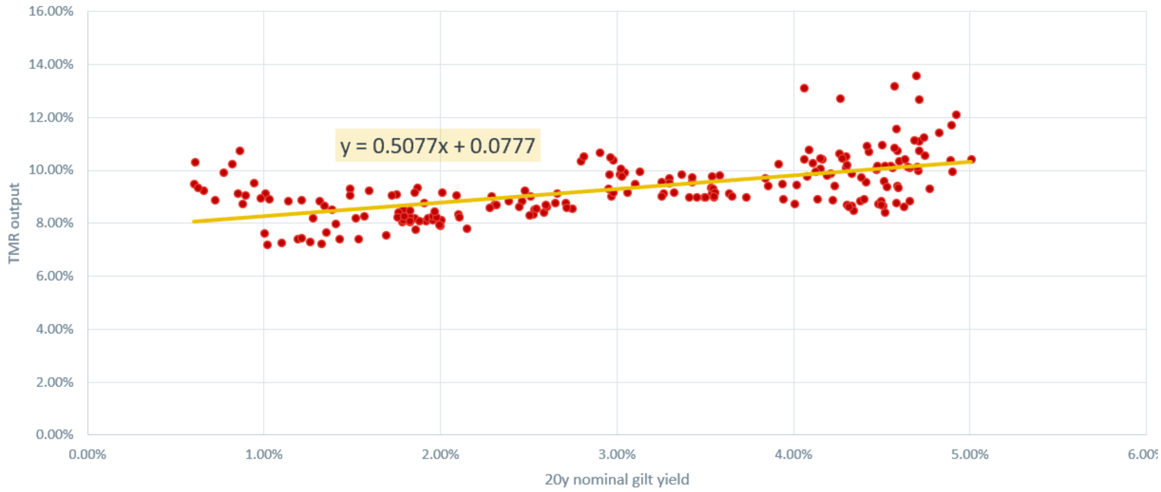
$$TMR_t = \alpha + \beta \cdot 20\ year\ ILG\ ytm_t$$

146 Following the academic literature, the purpose of this analysis is clearly not to provide a fully fitted, multidimensional macroeconomic model that explains the relative importance of all the potential determinants of TMR. Rather, we look to identify the simple relationship between the two variables over time in order to inform our TMR Glider.

147 We have considered three different specifications that result in slightly different parameter estimates.

148 Our first specification (Specification A) simply examines the relationship between our DDM TMR and 20-year gilt yields, over the entire period we have studied and including all observations. The outcome is shown in the figure below. We find that we are able to specify a linear relationship between TMR and RFR which reasonably runs through the data, but for a number of outliers on the top right hand corner of the figure.

Figure 7 Line of best fit between forward-looking required TMR and 20 year gilt yields using DDM



Source: *Frontier internal DDM model output*

Note: *The TMR output is from Specification 3 of the DDM model. The 20y nominal gilt yield is our proxy for the RFR.*

149 The line of best fit has an estimated slope of 50.8%, i.e. this evidence suggests a 100bps increase in yields on 20-year gilts is associated with a corresponding 50.8bps increase in the TMR. The intercept is estimated to be 7.8%, i.e. if nominal interest rates were to fall to 0%, the line of best fit would predict a nominal TMR of 7.8%.[68]

150 One possible concern with financial market data is outliers. In Specification B we retain the same simple model as for Specification A, but rely on statistical tests to identify outliers (values lying more than 3 standard deviations from the mean TMR). Five outliers are identified by this test, and these observations can be observed in the top right hand section of the graph. In each case, these points represent periods with estimated nominal TMR of greater than 12.5%. All five of these points occurred during the last quarter of 2008 and the first quarter of 2009. We therefore fit another line of best fit that excludes these outliers, and the results are presented in the table below (Specification B).[69]

151 For Specification C, we consider alternative ways to address potential outliers. Our examination of potential outliers indicates that there are historical events that we may wish to control for, such as the GFC and the Covid-19 pandemic, given that these episodes caused significant volatility in financial markets. To systematically

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68 Note that this is an out of sample prediction: there are no observations in our sample with a nominal RFR of 0%. Hence, the TMR prediction for this should be treated with caution.

69 As one would expect, excluding these five outliers leads to the line of best fit becoming marginally shallower and the intercept moving marginally higher (see the results in Table 1).

identify such events, we consider the VIX index to specify which windows of significant volatility should be controlled for.[70] We therefore fit a third line where we control for these events, shown as Specification C in the table below.[71]

Table 7 TMR and RFR relationship results

	Spec A	Spec B (drop outliers)	Spec C (control for shocks using dummies)
Time period	*2006-2023*	*2006-2023*	*2006-2023*
Intercept (nominal)	**7.8%**	**7.9%**	**7.8%**
Slope (nominal)	**50.8%**	**44.5%**	**42.3%**
Other dummies	N	N	Y
Implied TMR today (nominal)	10.0%	9.9%	9.7%

Source: Frontier analysis

152 The three approaches to fitting a relationship between TMR and 20-year gilt yields are shown in the table above. The results suggest that there is a change of 0.4%-0.5% to TMR when gilt yields change by 1%. The intercepts of the lines of best fit also remain in a tight range, between 7.8% to 7.9%.

153 In comparison to the past PwC study, our analysis indicates that TMR is more responsive to changes in gilt yields. We consider that this is likely to be a consequence of the period of analysis – PwC's study ran from 2000 to 2017, whereas ours runs from 2006 to the present (due to data availability). This does suggest that a Glider of this kind should not become a 'fit and forget' kind of mechanism, if it came to play some role in UK regulation, but should be revisited over time.

154 In the following chapter we explore further the results from Specification C. We do however note that our analysis shows that specification choice does not have a particularly material effect on the location of the line of best fit.

[71] The VIX index is an index that captures market expectations regarding volatility over a future fixed period, usually 30 or 60 days ahead. The VIX timeseries allows us to identify periods of greater than usual volatility: we define this as VIX levels greater than 2 standard deviations from the mean VIX over our time period. The results as precisely: from 23/01/2008 to 22/04/2009 (the Global Financial Crisis) and from 28/02/2020 – 15/06/2020 (the Covid-19 pandemic). We use dummies to control for these two periods in Specification C..

5.2 Testing past regulatory decisions against the TMR Glider

155 Based on our DDM modelling and analysis of the relationship between the TMR estimates produced by that model and 20 year gilt yields, we have established a candidate Glider calibration. We now consider how well our Glider 'explains' previous regulatory decisions, particularly how those decisions moved down with the decreasing interest rate since the global financial crisis.

156 Below we show a comparison between our TMR Glider and regulatory decisions taken since 2009. This captures a reasonable number of regulatory decisions, tarting from the last decisions taken before the start of the era of low interest rates, and before regulatory TMR decisions began to be lowered (starting with the CMA NIE RP5 decision). The figure shows:

(c) The TMR Glider (dotted line) i.e. the level of TMR consistent with varying levels of the 20-year nominal gilt yield, used as a proxy for the RFR. This is the relationship estimated above using specification C, controlling for outliers from high volatility events.

(d) We then plot regulators' decisions along the TMR Glider line. We locate each dot on the basis of each regulator's own decisions for both TMR and RFR. We regard these as a matched pair, reflecting the choice each regulator made regarding TMR in the light of what they thought the wider interest rate environment was at the time. To illustrate how each dot has been located:

   (i) Ofwat in its PR14 decision determined that the TMR was 6.75% and the corresponding RFR was 1.25%. Both of these values are in RPI-real terms, and for the PR14 decision, Ofwat expected RPI inflation to be 2.8%.

