July 2019

Trust in water

PR19 draft determinations

Cost of capital technical appendix

Ofwat

PR19 draft determinations: Cost of capital technical appendix

Contents

1 Executive summary

This appendix contains our draft decision on the allowed cost of capital for 2020-25 that we have used in our draft determinations for the slow track and significant scrutiny companies[1]. We set a Weighted Average Cost of Capital (WACC) to provide a reasonable base level of return reflective of the sector's risks, and which is sufficient to cover efficient debt and equity financing costs.

We have consulted a wide range of market, regulatory and academic sources to inform these draft proposals, including the following:

- Europe Economics, who have provided analytical input and advice to inform our decisions – their accompanying report, "The Cost of Capital for the Water Sector at PR19" is published alongside this decision document.
- Recent academic reports, notably the March 2018 UKRN-sponsored cost of capital study (henceforth "The UKRN Study"),[2] which made various recommendations to UK economic regulators.
- PwC, who have provided updated evidence on Total Market Return from their dividend discount model and commentary explaining the most recent outputs.[3]
- Other regulators' recent publications regarding the cost of capital.

The analysis we have carried out to inform our proposals has drawn on market data up to our cut off point of 28 February 2019. Since then there has been a further downward trend in some of the market data that is used to inform our assessment of the cost of capital. We will further update our view of the cost of capital for our final determinations, which will take account of more recent market data on the risk-free rate, equity beta and the market benchmark we use for the cost of debt. We discuss these issues further in section 1.2.

All of the responses to the initial assessment of business plans, including all of the companies' revised business plans, provided by the 1 April 2019 are taken into account in our decisions where relevant. Where appropriate, we explicitly set out our response to points and issues raised by respondents.

[1] The draft determinations for the fast track companies (Severn Trent Water, South West Water and United Utilities) were underpinned by our 'early view' cost of capital set out in the PR19 methodology. The cost of capital we determine for our final determinations will apply to all companies that were assigned fast track, slow track or significant scrutiny status in our Initial Assessment of business Plans.
[2] P. Burns et al., *'Estimating The Cost of Capital For Implementation of Price Controls by UK Regulators'*, March 2018
[3] PwC, 'Updated Dividend Discount Model analysis for PR19', July 2019

Our decisions also take into account the representations made on the fast track draft determinations where the points and issues raised are relevant to the slow track and significant scrutiny draft determinations. We will deal with the other elements of the representations to the fast track draft determinations as part of the final determinations.

We have not necessarily been able to take full account of all late evidence, submitted after the 1 April 2019 business plans, and we will consider this information for the final determination.

1.1 Our decision on the cost of capital

For our PR19 methodology, we made a preliminary assessment of the required cost of capital for 2020-25. This 'early view' cost of capital was intended to facilitate the production of business plans. We set out that we would revisit our view for draft and final determinations, to take new evidence into account. We also noted in particular, we would consider our approach to the assessment of beta in further detail. We discuss our approach to equity beta in section 3.4; we welcome views on this issue in particular.

Our updated view of the cost of capital for draft determinations is set out in Table 1.1 below. We discuss the reasoning behind our choices in sections 2 to 4.

Table 1.1 The cost of capital for our draft determinations

Component	'Early View' (nominal)	Draft determination			Notes
		Nominal	CPIH	RPI	
Gearing	60%	60%			The percentage share of debt in the capital structure of the notional company.
Risk-free rate (RFR)	2.10%	1.54%	-0.45%	-1.42%	The estimated return for investment in an asset with zero risk. We discuss the risk-free rate in section 3.2.
Total Market Return (TMR)	8.60%	8.63%	6.50%	5.47%	The total yield required by investors to invest in a well-diversified benchmark index (e.g. the FTSE All-Share). We discuss TMR in section 3.3.
Equity risk premium (ERP)	6.50%	7.09%	6.95%	6.88%	Calculated as the difference between the total market return and the risk-free rate.
Raw equity beta for listed comparators	0.63	0.64%			Judgment-based pick using econometric estimates of beta drawing on OLS and

					GARCH estimators and data from United Utilities and Severn Trent Water.
Gearing for listed comparators	49.3%	54.7%			Weighted average Enterprise Value gearing for Severn Trent Water and United Utilities.
Asset beta on PR14 basis (no debt beta)	0.32	0.29			A measure of undiversifiable risk faced by un-geared equity investors in water. We discuss betas in section 3.4.
Debt beta	0.10	0.125			A measure of undiversifiable risk faced by debt investors in water. We discuss debt betas in section 3.4.
Asset beta on PR19 basis (including debt beta)	0.37	0.36			A measure of undiversifiable risk faced by un-geared equity investors in water, reflecting a non-zero debt beta. We discuss betas in section 3.4.
Notional equity beta	0.77	0.71			A measure of undiversifiable risk faced by geared investors in water, assuming gearing at the notional level of 60%. We discuss betas in section 3.4.
Cost of equity (including a debt beta)	7.13%	6.56%	4.47%	3.46%	An estimate of the return required by equity investors in the notional company.
Ratio of embedded to new debt	70:30	80:20			Assumed average ratio of embedded to new debt for the notional company. We discuss this in section 4.1.
Cost of new debt	3.40%	3.36%	1.33%	0.35%	An estimate of the cost of raising debt over the period 2020-25 We discuss the cost of new debt in section 4.2.
Cost of embedded debt	4.64%	4.50%	2.46%	1.46%	Our assessment of cost of debt for the notional company as at 31 March 2020. We discuss embedded debt in section 4.3.
Issuance and liquidity costs	0.10%	0.10%	0.10%	0.10%	An allowance for debt issuance fees and liquidity facilities.
Overall cost of debt	4.36%	4.38%	2.33%	1.34%	Weighted average using the 80:20 split.
Appointee WACC (vanilla)	5.47%	5.25%	3.19%	2.19%	Weighted average using the 60% notional gearing assumption.
Retail net margin deduction	0.10%	0.11%	0.11%	0.11%	Deduction to derive a WACC for wholesale operations.
Wholesale WACC (vanilla)	5.37%	5.14%	3.08%	2.08%	Cost of capital allowance which will apply to the wholesale controls.

Our cost of equity for the draft determinations is 6.56% in nominal terms, equivalent to 4.47% and 3.46% in CPIH and RPI terms, deflated using our long-term inflation

assumptions.[4] This represents a decrease of 57 basis points on our 'early view' from our PR19 methodology published in December 2017.

Our cost of debt for draft determinations is 4.38% in nominal terms, equivalent to 2.33% and 1.34% in CPIH and RPI terms – and represents a 2 basis point increase on our 'early view' estimate.

Our overall appointee WACC is 5.25% in nominal terms, equivalent to 3.19% and 2.19% in CPIH and RPI terms. It is 21 basis points lower than our 'early view' estimate.

Our nominal appointee WACC point estimate of 5.25% is within the 4.81% – 5.50% range calculated for us by our consultants, Europe Economics, and slightly above their proposed point estimate of 5.21%. It is also within the range of 4.78% to 5.45% proposed by ECA in its 2019 report for CCWater.[5] The reduction in the WACC (21 basis points relative to our 'early view') is also broadly aligned with debt and equity analyst expectations transmitted between April and June 2019, which ranged from 4 to 50 basis points.[6,7]

1.2 Data cut off

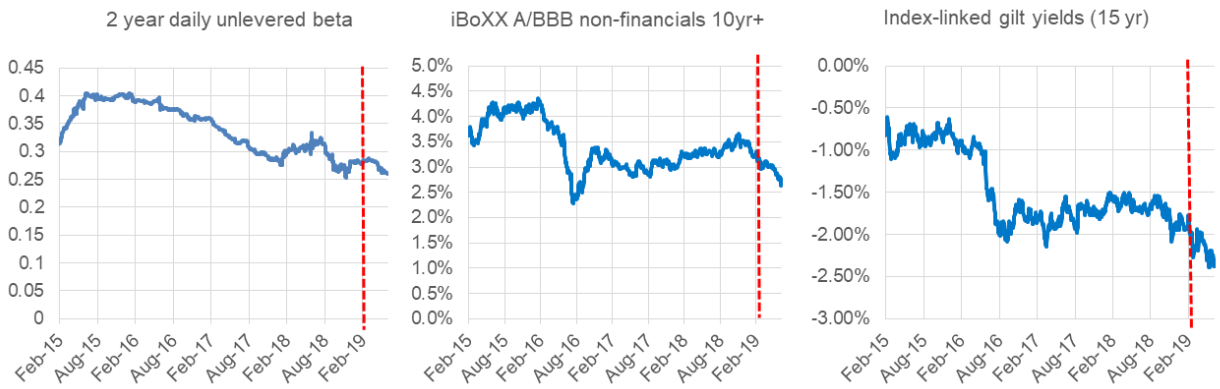
We have used 28 February 2019 as the cut off point for inclusion of market evidence that has been used in our assessment of the cost of capital. The market data on which our assessment is based is dynamic, responding to changes in the domestic and global economy. We note there have been unusually large movements in market data since the cut off date for our assessment. As a consequence, we consider it is appropriate to use market data up to 28 February 2019 and closely monitor whether further movements continue recent trends or unwind back towards February 2019 levels.

Using a data cut off point of 28 June 2019 for three important inputs to our cost of capital model (the risk free rate, equity beta and the market benchmark we use to forecast the cost of debt), points to values that could lead to a lower cost of capital at the time we set our final determinations. This movement is set out in in Figure 1.1,

[4] 2.0% and 3.0% for CPIH and RPI, respectively.
[5] ECA, Update to our recommendations for the Cost of Capital for 2020-2025, 29 January 2019.
[6] Barclays, 'RORE Bridge over troubled waters', 5 April 2019 (cited 10bp fall in cost of equity which is equivalent to 4bp fall in WACC).
[7] Moodys 'Credit Opinion, Southern Water Services (Finance) Limited', 28 June 2019 (provided its view that a 20-50bp fall in the WACC was likely)

showing falls in these three inputs in the period after 28 February (denoted by the red dotted line).

Figure 1.1: Changes in unlevered beta[8], our benchmark index and gilt yields 2015-2019



Source: Ofwat and Europe Economics analysis of Refinitiv, IHS Markit and Bank of England data.

We will reflect on market data that will be available in the autumn of 2019 at the time we make our decisions for our final determinations. Customers and companies are protected from market movements in the cost of new debt as a result of the introduction of our cost of new debt indexation mechanism for PR19; however it is possible for there to be small movements in our assessment of the cost of embedded debt. We will fix our assessment of the cost of equity that will apply for 2020-25 based on market data that will be available in the autumn of 2019; this may be impacted particularly by market movements and market expectations for the risk-free rate and equity beta for the period of the price control.

While our cost of capital for the draft determinations of slow track and significant scrutiny companies is 21 basis points below our ‘early view’; expectations of greater reductions to our ‘early view’ have been cited by some analysts, informed by more up-to-date market data than that which underpins our analysis. Table 1.2 sets out our assessment of changes to our updated cost of capital which would have resulted if we had used values of the three inputs from Figure 1.1 on the basis of their values on the later cut off date of 28 June 2019.

[8] Asset beta figure assumes a debt beta of zero.

Table 1.2: Illustrative impact of data changes to our updated cost of capital estimate, February – June 2019 (nominal)

Input	28 February	28 June	WACC change (basis points)
Risk-free rate (15 year index-linked gilt yield)	1.54%	0.99%	-6
Unlevered beta (2 year daily data)	0.29	0.26	-21
Cost of new debt (iBoxx A/BBB index)	3.36%	2.61%	-9
Total:			**-37**

Source: Ofwat and Europe Economics analysis of Refinitiv, IHS Markit and Bank of England data.

As set out in the 'Aligning risk and return technical appendix', we require all companies to provide further Board assurance that their activities will remain financeable on a notional and an actual basis through 2020-25, and to provide assurance that they will maintain financial resilience in the long term. We expect companies to provide this taking account of the reasonably foreseeable range of plausible outcomes of their final determination including evidence of further downward pressure on the cost of capital.

1.3 Structure of this appendix

The analysis in the rest of this appendix is set out as follows:

- **Section 2** covers our approach to setting the cost of capital.
- **Section 3** covers our approach to setting the cost of equity and explains the components we have used in our allowance.
- **Section 4** covers our approach to setting the cost of debt and explains the components we have used in our allowance.
- **Appendix A1** sets out our decision on company-specific adjustments for Bristol Water, SES Water and Portsmouth Water.
- **Appendix A2** contains stakeholder representations on the cost of capital and an account of how we have responded.

2 Our approach to setting the cost of capital

This chapter explains the methodological decisions we have made for setting the cost of capital; particularly aspects which are not specific to either cost of debt and equity.

This section is structured as:

- **Section 2.1:** Our approach to inflation
- **Section 2.2:** Our approach to notional gearing
- **Section 2.3:** Our approach to retail margins

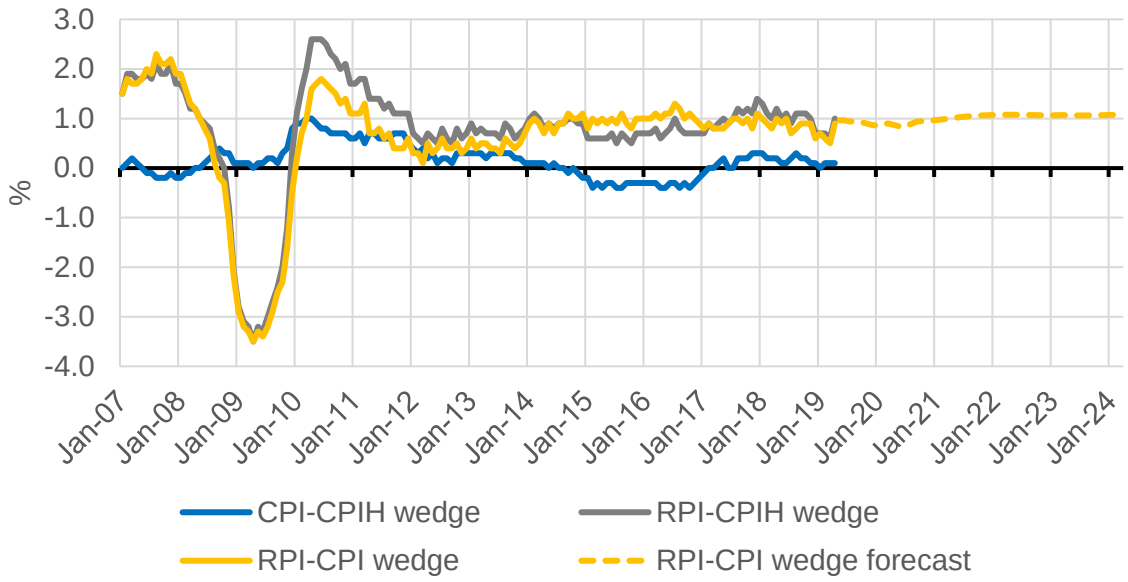
2.1 Our approach to inflation

Our 'PR19 methodology' confirmed that we will transition away from indexation using the Retail Prices Index (RPI). This series is discredited as a robust measure of inflation, and since 2013 is no longer an official statistic.[9] We set out that from 1 April 2020, 50% of each company's RCV would be indexed to RPI; the rest, including RCV additions will be indexed to CPIH. Our decision means that we will apply an RPI and CPIH WACC to each of these tranches. To derive our CPIH WACC we have retained the long-term assumptions of 2.0% from our 'early view'. Similarly, we retain our estimate of a 100 basis point RPI-CPIH 'wedge' which we use to inform our long-term assumption of 3.0% RPI in deriving an RPI-based WACC.

Our assessment is supported by the view of Europe Economics, whose report discusses inflation assumptions in more detail and assumes that over the long term, the Bank of England will, on average, hit its CPI inflation target of 2.0%, and that CPIH will not be systematically higher or lower than this. Figure 2.1 suggests that in recent years this has been a good approximation - between January 2013 and April 2019, the CPI-CPIH wedge was on average 0.0%.

[9] UK Statistics Authority, 'Assessment of compliance with the Code of Practice for Official Statistics: The Retail Prices Index', Assessment Report 246, March 2013

Figure 2.1: Wedge between CPI, CPIH and RPI



Source: Office for Budget Responsibility, Ofwat analysis

Our estimate of a 100 basis point RPI-CPIH wedge is obtained from the Office for Budgetary Responsibility's estimate of the long-term RPI-CPI wedge of 1.0%[10]. The actual outturn wedge between CPIH and RPI is unlikely to perfectly match our assumption because it varies over time – for instance the average wedge between January 2013 and April 2019 was 0.8%. We will reconcile any differences as part of PR24. This will ensure both investors and customers are protected from any variance in our estimate and the actual outturn RPI-CPIH wedge.

Shorter term inflation forecasts

The long term view of inflation stated above is used to determine the cost of capital. However, we also make shorter term assumptions about CPIH and RPI inflation for the period of the price determinations, taken from the Office for Budgetary Responsibility's forecasts.[11] These assumptions are set out in Table 2.1.

[10] Office for Budgetary Responsibility, '*Revised assumption for the long-run wedge between RPI and CPI',* March 2015
[11] Office for Budgetary Responsibility, 'Economic and Fiscal Outlook', March 2019

Table 2.1: Short term inflation assumptions used for PR19 draft determinations

Input	2020-21	2021-22	2022-23	2023-24	2024-25
RPI, financial year average	2.89%	3.02%	3.07%	3.07%	3.07%
CPIH, financial year average	1.95%	1.98%	2.00%	2.00%	2.00%
RPI minus CPIH wedge	0.94%	1.04%	1.07%	1.07%	1.07%

Source: Ofwat analysis of Office for Budgetary Responsibility data

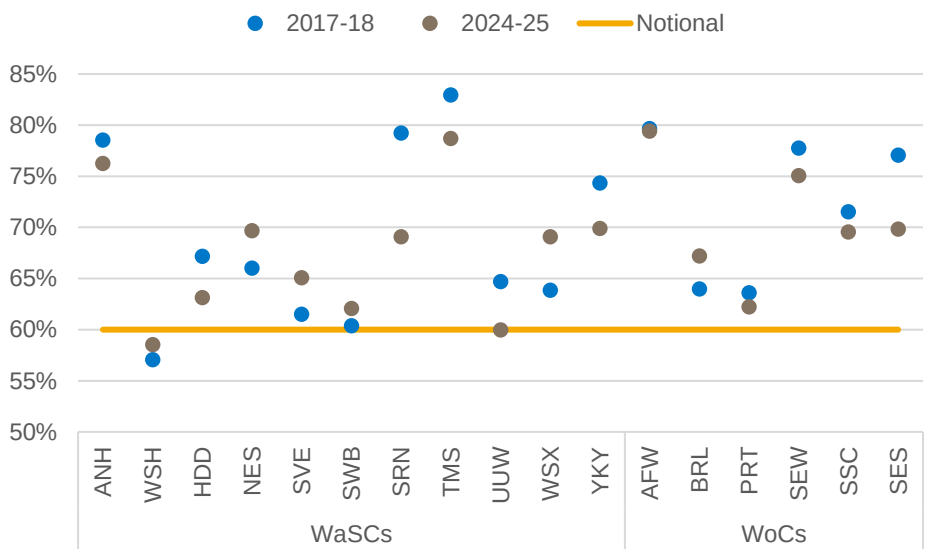
We will use the inflation data from table 2.1, reflecting updated inflation forecasts where possible, as an input to the RPI-CPIH wedge reconciliation model, to reconcile allowed revenues for the path of the actual RPI-CPIH wedge at PR24.

2.2 Our approach to notional gearing

Our estimate of notional gearing is 60%, unchanged from our 'early view'. We continue to consider that a lower notional gearing level compared to the PR14 level of 62.5% is appropriate, given the greater share of revenue at risk associated with service performance and our proposals to make greater use of markets on a forward looking basis. A larger equity buffer will increase the resilience of the notional company to the revenue volatility which these changes may imply.

Figure 2.2 compares our notional assumption against company gearing levels for 2017-18 to 2024-25. Overall, weighted average gearing for the actual company structures over this period is forecast to reduce by around two percentage points, with predicted gearing reductions generally higher for highly-geared companies. We expect companies to keep their actual financial structures under review within the context of a need to maintain financial resilience in the long term.

Figure 2.2: Company forecast gearing, 2017-18 to 2020-25



Source: Ofwat analysis of PR19 business plans

2.3 Our approach to retail margins

As set out in the PR19 methodology 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.

Residential retail margin

Our margin is applied as a fixed mark-up over the sum of residential retail costs and the proportion of wholesale revenue allocated to residential services.

For our 'early view', Europe Economics assessed EBIT[12] margins for a range of comparators and other economic regulators' estimates. The consultancy concluded that a household retail margin of 1.0% was appropriate for 2020-25. No company objected to this figure, and two companies jointly commissioned a report which argued for a range of 0.7% to 3.1%, and which accepted 1.0% as a reasonable point estimate.[13] Europe Economics remain of the view that this point estimate is appropriate,[14] and we have therefore retained this estimate for our draft determinations.

[12] Earnings Before Interest and Taxation
[13] Economic Insight, 'Household retail margins at PR19: A report for Bristol Water and Wessex Water' September 2017
[14] Europe Economics, 'The Cost of Capital for the Water Sector at PR19', July 2019

Business retail margin

Consistent with the approach adopted at PR16, our revenue control for business retail takes the form of default tariff caps based on allowed average cost per customer, and gross margins. The application of each approach depends on the contestability of market segment and customer type.

For the English company which has not yet exited the business retail market, Yorkshire Water, we use a net margin approach for customers using less than 5Ml of water per year (customer group 1), and a gross margin approach for all other customers (customer group 2).

For Welsh companies (Hafren Dyfrydwy and Dŵr Cymru), we use a net margin approach for customers using less than 50Ml of water per year and all wastewater customers (customer group 1) and a gross margin approach for customers using at least 50Ml of water per year (customer group 2).

For each customer type in customer group 1, the allowed revenue is based on:

- the allowed retail cost to serve – this is the allowed average retail cost per customer multiplied by the number of customers; and

- a net margin, calculated as a percentage on the allowed retail cost to serve and the wholesale charge for that customer group.