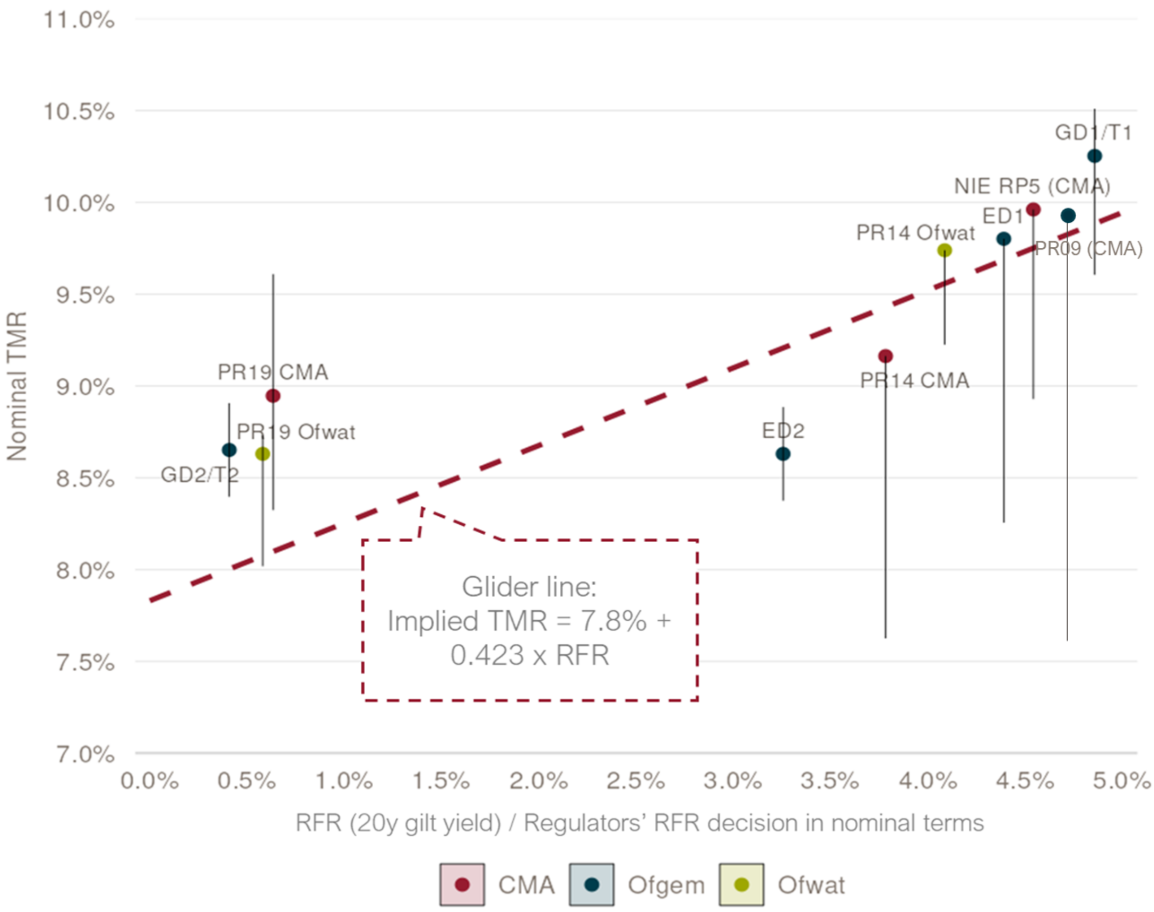
   (i) Hence, given Ofwat's inflation expectation, it considered the nominal RFR and TMR were 4.1% and 9.74% respectively.

   (ii) Therefore, the PR14 (Ofwat) decision point is located at 4.1% on the X-axis, and 9.74% on the Y-axis.

   (iii) We repeat this process for the regulatory decisions made since 2012 to locate each decision along the Glider line.

157 For each regulatory decision, we also show the TMR range: this is represented by the solid black line running through each of the regulatory TMR point estimates (dots) in the figure. Where the dots lie at the top of the line, this demonstrates that the regulator had aimed up; where the dots lie in the middle of the line, this shows that regulators had aimed straight.

Figure 8 TMR Glider against regulatory TMR and RFR decisions



Source: Frontier economics analysis of regulatory decisions, Ofwat, Ofgem, CMA

158 Our assessment is that the Glider is able to explain past regulatory TMR decisions, given each regulator's assessment of RFR, reasonably well. Most points lie close to the Glider line.

159 The implication of this is that past regulatory decisions have indeed responded to interest rate developments. While the UK regulatory regime has often been presented as relying on a fixed TMR construct, it seems that the prevailing UKRN guidance, which focuses on TMR being stable but not fixed, appears to be an accurate characterisation.

160 We also observe that to understand past decisions one must also consider aiming up. In the past it was common for regulators to aim up – over this period we see aiming up when interest rates have been high. This practice has actually aided

regulators in sticking to the line, i.e. by aiming up they have better reflected prevailing interest rates.[72]

161 Conversely, when interest rates were low, regulators appeared to have 'aimed straight' (Ofgem GD2/T2, Ofwat PR19). This has (obviously) tended to lower TMR versus historical decisions, and has been part of the reason why regulatory decisions on TMR have followed rates down.[73]

162 A final insight we can draw from the figure is with regards to the PR19 CMA redetermination, which appears to represent the final attempt at implementing a long-term, 'fixed' TMR model. The PR19 redetermination included a lengthy debate on TMR, but we note there was a significant shift in approach and range between the draft and final report,[74] where the final report represented a higher TMR point estimate. This change may have reflected the tension between fully upholding the long-term model (with more emphasis on 'fixed' TMR) in the face of a continued low interest rate environment, which prevailed during the redetermination process.

163 While there is always important context and detail around any price control decision, these historic records show that the Glider performs reasonably well in terms of characterising regulatory decisions on TMR taken in the past decade. On this basis, we think that the Glider provides useful guidance and insight on how the TMR can be set for future price controls. In fact, using the TMR Glider would represent a consistent approach to how regulators have set TMR so far. We discuss this in the following section.

5.3 Implications for future TMR decisions based on the TMR Glider

164 Above we have shown that our candidate TMR Glider is able to explain, to a reasonable degree of accuracy, past TMR decisions given the regulators' assumptions of RFR, albeit with the need to understand some context. Given this, we now ask what the Glider would imply for current and future regulatory decisions, and whether the Glider can facilitate regulatory decision making going forward.

72 Regulators have aimed up at PR09 (CMA), GD1/T1, NIE RPG (CMA), ED1, PR14 Ofwat, and PR14 CMA.

73 ED2 appears to be something of an anomaly – it embodied a TMR decision materially below the line. The ED2 decision (dated 30 November 2022) came approximately a year after the CMA found Ofgem's RIIO-2 cost of equity calibration was "not wrong" at ELMA 2021, and the ED2 process was also concluded during a highly volatile period for capital markets. The TMR Glider suggests that the ED2 decision on TMR was too low, based on the high risk-free rates at the time of the decision, but the decision may have been judged closer to the line based on the interest rates that prevailed as the price control was being designed.

74 We also note that this change in approach was largely unexplained in the PR19 redeterminations Final Report, and it is our understanding that the final position on TMR was established in closed Working Groups that took place after the publication of the Draft Report.

5.3.1 TMR Glider predictions for the current environment

165 Using the various Glider specifications we explored, we show below what the TMR Glider predicts the TMR should be given current RFR levels.

Table 8 TMR Glider predictions based on current RFR

	Spec A	Spec B (drop outliers)	Spec C (control for shocks)
Time period	*2006-2023*	*2006-2023*	*2006-2023*
Intercept (nominal)	**7.8%**	**7.9%**	**7.8%**
Slope (nominal)	**50.8%**	**44.5%**	**42.3%**
Implied TMR today (nominal)	10.0%	9.9%	9.7%
Implied TMR today (CPI-real)	**7.86%**	**7.71%**	**7.55%**

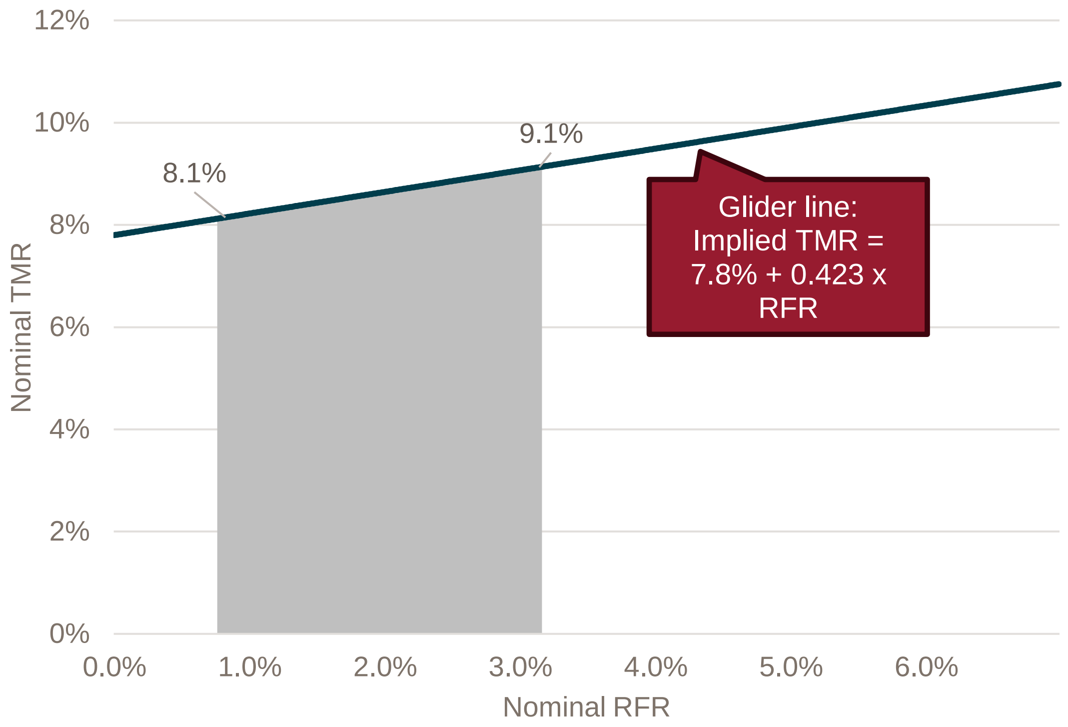
Source: Fronter analysis

Note: The Risk Free Rate is the UK 20Y Gilt from 31 January 2024, which was 4.49% in nominal terms.

166 All Glider specifications predict a current TMR above 7.5%, in the range of 7.55%-7.86%. Given that interest rates at prevailing levels have not been seen for decades, and the stable but not fixed regulatory construct that has emerged, it is perhaps not surprising that the predicted TMR is considerably higher than observed in most recent decisions.

167 While we would not propose that the Glider should be used mechanistically to set TMR, this brings a key insight. If the present interest rate environment, or something like it, is expected to persist, then, it could be that the TMR range proposed in Ofwat's PR24 Final Methodology (6% - 7% CPIH-real) could be inconsistent with past regulatory decisions and current interest rate levels. This is shown in the figure below.

Figure 9 Ofwat's PR24 Final Methodology TMR decision against the TMR Glider



Source: Frontier Economics, Ofwat

168 Ofwat's PR24 Final Methodology decision is 6% - 7% CPIH-real, which translates approximately to 8.1% - 9.1% nominal, assuming a 2% CPIH assumption. The Glider shows that such a TMR decision would have been consistent with a nominal RFR of approximately 1% - 3% (shaded grey in the figure above), which is much lower than the RFR observed in the current market environment, which is closer to 5% nominal.

Interpretation of the Glider prediction

169 Based on the current interest rate environment, rigid adherence to the TMR Glider would suggest a TMR of 7.55%-7.86% would be more appropriate. This would be broadly consistent with the line of best fit that emerges from our analysis of short-term market conditions, and, based on our tests, in line with past regulatory practice.

170 A higher TMR would also go some way towards the allowed cost of equity being closer to the cost of equity range suggested by the hybrid bond cross-check.[75]

171 However, the balance of evidence presented in this paper would support a TMR towards the top of the historic decisions taken by the regulators in the past decade based on. It is clear from Figure 8 that regulators had indeed given regard to the prevailing interest rate when setting the allowed TMR.

172 Based on this work, we find that a TMR decision of 6.46% CPIH-real, as set out in the PR24 Final Methodology, would represent a departure from both market evidence and established regulatory precedent. Therefore, it runs the risk that investors might conclude that 'stable but not fixed' applies only when interest rates are falling, but not when they are rising. This could be detrimental to investor confidence. A TMR at 6.46% is therefore a direct contributor to Ofwat's overall cost of equity estimates being too low, supported by our hybrid bond cross-check evidence.

173 This work aims to provide a tool through which regulators can re-appraise past decisions on the TMR, focus on how market evidence has influenced those decisions, and, hopefully, help to inform a proportionate and appropriate TMR decision for future price controls. Given the scale of investment water and wastewater networks need to deliver in the period ahead, it is important to set the cost of equity at a suitable level, as we consider that using this tool help support the interests of both investors and customers.

75 Although, this is just one component to estimating the overall cost of equity and we have not considered the other components in this report.

6 Conclusion and implications for the PR24 allowed return on equity

174 This report provides two specific tools which can be used by Ofwat to help gauge the appropriate cost of equity for PR24. These tools have been developed so that the regulatory framework is able to adapt to the challenges posed by the new capital market environment which has emerged.

175 Both tools are able to capture the impact of this new environment as their inputs are directly sourced from capital markets. This means they are transparent, simple to apply, and they are also tailored to the UK regulatory landscape.

(a) The outputs from the hybrid bond cross-check show a need to significantly revise the CAPM inputs used in the PR24 methodology to calculate the cost of equity. More specifically, our hybrid bond cross-check suggests a market-implied cost of equity of 5.8% to 8.4% while the ‘early central view’ from the methodology is an allowed equity return for PR24 at 4.14%. Without revision there are heightened risks to the sector in terms of the equity capital is able to raise.

(b) The TMR Glider provides a guide for how the TMR CAPM input can be revised in a proportional manner that is consistent with regulatory guidance and the wider capital market environment.

176 We note that there are other CAPM inputs which may also require revision in order to reach an appropriate cost of equity PR24 – such as beta. But those other inputs are beyond the scope of this report.

177 Investors clearly have a key role to play in the next five-year period. Significant sums of capital are required to make the investments set out in long-term plans a reality. However, capital cannot be transformed into assets if the sector cannot attract that capital in the first place.

178 By considering all available evidence there is a greater likelihood of striking an appropriate balance between customers and investors. We therefore invite further engagement with Ofwat on the tools set out in this report and the fresh perspectives they provide for the PR24 cost of equity.

Annex A - Hybrid bonds

A.1 In the Annex set out the sensitivity checks we have undertaken on key assumptions used in the hybrid bond cross-check (Annex A1). We then outline additional robustness checks that we have undertaken on the cross-check (Annex A2).

A.1 Sensitivity checks on key assumptions

Sensitivity test on historical hybrid/iBoxx spread

A.2 A key assumption in our analysis is that the hybrid spread to iBoxx has remained constant over time. We have adopted this approach for its simplicity, which allows us to address the complexities that could emerge as the bond approaches its first call date. During this time, investor perceptions about potential early calls and shorter maturities could influence price dynamics, making the comparison with iBoxx potentially problematic for measuring long-term expectations. In this section, we relax this assumption and check how the results vary within a reasonable range of scenarios.