The total allowed revenue is calculated in accordance with the following formula:

$$R_t = \left(\frac{\left(r_{c,t} \times \ c_{n,t}\right) + w_t}{1 - m_t} \right) - w_t$$

Where:
$r_{c,t}$= the allowed average retail cost component for a given customer type (in pounds) ;
$c_{n,t}$ = the customer numbers for a given customer type;
w_t = the wholesale revenue for a given customer type; and
m_t = the allowed net margin for a given customer type (expressed as a percentage)

For each customer type in customer group 2, the allowed revenue is based on an allowed gross margin cap. This sets a uniform national gross margin that retailers are allowed to charge on top of the wholesale charge for each region. The total allowed revenue is calculated in accordance with the following formula:

$$R_t = g_{m,t} \times w_t$$

Where:

$g_{m,t}$ = the allowed gross margin (expressed as a percentage); and
w_t = the wholesale revenue for customer group 2

For our 'early view' we said we would retain the net and gross margin caps set at PR16.[15] We continue to consider that these retail margin caps remain appropriate. For non-contestable market segments[16] we therefore apply a net margin cap of 1.0%.

For contestable market segments[17] involving smaller (customer group 1) users, we apply company-specific default tariff caps. For larger users (customer group 2) we apply uniform gross margin caps set out in Table 2.2.

Table 2.2: Uniform gross margin caps for our draft determination

Volume (Ml/yr)	Water (includes mixed use & non-potable water)	Wastewater (includes trade effluent & surface water drainage)
5 to 50	5.0%	5.3%
50 and over	3.3%	2.8%

We also said that we would retain the supplementary cap for customer group 2 that we introduced at PR16. The purpose of this cap was to avoid undue price disturbance at the opening of the business retail market and to prevent the average retail revenue in each tariff band increasing by more than 1% of customers' overall bill each year. We now propose to remove the supplementary cap, because retaining it would maintain a regulatory burden, because:

- for medium and high usage customers we have seen signs of effective competition developing in the market and these customers have high awareness of market opening and relatively high levels of engagement in the market; and
- any potential benefit of the supplementary cap in terms of price stability is much reduced.

[15] Ofwat, 'Business retail price review 2016: final determinations', December 2016
[16] Applying to all user groups for Hafren Dyfrdwy and Dŵr Cymru, other than water users >50Ml/yr
[17] Water users >50Ml/yr

This is consistent with our review of the Retail Exit Code where we proposed to relax regulatory protections for medium and higher usage customers and also remove the supplementary cap.

Retail margin adjustment

As we first calculate a cost of capital at the appointee level (including the risks associated with retail activities), using this cost of capital for the wholesale controls (which do not face retail risks) without making a retail margin adjustment would result in companies being compensated twice for bearing the same risks.

To address this issue we have used the populated Ofwat financial model from April resubmissions and fast-track draft determinations to calculate the revenue requirement for the retail margin which we use to make a deduction from the appointee WACC. The steps of our calculation are detailed in Table 2.3.

Table 2.3: Retail margin adjustment calculation for 2020-25

Component	Calculation	Point estimate (£m, nominal)
Total apportioned wholesale charge for residential services	A	45,531
Total cost to serve for residential retail customers	B	4,083
Total residential retail revenue adjustment	C	- 29
Total residential revenue requirement (pre-tax)	D = (A + B + C)	49,585
Average annual residential revenue requirement	E = D / 5	9,917
Retail net margin	F	1%
2020-25 average effective tax rate (notional basis)	G	7.73%
Retail net margin (after tax)	H = F / (1+G)	0.93%

Retail net margin revenue	I = H * E	92
Average RCV	J	84,682
Retail margin adjustment	K = I / J	0.11%

Source: Ofwat analysis of populated PR19 Financial Models

This produces a figure of 0.11%, slightly above our ‘early view’ assumption of 0.10%. We deduct this from our appointee WACC to derive a wholesale WACC. We will update this calculation to reflect changes in input data for final determinations.

3 Our approach to the cost of equity

The components informing our updated view of the cost of equity are summarised in Table 3.1.

Table 3.1: Our updated view of the cost of equity for 2020-25

Component	Updated view (CPIH)	Updated view (RPI)	Early view (RPI)	Commentary
Risk-free rate (section 3.2)	-0.45%	-1.42%	-0.88%	Our lower estimate reflects lower market expectations of interest rate rises and a change in methodology – our current estimate is based on the yield from RPI-linked gilts
Total market return (section 3.3)	6.50%	5.47%	5.44%	Our updated estimate has a very small uplift compared to our 'early view'.
Equity risk premium	6.95%	6.88%	6.31%	Calculated as the difference between the TMR and RFR.
Raw equity beta (section 3.4)	0.64	0.64	0.63	Econometric estimate of beta drawing on OLS and GARCH estimators and data from United Utilities and Severn Trent.
Gearing for listed comparators (section 3.4)	54.7%	54.7%	49.3%	Enterprise value gearing has increased, primarily due to share price changes in our listed comparators, Severn Trent Water and United Utilities.
Unlevered beta (section 3.4)	0.29	0.29	0.32	Our raw equity beta estimate stripped of the impact of gearing, and no debt beta.
Debt beta (section 3.4)	0.125	0.125	0.100	Our higher estimate reflects evidence from bond yields that debt beta has increased.
Asset beta (section 3.4)	0.36	0.36	0.37	Calculated as the unlevered beta adjusted for the debt beta.
Re-levered equity beta (section 3.4)	0.71	0.71	0.77	Calculated from the asset beta, debt beta and gearing.
Appointee cost of equity	4.47%	3.46%	4.01%	Calculated as RFR + Equity beta x Equity risk premium
Wholesale cost of equity	4.21%	3.19%	3.76%	The cost of equity which, together with the appointee cost of debt estimate results in the wholesale WACC figure.

The rest of this chapter explains the methodological decisions we have made regarding our framework for deriving the cost of equity, and how we have interpreted market data on its components.

This section is structured as:

- **Section 3.1:** Our approach to setting the cost of equity
- **Section 3.2:** Risk-free rate
- **Section 3.3:** Total Market Return
- **Section 3.4:** Equity beta

3.1 Our approach to setting the cost of equity

Our approach to setting the cost of equity is unchanged from our 'early view' – we use the Capital Asset Pricing Model (CAPM) to calculate the cost of equity for the notional company. Use of the CAPM is a continuation of our approach from previous price controls, is widespread in UK economic regulation, and endorsed by the March 2018 UKRN-sponsored Cost of Capital Study. The cost of equity is calculated using three components:

$$K_e = R_f + (R_m - R_f) * \beta$$

Where:
K_e is the cost of equity
R_f is the risk-free rate
R_m is the Total Market Return
β is the equity beta of the notional company
$(R_m - R_f)$ is the Equity Risk Premium

3.2 Risk-free rate

The risk-free rate is the market yield which investors accept in return for investing their money at no risk to the principal invested. It acts as a benchmark for other, riskier financial investments, which have higher yields to compensate investors for this extra risk.

It is commonplace in economic regulation to use the yield on government bonds, in our case UK gilts, as a proxy for the risk-free rate, due to the perception of the

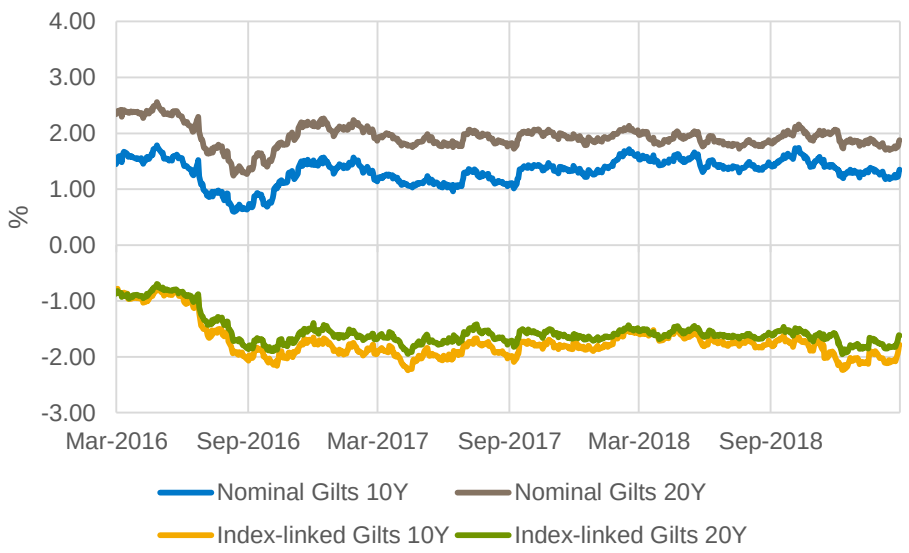
government as the most creditworthy entity in the UK economy,[18] and the comparatively deep and liquid market for these financial instruments.

3.2.1. Developments since our 'early view'

For our 'early view', we based our estimate of the Risk-Free Rate on March 2017 yields for 10 and 20 year UK nominal gilts, uplifted by the expectation of interest rate rises between then and the midpoint of 2020-25 of between 49 and 59 basis points, giving an overall point estimate in nominal terms of 2.10%. We did not consider index-linked gilts as the Bank of England suspended its zero-coupon index-linked gilt series in May 2017, with some risk that figures would be revised.

Since March 2017, average yields for both 10 and 20-year gilts have stayed broadly stable (Figure 3.1)

Figure 3.1: Yields for nominal and RPI-linked gilts



Source: Ofwat analysis of Bank of England data

We note the recommendation of the UKRN study that regulators should use the yield on inflation-indexed gilts at their chosen horizon to derive an estimate of the risk-free rate at that horizon.

In addition, one submission argued against a risk-free rate which is negative in RPI-deflated terms. It argued that a negative risk-free rate is difficult to support in

[18] At the time of publication, the British Government has never failed to make interest or principal payments on gilts as they fall due. (Source: UK Debt Management Office)

economic theory, as it is consistent with an economy expected to shrink in the long-term. We comment on this issue in section 3.2.3.

Since our 'early view' cost of capital, other economic regulators have published their updated view of the risk-free rate. In table 3.2 we set out the estimate for the risk-free rate from their most recent publication.

Table 3.2: Regulatory estimates of the risk-free rate, 2018-2019

Regulator	Publication	Risk-free rate point estimate (CPI or CPIH basis)	Commentary
Ofgem (May 2019)	RIIO-2 Sector Specific Methodology Decision - Finance	-0.96%	Ofgem focus on the yield for 20 year RPI-linked gilts
CAA (February 2019)	Draft UK Reference Period 3 Performance Plan proposals	-0.4%[19]	CAA use RPI-linked gilt yields for maturities in the 5-20 year range.
Ofcom (November 2018)	Business connectivity market review	-0.38%	Ofcom place most weight on yields for 10 year RPI-linked gilts.

Source: Ofwat analysis of regulatory publications

3.2.2. Our estimation framework for the risk-free rate

We retain our 'early view' assumption of a 15 year investment horizon. This is approximately the weighted average years to maturity of sector debt[20], and aligned with the UKRN Study's recommendation to choose 'a fairly long horizon, for example 10 years'.[21] To derive an estimate of the risk-free rate consistent with this horizon, we uplift the spot yield on 28 February 2019 for gilts at 10 and 20-year maturities based on market expectations of the average interest rate rise for these gilts over the period 2020-25.

As there is a public market for nominal and RPI-linked gilts (but not at present CPI or CPIH-linked gilts), deriving a risk-free rate on an RPI and CPIH basis requires taking either nominal or RPI-linked gilts as a starting point, as follows:

[19] Figure has been inflated from RPI terms using our assumption of a 100 basis point RPI-CPIH wedge
[20] We assess the weighted average years to maturity of company debt as 15.2 years on March 31 2018
[21] P. Burns et al., *'Estimating The Cost of Capital For Implementation of Price Controls by UK Regulators'*, March 2018, p7

- **Nominal gilts:** deflating the observed yield on nominal gilts by the long-term assumptions for RPI and CPIH inflation to derive RPI and CPIH risk-free rate assumptions.
- **RPI-linked gilts:** taking the observed yield to be the RPI risk-free rate, and inflating by the long-term assumption of the RPI-CPIH 'wedge' to derive a CPIH estimate.

We consider that there are advantages and disadvantages of each approach which should be considered carefully in the context of market conditions. Nominal gilts embed market expectations of inflation and an inflation risk premium to compensate investors for outturn inflation being higher than expected. This suggests that the yield on nominal gilts overstates the true risk-free rate. On the other hand, the market for RPI-linked gilts is less liquid than for nominal gilts, leading to a liquidity premium to compensate investors for the risk they may not easily be able to sell their investment at a fair price, at the time of their choosing. This suggests that the yield on index-linked gilts also overstates the true risk-free rate. We consider below, the market evidence on the relative importance of each risk premium, in the context of deciding which approach to estimating the risk-free rate is the most appropriate.

3.2.3. Evidence on the risk-free rate for 2020-25

We use Europe Economics' analysis of Bank of England daily yield curve data covering the period 1 February 2019 to 28 February 2019 to derive a market expectation of interest rate increases for 10 and 20 year bonds. This analysis uses yield curve data to calculate forward rates for bonds at these maturities at the start, midpoint and end of the 2020-25 period, comparing the rate at these points with the current rate to derive an average of the increase relative to spot rates on 28 February 2019. We interpret this to be the market expectation of how much long-term government bond yields will increase over 2020-25. Using the average across February of daily data on the expectations of interest rate increases mitigates the risk of relying on market expectations from one particular day.

Adding this rate rise expectation to spot yields on 28/02/2019 for nominal and index-linked bonds results in forward-looking 10 year and 20 year estimates of the risk free rate. The midpoint of these two figures is taken to be the assumption for our overall risk-free rate at our chosen 15 year horizon.

Table 3.3 compares the different estimates of the CPIH risk-free rate obtained when starting from the 28 February 2019 spot yields for RPI-linked and nominal gilts. The two methods yield -0.45% and -0.08% respectively – a 37 basis point difference.

Table 3.3: Forward-looking estimates of the risk-free rate based on nominal and RPI-linked gilts

	3 month rolling average on 28/02	Spot yield On 28/02	Market-implied rate rise	2020-25 average implied yield	2020-25 average implied CPIH-real yield
10 year RPI-linked gilt	-2.06%	-1.78%	0.32%	-1.46%	-0.49%
20 year RPI-linked gilt	-1.80%	-1.62%	0.24%	-1.37%	-0.40%
Average	**-1.93%**	**-1.70%**	**0.28%**	**-1.42%**	**-0.45%**
10 year nominal gilt	1.28%	1.35%	0.48%	1.83%	-0.17%
20 year nominal gilt	1.82%	1.88%	0.14%	2.02%	0.02%
Average	**1.55%**	**1.61%**	**0.31%**	**1.92%**	**-0.08%**

Source: Europe Economics analysis of Bank of England, Refinitiv data

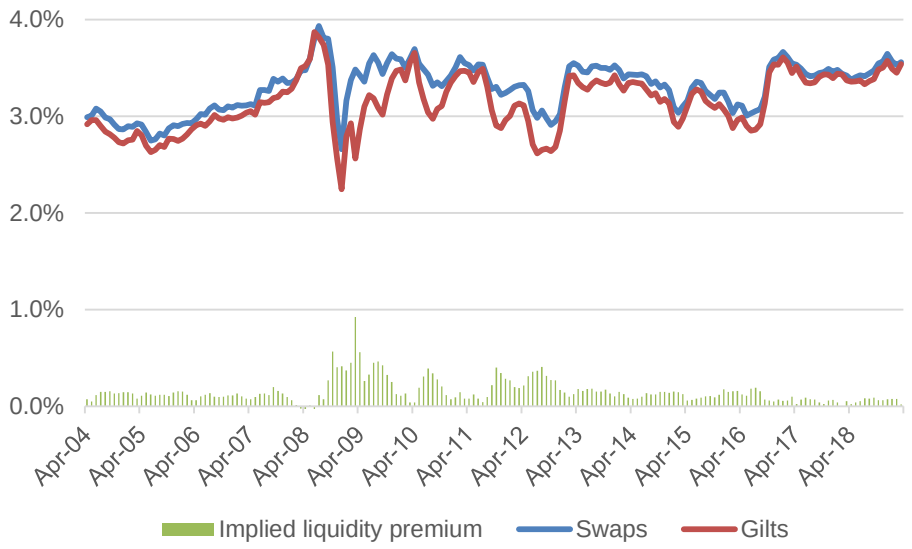
Turning to the question of how much weight to place on the data from RPI-linked or nominal bonds, we investigate the potential sources of premia which impact the use of this data for our risk-free rate estimate. We observe there is a paucity of frequently updated public estimates of both the inflation risk and liquidity premia. The Bank of England has estimated that between 1997 and 2007, the inflation risk premium was around 30 basis points,[22] while Golden et al (2010) find an average premium of 35 basis points using gilts data from 1985-2009 and 70 basis points using swap data from 2004-2009.[23] For the liquidity premium, Pflueger et al (2015) estimates this as around 50 basis points on average over 1999-2014, declining to 10 basis points at the end of their sample period.[24]

To derive a more up-to-date estimate of the liquidity premium, we adapt an approach in one study which infers the premium as the difference in 'break-even inflation' implied by index-linked swap and bond prices.[25] One likely driver of liquidity premia is the need for large up-front investment in capital to reduce inflation exposure –

[22] Bank of England, Quarterly Bulletin, Q3 2012, Vol 52, No. 3
[23] J. Golden et al., 'Forecasting UK inflation: an empirical analysis', June 2010
[24] C.Pflueger, L. Viceira, 'Return predictability in the treasury market: real rates, inflation and liquidity', Harvard Business School, September 2013
[25] Liu et al., 'The informational content of market-based measures of inflation expectations derived from government bonds and inflation swaps in the United Kingdom', Staff Working Paper No 551, September 2015

which is not the case for swap contracts. We therefore assume that breakeven inflation in swaps contains no liquidity premium component and that the liquidity premium can therefore be inferred as the difference between the two breakeven inflation rates. Figure 3.2 shows how this estimate of the liquidity risk premium has evolved over time. Based on this analysis, we assess the liquidity risk premium as currently being low and stable: our February 2019 estimate is 8 basis points, and the estimate has not exceeded 10 basis points since August 2016.

Figure 3.2: Breakeven inflation implied by swaps and gilts and the implied liquidity premium



Source: Ofwat analysis of Bank of England and Refinitiv data

We conclude on the basis of the above evidence that the inflation risk premium in nominal gilts is the most plausible factor driving the 37 basis point difference in the CPIH risk-free rate when derived using nominal and index-linked gilts (Table 3.3). This is firstly as the difference is broadly in line with the historical average difference of 30-35 basis points from academic studies we have reviewed. We also note that the higher difference in the risk-free rate implied by 20 year gilts versus 10 year gilts under the two approaches (42 basis points versus 32 basis points) is consistent with the finding of an upward sloping term structure of inflation risk premia in these studies. Further evidence consistent with a material inflation risk premium is that February 2019 breakeven inflation at the 10 year horizon was 3.3%, while February

2019 RPI inflation was 2.5% and the Office for Budgetary Responsibility's longest forecast to 2023 predicts 3.1% RPI inflation[26].

Following the above reasoning, we consider that basing our estimate of the risk-free rate on nominal gilts would effectively allow for an inflation risk premium in our cost of equity calculation, which would not be appropriate. This is because it would compensate investors for inflation risk which is not present in our regulatory framework due to the indexation of allowed revenues to inflation. We have therefore decided to base our point estimate of the risk-free rate wholly on RPI-linked gilts. This is consistent with the recommendation of the UKRN Cost of Capital study, and also follows practice in regulatory publications from Ofgem, Ofcom and the CAA (Table 3.2).

We express our estimate of the risk-free rate in nominal terms and deflate for our assumed future long-term average level of RPI and CPIH:

- **1.54%** - nominal;
- **- 0.45%** - CPIH based, assuming 2.0% CPIH; and
- **- 1.42%** - RPI based, assuming 3.0% RPI.

In CPIH terms, a lower bound to a plausible range for the risk-free rate can be derived by taking the 3 month trailing average instead of the spot rate of yields on 28 February 2019 – this produces a figure of -0.73%. We consider that the upper bound should be no higher than the figure implied by deflating nominal gilt yields: -0.08%.

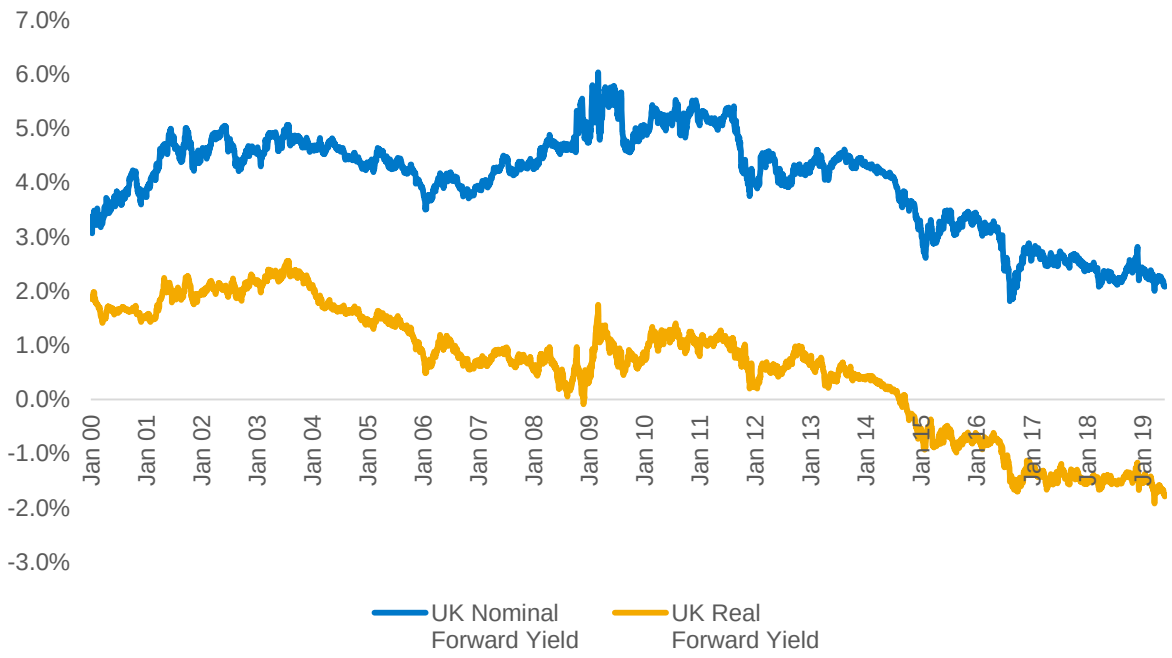
Our point estimate is very similar to the point estimate proposed by recent Ofcom and CAA publications (Table 3.2), which both propose a figure equivalent to around -0.4% in CPIH terms – although it is higher than Ofgem's figure of around -1.0%, in part reflecting our earlier February data cut off.