A.3 We measure the spread **over time**, allowing for comparisons as maturity approaches.

A.4 **First, we calculate the expected returns of the NGG 2073 hybrid to exclude compensating for higher risk.** We account for the fact that this hybrid bond's credit rating declined over the years (from BBB- to BB+ in March 2021, with 4 years remaining to next call). Table 9 provides an overview of the adjustments over time for BBB- and BB+ credit ratings following the methodology in UKRN (2018). Costs of default risk decrease as securities approach maturity and becomes less likely. At 4 years to maturity, the reduction to yields should shift by -0.06% to -0.14% following the BB+ route to align with the new rating. However, in the interest of simplicity, we take a conservative approach and adjust yields by -0.15% over the hold period. This corresponds with value applied to the hybrid yield at issue.

Table 9 Default risk adjustments for BBB- and BB+ credit rating

Credit rating	Years to maturity											
	1	2	3	4	5	6	7	8	9	10	11	12
BBB-	-0.04%	-0.05%	-0.07%	-0.08%	-0.09%	-0.10%	-0.11%	-0.12%	-0.13%	-0.14%	-0.15%	**-0.15%**
BB+	-0.07%	-0.09%	-0.12%	**-0.14%**	-0.16%	-0.17%	-0.19%	-0.20%	-0.22%	-0.23%	-0.24%	-0.24%

Source: *Frontier calculations following UKRN (2018).*
Note: *Assuming 80% recovery rate.*

A.5 Next, we establish a new iBoxx benchmark. For each day, we match the bond's expected returns with the corresponding iBoxx £ Utilities index according to its maturity to next call (July 2025).[76]

A.6 Finally, we calculate the daily spread as the difference between the two measures (NGG 2073 hybrid expected return net of the iBoxx benchmark).

A.7 We test the sensitivity of our analysis in response to the spread volatility over time by constructing a range around the 10th and 90th percentile. **We obtain a spread between 86 and 201bps, resulting in nominal equity returns between 7.8% and 10.1% (Table 10).** The expected return spread at issue of 136bps lies towards the centre of this sensitivity range.

Table 10 Sensitivity test on historical hybrid/iBoxx spreads

Cost of equity	Low	High
Historical hybrid bond spread to iBoxx	86bps	201bps
iBoxx £ Utilities 10Y+ (1Y average)	6.0%	6.0%
Higher returns on equity (based on 50% equity-like)	1.7%	4.0%
Nominal cost of equity	**7.8%**	**10.1%**
Real cost of equity (CPIH deflated)	**5.6%**	**7.9%**

Source: Frontier calculations
Note: Analysis as of 29 February 2024. We consider a 2% inflation assumption to derive CPIH-real cost of equity.

A.8 Based on this analysis, we conclude that the spread at issue on our chosen National Grid hybrid bond is a reliable and reasonable measure of the long-term differentials between hybrid and debt returns over time. In this instance, the simplified approach of taking spread at issuance can be considered robust in respect of the historical spread.

Sensitivity test on the percentage of equity-like

A.9 In our main analysis, we have taken the assumption that hybrid bonds stand at the midpoint between debt and equity, being assigned 50% equity-like from an analytical perspective. This is an approximation made by credit rating agencies based on investors' expectations. However, we test some sensitivities, ranging from 75% to 25%.

76 For example, in 2013, we compare it to iBoxx £ Utilities 10-15, and in 2021, which is four years away from maturity, to iBoxx £ Utilities 3-5.

A.10 Table 11 presents a span of nominal equity returns from 7.9% to 11.5% (equivalent to 5.7% to 9.3% in real terms). Although the lower end of this range aligns closely with the prior sensitivity, the upper limit exhibits a significant increase in magnitude. This is not surprising since in the upper case a larger multiplier is applied to the hybrid spread to imply the equity premium. All in all, we consider the resulting range is reasonably tight given the fact we are stretching the limit of the plausibility on the equity proportion assumption.

Table 11 Sensitivity test on the percentage of equity-like

Cost of equity	Low	High
Spread to iBoxx at issue	136bps	136bps
iBoxx £ Utilities 10Y+ (1Y average)	6.0%	6.0%
Higher returns on equity (based on 75-25% equity-like)	1.8%	5.4%
Nominal cost of equity	**7.9%**	**11.5%**
Real cost of equity (CPIH deflated)	**5.7%**	**9.3%**

Source: Frontier calculations

Note: Analysis as of 29 February 2024. We consider a 2% inflation assumption to derive CPIH-real cost of equity.

Sensitivity test on iBoxx averaging

A.11 In estimating the cost of equity cross-checks from hybrid debt, we considered the average value of the iBoxx £ Utilities 10Y+ during the latest year.[77] This average window, in our view, captures the outlook for debt market in the near future reasonably well whilst smoothing out short-term volatilities on market rates.

A.12 However, we have conducted sensitivity scenarios on the iBoxx yield, and assessed how different dates could influence the final value. We do so by constructing a number of different reference points for the iBoxx yield:

- **Transition (2 year average).** From late 2021, interest rates started rising in response to the central bank's efforts to control inflation. This shift was gradual but persistent and within the space of one and half years took the economy out of the era of favourable borrowing costs, into the current higher interest rate environment. A two year average captures this transitional period and reflects a reasonable low bound we could expect in the medium term future

77 As of 29 February 2024.

should the monetary policy soften in response to potential macro-economic environment.

- **Maximum (12 Oct 2022).** This reflects the point in time when the iBoxx Utilities yields reached their highest level during the recent upward trend. We consider this as a credible upper bound which could be "retested" by the market should conditions worsen and revert back to more stringent tightening of the policy.

- **Settlement (since 12 Oct 2022 to present)**. After reaching the peak, interest rates began to decline gradually but remained relatively high. Therefore, this period can be considered to represent a stable phase following the peak, which could be interpreted as a representation of the "high interest environment period to date".

A.13 Figure provides an overview of the iBoxx £ Utilities 10Y+ evolution since 2013, indicating these key timeframes.

Figure 10 Evolution of the iBoxx £ Utilities 10Y+, 2013 to 2024

Source: Markit

A.14 When we average across these periods, we find that the iBoxx values range from 5.4% to 7.4%. Consequently, the nominal cost of equity falls between 8.2% to 10.1%, which translates to 6.0% to 8.0% in real terms. This aligns with the sensitivities observed in the previous sections.

Table 12 Sensitivity test on iBoxx averaging

Nominal equity returns	Transition	Settlement	Maximum
Spread to iBoxx at issue	136bps	136bps	136bps
iBoxx £ Utilities 10Y+	5.4%	5.9%	7.4%
Higher returns on equity (based on 50% equity-like)	2.7%	2.7%	2.7%
Nominal cost of equity	**8.2%**	**8.6%**	**10.1%**
Real cost of equity (CPIH deflated)	**6.0%**	**6.5%**	**8.0%**

Source: Frontier calculations
Note: Data as of 29 February 2024. We consider a 2% inflation assumption to derive CPIH-real cost of equity.

A.15 The hybrid bond implied cost of equity from our point estimate, based on the latest year average iBoxx yield, stands at 6.6% in CPIH real terms, which is closely aligned with the middle scenario in our sensitivity test (settlement period).[78]

A.16 Overall, we consider our point estimate of 6.6% implied cost of equity is robust to the sensitivity test of plausible iBoxx scenarios, and because it is based on a one-year average, is not subject to extreme short-term movement of the bond market.