Our figure lies at the bottom of the CPIH range for the risk-free rate recommended by our consultants, Europe Economics, of -0.45% to -0.08%, and below their point estimate of -0.19%. This is due to their preference to base their calculations primarily on nominal yields (with some weight on index-linked gilts at the 20 year horizon). This is because Europe Economics places less weight than us on the risk that an inflation risk premium will distort estimates of the risk free rate, due to its view that the Bank of England's inflation targeting framework has hitherto been successful at achieving CPI inflation on average at around 2%, meaning any risk premium should be low.

[26] Office for Budgetary Responsibility, 'Economic and Fiscal Outlook', March 2019

Our point estimate is negative in both CPIH and RPI-deflated terms. We consider there is no reason in economic theory why a negative rate could not manifest over a period of time – and note that this is also the UKRN study authors' conclusion.[27] Indeed, it would be difficult to justify a rate which is positive in real terms, as evidence on forward rates continue to indicate market expectations of negative real long-term interest rates as far out as 2029. This is set out in Figure 3.3, which gives the market expectation of the 10 year gilt rate that will prevail 10 years from a given date on the horizontal axis. We also note that since our data cut off point of February 2019, the average of 10 and 20 year yields on index-linked bonds have fallen by around 60 basis points. We would expect to update our risk-free rate estimate at final determinations to capture the most recent market data.

Figure 3.3: Evolution of the 10 year forward 10 year gilt rate (2000-2019)



Source: PwC analysis of Bank of England data

3.3 Total Market Return

The Total Market Return (TMR) is a measure of the return which equity investors require to hold a diversified portfolio of UK shares. While the TMR is embedded in daily transactions in equity markets, it is difficult to observe directly, and there are a

[27] P. Burns et al., *'Estimating The Cost of Capital For Implementation of Price Controls by UK Regulators'*, March 2018, p35

number of approaches regulators have used to estimate it. We consider these approaches in this section.

3.3.1 Developments since our 'early view':

Our 'early view' featured a TMR figure of 6.47% and a range of 5.9% - 7.2%, deflated by our long-term assumption of 2.0% CPIH.

Since we published our 'early view' cost of capital, the UKRN Study[28] has recommended that regulators use long-term equity returns data – taking into account both UK and international evidence - to derive their estimates of TMR. The authors used the Bank of England's back-projected CPI series[29] to derive their view of TMR, proposing a range of 6-7% in CPI-deflated terms.

Points raised in company submissions on TMR included:

- that it could be appropriate to apply our long-term inflation assumption to an average of nominal historical equity returns to derive TMR (we address this point in section 3.3.3).
- that the low estimate of TMR from our 'early view' was inconsistent with assumptions made in cost assessment. In particular, respondents argued that our estimate of frontier shift[30] implied high productivity growth, and that this was inconsistent with a low TMR (we address this point in section 3.36).
- that our point estimate for the TMR assumption placed undue weight on recent data. These submissions argued for a higher TMR assumption based on long-term average equity returns (we address this point in section 3.36).

Since our 'early view' cost of capital, other UK economic regulators have published their updated view of TMR. In Table 3.4 we set out the TMR estimates from each regulator's most recent publication.

[28] P. Burns et al., *'Estimating The Cost of Capital For Implementation of Price Controls by UK Regulators'*, March 2018
[29] Bank of England, *'A millennium of macroeconomic data for the UK'*, version 3.1, 30 April 2017
[30] Frontier shift is the ability of the sector as a whole to improve its cost-efficiency over time

Table 3.4: Regulatory estimates of Total Market Return, 2018-2019

Regulator	Publication	TMR point estimate (CPI or CPIH basis)	Commentary
Ofgem (May 2019)	RIIO-2 Sector Specific Methodology Decision - Finance	6.25% - 6.75%	UKRN Study 6-7% range with cross-checks from forward-looking evidence
CAA (February 2019)	Draft UK Reference Period 3 Performance Plan proposals	6.4%[31]	Near midpoint of UKRN Study 6-7% range; supported by forward-looking approaches and regulatory precedent.
Ofcom (November 2018)	Business connectivity market review	6.7%	UKRN Study 6-7% with cross-checks from forward-looking evidence

3.3.2. Our estimation framework for Total Market Return

We retain the framework used for our 'early view' cost of capital, which considers three different approaches to estimating prospective TMR, updating where appropriate for new evidence:

- '**Ex-post' approaches** – which assume that observed historical equity returns can be used to make inferences about investors' current expectations for TMR.
- **'Ex-ante' approaches** – which aim to separate historical return expectations from realised returns, using the former to infer current expectations for TMR.
- **'Forward-looking' approaches** – which use more recent market data and sentiment to infer expectations of TMR – particularly via the pricing of financial assets considered against their predicted cashflows.

[31] Figure has been inflated from RPI terms using our assumption of a 100 basis point RPI-CPIH wedge

3.3.3. Ex-post evidence

For our ex-post analysis we have used the 2019 edition of the Credit Suisse Global Investment Returns Yearbook 2019, authored by Dimson Marsh & Staunton (henceforth "DMS"), which contains data on UK equity returns from 1900 to 2018. This publication is a long-running and widely respected source of data on equity returns. In addition, the DMS Yearbook provides data on nominal as well as real returns,[32] permitting the use of different inflation series to derive real returns.

We focus our analysis on real equity returns. In doing so, we also avoid distortions caused by assuming that high historical levels of inflation reflected in historical nominal returns will persist into the future. This is apparent from the DMS yearbook which shows that pre-2000 average inflation is 4.1%, whereas post-2000, the comparable figure is 2.1%.

In assessing ex-post evidence there are two important factors that need to be considered:

- **Treatment of long-term inflation:** Different series of historic inflation data exist, with the choice of series leading to non-trivial differences in calculated real returns data.
- **Averaging technique:** There exists a substantial academic literature which considers whether more weight should be placed on arithmetic or geometric averages.

Treatment of long-term inflation

We have considered three different historical inflation series which span the 1900-2018 period covered by DMS:

- **DMS inflation**: Featured in the 2019 Yearbook, this series uses the Cost of Living Index up to 1949, ONS's backcast measure of CPI since 1949[33], and CPI from 1988 onwards.
- **Millennium dataset[34] 'original' CPI inflation**: This series, compiled by the Bank of England, uses a composite price index series from a paper by O' Donoghue et al (2004)[35] which uses ONS's Consumption Expenditure Deflator (CED) up to 1949. It uses the ONS's backcast measure of CPI since 1949, and CPI from 1988 onwards.

[32] This is not the case for the 2019 edition of the Barclays Equity Gilt Study, for instance.
[33] This is a change relative to the 2018 edition of the Yearbook.
[34] Bank of England, *'A millennium of macroeconomic data for the UK'*, version 3.1, 30 April 2017
[35] O'Donoghue et al, 'Consumer price inflation since 1750', ONS Economic Trends, March 2004

- **Millennium dataset 'preferred' CPI inflation**: This is identical to the 'original' series apart from the period 1900-1914, which instead of the O'Donoghue et al. (2004) series is based on a series from a paper by Feinstein (1991).[36]

In the round we consider that all three series include a sufficiently large span of unambiguously CPI-like data to interpret ex-post estimates as being on a CPI basis. Though more RPI-like series exist, we consider that using CPI-like data to deflate historical nominal returns provides results which are more relevant to analysis of current economic conditions. This is because:

- RPI is a protected series – once a value is published it is not subsequently altered to reflect methodological changes. This inconsistency in the way inflation is calculated across the historical series makes RPI less backwardly compatible than CPI.
- Changes made by the Office for National Statistics in 2010 to inflation measurement corrected a tendency of previous approaches to understate inflation in clothing and footwear. This change also led to a structural increase in measured inflation between CPI and RPI due to the averaging formula ('the formula effect'). This statistical artefact in the post 2010 data represents a discontinuity with the historical data. While historical averages of RPI can be adjusted for this phenomenon (henceforth the 'formula effect adjustment'), estimation of this adjustment represents an additional source of potential error.

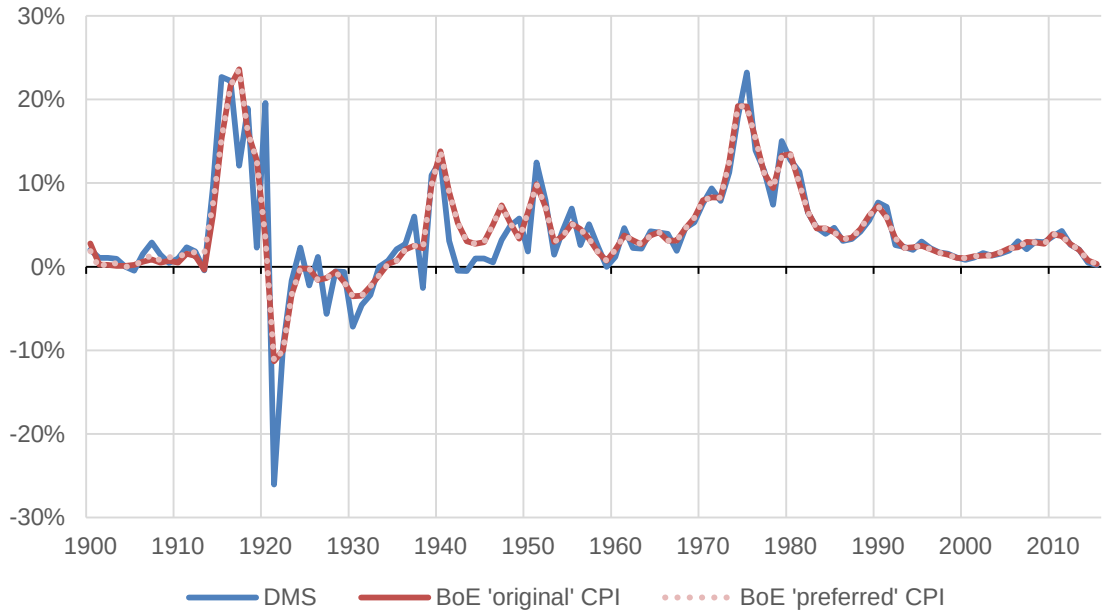
As set out in Figure 3.4 there are important differences between the DMS series and the Bank of England's Millennium Dataset series – particularly considering years prior to 1949 when DMS inflation is on average lower than the Millennium Dataset's. In our view, this is because the DMS data relies on the publication 'Retail Prices 1914-1990' – which is based on the Cost of Living Index (COLI) between the years 1914-1947. In contrast, the Millennium Dataset uses an implied consumers' expenditure deflator, inferred from the National Accounts, and covering 1870-1947. The Office for National Statistics has stated its preference for using the implied deflator, due to the COLI's relatively limited coverage in terms of both products and population, and concerns about the quality of the weights.[37]

The implied deflator is constructed through analysis of the unofficial national accounts of the UK[38], which we consider to be closer to CPI than RPI by design. For

[36] C. H. Feinstein 'A new look at the cost of living', in Foreman-Peck J. ed. 'New perspectives on the late Victorian Economy', Cambridge University Press, 19991
[37] Office for National Statistics, 'Consumer Price Indices Technical Manual, 2007 edition', p73
[38] O'Donoghue et al, Consumer Price Inflation since 1750, Economic Trends (March 2004).

instance, being a deflator, it is by definition not affected by the RPI 'formula effect', and we note that its coverage of housing-related expenditure in particular is closer to CPIH than RPI.[39] For these reasons, we consider the Millennium Dataset's inflation series to be a more accurate depiction of consumer price inflation than that featured in DMS.

Figure 3.4: Comparison of DMS and Bank of England inflation series



Source: Ofwat analysis of Bank of England, Credit Suisse Equity Returns Yearbook 2019 data

Although the two Bank of England inflation series are very similar, we consider that the 'original' series to be superior. This is because we consider there is merit in the consistency of approach used in compiling the O'Donoghue series, which also reduces the risk in the 'preferred' series of double-counting the jump in inflation at the 1914 discontinuity between the Feinstein and O'Donoghue series, also marked by the start of the First World War.

Averaging technique

Another important issue is the choice of arithmetic versus geometric averages, when deriving estimates for TMR. Most textbook treatments of the issue[40] agree that the arithmetic average is the best unbiased estimator to forecast one year ahead if there is no serial correlation of returns. However, the 2019 DMS data shows evidence of

[39] For instance, CED includes a component of imputed rent payment by owner-occupiers which is CPIH-like, but excludes the RPI items of mortgage interest payments and depreciation.
[40] For instance A. Damodaran 'Principles of Corporate Finance, 10th Edition' 2011, p96

serial correlation in the UK data,[41] while the heavy representation in water of institutional investors with longer-term investment horizons means it is unlikely that one year is a representative holding period. The upward bias of the arithmetic average can be demonstrated simply with the UK real returns data for 1900-2018, where compounding the 1900 index value using the single-period arithmetic average return over the period 1900-2018 overstates the actual 2018 value by a factor of 7.6.

Blume[42] (1979), Indro & Lee[43] (1997), and Jacquier, Kane and Marcus[44] (2005), all find that both the arithmetic and geometric average of past returns are likely to be biased estimators when used to forecast future returns. Through simulations, Blume proposes an unbiased estimator which is the horizon-weighted average of both arithmetic and geometric averages, with the weight on the geometric increasing with the time horizon.

Jacquier, Kane and Marcus[45] (2005) argue that a more important criterion than unbiasedness is the confidence interval of the estimator as measured by the mean squared error[46]. They propose an alternative weighted average estimator involving arithmetic and geometric averages which has superior forecasting performance than Arithmetic, Geometric and their unbiased estimator (which gives similar estimates to the Blume). They demonstrate their optimal estimator is econometrically the best estimator and is the most precise as an estimator of terminal value at all forecasting horizons, based on its performance in simulations.

When calibrating ex-post estimators, we consider it important to consider the appropriate holding period for estimating returns. This is primarily because for a data sample with high inter-year volatility,[47] taking an average of longer periods tends to smooth this volatility, reducing the size of the arithmetic average. For estimators involving a horizon-weighted average, a longer period also places more weight on the lower geometric average. We consider it appropriate to focus on periods that are longer than one year due to evidence that infrastructure funds focus on holding periods of longer than 10 years[48], as well as generic investment advice that

[41] The 2019 DMS data shows a serial correlation coefficient of -0.07.
[42] Blume, 'Unbiased estimators of long-run expected rates of return', Journal of the American Statistical Association, 1979
[43] D. Indro, W. Lee, 'Biases in Arithmetic and Geometric Averages as Estimates of Long-Run Expected Returns and Risk Premia', 1997
[44] Jacquier, Kane and Marcus 'Optimal estimation of the risk premium for the long run and asset allocation: a case of compounded estimation risk' Journal of Financial Econometrics, 2005
[45] Ibid.
[46] i.e. the expectation of the squared deviation of the estimator from the true parameter
[47] The DMS data indicates a standard deviation of 19.7%.
[48] Stirling Infrastructure Partners, 'Institutional Infrastructure Survey 2017'

recommends investors remain invested in equities for a long time horizon to manage the risk of equity volatility.[49]

Table 3.5 compares results from different estimators discussed in this section, using inflation as featured in the DMS data and the 'original' CPI series from the Millennium Dataset:

Table 3.5: 'Ex-post' estimates of future return requirement (UK data, 1900-2018)

Holding period	Inflation series	Arithmetic average	Geometric average	Blume unbiased estimator	JKM optimal estimator
1 year	DMS	7.25%	5.44%	7.25%	7.27%
	BoE	6.89%	5.14%	6.89%	6.89%
5 years	DMS	7.06%	5.65%	7.19%	7.08%
	BoE	6.77%	5.34%	6.83%	6.71%
10 years	DMS	7.00%	5.71%	7.11%	6.84%
	BoE	6.72%	5.39%	6.75%	6.48%
15 years	DMS	7.12%	5.83%	7.03%	6.60%
	BoE	6.85%	5.48%	6.68%	6.26%
20 years	DMS	7.08%	6.10%	6.96%	6.36%
	BoE	6.81%	5.71%	6.61%	6.03%

Source: Ofwat analysis of 2019 Credit Suisse Equity Returns Yearbook and Bank of England data

The figures in this table provide a wide overall range of around 5.1-7.3% in CPIH-deflated terms. However, in light of the aforementioned bias in both the arithmetic and geometric estimators, we consider that more robust estimates can be defined based on the JKM optimal estimator. Taking a range of holding periods of 5-10 years consistent with evidence on institutional investor holding periods, [50] and using Bank of England inflation data gives a real TMR range in CPIH terms of around 6.5% to 6.7%.

[49] The Money Advice Service suggests ten years as an appropriate period: https://www.moneyadviceservice.org.uk/en/articles/pensions-review-your-investments
[50] Schroders found in 2016 that 22% of surveyed institutional investors have a holding period of 5-10 years (Source: Schroders, 'Global Investor Study 2016 – Plan Sponsors

The alternative approach to estimating the ex-post TMR is to start with the geometric mean and include an adjustment for serial correlation of returns. This is consistent with the recommendation of the UKRN study:

> *"it is more appropriate to work from geometric (compound) average returns and add an adjustment of 1 to 2 percentage points, depending on the extent to which regulators wish to take account of serial correlation of returns."* [51]

The UKRN study uses its geometric estimator of around 5% ("a figure of not much more than 5% on a compound basis appears increasingly persuasive"), uplifted by up to 2 percentage points to produce a range of 6-7%. As the authors of that report state:

> *'the case for an adjustment to arithmetic averages as large as 2 percentage points… is distinctly weakened if regulators wish to set returns on a consistent basis at a relatively long (e.g., 10-year) horizon, given that long-horizon returns have distinctly lower volatility than would be the case in a random walk.'* [52]

PwC, for the CAA, investigated the potential size of adjustment for serial correlation, over relatively long investment horizons. PwC's analysis supports an upward adjustment to the geometric mean of around 0.4-1.3% for a 10-year holding period, or 0.7-1.5% for a shorter 5-year holding period. We note this is towards the lower end of the 1-2% range cited in the UKRN Study.[53] Combined with our geometric return estimate over the sample period 1899 to 2018 derived using Bank of England data of 5.14%, this produces a range of around 5.5% to 6.6%. This method of uplifting the geometric one-year average is consistent with the UKRN Study and Smithers et al. (2014)[54] recommendation that regulators should base TMR estimates on long-term geometric average returns and then making an adjustment for the impact of arithmetic averaging, rather than measuring arithmetic returns directly. Smithers et al. (2014) note that doing so avoids the risk of short-term exchange rate movements distorting estimates.

[51] P. Burns et al., *'Estimating the Cost of Capital For Implementation of Price Controls by UK Regulators'*, March 2018 Page E-125
[52] P. Burns et al., *'Estimating The Cost of Capital For Implementation of Price Controls by UK Regulators'*, March 2018, E-125
[53] PwC (2019), "*Estimating the cost of capital for H7 - Response to stakeholder views*" Page 44.
[54] Smithers et al. (2014), 'The cost of equity capital for regulated companies, a review for Ofgem', January 2014, pp8-9

International evidence

In line with the UKRN Study's recommendation that regulators also consider international evidence, Table 3.6 below sets out historical average realised returns from the 2019 DMS Yearbook.

Table 3.6: 'Ex-post' estimates of future return requirement (International data, 1900-2018)

Geographical region	Arithmetic average (CPI-deflated)	Geometric average (CPI-deflated)
UK	7.2%	5.4%
Europe	6.0%	4.2%
World	6.5%	5.0%

Source: Credit Suisse Equity Returns Yearbook, 2019

This evidence suggests an arithmetic average CPI-real range of around 6.0 - 6.5% for international TMR – somewhat lower than UK average (using DMS inflation data) of 7.2%. As argued by Europe Economics - and given the historical trend observed in recent decades for increasing global integration of capital markets - it is plausible that we should expect some convergence between the UK and World returns over time. Overall, the lower level of Europe and World averages from Table 3.6 validates the use of the UK historical data to inform an ex-post allowance which is adequate to attract international capital.

Summary of evidence from ex-post approaches

We note that ex-post approaches give results in the range 5.5% to 6.7%. Drawing on analysis using the JKM optimal estimator on UK returns (6.5-6.7%), the UKRN Study approach of adjusting the long-run UK geometric average (5.5%-6.6%), and international evidence, we find evidence for a narrowed range of 6.5%-6.6% where these ranges overlap. This narrowed range sits roughly in the middle of the 6-7% range recommended by the UKRN Study.

3.3.4. Ex-ante evidence

As set out in the PR19 methodology, various studies have emphasised that observed risk premia[55] throughout much of the 20th century are too high to be

[55] I.e. the difference between equity returns and the risk-free rate.

consistent with any plausible degree of risk aversion on the part of investors – for instance Mehra & Prescott (1985)[56] or Fama & French (2002).[57] These studies have tended to conclude that actual expectations of returns must therefore have been lower then returns which were observed. Other studies, for instance Dimson et. al. (2019)[58] have derived forward-looking estimates by removing the estimated contribution to historical equity returns of events which are unlikely to be repeated in future. The implications of this academic evidence are that averages of historical returns are likely to provide an upward-biased guide to current return expectations.

For our 'early view' we applied the Fama-French dividend growth model approach to estimate the TMR using the sum of the average real dividend yields and the average real rate of dividend growth over the period 1900-2018.[59] Updating this analysis with the latest data from the 2019 Barclays Equity Gilt Study produces a CPIH-deflated estimate of TMR of 6.5% using the period 1900-2018, and 5.6% using the period 1990-2018. These figures include a downwards adjustment of 0.34% to the base RPI figures before converting to CPIH, reflecting the structural increase in the RPI formula effect due to the ONS's inflation measurement changes from 2010.[60]

Volatility in returns can be decomposed into volatility in dividend growth and volatility in equity price growth. As a result, investors require compensation for volatility in dividends and share prices. Fama & French (2002) argue that under the dividend growth model approach, the mean forward-looking return only takes into account the dividend yield volatility through the dividend growth input (where the growth assumption is calculated using an arithmetic average of historical dividend growth rates[61]). Hence, the authors argue that the approach understates expected returns by failing to recognise that volatility in capital price growth has been higher than volatility in dividend growth – thereby requiring a relative volatility adjustment. The authors recommend adjusting estimates from the dividend growth model for the difference in variance of share price growth and dividend growth in order to correct for this downward bias. This would give figures of 7.5% and 6.8%, respectively. We consider the case for such an adjustment to be weak however – as PwC show in data over 2006-2017 that in fact volatility in capital price growth has been lower than

[56] Mehra & Prescott, The Equity Premium, 1985
[57] Fama & French, The Equity Premium, The Journal of Finance, 2002
[58] E. Dimson, P. Marsh, M. Staunton, 'Credit Suisse Global Investment Returns Yearbook 2019', Credit Suisse, February 2019, p37
[59] Fama & French, The Equity Premium, The Journal of Finance, 2002
[60] This compares the average formula effect between 2006-09 and that for 2011-18, yielding 0.34% of difference. Source: ONS, 'Causes of the difference between the RPI and CPI inflation rates, 2006 to 2018'
[61] The GDP growth-based models of PwC and Europe Economics base their dividend growth assumption on GDP growth forecasts, which are typically higher than arithmetic means of historical dividend growth rates.

volatility growth over this period.[62] This suggests that a relative volatility adjustment is not necessary.

Our range of 5.6% to 6.5% using the Fama & French approach (including a formula effect adjustment and no relative volatility adjustment) overlaps considerably with other 'ex-ante' ranges of the UK TMR from previous studies:

- **Gregory (2007)[63]** adapts the Fama-French approach to Barclays Equity Gilts Study data, 1925-2006. Gregory proposes an 'ex-ante' estimate of prospective TMR for the UK of 4.30% to 6.18%. This equates to a CPIH range of 4.98% to 6.88%, including an RPI formula effect adjustment. The wide range is driven by the sensitivity of the estimate to choices; especially around which date range is used to provide average dividend yield and average dividend growth rate.
- **Vivian (2007)[64]** adapts the Fama-French approach to Barclays Equity Gilts Study data, 1901-2002. Vivian proposes an 'ex-ante' estimate of prospective TMR for the UK of 5.04% to 6.13% depending on which period of the date range is chosen. This equates to a CPIH range of 5.73-6.83% including an RPI formula effect adjustment.
- **Dimson et al. (2019)** [65] adjust historical returns for events which they consider are unlikely to be repeated (for instance, expansion of the price-to-earnings ratio). They find that once these factors are stripped out, from a world perspective the expected equity risk premium is 3.5% on a geometric basis and 5.0% on an arithmetic basis. The authors cite these figures as their estimate of the long-run equity risk premium for use in asset allocation, stock valuation, regulatory and capital budgeting applications. Adding to the arithmetic average the authors' preferred definition of the World risk-free rate – US Treasury Bills (whose arithmetic average real return is 0.9%), the World point estimate for TMR is 5.9%. Relative to this estimate, an uplift of up to 0.7% might be appropriate, depending on the extent to which the historical average premium of 0.7% in UK arithmetic average equity returns is likely to persist over the World equivalent. Overall, this produces a range of 5.9% to 6.6%.

Summary of evidence from ex-ante approaches

Table 3.7 summarises the 'ex-ante' figures we have used to inform our updated range.

[62] PwC, *'Updated analysis on the cost of equity for PR19'*, December 2017, p16
[63] A. Gregory, '*How low is the UK Equity Risk Premium',* September 2007
[64] A. Vivian, '*The Equity Premium: 101 Years of Empirical Evidence from the UK',* July 2005
[65] E. Dimson, P. Marsh, M. Staunton, '*Credit Suisse Global Investment Returns Yearbook 2019'*, Credit Suisse, Febrry 2019, p37

Table 3.7: 'Ex-ante' estimates of prospective UK TMR

	Unadjusted RPI range	Formula effect adjustment	Adjusted RPI range	CPIH range
Ofwat (2019)	4.9% - 5.8%	0.3%	4.6% - 5.4%	5.6% - 6.5%
DMS (2019)	n/a	n/a	n/a	5.9% - 6.6%
Gregory (2007)	4.3% - 6.2%	0.3%	4.0% - 5.8%	5.0% - 6.9%
Vivian (2007)	5.0% - 6.1%	0.3%	4.7% - 5.8%	5.7% - 6.8%

The figures in this table provide an overall range of around 5.0% to 6.9% in CPIH-deflated terms. We place little weight on the lower and upper end of this range (5.0%-5.5% and 6.5-6.9%), as estimates in this range tend to require relatively unfounded assumptions that prospective dividend growth or yields will resemble a subset of the historic data – or that a relative volatility adjustment is required. A narrower plausible range may be derived using the 5.6% lower bound from our Fama-French dividend growth model (encompassing the period 1990-2018), and an upper bound by the high end of the DMS decompositional approach of 6.7% (assuming that the full historical average premium of UK over World equities persists into the future). We consider that this narrower range provides some support to the view that that basing prospective TMR on realised historic returns may overstate the true return requirement.

3.3.5. Forward-looking evidence

Forward-looking approaches are characterised by a greater focus on more recent market data to make inferences about the TMR which investors require. In this section we set out evidence from forward-looking Dividend Discount Models (DDM), Market-To-Asset Ratio Analysis, and opinion-based evidence from surveys and asset managers.

Dividend discount models

One of the more common forward-looking approaches in economic regulation is the Dividend Discount Model, which combines assumptions about dividend growth with the current price and dividend yield of a given equity index, in order to make inferences about Total Market Return.

For the purpose of this cost of capital update, we commissioned both PwC[66] and Europe Economics[67] to provide estimates from their Dividend Discount Models updated to 28 February 2019. The details of each model are set out below in Table 3.8.

[66] PwC (2019), ”Updated Dividend Discount Model Analysis for PR19”
[67] Europe Economics, ‘The Cost of Capital for the Water Sector at PR19’, July 2019

Table 3.8: Results of PwC and Europe Economics Dividend Discount Models, February 2019

Model and originating institution	Key features of the model
PwC multi-stage GDP-based DDM	• Nominal model operating on nominal inputs and estimating nominal TMR • Based on FTSE All-Share index, includes buybacks. • Dividend growth assumption based on UK GDP growth forecasts from Office of Budget Responsibility and Consensus Economics • Different dividend growth assumption for short term (<5 years) and long-term (>5 years)
Europe Economics multi-stage GDP-based DDM	• CPI-real model operating on CPI-real inputs converted from nominal ones and estimating a CPI-real TMR • Based on FTSE All-Share index, includes buybacks • Dividend growth assumption based on UK GDP growth forecasts and forecasts from the IMF • Different dividend growth rate assumption for short term (<5 years) and long-term (>5 years)
Europe Economics historical dividend growth based DDM	• CPI-real model operating on CPI-real inputs converted from nominal and estimating CPI-real TMR • Based on FTSE All-Share index, includes buybacks • Dividend growth assumption provided by outturn dividend yields and growth from FTSE All-Share • Different dividend growth rate assumption for short term (<5 years) and long-term (>5 years)

Table 3.9 below summarises the results from models built by PwC and Europe Economics. These results have been tabulated in nominal, RPI and CPIH terms. Because PwC's model operates on data in nominal terms, we have used our long-term assumptions of 3.0% RPI and 2.0% CPIH inflation to derive real-terms TMR figures. Europe Economics' model operates on data in CPI-real terms. Nominal and

RPI counterparts have been derived from the model's outputs by inflating their CPI-real estimates by 2.0% and deflating by 1.0%, respectively.

Table 3.9: DDM estimates of forward-looking TMR

Model	Nominal range	CPIH range	RPI range
PwC multi-stage GDP model	8.90 - 10.40%	6.76% - 8.24%	5.73% - 7.18%
Europe Economics multi-stage GDP model	8.24% - 8.39%	6.12% - 6.26%	5.09% - 5.23%
Europe Economics historical dividend model	8.64% - 9.62%	6.51% - 7.47%	5.48% - 6.43%

Source: PwC, Europe Economics

In each of the three models, the upper end of the range is determined by the most recent estimate in February 2019, while the lower end is denoted by the 5-year rolling average. The different ranges of the PwC and Europe Economics GDP models can largely be explained by different sources of data for the buyback assumption.[68]

In their note, PwC, investigate the reasons for the recent rise in the TMR estimates using their updated Dividend Discount Model. This is caused by a modest rise in dividend yield (in part to due weak share prices around February 2019, which have subsequently recovered) and a considerable rise in the share buyback yield from 0.5% in 2017 to 1.9% in 2019. PwC find a range of reasons for increases share buybacks from larger UK listed companies including the uncertain economic and political outlook, weak business investment and some company restructurings which have returned excess capital to shareholders. While these conditions are likely to persist in the short-term, PwC expect the share buyback yield to return to historic levels in the medium term (which would reduce the TMR estimate).

PwC also identify some large UK listed companies have returned capital following disposals. This represents a return <u>of</u> capital, rather than a return <u>on</u> capital and therefore may inflate the sustainable share buyback yield assumption used in the Dividend Discount Model.

[68] PwC uses annualised Capital IQ data, while Europe Economics uses monthly Refinitiv data.

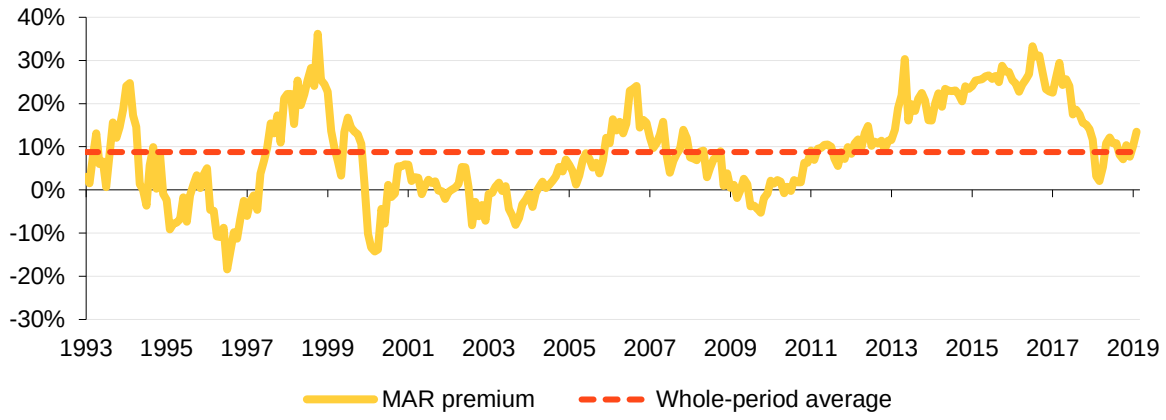
For these two reasons PwC recommend focusing on the 5-year trailing average estimate of the TMR derived using Dividend Discount Models, rather than the February 2019 estimate. This produces a range of 6.1% to 6.8% in CPIH terms.

3.3.6. Market to Asset Ratios (MARs)

To inform our 'early view' of TMR we commissioned consultants PwC and Europe Economics to infer an investor cost of equity from the premium of the market valuation of regulatory equity over its face value. This analysis drew on analyst estimates of outperformance from different aspects of the price control to isolate (as a residual) the monetary value of the premium due to anticipated outperformance on the cost of equity. The analysis inferred an actual investor cost of equity by solving for the discount rate which would equalise the present value of future cost of equity allowance cashflows to the monetary value of the residual premium. This was then converted into a TMR figure by using the Capital Asset Pricing Model.

MAR premia have declined somewhat since we published our 'early view', albeit remaining close to the whole-period average of 1.09x RCV (Figure 3.5). This could reflect lower market expectations of future outperformance.

Figure 3.5: Market to Asset ratios for listed water companies, 1993-2019



Source: Ofwat analysis of Thomson Reuters data

For this update to our cost of capital assessment, we have decided not to revise the MARs analysis we previously commissioned. This is mainly as there is a risk of circularity in basing an estimate of TMR on analyst estimates of outperformance, which might then influence analysts forecasts of outperformance. In addition, the market data informing the analysis dates from prior to the May 2017 publication of the Labour Party Manifesto, which proposed a policy of nationalising the water

sector. It is plausible that the size of MAR premia after this document was published has been influenced by market sentiment on the prospects of this policy being enacted – we consider that there is no robust way of stripping out this impact.

Given that the estimates of TMR derived from MARs which informed our 'early view' are still comparatively recent, we consider that they continue to embody useful information on the TMR applicable to current equity financing conditions. We include the estimates from the original analysis in our sample of estimates, which lie in the range 5.3 - 6.5% in CPIH-deflated terms.

3.3.7. Surveys and sentiment

In addition to forward-looking approaches relying on market data, practitioners in financial markets may also provide their own views of TMR.

- **Fernandez** (2019)[69] via survey asks finance and economics professors, analysts and company managers of companies for the risk-free rate and equity risk premium they are using in 2019. From the 86 UK responses, the average implied TMR from the sum of these two figures is 8.3% in nominal terms, or 6.2% in CPIH-deflated terms. The median is 7.9% in nominal terms, or 5.8% in CPIH-deflated terms.
- **Ofgem** (2019)[70] provide expectations of returns from discussions with 9 financial practitioners and analysis of their publications. The nominal average expectation of TMR from this exercise is 7.65% (5.54% in CPIH-deflated terms), with a range of 6.6% to 8.9% (4.5 to 6.8% in CPIH-deflated terms).

Summary of evidence from forward-looking approaches

Table 3.10 below summarises the TMR ranges we have derived, drawing on different forward-looking approaches. We note that across all approaches, 6.8% in CPIH-deflated terms represents an upper bound on estimated TMR.

[69] P. Fernandez, 'Market Risk Premium and Risk-Free Rate used for 69 countries in 2019: a survey', April 23, 2019
[70] Ofgem, 'RIIO-2 Sector Specific Methodology Decision – Finance', May 2019, p39

Table 3.10: TMR ranges derived using forward-looking approaches

Model	Nominal range	CPIH range	RPI range
Dividend Discount Models (5-year rolling averages, February 2019)	8.2%-8.9%	6.1%-6.8%	5.1%-5.8%
Market to Asset ratio analysis (March 2016 – March 2017)	7.4%-8.6%	5.3%-6.5%	4.3%-5.5%
Surveys and sentiment (2019)	6.6%-8.9%	4.5%-6.8%	3.5%-5.8%

In informing our overall view of forward-looking TMR, we place proportionately more weight on the range provided by our DDM evidence (6.1% - 6.8% in CPIH-deflated terms) over that derived from Market to Asset ratio analysis, as it is more recent, and directly derived from a suitably broad index (the FTSE All-Share) which can credibly proxy for the UK TMR. Following the advice of our consultants, Europe Economics and PwC we base our range on February 2019 five-year rolling averages. This is because volatility makes spot estimates unsuitable to inform our estimate for TMR, and also because Europe Economics find through statistical tests and academic research that 5-year rolling averages are a better predictor of future returns than spot values.[71]

In common with previous regulatory decisions we do not place much weight on survey evidence to inform our 'forward-looking' range. This is mainly as the lack of clarity around the assumptions used to propose estimates of TMR makes interpretation of the results difficult. [72] In addition, both asset managers and financial regulators may face incentives to use low equity return expectations. Nonetheless, this evidence does raise the possibility that the return requirements of investors could be significantly lower than our point estimate for TMR over 2020-25.

We consider that the lower ranges from Market to Asset ratio analysis and surveys and sentiment justify a small downwards adjustment of 0.1% to the lower end of the DDM range. This gives an overall range from forward-looking approaches of 6.0-6.8% in CPIH-deflated terms.

[71] Europe Economics, 'PR19 – Initial Assessment of the Cost of Capital', December 2017, p30
[72] For instance, the investment horizon, or whether geometric or arithmetic average should be used.

3.3.9. Our overall conclusion on TMR

Restating our summary of evidence from sections 3.3.3, 3.3.4, and 3.3.5, we find that:

- Our analysis using **ex-post** approaches gives an overall range of 5.5% to 6.7%. We find a more credible range to lie between 6.5%-6.6%, where there is overlap from the ranges derived from different ex-post approaches.
- Our analysis using **ex-ante** approaches gives an overall range of around 5.0% to 6.9% in CPIH-deflated terms. We find a more credible range to lie between 5.6% and 6.7%.
- Our analysis using **forward-looking** approaches gives an overall range of 4.5% to 6.8%. We find a more credible range to lie between to 6.0% - 6.8%.

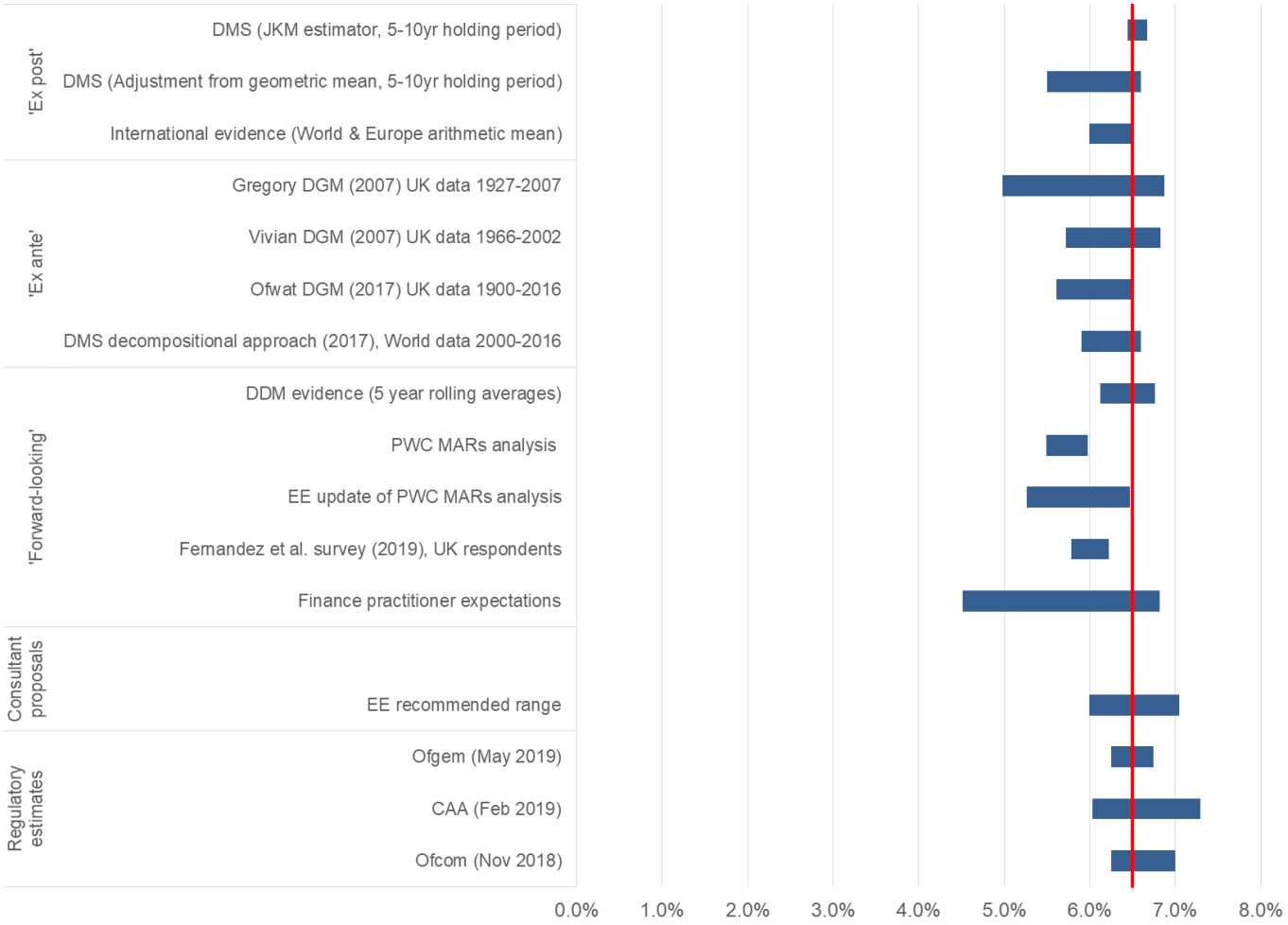
We note the overlap of narrowed ranges from the three approaches is in the region of 6.5% to 6.6%, from which we pick a point estimate of 6.5%. We express our estimate below in nominal terms and deflate for our assumed future long-term average level of RPI and CPIH:

- **8.63%** - nominal;
- **6.50%** - CPIH based, assuming 2.0% CPIH; and
- **5.47%** - RPI based, assuming 3.0% RPI.

We do not consider that our approach in deriving our estimate has necessitated placing significantly more weight on one class of approaches over another. Our point estimate is contained within the ranges of all three perspectives we have considered in this section, is the midpoint of the range of 6-7% recommended by both Europe Economics and the UKRN study authors, and is broadly the midpoint of recent regulatory estimates of UK TMR (Table 3.4).

Figure 3.6 brings together the ranges yielded by the different approaches we have captured to derive an estimate for TMR.

Figure 3.6: Range of real TMR estimates (assuming long-term CPIH of 2.0%).