Summary of sensitivity checks on key assumptions

A.17 Summarising the three ranges we produced based on the scenarios, we construct an overall range for the hybrid bond implied cost of equity. Taking the average of the lower bounds and higher bounds, we obtain a range of **7.9% to 10.6% in nominal terms (5.8% to 8.4% in CPIH-real terms).** Our point estimate of 6.6% CPIH-real falls within this range, leaning towards the conservative side as it is closer to the lower bound.

[78] Furthermore, we'd get a similar results even if one took the latest monthly average of iBoxx yield as of the time of writing of this report (February 2024 average), the resulting implied cost of equity would be 6.3% in CPIH-real terms.

Table 13 Summary of sensitivity checks on key assumptions

Summary results	Low	High
Sensitivity on historical hybrid/iBoxx spread	7.8%	10.1%
Sensitivity on the percentage of equity-like	7.9%	11.5%
Sensitivity on iBoxx averaging	8.2%	10.1%
Nominal cost of equity	7.9%	10.6%
Real cost of equity (CPIH deflated)	**5.8%**	**8.4%**
Real cost of equity (CPIH deflated) – point estimate		**6.6%**

Source: Frontier calculations

Note: Results for the cost of equity are obtained by averaging the low and high values of each sensitivity respectively. We consider a 2% inflation assumption to derive CPIH-real cost of equity.

A.2 Additional robustness checks

A.18 In this section of the annex, we conduct additional analyses to assess the robustness of our hybrid bond results. These tests provide us with additional reassurance regarding our findings and conclusions.

Comparison of hybrid/iBoxx spreads for securities issued by GB utilities

A.19 As an input to the cross-check, we obtained a spread of 136bps between the NGG 2073 hybrid and the iBoxx Utilities benchmark. To check that this result is not specific to this one bond, we expand the analysis to include the remaining NGG Finance and SSE hybrid bonds. The results of this comparison are detailed in Table 14. As shown, the benchmark we consistently apply for the purposes of this robustness check is the iBoxx Utilities index matched to the currency of each hybrid bond.

Table 14 Spread of GB hybrid bonds relative to benchmark

Hybrid bond	Yield to next call at issue date	Expected return	Selected index	iBoxx yield at issue date	Yield spread at issue date	Expected return spread at issue date
	(1)	(2)		(3)	(1 - 3)	(2 - 3)
NGG Finance Plc, 2079	1.63%	1.49%	iBoxx € Utilities	0.42%	1.21%	1.08%
NGG Finance Plc, 2082	2.13%	1.95%	iBoxx € Utilities	0.42%	1.72%	1.53%
NGG Finance average						**1.30%**
SSE Plc (ISIN XS2195190876)	3.51%	3.41%	iBoxx £ Utilities 5-7	1.29%	2.22%	2.13%
SSE Plc (ISIN XS2195190520)	3.00%	2.90%	iBoxx € Utilities	0.79%	2.21%	2.11%
SSE Plc (ISIN XS2439704318)	3.97%	3.80%	iBoxx € Utilities	2.24%	1.73%	1.56%
SSE average						**1.93%**

Source: Bloomberg, Frontier calculations

Note: The expected return adjustment is based on the 2018 UKRN cost of equity study

A.20 We obtain similar results using NGG Finance's Euro denominated bonds.[79] **The range of spreads from NGG Finance hybrid bonds is 108bps to 153bp, with an average of 130bps.** In both cases we match the tenor and currency of the iBoxx to the characteristics of each bond. Using the iBoxx Euro Utilities benchmark approximately matches to the tenors-to-next-call of 5.0 and 7.8 years of the 2079 and 2082 hybrid bonds, respectively.[80]

A.21 **For the SSE hybrid bonds, spreads range from 156bps to 213bps, with an average of 193bps.** These spreads are higher than the spreads observed for the National Grid hybrid bonds, but this is not surprising as the implied cost of equity for SSE is expected to be higher due to its significant ownership of non-regulated

79 Note that both were issued in Euro currency so are compared to Euro denominated iBoxx indices.

80 The average years to maturity on this index has been relatively stable at around 6 years.

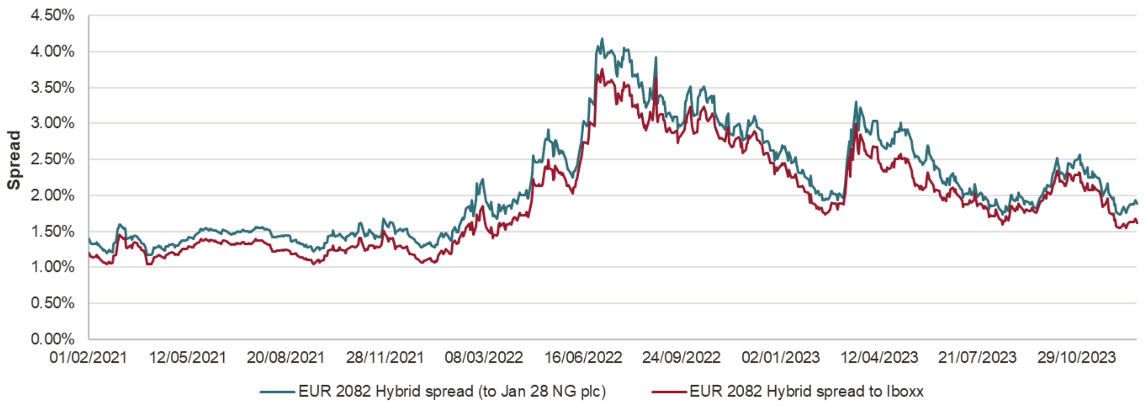
businesses. This is also in line with SSE having a significantly higher beta than NG.

A.22 Overall, we find these robustness checks are supportive of our analysis.

Comparison between hybrid/iBoxx and bond/iBoxx spreads

A.23 In this exercise, we assess the spreads of hybrid-to-iBoxx compared to NG plc bonds-to-iBoxx. We focus on the NGG 2082 hybrid, denominated in EUR, to ensure a direct comparison with NG plc bonds which are also issued in Euros.

Figure 11 Spread of yield to next call (Jun 2027) on the NGG Finance 2082 Hybrid to the iBoxx € Utilities



Source: Frontier calculations based on Bloomberg and Markit data
Note: Both series are Euro denominated

A.24 The results in Figure show that the spread between National Grid hybrid and National Grid senior debt follows similar pattern as the spread over iBoxx in our main analysis. We note that the spread to National Grid senior debt is almost always higher than the € iBoxx utilities index.

A.25 This suggests that there is unlikely any systematic over-estimation of the hybrid spread when we use market benchmark, in comparison with the senior debt issued by the relevant company. This is also consistent with the finding using SVT's hybrid bond quotes.

Comparison of National Grid's regulatory gearing from FY2013

A.26 In our main analysis, we have used National Grid specific hybrid bond data from March 2013 as a key part of the methodology for the hybrid bond cross-check. As this cross-check is being used as a point of comparison with allowed equity return based on a notional gearing assumption, we have checked if National Grid's GB network regulatory gearing (RAV based) from the same time period which underpins the hybrid bond has roughly the same level of gearing as is being applied by regulators today.

A.27 In the table below we set out regulatory gearing for National Grid's electricity transmission and gas business as of March 2013, using figures from the regulatory accounting statements for each. As shown, the actual gearing figures from those business are around 60%. This aligns with the gearing assumptions adopted by Ofwat for PR19, and by Ofgem recently. Albeit it is slightly higher than Ofwat's PR24 methodology figure of 55%. when calculating the cost of equity – both on a network specific basis, and in total.

A.28 As a matter of principle, one would ideally re-gear the outcome of this cross check to match the notional gearing adopted in the relevant price control, in order to ensure a completely like-for-like comparison. However, given that actual gearing is close to the notional gearing as well as the actual gearing of UU and SVT at the time the hybrid bond was issued, we have not undertaken this step at this stage. This could be considered in future work.