We do not consider our estimate of TMR to be inconsistent with our estimate of frontier shift. Europe Economics' productivity growth range is 0.6%-1.2% per year for total expenditure. The lower end of the range is based on productivity growth after the financial crisis. The upper end of the range is based on growth of better performing comparable sectors and takes into account data over longer term historical periods. Europe Economics recommend picking a figure from the upper end of the range. This is not because they place more weight on historical periods that demonstrated higher productivity growth (potentially causing an inconsistency if these periods had higher TMR), but because the measures and data used to calculate the low end of their range are liable to understate productivity growth.

In any case, productivity growth is just one of many factors which may influence TMR, such as the secular global trend of falling consumption per capita and an excess demand over supply for safe assets. It is entirely possible that the countervailing impact of these factors could result in a lower TMR, despite high productivity growth.

3.4 Equity beta

According to the CAPM framework, equity investors only require compensation for bearing market-wide risks, not firm-specific risks. This is because equity investors can significantly mitigate firm-specific risk by diversification through holding a portfolio of investments. In a large portfolio, it is argued, these effects will broadly average out to zero, on the basis that weak performance in some companies will be cancelled out by strong performance in others, and no individual investment represents a large share of the portfolio.[73]

The equity beta is a component of the CAPM framework which serves as a measure of relative risk. It describes how much more or less exposed to market-wide risk the equity returns of a given company are, in relation to Total Market Return. Required equity returns are positively related to this measure – the higher the exposure to risk, the higher the required return.

The equity beta is influenced by a range of factors, for instance the nature of the product or service provided by the firm in question. It is also influenced by the level of gearing of the firm. This is because a smaller proportion of equity financing is exposed to more volatile returns, and ultimately could be eliminated altogether in the case of a large adverse shock.

Equity betas are usually estimated by regressing equity returns against a suitably broad index of home-currency equities (e.g. the FTSE All-Share). The resulting equity beta reflects the firm's financial gearing over the estimation period, and its underlying business risk.

The underlying business risk can be separated out as the asset beta. The asset beta is typically calculated by adjusting an econometric estimate of market-derived equity beta to remove the contribution of gearing to beta risk. The level of asset beta derived via this approach also depends on the estimate used for debt beta, which (similarly to equity beta) describes how more or less exposed to market-wide risks debt investments are relative to the Total Market Return.

3.4.1. Developments since our 'early view'

For our 'early view' cost of capital, we based our econometric estimate of equity beta on daily returns data with a 2 year trailing window up to 31 July 2017, using Ordinary

[73] Brealey, Myers, Allen, 'Principles of Corporate Finance, Tenth Edition', 2011, p170

Least Squares to regress FTSE All Share returns data on returns for Severn Trent and United Utilities. The average of betas for these two companies was 0.63.

We used a debt beta of 0.10 and adjusted for enterprise value gearing[74] to derive an asset beta of 0.37,[75] which we then re-levered using our notional company gearing of 60%, resulting in a notional company equity beta of 0.77.

We set out in our final methodology that we would update and reconsider evidence on equity beta for draft and final determinations. Figure 3.7 shows that as at 28/02/2019 there has been a fall of 1 basis point in the econometric estimate of our raw beta using the 'early view' approach.[76]

Figure 3.7: 2 year raw beta for Severn Trent, United Utilities and Pennon

Source: Europe Economics analysis of Refinitiv data

Research commissioned by UKRN members has challenged the traditional regulatory practice of using Ordinary Least Squares (OLS) to derive econometric estimates of beta. The UKRN Study and Ofgem-commissioned Indepen study[77] both argue that an alternative estimator (GARCH)[78] is superior to OLS in dealing with time-varying volatility observed in the returns data.

Some of the UKRN study authors also argued for estimating beta over a longer span of historical data (to align with the investment horizon), and at lower frequencies (i.e.

[74] i.e. the book value of net debt over the sum of the market value of equity and the book value of debt
[75] The comparable figure to the PR14 asset beta of 0.3 (i.e. assuming zero debt beta), was 0.32.
[76] 2 year raw daily beta for SVT/UUW was 0.62 vs our 'early view' estimate of 0.63
[77] Indepen, 'Ofgem Beta Study – RIIO-2, Main Report', December 2018.
[78] Generalised Autoregressive Conditional Heteroskedasticity

quarterly), which they argued would correct for volatility and an apparent upward bias evident in the shorter trailing windows used by regulators. Adopting this approach produces equity beta estimates in the range 0.3 to 0.5 – significantly lower than recent determinations in energy and water. Not all authors agreed on this recommendation, however.

In addition, some of the UKRN study authors criticised existing regulatory practices regarding the de-gearing and re-gearing of equity beta, arguing that this approach counterintuitively led to a level of beta used in the cost of equity calculation which was higher than the directly derived econometric estimate for the company in question. The Indepen study argued that it was inconsistent to de-gear using enterprise value gearing and re-gear using book value gearing, proposing that the notional re-gearing assumption should be adjusted by a plausible figure for the Market-to-Asset ratio. Finally, a report by Citizens' Advice recommended that we should use the econometric estimate of equity beta from our listed comparators as a direct input to our overall cost of capital without adjusting for any difference in gearing relative to our notional assumption.[79]

Separately to these estimation issues, several water-only companies argued that the higher level of operational gearing implied by their operating model meant that their beta was higher than that of the listed comparators and that evidence supported a company-specific beta and cost of equity.

3.4.2. Our high-level framework for estimating equity beta

Consistent with Europe Economics' recommendation for our 'early view', we retain the Harris Pringle[80] approach to calculating an estimate of equity beta for the notional company.[81] This firstly involves deriving an initial econometric estimate of beta from relevant listed water companies, before removing the impact of gearing ('unlevering'), and then finally incorporating the impact of gearing at our notional assumption ('re-levering').

Following the approach in Europe Economics' accompanying report to this document, we draw a distinction between the unlevered beta (the econometric estimate of beta minus the impact of gearing – and no debt beta), and the asset beta, which in addition to removing gearing, also incorporates the impact of debt bearing some systematic risk. The formula for unlevered beta is as follows:

[79] Citizens Advice, '*Monopoly Money: How consumers overpaid by billions',* May 2019
[80] Harris, R.S. and J.J. Pringle (1985), "Risk-Adjusted Discount Rates Extension from the Average-Risk Case", *Journal of Financial Research*, (Fall), 237-244.
[81] Europe Economics, 'PR19 – Initial Assessment of the Cost of Capital', December 2017, pp50-51

$$unlevered\ beta = equity\ beta\ x\ (1 - gearing)$$

We apply the following formula to derive asset beta.

$$asset\ beta = unlevered\ beta + (debt\ beta\ x\ gearing)$$

Finally, we re-lever to our notional gearing assumption of 60% using the following formula to estimate the equity beta faced by our notional company:

$$notional\ equity\ beta = \frac{asset\ beta - (debt\ beta\ x\ gearing)}{(1 - gearing)}$$

Our estimate of beta is a weighted average of the two largely 'pure-play' regulated water companies (Severn Trent Water and United Utilities), with weights given by the market capitalisation of each company. We have not included Pennon as part of this average as we consider its data is impacted by the presence of significant unregulated revenues in the form of its waste management business, Viridor. This view is supported by the historical behaviour of Pennon's raw beta (Figure 3.7) which shows periods of material divergence from the more closely aligned raw beta of Severn Trent Water and United Utilities. As noted by Europe Economics, the inclusion of Pennon has a minor impact, increasing unlevered beta by around one basis point.

Beta estimation issues

We commissioned Europe Economics to advise on the estimation issues raised by the UKRN and Indepen studies – in particular around which estimator to use and which frequency and size of trailing window to choose. Detailed findings are set out in the consultancy's accompanying report. In summary, Europe Economics concluded the following.

- A single stable 'long-run beta' using the span of available data (2000-2019) is implausible given changes in both the risk profile of the water sector and that of the wider UK equities market over the past two decades. This conclusion is also supported by Robertson (2018).[82]
- Based on its own estimation efforts, that GARCH and OLS estimates are very similar across all trailing windows and frequencies, although GARCH estimates exhibit lower volatility.
- Use of lower frequency data is associated with a loss of precision in the econometric estimates of beta, due to having fewer data points.

[82] D. Robertson, 'Estimating β", April 19, 2018

- The trading of stocks at daily frequency is sufficient to limit the prospect of biases introduced by thin trading.
- Betas based on shorter (e.g. one year) trailing windows are more responsive to information from the recent events but — being based on relatively small sample sizes — they run the risk introducing uninformative volatility.
- Betas based on longer (e.g. five year) trailing windows are less prone to uninformative volatility, but contain a higher proportion of relatively old information and therefore have a higher risk of being irrelevant to investor expectations of beta for 2020-25.

Overall we agree with Europe Economics that two year betas represent a good trade-off between the need to reflect up-to-date information whilst minimising the risk of uninformative volatility, and agree that the greater precision of estimates derived using daily data should tend to favour the use of this frequency.

Unlevering and re-levering issues

The definition of gearing when unlevering and re-levering beta can have an important impact on the ultimate level of relevered equity beta. For our updated view of the cost of capital we have considered the following formulations:

- **'Enterprise value approach'** – defined as unlevering using Enterprise Value gearing and re-levering using the notional gearing assumption. We utilised this approach to derive our point estimate of beta for our 'early view'.
- **'Book value approach'** – defined as unlevering using book value gearing (the ratio of the book value of net debt to RCV), and re-levering using the notional gearing assumption
- **'Indepen approach'** – defined as unlevering using Enterprise Value gearing, and re-levering using the notional gearing assumption divided by an estimate of the Market to Asset ratio for the notional company. Indepen use a figure of 1.1[83] as their assumption, and call the resultant level of gearing the 'Implied Enterprise Value' (IEV). Indepen argue that this step is necessary to ensure consistency across the unlevering and re-levering process.

Table 3.11 considers how our estimate of re-levered beta might vary across the different approaches to gearing.

[83] Indepen's report describes this point estimate as defensible, as being around the historical average for listed water stocks. This is consistent with our assessment covering 1993-2019, of 1.09.

Table 3.11: Equity beta estimates derived under different definitions of gearing

	Calculation	Enterprise value approach	Book value approach	Indepen approach
Raw equity beta	A	0.64	0.64	0.64
Gearing of listed comparator	B	54.7%	62.8%	54.7%
Unlevered beta	C = A x (1 – B)	0.29	0.24	0.29
Debt beta	D	0.125	0.125	0.125
Asset beta	E = C + D x B	0.36	0.32	0.36
Notional gearing	F	60%	60%	55%
Re-levered beta	G = (E – (D x F)) / (1 – F)	0.71	0.60	0.64

Source: Ofwat analysis of Thomson Reuters data and 2018 Annual Performance Reports

It is clear that the Enterprise Value approach used in our 'early view' results in the highest re-levered beta figure. The approach incorporates the full impact of a Market to Asset ratio higher than 1 to unlever, but assumes that the ratio is 1 when re-levering. It is notable that the estimate of re-levered beta is significantly higher than the raw equity beta, despite the relatively similar book value gearing between Severn Trent Water and the notional company.[84]

One issue which this approach raises is around feedback effects. Enterprise Value gearing is influenced by the share price for the listed companies. There are a number of reasons why a Market to Asset ratio of 1 might be exceeded, including for example the extent to which companies are expected to outperform regulatory determinations which could be related to company specific factors such as rewards for good company performance or sector specific factors that could include the toughness of decisions made in setting the current price control. Where price controls result in significant outperformance, this may lead to high share price and thus low enterprise value gearing. As lower gearing results in a higher unlevered

[84] This finding would remain if notional gearing was set equal to Severn Trent Water's book value gearing of 61.5%

(and ultimately, re-levered) beta, there is a risk that the beta point estimate for the subsequent price control will be unduly influenced by the parameter setting of the current control.

The Book Value approach addresses this issue through assuming that share price has no impact on gearing. This results in a re-levered equity beta figure which is more aligned with the raw equity beta, and avoids feedback effects. However, the assumption of no share price impact on gearing is contentious. One impact of share price increases is to increase the market value of equity, lowering the prospect that systematic shocks will eliminate equity value. This reduces risk to the marginal equity investor, hence it seems unusual to not take this into account.

The Indepen approach represents an alternative way of partially circumventing the feedback issue. Indepen argue that the 'Enterprise Value' approach implicitly assumes that the Market to Asset ratio of the notional company is 1 – and that this is a strong assumption. The Indepen report recommends that the notional gearing be divided by 1.1 before re-levering to derive an implicit enterprise value gearing consistent with the enterprise value definition of gearing used to unlever.[85] We agree that there may be some evidence of ratios being structurally higher than 1 – for listed water companies the average premium since 1993 is 9%, while 11 non-listed equity transactions we were privy to pricing details for between 2011 and 2017 all had positive premia, with an average of 28%. This raises the prospect that the notional company could also have a positive Market to Asset ratio.

An alternative approach would be to adjust the Market to Asset premium for outperformance that is specific to the companies used to estimate beta before unlevering. If there were features of these companies that meant they were more likely to outperform the benchmarks used in our determination, there may be reason to adjust the Market to Asset premium before unlevering. These are issues that have been recognised in Europe Economics' advice to us. Examples might include expectations of outperformance against cost or service benchmarks, and outperformance related to company specific factors such as rewards for fast track status or expected performance against our assessed cost of debt (we note for example, the companies from which our beta calculations are derived have more efficient embedded debt costs than other companies in the sector – see Figure 4.5).

For our draft determination, we retain our 'early view' approach of unlevering using enterprise value gearing, and re-gearing using our unadjusted notional assumption of 60%. We note that using the alternative approaches from Table 3.10 all imply strikingly lower values of re-levered beta, as would an approach adjusting the initial

[85] This figure represents the Indepen study's assessment of recent MAR premia for pure-play water companies.

enterprise value gearing for company-specific contributors to the Market to Asset premium. We expect to revisit this issue for final determinations, and welcome further views on this issue and how we should take it into account.

Operational leverage

Conventionally, 'operational leverage' is a measure of the proportion of total company costs that are fixed in relation to project value. It is widely recognised as a determinant of asset beta.[86] Textbook examples commonly tend to focus on fixed costs which cannot be scaled down in response to systematic risks (for instance, a recession which reduces demand for a firm's products), thereby amplifying the revenue impact of a change in sales.

When considering the specific context of water regulation, we are unconvinced that having a higher share of fixed costs implies greater risk. As water regulation operates under a revenue control, firms are substantially insulated from the revenue impact of changes in water demand, regardless of their share of fixed costs.

Representations by water only companies suggest they have higher operational gearing due to their smaller size of RCV relative to both revenues and costs, and therefore a higher proportion of operating costs to revenues. Firms with a relatively lower share of capital costs have proportionally smaller allowances for the return on and return of capital. Water only companies therefore contend they are less insulated from the impact of systematic cost shocks. They tended to cite the Competition and Market's Authority's 2015 redetermination of Bristol Water's price control, where it uplifted the econometric estimate of beta to reflect the differing ratio of cash flow from operations to revenue.

We continue to consider this approach unsuitable for comparing risks across companies. We reviewed this issue at length at PR14 and concluded that the impact of different cost structures was not clear-cut, for example, a higher proportion of operational costs could reduce risk. This is because operational costs with exposure to systematic risks (under a fixed revenue control) will introduce negative correlation with wider market performance and exert a downward pressure on the cost of equity.

The empirical evidence we examined at PR14 was also unclear[87]:

- There was no tendency for water only companies to have lower valuation ratios in equity transactions, which suggests that shareholders do not perceive a difference in risk;

[86] Brealey, Myers, Allen, 'Principles of Corporate Finance, Tenth Edition', 2011, pp222-223
[87] PwC (2014), "Company specific adjustments to the WACC A report prepared for Ofwat"

- There was no significant difference between the level of gearing of water and sewerage companies and water only companies, which suggests that debt investors do not perceive a difference in overall risk;
- PwC analysis of the asset betas of Dee Valley, Severn Trent, Pennon and United Utilities showed that Dee Valley's beta was not demonstrably different, which suggests that there is no difference in systematic risk between water only companies and water and sewerage companies.

We also note that applying the CMA approach adopted in the Bristol Water PR14 appeal would lead to implausibly large uplifts for some companies. For instance, the uplift to the asset beta for one large water only company (Affinity Water) would have been 56%; 3.5 times that of another large water only company (South East Water).[88]

3.4.3. Evidence on equity beta for 2020-25

Given the recommendations of the UKRN study and Indepen study favouring GARCH as an estimator, we commissioned Europe Economics to produce econometric estimates of beta using both OLS and GARCH estimators.

Figure 3.8 plots the evolution of unlevered beta over time for our composite of Severn Trent and United Utilities. It demonstrates the higher volatility of estimates as the length of the trailing window decreases. The GARCH estimate is less volatile over time, though in recent data, estimates derived using both OLS and GARCH are very similar in magnitude:

[88] Ofwat, 'Ofwat's response to Bristol Water's price determination statement of case dated 11 March 2015'

Figure 3.8: Unlevered beta for Severn Trent - United Utilities composite using different trailing windows, February 2019

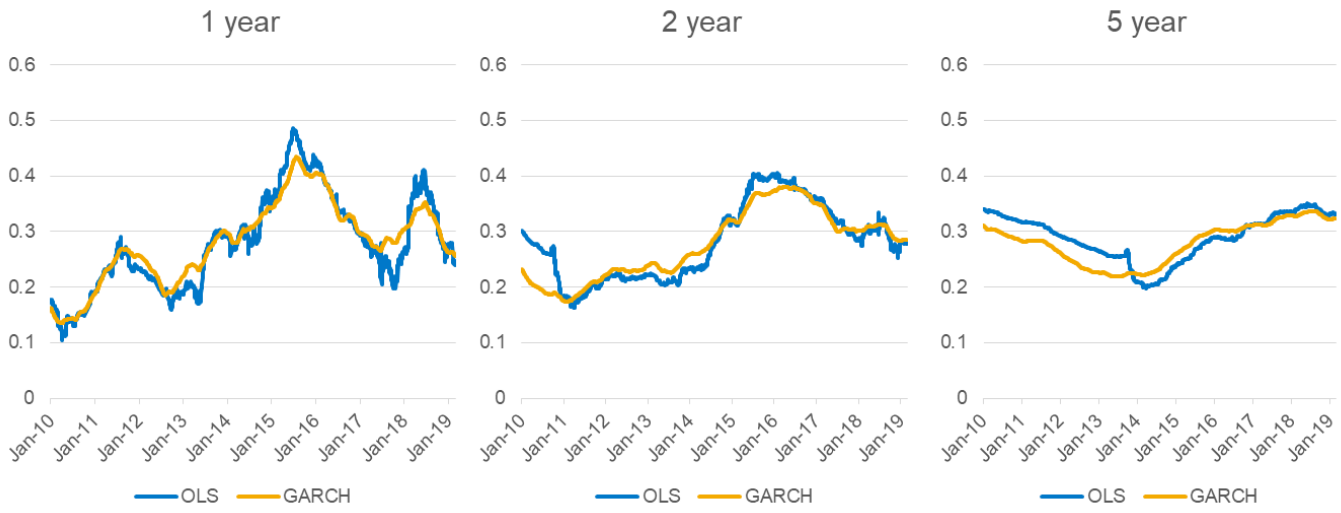


Table 3.12 sets out the permutations of trailing window and frequency which Europe Economics considered in choosing a point estimate and range for unlevered beta.

Table 3.12: Estimates of unlevered beta for the notional water company (February 2019)

	Estimator	1 year	2 year	5 year
Daily	OLS	0.24	0.28	0.33
	GARCH	0.26	0.29	0.32
Weekly	OLS	n/a	0.27	0.32
	GARCH	n/a	0.29	0.31
Monthly	OLS	n/a	n/a	0.38
	GARCH	n/a	n/a	0.33

Source: Europe Economics analysis of Refinitiv data

Europe Economics propose a range of 0.26-0.30 for unlevered beta with a point estimate of 0.28, placing most weight on 2 year beta, with cross checks from 1 year and 5 year betas. We consider a point estimate anchored on 2 year daily betas is appropriate, supporting a narrower range of 0.28-0.29. This is consistent with the

implied unlevered beta range of 0.28 to 0.35 estimated by Ofgem in May 2019 using five companies[89] and a long trailing window ranging from 5 to 17.5 years.[90]

Our point estimate of 0.29 recognises the slightly higher figure derived using GARCH, which we consider to be less prone to daily volatility and more stable over time. We note however that the lower 1 year daily figures could result in a decline in the 2 year betas at the time we assess the cost of capital for final determinations – we will therefore update the calculation for final determinations.

3.4.4. Debt beta

Debt beta is a similar concept to equity beta, measuring the relative riskiness of returns on debt in comparison with the market portfolio. The presence of a positive debt beta reduces the required return on equity, as some systematic risk is borne by debt investors. For our 'early view', we used an estimate of 0.1, based on advice from our consultants, Europe Economics.

We continue to consider it highly probable that a positive debt beta applies in water, despite the absence of defaults on debt since privatisation. To conclude otherwise would imply that systemic risks such as recessions do not increase the probability of default, and that all of the debt premium over the risk-free rate can be accounted for through idiosyncratic, company-specific risk. We do not consider such an assumption is appropriate for the water sector.

Recent regulatory publications have tended to assume a debt beta in the range 0.05 – 0.2 (Table 3.13).

Table 3.13: Previous regulatory estimates for debt beta

Price control	Date	Debt beta assumption
CMA (NIE)	2014	0.05 – 0.1
Ofwat (PR19 'early view')	December 2017	0.1
Ofgem (RIIO-2)	May 2019	0.1 - 0.15
Ofcom (BMCR)	November 2018	0.1
CAA (RP3)	February 2019	0.1 – 0.19

Source: Ofwat analysis of regulatory publications

[89] SSE, National Grid, United Utilities, Severn Trent, and Pennon.
[90] Ofgem, 'RIIO-2 Sector Specific Methodology Decision – Finance', May 2019

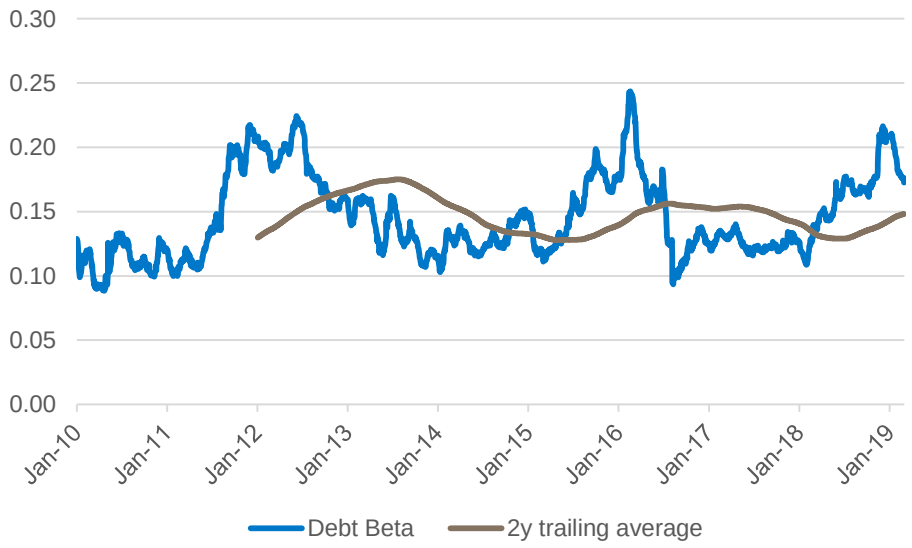
We commissioned Europe Economics to provide a view on the appropriate value of debt beta over 2020-25. In response, the consultancy carried out regression analysis and a 'decompositional approach' aiming to infer the debt beta as a component of the overall debt premium.

Europe Economics' regression approach regresses the returns of the iBoxx A/BBB indices against the FTSE All-Share and returns on selected water bonds against the FTSE All-Share index. In both cases, a range of trailing windows and frequencies of data are used. Europe Economics conclude that estimates of debt beta via this method:

- Are volatile and lie within a wide range
- Are often measured as being negative for periods of time
- Are often not statistically significantly different from zero.

Europe Economics' decompositional approach reasons that the debt premium must be composed of idiosyncratic default risk, liquidity risk, and market-wide risk. By stripping out the components which do not relate to market-wide risk, Europe Economics derive an estimate of the debt beta.

Figure 3.9: Debt premium obtained through the calibrated decomposition approach



Source: Thomson Reuters, PwC, and Europe Economics' calculations.

The decompositional approach yields figures broadly in the range 0.10 to 0.20, with a central estimate of 0.15 – Europe Economics' preferred estimate.

Overall, we conclude that the regression approach does not provide conclusive results, but that the decompositional approach does provide support for estimates of

debt beta higher than 0.1 used for our 'early view'. We also note that the Competition Commission clearly set out that it favoured the decompositional approach over carrying out regressions in deriving estimates of debt beta for the 2007 Gatwick & Heathrow re-determination.[91]

Finally, we observe that the increase in bond spreads may also support a higher debt beta assumption relative to our 'early view'. As noted by Europe Economics, the Capital Asset Pricing Model applies to every asset, through the following relationship:

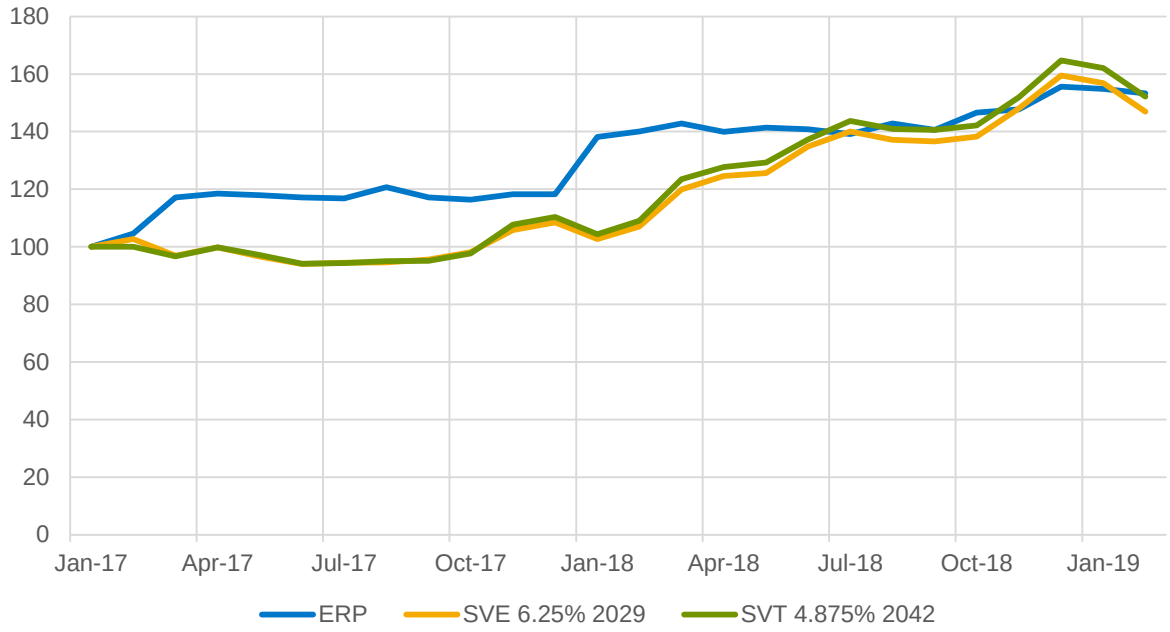
$$\text{Expected return on debt} = R_f + \beta_D \times (R_m - R_f)$$

Where:
R_f is the risk-free rate
β_D is debt beta
$(R_m - R_f)$ is the equity risk premium

We compared the growth in the equity risk premium[92] and spreads to the relevant benchmark gilt for two bonds issued by a company - Severn Trent Water - whose book value gearing (61.5%) is close to our notional assumption of 60%. Figure 3.10 shows that the growth in spreads for these bonds has risen even in periods of stable ERP (e.g. 2018). Taken in the context of the above equation, we infer from this data that some of the increase in yield over the risk-free rate is due to an increase in underlying debt beta, rather than increases in ERP.

[91] See p F24 of https://webarchive.nationalarchives.gov.uk/20140402235745/http:/www.competition-commission.org.uk/assets/competitioncommission/docs/pdf/non-inquiry/rep_pub/reports/2007/fulltext/532af.pdf
[92] As measured by the difference in nominal TMR calculated by PwC's nominal dividend discount model and the average of 10 and 20 year nominal gilts

Figure 3.10 : Growth in bond spreads vs. growth in ERP (index scale, Jan 2017=100)



Source: Ofwat analysis of Thomson Reuters data and PwC Dividend Discount Model outputs

Although we consider that market evidence suggests that debt beta is currently higher than our 'early view' estimate of 0.1, we have chosen an estimate for 2020-25 which is only slightly higher at 0.125, reflecting the relatively high historical volatility in estimates derived using the decompositional approach. This choice reflects the possibility that currently high estimates of debt beta may not be sustained as we head further into 2020-25.

3.4.5. Our conclusion on equity beta

We set out in our PR19 final methodology that we would consider further the approach to the calculation of equity beta. We have developed our approach from our 'early view' cost of capital to consider a much wider range of frequencies and trailing windows for our estimate of beta, and have derived estimates using both OLS and GARCH as estimators.

Overall, we find strong evidence that equity beta has fallen relative to our 'early view', though this is mostly due to the higher Enterprise Value gearing of our composite of Severn Trent Water and United Utilities

Combining our point estimate of debt beta with our narrowed range of unlevered beta of 0.28-0.29, notional gearing of 60%, and our debt beta estimate of 0.125 results in a re-levered equity beta range of 0.68 - 0.71. Our estimate places more

weight on the GARCH estimate (0.29) due to its lower volatility, leading to a re-levered equity beta point estimate of 0.71. We set out the calculations involved in deriving this figure in Table 3.14 below, including for context the result if we were to use a debt beta estimate of zero, and the calculation from our 'early view'.

We discussed our approach to degearing and re-gearing in section 3.4.2 where we noted that differences in the calculation approach can have a material impact on the overall calculation of equity beta, potentially pointing to a lower assessment of beta. We seek further views on this in response to our draft determination.

Table 3.104: Equity beta for PR19 draft determinations

	Calculation	Updated view for draft determinations	Illustration with debt beta of zero	'Early view'
Raw equity beta	A	0.64	0.64	0.63
Observed gearing	B	54.7%	54.7%	49.3%
Unlevered beta	C = A x (1 – B)	0.29	0.29	0.32
Debt beta	D	0.125	0.00	0.10
Asset beta	E = C + D x B	0.36	0.29	0.37
Notional gearing	F	60%	60%	60%
Re-levered beta	G = (E – (D x F)) / (1 – F)	0.71	0.72	0.77

4 Our approach to the cost of debt

We set a cost of debt allowance so that our notionally geared company can cover efficient debt interest costs. In this section we discuss the approach used to derive the overall cost of debt and the components that make up this allowance. We also address comments provided by respondents to our 'early view' as outlined in our final methodology.

The components informing our updated view of the cost of debt are summarised in table 4.1.

Table 4.1: Our updated view of the cost of debt for 2020-25

Component	Updated view (CPIH)	Updated view (RPI)	Early view (RPI)	Commentary
Ratio of embedded to new debt	80:20	80:20	70:30	Our updated estimate is based on business plan data on opening debt balances and proposals to issue and pay down debt over 2020-25.
Cost of new debt	1.33%	0.35%	0.38%	An initial fixed allowance based on our benchmark index which will be subject to a reconciliation as part of PR24 using actual movements in the index.
Cost of embedded debt	2.46%	1.46%	1.59%	Our updated estimate is based on a 15 year average of our benchmark index, adjusted for 25 basis points of expected outperformance.
Issuance and liquidity costs	0.10%	0.10%	0.10%	Our estimate is unchanged from our 'early view'.
Overall cost of debt	2.33%	1.34%	1.33%	Calculated as the weighted average of the cost of new and embedded debt using the assumed proportions of each as weights.

This section is structured as follows:

- **Section 4.1:** Our approach to assessing the cost of debt
- **Section 4.2:** Cost of new debt
- **Section 4.3:** Cost of embedded debt
- **Section 4.4:** Issuance and liquidity costs

4.1 Our approach to assessing the cost of debt

We set out in the PR19 final methodology that our assessment of the overall cost of debt for the notional capital structure would be calculated as a weighted average of new and embedded debt costs. This requires us to derive an estimate for the proportion of each type of debt and its cost. In addition to this allowance, we allow for an uplift to account for issuance and liquidity costs.

4.1.1. Developments since our 'early view'

In our final methodology we confirmed that we would:

- Adopt a fixed assumption for embedded debt.
- Adopt an indexation approach for the cost of new debt, using an average of the IHS Markit iBoxx 'A' and 'BBB' rated GBP non-financials indices for bonds with 10 years or more to maturity (henceforth 'our benchmark index').
- Set an initial allowance for the cost of new debt, and perform a reconciliation at the end of the 2020-25 period to reflect the actual evolution of our benchmark index over 2020-25.
- Use our long-term view of CPIH inflation, set at the time of the price determination, when calculating the reconciliation adjustment.

For our 'early view' we drew on Europe Economics' analysis of company debt data and extrapolation of RCV growth rates to make a provisional estimate that the split of embedded to new debt over 2020-25 would be 70:30. We recognised that we would need to revisit this figure once business plan forecasts of debt issuance and repayments were made available to us.

We set a cost of embedded debt estimate which considered evidence from our benchmark index as well as company reported borrowing costs (we discuss this component in section 4.3). We also set an initial cost of new debt assumption based on our benchmark index (we discuss this component in section 4.2).

In their business plans, several companies commented that our 'early view' assumed share of new debt of 30% was higher than their estimate, and did not accord with their expectations. We discuss the share of new debt in section 4.1.2.

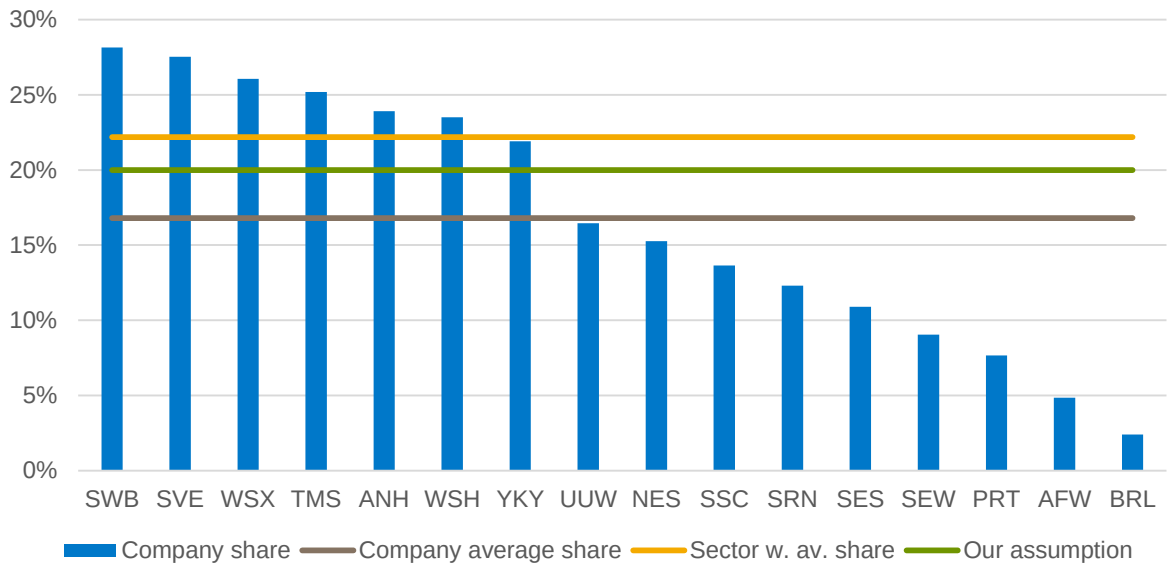
Several companies also stated that their small size required them to issue debt in larger tranches than their financing needs implied in order to access financing efficiencies of scale. These companies argued that an uplift to their cost of debt would be appropriate due to the additional cash holding costs resulting from the

difference between the interest rate of long-term borrowings, and the deposit rate received from holding these funds in a short-term account. We address this issue in section 4.4.

4.1.2. Ratio of new to embedded debt

We have analysed PR19 business plan data, and assess that an estimate of 20% is appropriate for the average share of new debt over 2020-25. This is based on analysis provided by each company on opening debt balances in 2020, debt issuance and debt repayment plans, from which we generate yearly new and embedded debt balances over 2020-25. Our estimate is also supported by Europe Economics, who propose a 20% average share of new debt for 2020-25. Figure 4.1 depicts the average split of new to embedded debt by company over 2020-25, together with the company-level sector average and the sector aggregate split.

Figure 4.1: Forecast average share of new debt over 2020-25



Source: Ofwat Analysis of PR19 Business Plans

Our analysis points to a range of 17%-22%. The lower end of the range is calculated as the average share of new debt as an unweighted average across the companies, the higher end is based on the average of for debt issued by the sector. From this range we take 20% as our point estimate for the notional company.

4.2 Cost of new debt

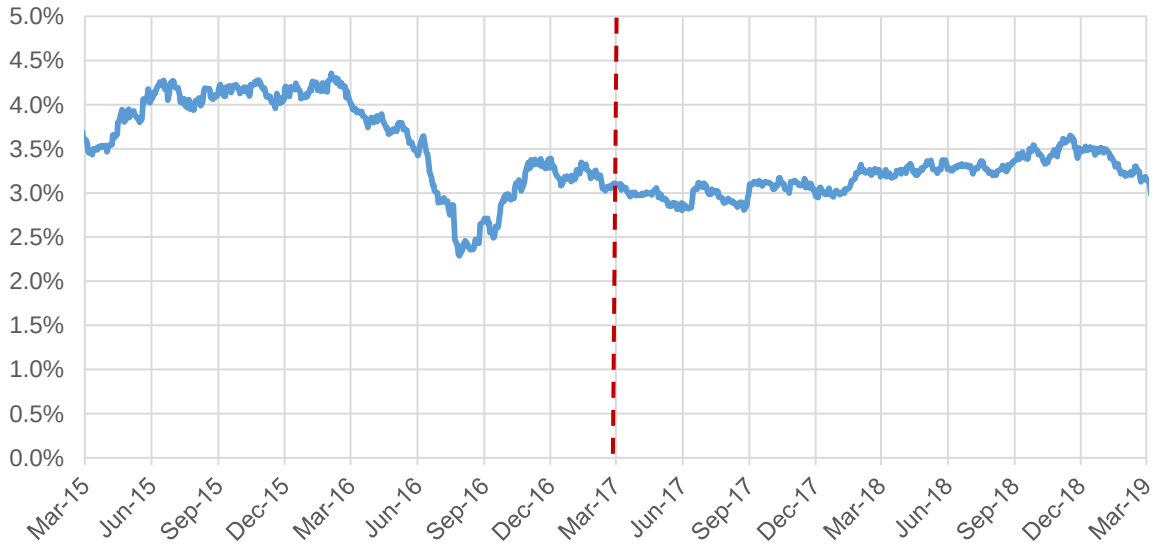
Our allowance for the cost of new debt is intended to remunerate the efficient financing costs for debt issued over the period 2020-25 for a company with a notional financial structure.

4.2.1. Developments since our 'early view'

Our 'early view' estimate of the cost of new debt relied on the spot value of our benchmark index on 31 March 2017 (3.01%). We uplifted this yield to account for the interest rate rise implied by the difference between the Bank of England's spot and instantaneous forward yield curves between January and July 2017 (54 basis points). We also made a downwards adjustment of 15 basis points to this figure to reflect our view of the 'outperformance wedge' relative to our benchmark index - informed by analysis from Europe Economics[93], PwC[94], and CEPA[95] – that regulated companies were able to outperform our benchmark index by at least this much. This resulted in a figure of 3.40% in nominal terms.

As shown in Figure 4.2, our benchmark index as at 28 February 2019 has increased slightly since the date (31 March 2017) used to inform our 'early view' cost of new debt.

Figure 4.2: iBoxx A/BBB non-financials 10yrs+ index, 2015-2019



[93] Europe Economics, 'PR19 – Initial Assessment of the Cost of Capital', December 2017, pp73-74
[94] PwC, "Cost of Capital for PR14: Methodological Considerations" July 2013, p36
[95] CEPA, 'Alternative approaches to setting the cost of debt for PR19 and H7'

Source: Ofwat analysis of IHS Markit data

Several submissions argued that it was inappropriate to adjust our cost of new debt estimate for historic outperformance. These representations argued that outperformance was negligible once other factors such as tenor and credit rating were controlled for, and cited the Competition and Markets Authority's finding of zero outperformance relative to the iBoxx A/BBB after 2010 for bonds issued by Distribution Network Operators (DNOs).[96] We address this issue in section 4.2.3.

One company also expressed an objection to the use of our long-term assumption for CPIH (2.0%) to deflate nominal outturn values of our benchmark index for the purposes of reconciliation. This company argued that this inflation assumption might change over the course of the control period, leading to under or over-recovery relative to firms' actual CPIH-deflated cost of debt. We discuss this in section 4.2.2.

4.2.2. Our approach to setting the cost of new debt

As confirmed in our final methodology, we will set an initial estimate for the cost of new debt, based on our market benchmark – the IHS Markit iBoxx 'A' and 'BBB'-rated GBP non-financials indices for bonds with 10 years or more to maturity. In their business plans, a number of water companies expressed their support for the use of this index, citing its large number of constituent bonds, widespread use by investors, and tenor aligned to the sector's weighted average.

We confirmed in our PR19 methodology that at PR24, we will carry out a reconciliation adjustment by calculating the difference between company revenues based on the initial fixed allowance and company revenues if they had been based on the outturn values of our benchmark index. Our intent is that the reconciliation adjustment will be reflected in future revenues as part of PR24. The detailed mechanics of this reconciliation are set out in our updated cost of new debt reconciliation model.[97]

Our reconciliation will be based on deflating both our initial estimate and outturn series using our long-term assumption of 2.0% for CPIH. Though we recognise that investor expectations of long-term CPIH inflation may vary over time, we were unable to find a more credible assumption than the Bank of England's inflation target of 2.0% CPI and the assumption that the level of CPIH will remain broadly at this

[96] Competition and Markets Authority, 'British Gas Trading Limited v The Gas and Electricity Markets Authority, Final determination' September 2015, p150
[97] Our update is minor, with changes including: additional calculations to derive an ex-post cost of debt which can be used in our tax reconciliation model, and year-average iBoxx values.

level. We also note that using this inflation assumption was supported by water industry delegates at a workshop held in January 2017.[98]

We disagree with company representations that any outperformance adjustment to our benchmark index ought to capture only outperformance after controlling for the impact of factors such as credit rating and tenor. Our approach, in line with our statutory duties, is to set an allowance for the cost of new debt which is reflective of observed borrowing costs and which does not materially overcompensate companies for these costs. Viewed in this light, our benchmark index is simply a reference point for the sector's cost of borrowing. Where we observe evidence of consistent outperformance, we consider it appropriate to calibrate the level of the index for the observed 'outperformance wedge' to make it a better fit to the new debt costs the sector is observed to actually achieve. We consider outperformance due to credit rating or tenor of debt should not be excluded from this process.

4.2.3. Evidence on cost of new debt for 2020-25

We have conducted analysis on yield-at-issuance for a sample of 152 GBP-denominated listed water sector bonds spanning the period 2000-2019. The simple average outperformance relative to our benchmark index over this period for all instruments was 47 basis points, while the weighted average was 49 basis points. However, for our estimate of the 'outperformance wedge', we considered that not all debt instruments should be included. We made exclusions based on the following criteria:

- **Index-linked bonds:** To compare real yields with the nominal yields in our benchmark index we used Bank of England inflation expectations derived using breakeven gilt rates. Though informative, our analysis from section 3.2.3 shows that the breakeven rate is affected by time-varying liquidity premia in index linked gilts. As this phenomenon represents a potential source of inaccuracy in measured outperformance, we excluded index-linked bonds from our analysis.
- **Bonds with tenor shorter than 10 years:** We observed that outperformance relative to our benchmark index was significantly higher for bonds with tenor shorter than 10 year at issue. We considered, however, that including these bonds might incentivise issuance at tenors lower than 10 years, which would introduce greater refinancing risk to the sector. We were not convinced that this would be in customers' best interests, and so excluded these instruments.