Table 15 Gearing of National Grid's network activities, as of 31 March 2013

<table>
<tr><th>Activity</th><th>Net debt (£m)</th><th>RAV (£m)</th><th>Gearing</th></tr>
<tr><td>Electricity transmission</td><td>5,919</td><td>10,145</td><td>58%</td></tr>
<tr><td>Gas transmission</td><td rowspan="2">8,669</td><td>5,340</td><td rowspan="2">63%</td></tr>
<tr><td>Gas distribution</td><td>8,330</td></tr>
<tr><td>All activities</td><td>14,588</td><td>23,815</td><td>61%</td></tr>
</table>

Source: Annual Report and Accounts 2012/13 National Grid Electricity Transmission plc; and National Grid Gas plc NTS Regulatory Accounting Statements 2012/13

Note: Net debt combined for both gas businesses

Annex B - TMR Glider annex

B.1 In the Annex we set out the details which support the TMR Glider analysis.

- In Annex B1 we set out the academic evidence reviewed;
- In Annex B2 we provide an introduction to the DDM analysis undertaken;
- In Annex B3 we outline the Bank of England's approach to DDM;
- In Annex B4 we compare our approach with the Bank of England; and
- In Annex B5 we set out our DDM data sources.

B.1 The academic evidence covering the relationship between TMR and ILG Yields (as a proxy for the RFR)

Harris and Marston (2013)[81]

B.2 Harris and Marston examine whether there is evidence that the equity risk premium (ERP) is not constant, and consider whether there are any implications for estimating the cost of capital. Using data from US markets, Harris and Marston found that the equity risk premium varies over time. They found that these changes in the ERP could be linked to changes in long term interest rates, credit spreads on corporate bonds and anticipated volatility in equity markets.

B.3 More specifically, Harris and Marston use a discounted cash flow model (DCF) with US market data from 1986 to 2010 in order to estimate forward-looking market required returns.[82] The market required return is defined as the sum of the return on the risk-free asset and the market risk premium. In other words:

179 *Total Market Return (TMR) = Risk-free rate (RFR) + Equity risk premium (ERP)*

B.4 Given that Harris and Marston aim to examine the evolution of the ERP over time, they derive the forward-looking ERP by subtracting the RFR from the forward-looking TMR.

B.5 The authors use regression analysis to investigate the extent to which changes in their estimated ERP moves with changes in long term interest rates. They find a coefficient of -0.79%. They suggest that this coefficient can also be interpreted to

81 Changes in the Market Risk Premium and the Cost of Capital: Implications for Practice (2015), Robert S. Harris & Felicia C. Marston. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2686739

82 Harris and Marston (2013) Equation 2. The authors use a static Dividend Discount Model (DDM). The data used includes SP500 dividend paying stock and individual analysts' forecasts of long-run growth in earnings.

mean that the coefficient between the change in TMR and change in interest rates would be +0.21%.

B.6 These findings support the premise that changes in TMR are related to changes in the RFR. However, we cannot consider Harris' and Marston's analysis directly for the purposes of specifying the TMR Glider. This is because Harris and Marston examine the relationship between changes in ERP and changes in RFR, which is related to our enquiry but not exactly the same.[83] Nevertheless, this study provides evidence that the required equity risk premium does change alongside changes in RFRs, which provides a foundation for further considering a TMR Glider.

PwC for Ofwat (2017)[84]

B.7 PwC prepared a report for Ofwat that aimed to examine the balance of incentives introduced at Periodic Review 2014 (PR14), and potential improvements for the next periodic review (PR19). As part of this, PwC also examined the potential impacts of the 'lower for longer' interest rate era on estimating equity returns. The 'lower for longer' era was defined in a UK market context, as a period wherein the Bank of England was likely to keep the cost of borrowing very low for a prolonged time.[85]

B.8 PwC sought to understand whether the 'lower for longer' environment justified a potential adaptation in Ofwat's approach to setting TMR, i.e. whether there was any reason to consider more current market evidence in addition to the conventional approach of relying on long term historical equity returns.[86] The consideration of current evidence would mean that the resulting cost of equity would be calibrated according to both short term market dynamics and long term market expectations.[87]

B.9 Following Harris and Marston, PwC used a dividend discount model (DDM) to estimate a market-implied TMR for the UK market, covering the period 2000 to

83 Associating *changes* in *MRP* and *changes* in the RFR, cannot be transformed in a straightforward manner into a comparable coefficient for *levels* analysis. This is because the changes regression is identifying the rate of change of the slope of the line of best fit between the MRP and the RFR. This (i) suggests that the modelled overall relationship is non-linear, and (ii) a starting point for both the MRP and the RFR would be needed to identify the corresponding actual slope at one point on this non linear line of best fit.

84 PWC (2017) Refining the balance of incentives for PR19. Accessible here: https://www.ofwat.gov.uk/wp-content/uploads/2017/07/PWC-Balance-of-incentives-June2017.pdf

85 PWC (2017), Refining the balance of incentives for PR19, Appendix B.

86 PWC (2017), Refining the balance of incentives for PR19, state that the approach to setting the cost of equity (including the choice RFR, EMRP and the TMR) on the basis of long run averages relies on the assumption that any current divergences are "temporary or exceptional in nature" (p77). They argue that if market conditions persistently deviate from the long run averages such as in the 'lower for longer' era, long run averages will overstate required returns (the inverse to be true if rates were higher than the long term rates).

87 PWC (2017), Refining the balance of incentives for PR19, p81.

2016.[88] The PwC DDM model found the TMR value that equates the equity value today with the present value of future dividends. The authors relied on a multi-stage DDM growth model, in which there is a short term (5 year) growth rate of dividend value and an expected long term growth rate, used to calculate a "terminal dividend value".[89]

B.10 The dividend data used in the model are from the UK FTSE All-Share Index over the period January 2000 to December 2016. We also obtain data on the initial market value of the FTSE index and the observed cash yield. This dataset is combined with data on estimations for stock buyback yields. The expected short and long term growth rates are based on nominal growth rates calculated from forecast real GDP growth rates and forecast inflation (thus making the assumption that GDP growth is a reasonable proxy for this whole-market approach).

B.11 The DDM model is run on a monthly basis and hence solves for monthly estimated TMR spot rates from 2000 to 2016. To provide an illustration of the results, the spot rate for December 2016 is 8.3% (in nominal terms).[90] The 5 year average of the DDM outputs for TMR is 8.8%.

B.12 The monthly TMR timeseries is in turn used to derive a monthly ERP by subtracting yields on UK nominal bonds, a proxy for RFR.[91]

B.13 The final step of the PwC analysis investigates the relationship between the RFR and the ERP. The authors plot these two variables over time (see the Figure below). They fit a linear relationship between the two variables, and report the gradient of this relationship for the full period of analysis, and separately for the later part of the period only (2010 to 2016). The best fit line has a gradient of approximately -0.76 for the period 2000 to 2016, suggesting that a 100 bps drop in the RFR is associated with a 76bps increase in the ERP. For the period 2010 to 2016 the equivalent figure was approximately -0.88.

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88 The authors use a multi-stage Dividend Discount Model (DDM). They use data from the UK FTSE All-Share Index. The expected short- and long-term growth rates are nominal growth rates calculated from forecast real GDP growth rates and forecast inflation (this relies on the assumption that GDP growth is a reasonable proxy for their whole-market approach).

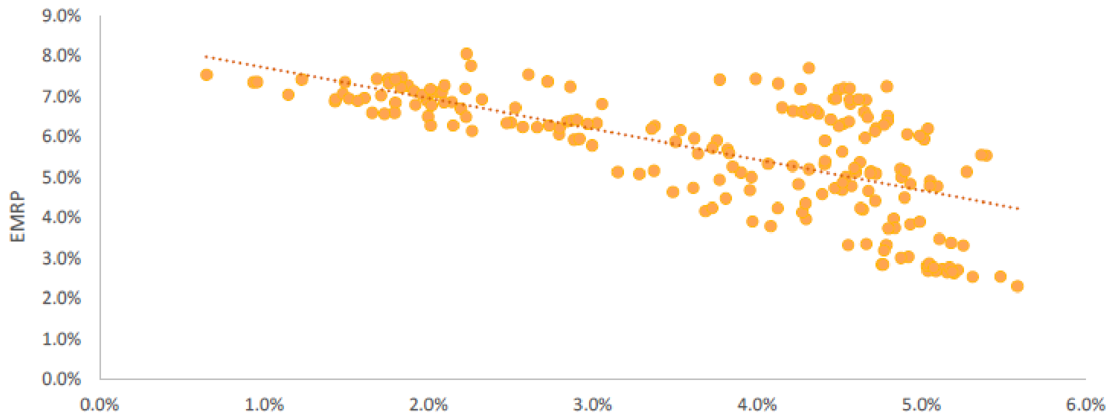
89 The underlying equation is as follows: $V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k_e)^t}$ where *V* is the intrinsic value (price today), *D* is the dividend value and *k* is the cost of equity.

90 The authors note that DDM outputs can be sensitive to the choice of data inputs, and therefore conduct sensitivity analyses; these analyses test the sensitivity of the TMR estimates to:

- The real growth rate of dividends and forecasted inflation: adding 1% to each of these increases the TMR by approximately 2%, reducing each of these by 1% decreases the TMR by approximately 1.5%.
- Share buybacks assumption: adding 1% to buybacks increases the TMR by approximately 1%, whilst excluding buybacks decreases it by approx.. 1%.

91 Two alternatives are used for the RFR: the spot yield on 10 year UK nominal government bonds and on 20 year UK nominal government bonds.

Figure 12 Reproduction of Figure 23 from PwC's report, relationship between risk-free rate and EMRP from implied DDM (2000 to 2016)



Source: PWC

B.14 PwC infer (based on their analysis) that if current market conditions are expected to diverge from long-run historical averages for an "extended period" of time, then one must consider the suitability of the long-run historical averages for calibrating price control returns.[92]

Damodaran (2020)[93]

B.15 In his 2020 paper Professor Damodaran considered the determinants of ERPs and provides a review of the techniques for estimating ERPs. He identified three approaches: survey premiums, historical premiums or implied equity premiums (including those estimated from discount cash flow models, default spread based ERPs or option pricing model based ERPs).

B.16 Damodaran used a variety of discounted cash flow models populated with US market data over the period 2008 and 2020. Damodaran compares the ERPs estimated using these methods with ERPs estimated using historical methods. Although this comparison is the focus of the paper, Damodaran notes the results of a series of simple regressions investigating the implied ERPs' relationship with other macroeconomic variables.[94] In particular, as an adjunct to his main analysis,

92 PWC (2017) Refining the balance of incentives for PR19, p79.

93 Damodaran (2020) Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2020 Edition Accessible here: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3550293

94 Damodaran (2020) Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2020 Edition, Table 21.

Damodaran looks at the relationship between estimated ERP and interest rates, economic growth, inflation rates and exchange rates.

B.17 Damodaran does not find evidence of a significant relationship between the implied ERP and long term interest rates, although this finding is not explored or tested in great detail and, as noted, identifying the relationship between ERP and gilt yields was not the primary focus of the paper.[95] Damodaran's findings would however be consistent with a finding that TMR and gilt yields move together in line with the other academic studies we have reviewed, and the study does provide a potential further approach to testing the elasticity of TMR against RFRs.

B.2 Introduction to the Dividend Discount Model

What is the dividend discount model

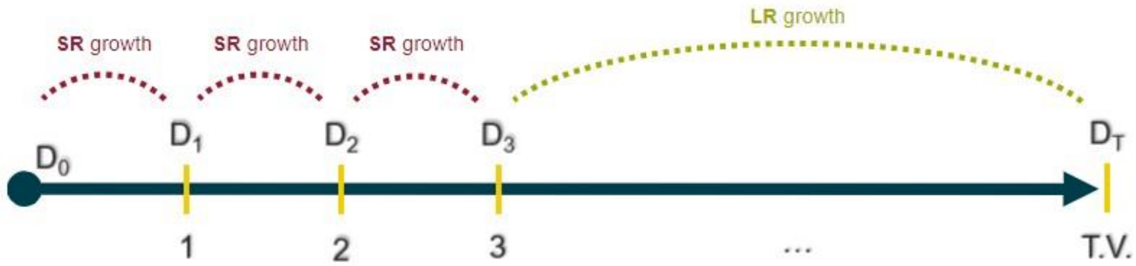
B.18 The DDM is a standard method for calculating the expected forward-looking return on a security, based on the fundamental assumption that the present value of a dividend is the sum of all its future dividends discounted to the present. The model is used in one of two forms; (i) a constant growth model, or (ii) a two-stage DDM.

B.19 As discussed in the main body of the report, we consider it appropriate to take account of share buy backs in a DDM, as such buy backs are an important form of cash received by equity investors.

The two stage DDM

B.20 The two-stage model is used to calculate the current present value of expected future dividends (or current index price), P_0, for a stock that is expected to grow dividends at different rates over different periods.

B.21 The following diagram shows a model which assumes a short-run growth rate for a company to determine dividends in the first three years, and then a long-run growth rate to determine a terminal dividend value from year 3.



95 Damodaran (2020) Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2020 Edition, p105-107.

B.22 The below formula is used to solve for the expected return:

$$\boxed{P_0} \quad = \quad \boxed{\left\{\frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + D_3\frac{(1+g)}{(r-g)(1+r)^3}\right\}}$$

Find the **r** that equates the **index price today** to the **sum of future dividends** in present value terms

B.23 D_1, D_2, D_3 represent the expected dividends per share for each of the first three periods, calculated using the initial dividend value and the short term growth rate, *f*:

$$D_1 = D_0 * f$$
$$D_2 = D_1 * f$$
$$D_3 = D_2 * f$$

r is the required rate of return.

g is the expected future growth rate in perpetuity.

Usefulness of the DDM and its limitations

B.24 Many academic papers agree that the DDM is an effective method to infer a forward-looking TMR, since it reflects current stock prices (that should embody the investors' best view of value) plus upcoming market and future growth expectations. For example, Damodaran (2016) found that the use of DDMs resulted in the best predictive power of actual returns in the US market, and a 2015 working paper by the Bank of England found similar results.

B.25 By estimating the forward-looking growth rate, the model provides insights into how expected future earnings growth contributes to the equity risk premium. Its long term focus and flexible framework make it a more realistic model than a model using historic dividend returns to estimate forward-looking returns.

B.26 The two-stage model in particular takes a more realistic view than the constant growth rate model, as it recognises that a company's growth rate in dividends varies over time, and captures the transition period that a company may face when moving from the short-run to the long-run.

B.27 The main drawback of DDM analysis is its sensitivity to key assumptions. Changes in the assumptions underlying the discount rate, growth rate and dividend payouts can have significant implications to the DDM. Forecasting future dividend growth rates can also be a challenging aspect of DDM analysis, especially for companies with unstable earnings. However, sensitivity analyses can be performed on the model to assess the impact of any changes in the inputs, and how these could change the estimated stock value.

B.3 Bank of England's use of DDM

B.28 In addition to the academic literature investigating the relationship between ERP/TMR and the RFR, we note the Bank of England's work on using DDM to estimate TMR over time. This work supports our use of DDM to estimate required returns to equity.