[98] Ofwat, 'Cost of debt workshop – workshop discussion summary', Friday 20 January 2017

Table 4.2 sets out average annual outperformance of our sample of selected bond issues relative to our benchmark index. The average of all years was 31 basis points, with evidence that outperformance may have increased in recent years – the post 2015 average was 44 basis points. Overall, we consider that this analysis represents compelling evidence in support of a larger 'outperformance wedge' than the 15 basis point estimate used for our 'early view'. We have accordingly revised our estimate upwards to 25 basis points. The analysis we have carried out supports a larger figure, however we have picked our estimate to reflect the fact that not all years were marked by outperformance, and there is a degree of uncertainty over the ability of the sector to sustain current levels of outperformance in future.

We note that our estimate is consistent with the Competition and Markets Authority's 2015 finding that the weighted average outperformance of 22 WaSC bonds relative to our benchmark index was 26 basis points between 2000 and 2015.[99] We apply this 'wedge' to both the initial allowance for the cost of new debt, and the outturn iBoxx index on which the end-of-period reconciliation will be based.

[99] Competition and Markets Authority, 'Bristol Water Plc – A reference under section 12(3)(a) of the Water Industry Act 1991', October 2015

Table 4.2: Average outperformance against the iBoxx A/BBB index, 2000-2019

	Number of instruments	Average outperformance (basis points)
2000	2	6
2001	3	34
2002	4	46
2003	6	32
2004	**4**	35
2005	5	44
2006	4	29
2007	3	60
2008	-	n/a
2009	8	61
2010	1	-51
2011	1	8
2012	5	27
2013	4	13
2014	1	48
2015	-	n/a
2016	8	44
2017	5	39
2018	1	50
Whole period average:		**31**
Post 2015 average:		**44**

Source: Ofwat analysis of Refinitiv data

4.2.4. Our conclusion on the cost of new debt for 2020-25

We derive a range for our cost of new debt estimate by taking the minimum and maximum spot values of our benchmark index between 1 January 2019 and 28 February 2019, and uplifting by the market-implied interest rate rise increase embedded in forward rates for nominal 10 and 20 year gilts over February 2019. We follow a similar process to derive our point estimate, which is based on the spot yield

on 28 February 2019. Finally, we apply our adjustment of 25 basis points for the 'outperformance wedge'. This gives an overall range of 3.24% to 3.57%, and a point estimate of 3.36% (Table 4.3). Our point estimate is identical to Europe Economics' recommendation, having been derived in the same manner.

Table 4.3: Cost of new debt for PR19 draft determinations (nominal)

	iBoxx A/BBB spot figure	Rate rise	Outperformance wedge	New debt cost
Low scenario	3.19%	0.30%	0.25%	3.24%
High scenario	3.51%	0.31%	0.25%	3.57%
Central case	3.30%	0.30%	0.25%	3.36%

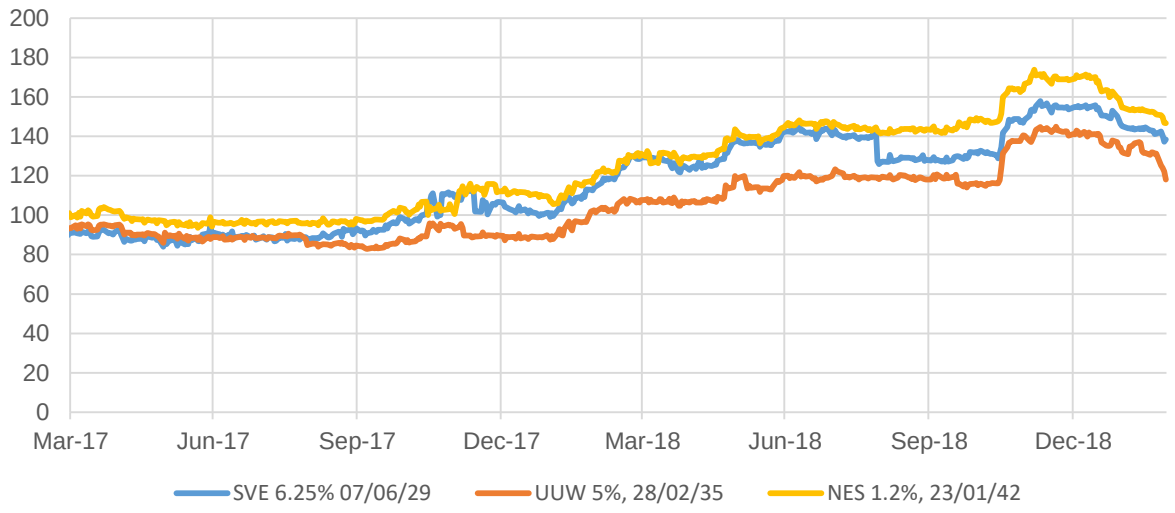
Source: Ofwat & Europe Economics analysis of IHS Markit and Bank of England data

We express our point estimate for the cost of new debt in nominal terms and deflated for our assumed future long-term average level of RPI and CPIH:

- **3.36%** - nominal;
- **1.33%** - CPIH based, assuming 2.0% CPIH.
- **0.35%** - RPI based, assuming 3.0% RPI

As a cross-check to our iBoxx approach we have also calculated a bottom-up estimate of new debt costs in 2020-25, based on spread to benchmark gilts for water bonds in a maturity range of approximately 10-20 years, issued by companies with gearing similar to our notional assumption of 60% (Figure 4.3). Adding the average spread for the three bonds to the average of 10 and 20 year nominal gilts, and uplifting by 30 basis points to reflect forward rate rises gives an average figure of 3.48% for the month of February. This figure is broadly similar to the 3.36% derived using our iBoxx approach, providing additional assurance that our estimate is a reasonable reflection of market evidence. We note however that yields from our benchmark index have declined since 28 February 2019. We will update our assessment for latest market evidence at the time we set our final determinations.

Figure 4.3: Spread to benchmark gilt for selected water bonds (basis points)



Source: Ofwat analysis of Refinitiv data

4.3 Cost of embedded debt

Our allowance for the cost of embedded debt is intended to remunerate the efficient debt financing costs incurred prior to the start of the PR19 control period for a company with a notional financial structure.

4.3.1. Developments since our 'early view'

In our assessment of the cost of debt in our 'early view', we considered evidence on embedded debt costs using two approaches:

- **Balance sheet approach**: setting an allowance based on data regarding debt and other financial instruments which companies had accumulated on their balance sheet as at March 2017. Our analysis focused on 'pure debt' – i.e. fixed, floating-rate and index-linked instruments, excluding non-standard instruments and swaps. We made adjustments to instruments' headline coupon values to reflect our long-term inflation assumption, and also to reflect the impact of refinancing on debt scheduled to fall due before the start of the PR19 control period.
- **Benchmark index approach:** setting an allowance based on the 10 and 15 year trailing average of the A and BBB-rated IHS Markit GBP non-financials 10yrs+ index. As at 31 March 2017, the nominal levels of these trailing average were 5.10% and 5.30%, respectively. We did not adjust these figures for our assessment of companies' ability to outperform the iBoxx, and did not project the level of the index forward to derive trailing averages which might apply at the end of 31 March 2020.

We took the low end of our embedded cost of debt range to be the company-level weighted average of embedded debt costs – 4.34% (nominal), with the high end based on the 10 year trailing average of the iBoxx on 31 July 2017 of 5.10%. We decided to base our point estimate on the company-level median of 4.64%, on the basis that this was a measure which was relatively resilient to the impact of outliers – and our assessment that an iBoxx-derived estimate was likely to materially overcompensate the majority of companies in the sector relative to their true cost of debt.

The UKRN study recommended that, for consistency with the definition of the CAPM-WACC as an expected return, cost of debt estimates should include an adjustment to corporate bond yields to convert these into expected returns. The study argued that a positive probability of default means that the expected value will tend to be lower than the yield. However, the study acknowledged that using yields

instead of expected values was liable to overcompensate investors by less than 10 basis points for 10 year A-rated bonds. We discuss this issue in section 4.3.2.

Some of the UKRN study authors also proposed that the regulatory WACC could be set entirely using CAPM – i.e. without an allowance for embedded debt costs. These authors argued that it was not clear that it was in customers' interests to fund embedded debt costs and noted that this ability to pass through historic borrowing costs to consumers was not enjoyed by unregulated companies. We discuss this issue in section 4.3.2.

4.3.2. Our framework for setting the cost of embedded debt

Our PR19 final methodology, confirmed we would remunerate efficient embedded debt costs for the notional financial structure. A move away from allowing for embedded debt would represent a major change in our regulatory framework– and it is not currently clear that such a move would be in customers' interests.

As at our 'early view', we base our assessment for the cost of embedded debt on evidence from the balance sheet and benchmark index approaches. The former approach has the merit that resultant benchmarks are founded on cost of borrowing data demonstrably achieved by the sector; however if the sector is, as a whole, inefficient at issuing debt, these benchmarks may not be sufficiently challenging. One advantage of the latter approach is that it challenges companies to match the financing efficiency of comparable companies outside as well as within the water sector. This reduces the reliance on efficient issuers in the water sector to derive a stretching sector benchmark. Overall, we consider that both approaches should be considered when forming a view of the appropriate allowance for the cost of embedded debt.

Our updated **balance sheet approach** draws on company-reported data on debt and other financial instruments embedded in company balance sheets as at 31 March 2018, as well as three listed bond instruments which were issued after this point. Our approach again focuses on 'pure debt' – that is fixed, floating and index-linked instruments - excluding the contribution of non-standard debt instruments. It also makes adjustments to reflect our assessment of the debt that companies will refinance between 31 March 2018 and 31 March 2020. It should be noted that approximately 93% of reported debt instruments are included under our definition of 'pure debt' for the purpose of this analysis. We set out the reasoning for our adjustments in Table 4.4 below.

Table 4.4: Adjustments featured in our balance sheet approach:

Instruments subject to adjustment	Rationale
Swaps	We excluded the financial impact of swaps we identified (other than currency swaps), as their bespoke nature makes it difficult to make comparisons and assess if they have been efficiently incurred. We maintain our 'early view' position that shareholders – not customers – should bear the risks and rewards of swaps. Where instruments have been swapped, we based our analysis on the pre-swap coupon rate provided by companies.
Non-standard debt: Debt with equity-like characteristics: • Irredeemable debentures • Debenture stock • Preference shares • Subordinated / Class B debt Short-term credit facilities: • Overdrafts • Liquidity Facilities • Revolving Credit Facilities Callable debt	We excluded debt with equity-like characteristics (including no maturity date, low seniority, and discretion over interest payments), as these instruments carry a different risk-reward profile to the investment-grade debt which we expect that a company at our notional gearing would issue. We excluded costs associated with overdrafts and liquidity facilities on the basis that costs associated with these facilities are allowed for within our 10 basis point uplift to the cost of debt to account for issuance and liquidity costs (See section 4.4). We excluded callable debt, as the option to repay principal early assigns a material amount of reinvestment risk to the bondholder, potentially distorting the pure interest cost of borrowing which we aim to capture in our analysis.
Bonds issued at a premium or discount to face value.	The coupon rate for bonds in this category is liable to present a distorted picture of the effective borrowing rate. This is a known issue with certain tranches of Artesian borrowing – instead of using coupon rates we relied on PwC analysis of effective interest costs from PR14 to inform our analysis (Artesian debt was all issued prior to PR14).[100] We also identified 24 listed instruments where the difference between face value and proceeds of issuance was material (above 1% in either direction). For these instruments, we adjusted the interest rate used in our analysis to the effective rate; defined as annualised nominal interest payment as a proportion of the proceeds of issuance.

[100] PwC, 'Company specific adjustments to the WACC: A report prepared for Ofwat', August 2014, p14

Refinancing assumption	Approximately £2.8 billion of the total £48.8 billion of pure debt in our analysis falls due for refinancing before April 2020. We have used a simplifying assumption that this debt will be refinanced at the forecast average spot rate for our benchmark index over 2018/19 and 2019/20, adjusted for 25 basis points of outperformance – which we calculate as 2.98%. This calculation uses outturn 2018/19 iBoxx figures and forecast 2019/20 figures. Forecast figures are derived by projecting our series forward to account for market-implied rate rises embedded in February 2019 nominal forward rates for 15 year debt.
Inflation adjustment for index-linked bonds	Our analysis focuses on the cost of borrowing in nominal terms. To promote consistency with our overall long-term inflation assumptions featured in this report, we assumed that the nominal coupon rate for index-linked bonds could be expressed using the real coupon uplifted by our long-term assumptions of 3% RPI and 2% CPI, respectively.

From this data it is possible to use a variety of descriptive statistics to provide a benchmark for the sector – for instance the simple average, weighted average, and median.

Our **benchmark index approach** draws on yield data from our benchmark index (the average of the A and BBB-rated IHS Markit iBoxx GBP 10yrs+ non-financials indices.) This is the same benchmark we used at PR14 to set an allowance for the cost of new and embedded debt, and is also used by Ofgem in its RIIO-1 price controls (and is expected to feature in its forthcoming RIIO-2 controls). We consider that the range of ratings covered by these indices represents an achievable target for the notional company. We rejected the use of the alternative iBoxx GBP Utilities index on the basis that the share of UK water bonds in this index is high (26%, against 11% in our benchmark index[101]) . This would dilute one of the main advantages of using a benchmark index approach (i.e. the additional challenge provided by external comparators).

We have improved on our 'early view' approach used to produce our 'early view' cost of capital by projecting forward the index using market expectations of rate rises to forecast the level of the 10 and 15 year trailing average which will apply at the start of the PR19 control period on 1 April 2020. We apply our updated estimate of the 'outperformance wedge' – 25 basis points (discussed in section 3.2) - to this figure to produce our cost of embedded debt estimate.

Difference between expected return and calculated yield

[101] Source: IHS Markit, June 2019

While accepting the argument put forward by the UKRN study authors that the relevant concept in the Capital Asset Pricing Model is expected return, and that expected cost of debt is likely to be lower than the coupon rate and calculated yield to maturity, we did not make an explicit adjustment to reflect this in the cost data that we used to calculate our allowance. This was primarily due to the low materiality (<10 basis points) of the adjustment, and the authors' recognition that high recovery rates would reduce this figure. Since privatisation there have been no defaults on water sector debt at the regulated company level.

4.3.3. Evidence on cost of embedded debt for 2020-25

Table 4.5 below sets out our view of the company-level nominal cost of embedded debt for 31 March 2020, using our **balance sheet approach**, and after applying adjustments set out in Table 4.4 above.

Table 4.5: Company-level cost of embedded pure debt on 31 March 2020 costs for 2020-21 to 2024-25

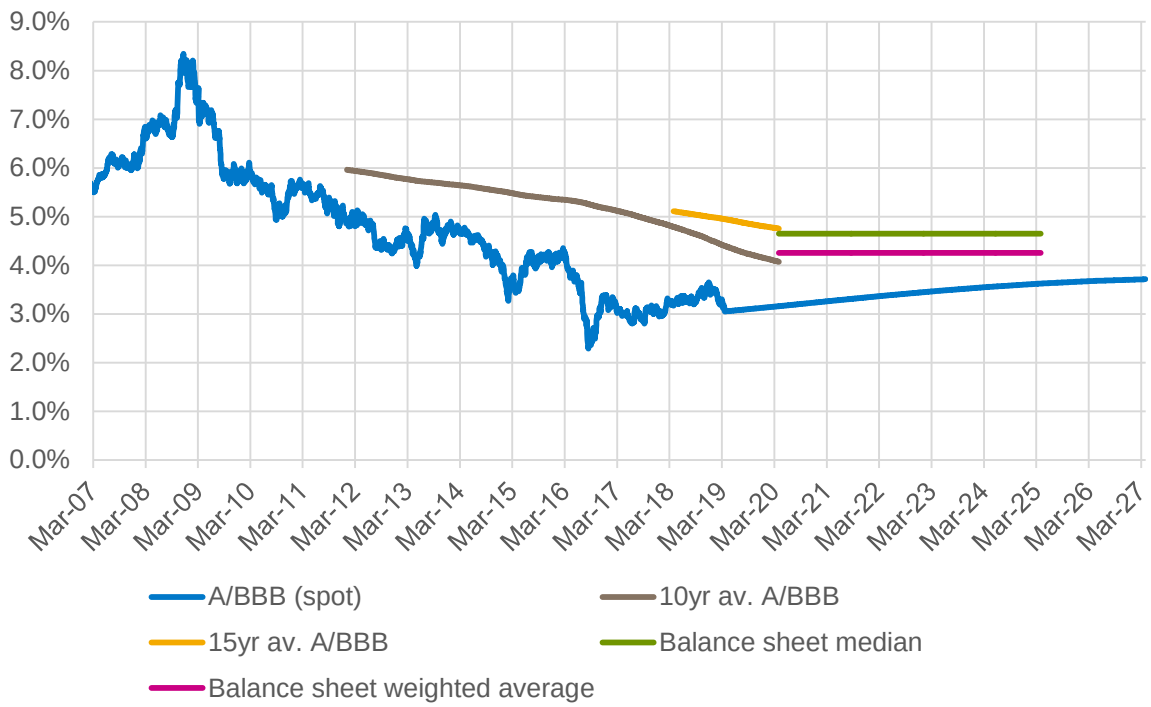
	Sector	WaSCs and large WOCs[102]	Small WOCs[103]
Weighted Average[104]	4.25%	4.23%	5.60%
Simple average	4.63%	4.25%	5.76%
Median	4.65%	4.45%	5.47%

Source: Ofwat & Europe Economics analysis of PR19 business plan data

For our **benchmark index approach**, our assessment of the evolution of the 10 year and 15 year trailing averages is set out in Figure 4.4 below. Using market-implied interest rate rises embedded in forward gilt rates at a tenor of 15 years, we extrapolated spot values of the index to forecast the evolution of the index and associated trailing averages up to 31 March 2020. On this date, we forecast that the spot figure for the index will be 3.14%, with 10 and 15 year trailing averages calculated as 4.07% and 4.75% respectively. For context, we have depicted the sector median and weighted average embedded cost estimate calculated using our balance sheet approach.

[102] Large WOCs refers to South East Water and Affinity Water
[103] Small WOCs refers to Bristol Water, Portsmouth Water, SES Water, and South Staffs Water
[104] Weights for the average are given by principal outstanding

Figure 4.4: iBoxx A/BBB non-financials 10yrs+ index, 2007-2027 (nominal)



Source: Ofwat analysis of IHS Markit and PR19 business plan data

In assessing the most appropriate length of trailing average to use for our benchmark index approach, we have considered durations in the range of 10 to 20 years.

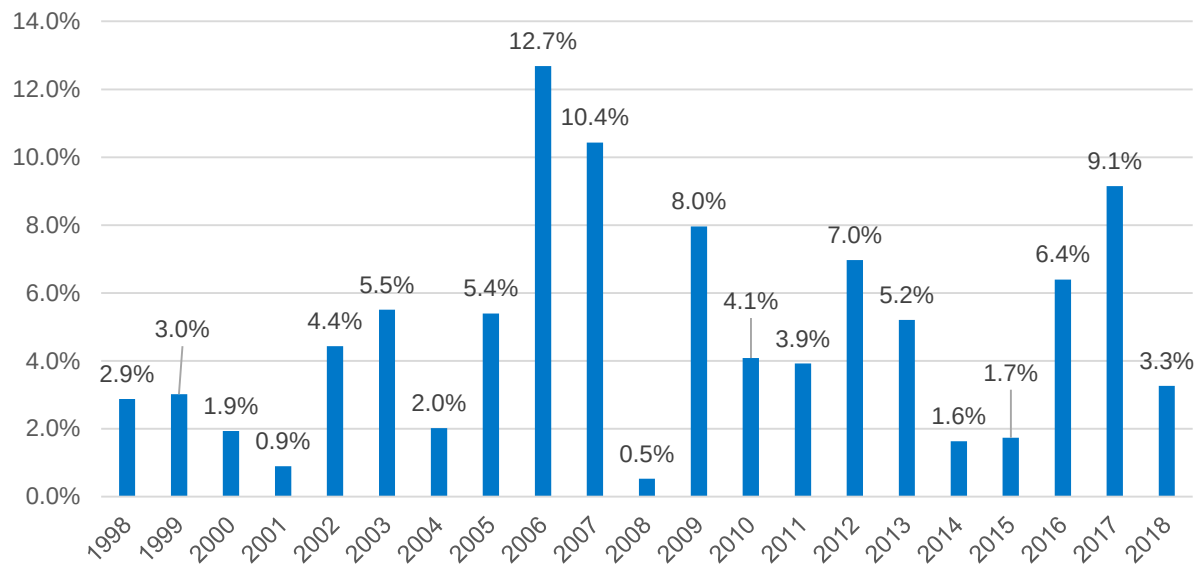
The level of the 10 year trailing index we forecast for 31 March 2020 has, at 4.07%, declined by 103 basis points relative to its level of 5.10% on 31 March 2017, with a significant contribution from the relatively more expensive post-crisis years in 2008 and 2009 dropping out of the 10 year average. Applying our estimate of 25 basis points outperformance would result in an embedded cost allowance of 3.82% based on this metric. Our analysis of balance sheet pure debt suggests that an assumption set at this level would lead to only three companies recovering their embedded debt costs.

The 10 year trailing average does not reflect the issuance profile of listed bonds in the sector. Table 4.6 sets out the proportion of outstanding listed water sector bonds which were issued in each year of the period 1998-2018, relative to the total of £30.6 billion recorded for this period.[105] Approximately 50 per cent of outstanding listed bonds date from the post-2008 period, with the balance accounted for by pre-2008 issuance. This suggests that an index based on a 10 year trailing average will not include market borrowing costs from a period covering potentially half of the sector's outstanding borrowings. We note that we used a 10 year trailing average in PR14 and earlier reviews, and there could be an argument to maintain consistency of approach to

[105] Source: Ofwat analysis of Refinitiv data accessed in October 2018.

embedded cost of debt across price review to reduce regulatory uncertainty. We also note that while we consider that risks around tenor and timing of debt should remain with companies, there still remains, a question as to whether a 10 year trailing average represents cost of debt of an efficient company in the water sector.