B.29 A 2015 working paper by Chin and Polk at the Bank of England seeks to evaluates two measures of expected returns: (i) Campbell's 1991 vector autoregression model (VAR) which looks at the relationship between short-term returns and other variables; and (ii) a DDM model. Specifically, the authors test whether the VAR and DDM models can forecast realised returns in a range of tests. They then compare the two models' performance against a range of traditional predictor variables such as the price-earnings ratio and term spread.

B.30 They find that both VAR and DDM perform favourably in simple forecast regression tests, where they significantly predict realised returns at a range of horizons. In-sample, they generate substantially lower forecast errors compared to the alternative predictors. Out-of-sample, they compare the range of forecast variables to a historical average benchmark forecast and find that the VAR and DDM offer economically and statistically significant forecast improvements. This paper therefore provides support for the appropriateness and accuracy of using DDM to estimate expected market returns.

B.31 We also note that a speech by Martin Taylor (External Member of the Financial Policy Committee of the Bank of England) in 2016 references DDM analysis that the Bank of England conducted (to investigate ERP rather than directly the TMR).[96] This speech commends DDM as a useful method to measure contemporary ERPs.

B.32 In 2017, Dison and Ratten published an article in the Bank of England Quarterly Bulletin,[97] updating the Bank's DDM analysis from the model that had been in use since 2010. In the next section, we compare this output to our own DDM output.

B.4 Comparison of Frontier and Bank of England DDM Outputs

B.33 Helpfully, the Bank of England's 2017 paper includes outputs from the BOE's own DDM modelling. We find that our model outputs closely resemble the BOE's, as shown in the figure below. The BOE's paper does not report TMR, but rather ERP.

96 Banking in the tundra (2016) Martin Taylor https://www.bankofengland.co.uk/-/media/boe/files/speech/2016/banking-in-the-tundra.pdf

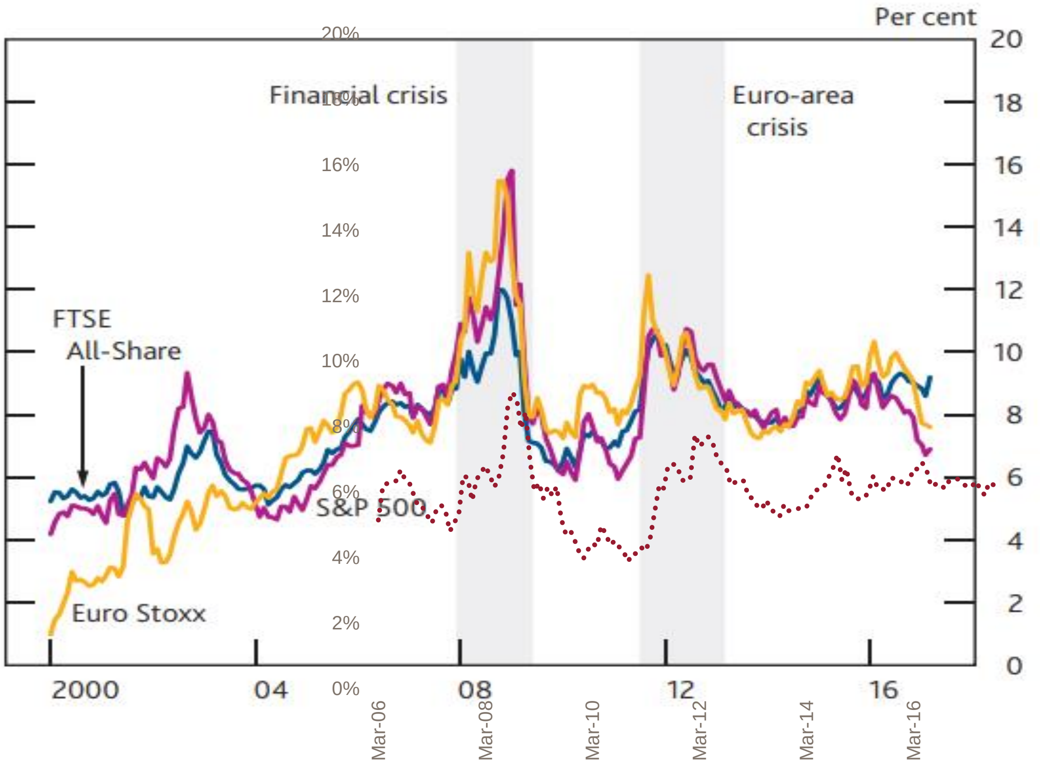
97 Bank of England (2017), Quarterly Bulletin, An improved model for understanding equity prices.

To conduct a high-level check of our modelling output, we first calculated the implied ERP, by subtracting the 20-year gilt yield from the required TMR reported by our DDM model.[98]

B.34 Note that we did not have access to the BOE's source data. As such, we simply super-imposed our DDM outputs alongside the BOE's, as a high level cross-check. Our DDM outputs are represented by the red, dotted line in the chart.

B.35 We observe that our DDM model outputs match the BOE's model outputs very well in terms of the rise and fall of the expected TMR, and our DDM outputs can almost be described as being a constant distance from the BOE's outputs. We understand that the difference between the outputs lies in the difference in RFR assumptions.

Figure 13 ERP, Our DDM outputs and BOE's 2017 DDM modelling



Source: Frontier Analysis, Bank of England (https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/2017/an-improved-model-for-understanding-equity-prices.pdf)

B.36 Our understanding is the BOE's modelling attempts to use a RFR which is proxied by the yields of extremely long-dated government bonds (longer than 20 years, which is what we have considered), to approximate the perpetual nature of equity.

98 The output from our DDM model is shown in Figure 4. To derive the ERP, we subtracting the 20-year gilt yield from the TMR values shown in Figure 4.

The BOE also noted that actual gilts covering such long term maturities do not exist, and the yields for this had to be extrapolated.[99]

B.37 Given the differences in RFR assumptions we consider that our modelling should produce a different result to the BOE's, but the similarities of both model outputs provides us a degree of comfort in the manner in which we have specified our DDM model for the analysis set out in this paper.

B.5 Frontier's DDM data sources

B.38 We use the following data sources for our main DDM analyses and DDM sensitivities. We note that the results of our primary DDM model and the sensitivity analyses are similar and therefore we focus our discussion on the results derived from our primary DDM model. Nevertheless, we have also listed the data sources we considered for our sensitivity modelling in the table below (flagged in italics).

99 Bank of England (2017), Quarterly Bulletin, An improved model for understanding equity prices, p8.

Table 16 DDM and Glider data sources

Data item	Data item name	Data fields and granularity	Data provider
Expected equity cash flow	FTSE Allshare index, analyst dividend yield consensus estimates	Monthly	Bloomberg
	Buyback yields	Calculated from shares buyback actual yields, at a monthly frequency	Bloomberg
Current index price	FTSE Allshare total returns index	Actual last price, at a monthly frequency	Bloomberg
	FTSE 100 total returns index (sensitivity)	*Actual last price, at a monthly frequency*	*Bloomberg*
Short-term growth rate (f), used for dividend growth in the first 3 years	Dividend 3 year forward rates	Calculated from analyst forecasts, at a monthly frequency	Bloomberg
	Blended rate from 3 sources (sensitivity)	*Nominal GDP growth, at a monthly frequency*	*HMT* *Bank of England* *IMF*
Long-term growth rates, used for dividend growth in perpetuity after 3 years (g)	Long run nominal GDP growth forecast	Monthly	IMF
Risk free rate	Nominal UK gilt spot curve for 20 year maturity	Monthly	Bloomberg

Source: Frontier Economics