Figure 4.5: Outstanding water sector listed bond issuance 1998-2019



Source: Ofwat Analysis of Refinitiv data

In contrast to this, the 15-year trailing average has the merit of providing greater coverage of years when the water sector was actively issuing debt – around 80% of outstanding listed bonds in our sample were issued in the period 2004-2018. Importantly, this trailing average would also capture the 2005-2010 period when particularly high volumes of debt were issued. Though longer indices (for instance a 20-year index) would be feasible, we consider that this would attach too much weight to the first 5 years of the 1999-2018 sample – which would account for 25% of the weights in the trailing average, but only around 16% of outstanding debt. We accordingly consider the 15 year trailing average more suitable than the 10 year as a benchmark. Adjusting our 31 March 2020 forecast figure of 4.75% for our 'outperformance wedge' of 25 basis points produces a point estimate of 4.50%.

Our decision to focus on a longer trailing average than the 10 years adopted at PR14 follows similar reasoning to Ofgem, which stated in May that firms it regulates should produce business plans under the working assumption of an extending trailing average (or 'trombone') starting at 11 years, and extending to 15 years. This is as the regulator forecasts that by 2022 40-50% of non-floating embedded debt in its regulated sectors will have been issued prior to 2011, and so would not be reflected in a 10 year trailing average. Ofgem have stated that they will follow a full indexation approach, calibrating the length, contributing indices, and potentially weights of the

trailing average index to match their sectors' expected efficient debt costs. The regulator has confirmed that its calibration exercise may exclude inefficiently raised debt, and/or complex or opaque products.[106]

4.2.4 Our decision on the cost of embedded debt

We have considered potential benchmarks from both balance sheet and benchmark index approaches, using an approach which has developed from our 'early view'. Our updated approach reflects new data on bond instruments issued since 31 March 2017, and our analysis is more forward-looking - projecting forward the level of trailing averages derived using our benchmark index. Table 4.7 sets out the benchmarks which we have calculated using both approaches:

Table 4.6: Comparison of embedded cost of debt benchmarks

	Nominal cost of embedded debt
Balance sheet approach (sector):	
Sector weighted average	4.25%
Sector simple average	4.63%
Sector median	4.65%
Balance sheet approach (large companies):	
WaSC and large WoC company weighted average	4.23%
WaSC and large WoC company simple average	4.25%
WaSC and large WoC company median	4.45%
Benchmark index approach	
iBoxx A/BBB non-financials 10yr trailing average, adjusted downwards by 25 basis points	3.82%
iBoxx A/BBB non-financials 15yr trailing average adjusted downwards by 25 basis points	4.50%

Considering the difference between the benchmark used for our 'early view' assumption - the sector median - and the large company median calculated using our balance sheet approach, we consider that including smaller WoCs in the sample skews the median upwards. Given that the four smaller WoCs account for less than 2% of total embedded debt used to inform our sector balance sheet approach estimate, it seems disproportionate to set a sector allowance according so much weight to smaller WoCs' borrowing costs.

We accordingly take the company-level median of 4.65% using the balance sheet approach as the upper end of our proposed range. For the lower end, we take the

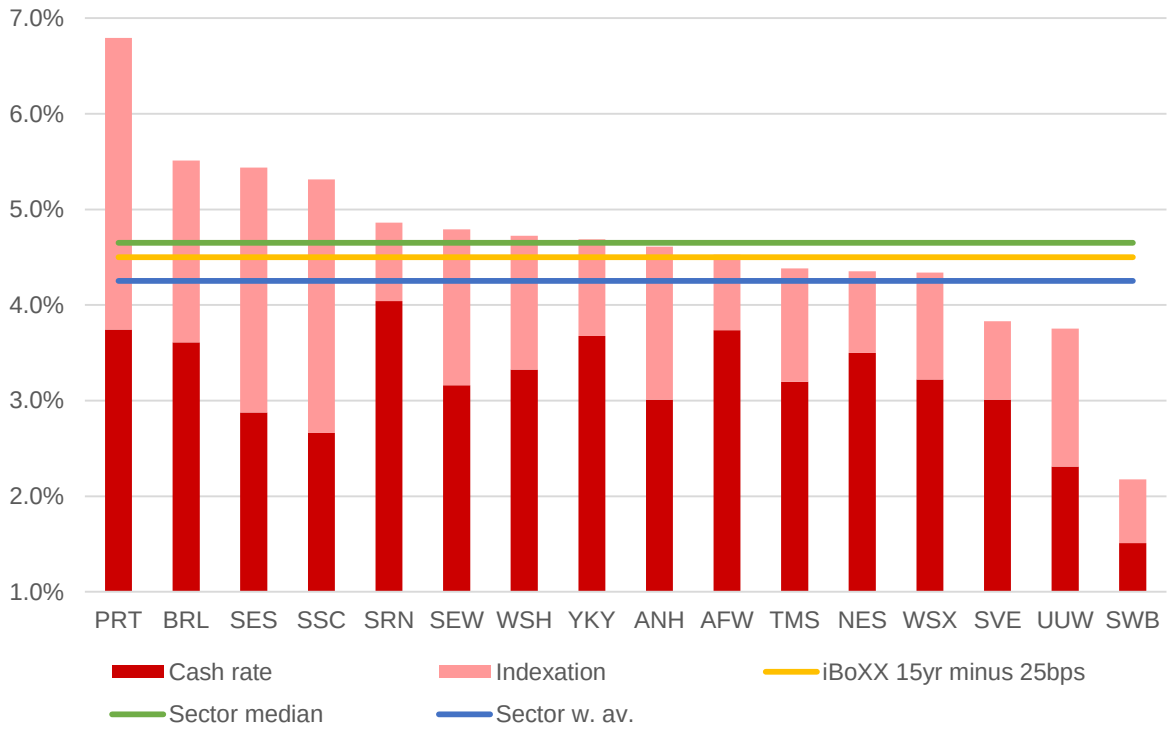
[106] Ofgem, 'RIIO-2 Sector-specific methodology decision – Finance', May 2019

company-level weighted average of 4.25%, all of which give some weight to both WoCs and WaSCs.

We have based our point estimate on the 15 year trailing average of our benchmark index, adjusted for 25 basis points of outperformance supported by our analysis covering 2000-2018, giving 4.50%.

Figure 4.6 compares our assessment of companies' pure debt costs on 31 March 2020 against our point estimate cost of embedded debt assumption. We consider our point estimate is sufficient for an efficient company, and maintains incentives for companies to raise efficient finance over the long term while protecting the interests of customers.

Figure 4.6: Forecast embedded cost of pure debt, March 2020 (%, nominal)



Source: Ofwat analysis of PR19 business plan data and IHS Markit iBoxx data

Note: Indexation rates assume 3.0% RPI and 2.0% CPI applied to index-linked real coupons

We express our point assumption for the cost of embedded debt in nominal terms and deflated for our assumed future long-term average level of RPI and CPIH:

- **4.50%** - nominal;
- **2.46%** - CPIH based, assuming 2.0% CPIH;
- **1.46%** - RPI based, assuming 3.0% RPI.

4.4 Liquidity and issuance costs

Firms incur costs in order to issue debt in addition to interest costs. Debt issuance fees to financial intermediaries (for example banks syndicating the issue) represent one significant source of such costs. In addition, the terms of some loans may also oblige firms to maintain liquidity, which can be achieved through holding cash or maintaining short-term lending facilities.

For our 'early view', we commissioned Europe Economics to derive an assumption for an uplift to the cost of debt to reflect issuance and liquidity costs. The consultancy concluded, based on a review of issuance costs associated with previously issued debt instruments, that a plausible range for this cost component was 3 to 6 basis points. Based on company data and Ofwat analysis, Europe Economics assumed that undrawn liquidity facilities would attract a cost of 34-45 basis points, and that companies would maintain facilities equivalent to 10 per cent of their debt balances. This gave a plausible range for liquidity costs of 3.5-4.5 basis points. Combining these two ranges, Europe Economics proposed a point estimate of 10 basis points for issuance and liquidity costs.[107] We accepted this estimate and incorporated it into our 'early view' cost of debt assumption.

We consider that our 10 basis point uplift to the cost of embedded and new debt remains appropriate to reflect issuance and liquidity costs. This is the same figure used for the notional cost of debt allowance in the Competition and Markets Authority's 2015 determination for Bristol Water,[108] and is the same as that used by Europe Economics in their recommendation to us.[109] We add this to our allowance for the interest costs for embedded and new debt.

We addressed the question of additional cash holding costs for smaller companies in our Initial Assessment of Plans.[110] Overall, we remain unconvinced that the potentially relatively higher cash holding costs for smaller companies outweigh the benefits from the observed higher share of lower-cost floating rate debt compared to larger companies. Where companies consider that this argument does not apply to their particular circumstances, we would expect an application under our procedure for assessing Company Specific Adjustments to the cost of capital.[111]

[107] Europe Economics, 'PR19 – Initial assessment of the cost of capital', December 2017, pp72-73
[108] Competition and Markets Authority, "Bristol Water PLC, A reference under section 12(3)(a) of the Water Industry Act 1991', October 2015, paragraph 10.82
[109] Europe Economics, 'The Cost of Capital for the Water Sector', July 2019
[110] Ofwat, 'Initial Assessment of Plans: Technical Appendix 4: Company-Specific Adjustments to the Cost of Capital', January 2019, pp21-22
[111] Ofwat, 'IAP Appendix 12 Risk & Return', p85

Company specific adjustments to the cost of capital

A1.1 Summary

In our PR19 methodology we set out a three-stage approach to assessing requests for a company-specific adjustment to the cost of capital, asking:

1. Is there compelling evidence that the level of the requested adjustment is appropriate?
2. Is there compelling evidence that there are benefits that adequately compensate customers for the increased cost?
3. Is there compelling evidence of customer support for the proposed adjustment?

Three companies (Bristol Water, Portsmouth Water, and SES Water) proposed a company-specific adjustment to their cost of capital in their initial business plans. In January 2019, as part of our initial assessment of business plans we found that Portsmouth Water passed all three stages of our assessment and so we apply a company-specific adjustment to our sector cost of debt allowance for Portsmouth Water.

Bristol Water and SES Water did not pass our assessment in the initial assessment of business plans, and submitted updated evidence in their revised business plans. We conclude that neither company has passed all three stages of our assessment, as required - and so we have not included a company-specific adjustment to their cost of capital in our draft determinations. The summary outcome of our assessment is set out in table A1.1. We explain the rationale for our assessment in this annex.

Table A1.1: Outcome of our current assessment of resubmitted applications for a company-specific adjustment:

Assessment:	Bristol Water	SES Water
Level of uplift:	Fail	Pass
Customer benefits:	Fail	Fail
Customer support:	Pass	Fail
Overall decision:	Fail	Fail

The structure of the rest of this annex is as follows:

- **Section A1.2, 'Responses to our IAP decision'** sets out the representations on our IAP decision from the two companies, and our response.
- **Section A1.3 'Updates to our benefits assessment'**, explains the updates we have made to the assessment of benefits that was applied in our January assessment.
- **Section A1.4'Levels assessment',** sets out our findings on the evidence that the companies' proposed level of uplift is appropriate.
- **Section A1.5 'Benefits assessment'**, sets out our findings on the evidence that customers are adequately compensated for the cost of providing the uplift.
- **Section A1.6 'Customer support assessment'**, sets out our findings on the evidence that each company's customers support funding the uplift.

A1.2 Responses to our IAP decision

In response to our decision at IAP, both Bristol Water and SES Water submitted additional representations as part of their resubmitted business plans in April 2019.

Table A1.2: Company representations about our IAP decision on company specific adjustments

Issue	Raised by	Our response
Level of uplift: The company used KPMG's analysis to conclude that an appropriate range for the embedded debt uplift for Bristol Water should be 0.50% to 0.96%, with a point estimate of 0.55%.	BRL	**No change:** We found KPMG's analysis on level of small company premium to be unconvincing. It is based on comparing WoC bond yields with a limited sample of WaSC bonds, which risks this sample being unrepresentative. It also misleadingly characterises Artesian borrowing as three single tranches. Correctly reflecting the drawdown of multiple tranches by companies in the analysis reduces the KPMG range to within or below our IAP view of 25-40bps.
Cost benchmarking benefits (precision): Ofwat has not attempted to assess the impact on the precision of totex models from losing a comparator under its mergers style approach to assessing benefits. This has featured as part of previous merger appeal decisions by the CC/CMA.	BRL	**No change:** In both recent mergers considered by the CMA (BWH-SWT and SVT-DVW), the CMA concluded that any adverse impact on modelling precision from mergers was not significant. The CMA has also noted that loss of precision may lead to higher or lower prices for customers, and so should not be straightforwardly interpreted as customer detriment. In light of the latter point we do not reflect precision in our assessment of benefits, as it is unclear

		whether it ought to be treated as a cost or benefit to customers.
Cost benchmarking benefits (totex): Ofwat's approach focuses on the static impacts of a company's efficiency score on the sector Upper Quartile. However, a company may also contribute to the benchmark through its data's impact on the econometric model which is estimated. Bristol Water cite KPMG's analysis which shows that taking Bristol Water's data out of the PR19 botex model results in a shift in the baseline which is worth £104m.	BRL	**No change:** While a particular company's cost data may affect model parameters in a way that reduces sector totex allowance in a given control (separately to the impact of its rank on the sector upper quartile), there is no basis for thinking this effect would be positive over multiple periods. We consider the multi-period approach as more relevant to the decision of whether company offers sufficiently compensating benefits (as the loss of data from a merger would affect future controls, not the current one). In addition, we note that this counterfactual assumes that the econometric model selection would be invariant to the resultant level of efficiency catch-up challenge – which is contentious.
Cost benchmarking benefits (totex): The company argues that it should have a higher efficiency score, which could affect its rank and thus our assessment of benchmarking benefits. In particular, it argues the following deductions should be made from the gap between its costs and modelled predictions : 1. Canal & River Trust (CR&T) efficiency add-back: -£0.5m 2. CR&T cost allowance for water sales to offset against cost paid: -£8.9m 3. Adding back network plus abstraction charges which were wrongly taken off: -£1.0m 4. Using top-down model only: -£27.7m	BRL	**Change:** We have addressed the points raised in the following ways. 1. & 2. We have reviewed and published alongside this document the company's special cost factor claim for Canal & River Trust spending and conclude that the modelled analysis is sufficient for current costs. 3. Abstraction charges are now reflected in the overall allowance separately as part of unmodelled totex. 4. We continue to consider that a triangulation approach appropriately reflects our finding (and that of our consultants) that more than one model has validity in explaining costs.
Cost benchmarking benefits (Retail): The retail model is poorly specified (signs of explanatory coefficients change when moving between top-down and bottom-up approaches).	BRL	**Change:** We have updated our retail totex model to ensure consistency of sign when moving between bottom-up and top-down perspectives.
Outcomes benchmarking benefits (leakage): Bristol Water argues that its above-UQ performance in 2016/17 for various measures (particularly leakage) should be scored as a benefit.	BRL	**No Change:** Customers already pay for strong outcomes performance via ODI reward payments (and potentially, totex overspend). Our assessment for Bristol Water takes account of forward-looking benchmarking benefits for leakage. Bristol Water's approach is selective; if increased focus is placed on 2017-18 data, it should be a net figure which encompasses

		outcomes where performance was below average (e.g. 2017/18 Supply Interruptions).
Outcomes benchmarking benefits (leakage and SI): Bristol Water argues the valuation we use to gross up benchmarking benefits for Leakage and SI should be doubled as we wrongly applied a factor of 50%.	BRL	**Change:** We recognise that the ODI reward rate was wrongly adjusted down by a factor of 0.5. Our revised analysis uses the unadjusted ODI reward rate for benchmarking benefits, or where this is not available – the penalty rate.
Outcomes benchmarking benefits (leakage): The company argues that it is penalised by our focusing on the benchmarking impact in terms of l/hh/day instead of m^3/km/day, which gives higher benefits figures.	BRL	**Change:** We agree that using l/hh/day instead of m^3/km/day is arbitrary. We have updated the analysis to focus on m^3/km/day
Outcomes benchmarking benefits (SIM): The company cites previous inclusion of SIM in our PR14 analysis and argues that this would result in positive benchmarking benefits.	BRL	**No change:** BRL's latest SIM rank was below average (13 out of 18 firms) in the 2017/18 data. This suggests there would be unlikely to be SIM benefits even if we were persisting with SIM instead of transitioning to C-MEX.
Outcomes benchmarking benefits (Unplanned outages): The company argues that forecast performance is above UQ and this provides a benefit.	BRL	**Change:** We have intervened to set various companies' service commitment levels by reference to the forecast sector median for 2024-25. We have accordingly monetised our estimate of the impact on service commitment levels over the PR19 control period if this median was recalculated without Bristol Water and SES Water.
Outcomes benchmarking benefits (Water quality – CRI): The company argues that its strong performance has influenced the level the deadband has been set at and that it should score benefits for this.	BRL	**No change:** The performance commitment level for CRI is set at 0 (100% compliance) by the Drinking Water Inspectorate, and so does not use comparative benchmarks. The contribution of company performance to the deadband is unclear given its range was influenced by discussions with the DWI and the Environment Agency, and the change in profile reflects technical arguments around metaldehyde control (The deadband is 2 in years 1 and 2 of the control, 1.5 thereafter).
Service benchmarking benefits (Water quality contacts): The company argues that forecast performance is above UQ and this provides a benefit.	BRL	**Change:** We have applied an upper quartile challenge for water quality contacts, and so reflect this in our assessment of benefits.
Other benefits (customer valuation): The company cites survey research showing most of its customers would	BRL	**No change:** We are not convinced that useful valuations of merger detriment can be elicited in a sector where customers do not

want benefits of £20/yr to justify a merger with another company. They argue this could represent a source of valuation in its own right.		have a choice and hence have little experience of what a change in supplier would involve.
Other benefits (innovation): The company argues that its provision of refill stations is worth £1m/yr, based on avoided plastic waste.	BRL	**No change:** we were unable to source assumptions from the company's workings, however using the assumptions given, we consider the estimate is overstated. The key assumption seems to be how many avoided bottle purchases are caused by each refill station. Assuming this is 50/week, we calculate £0.1m, based on following calculation: 52 weeks x 650 stations x 50 bottles/week x £0.05 = £84,500.
Other benefits (benefits of small and local company): EY were commissioned to establish evidence that smaller companies deliver benefits to society. They identified 4 possible hypotheses from theoretical evidence: • Small local firms have more agile decision-making structures • Small local firms are better at innovation • Small local firms are more consumer oriented • Customers prefer products and services from a local company	SES	**No change:** • EY state that its research draws on many sectors outside water, so caution must be applied before assuming that the conclusions of research apply to water. • The EY analysis provides a framework for further quantification of benefits to being a small local company, but no actual monetised estimates of benefits. • The EY analysis identifies examples of good practice in small WoCs but is insufficiently comparative against WaSCs.
Other benefits (social tariff performance): The company states it was one of the first companies with a social tariff, and is an UQ performer on social tariff penetration.	SES	**No change:** The impact is hard to quantify and so compare against the cost of providing the uplift, as it represents transfers from one customer group to another rather than a pure gain to customers.
Other benefits (Freeze/Thaw): The company states it compared well against the sector – only 4 customers experienced loss of supply for longer than 12 hours.	SES	**No change:** We have not used current-period performance to inform our benchmarks. However, some benefit will have been captured in our analysis due to SES Water's forecast supply interruptions performance (it is upper quartile on this measure).

A1.3 Updates to our benefits assessment

We have considered company responses carefully, and made modifications to our methodology for assessing benefits. There is no change in our high-level approach to focus our assessment of benefits on forecast benchmarking impacts which we set out in the PR19 methodology. Our assessment for the draft determination takes account of the following factors, which better align our assessment of costs and benefits with assessments made elsewhere in our draft determinations:

- **Data updates:** Our modelling of costs and benefits reflects companies' latest proposals on service levels and the latest evidence on base totex rankings, consistent with our draft determination assumptions.
- **Interventions on outcomes and 'stretch':** We now have more clarity on benchmarking benefits as companies' more stretching proposals and our interventions at draft determinations allow more precise estimation of how individual companies have contributed to our benchmarks. For instance, our analysis now reflects the glide path assumed for Supply Interruptions service commitments.
- **Corrected valuation rates:** We apply the outcome delivery incentives reward rate applicable for each performance commitment (or where unavailable the penalty rate) to monetise the impact on service commitment levels from including a given company. We consider this is the right approach, as it recognises the benefits to customers, less the additional cost customers will have to pay for improved performance via totex sharing menus.[112]
- **Full quantification of impacts:** For our IAP decision we stated that we were placing most weight on our forward-looking assessment of benefits, but only monetised totex benefits over this period. For the draft determination we quantify forward-looking non-totex net benchmarking benefits using a working-level assumption that the level of net benefits decays at a rate of 50% relative to the PR19 single-period value for each subsequent price control.

A1.4 Levels assessment

SES Water propose an uplift to its overall cost of debt of 25 basis points, unchanged from its initial business plan submission. As this is within our assessed plausible range of 25-40 basis points from our January assessment, we consider that it has passed this assessment.

Bristol Water propose an uplift of 55 basis points on embedded debt, removing its 15bp uplift on the cost of new debt which was included in its original submission.

[112] For a fuller discussion, see PR19 Final Methodology: Appendix 2, Outcomes, p92

Using our assumed share of embedded debt of 80%, this constitutes an overall uplift of 44 basis points on the overall cost of debt, and so is outside our 25-40 basis point range.

Though we did not accept the validity of the 55bp uplift to embedded debt in our January assessment, Bristol Water retains the assumption, citing analysis carried out by KPMG which Bristol Water claimed produced a range of appropriate notional uplift from 39 to 60bps on the cost of embedded debt.

We reviewed KPMG's analysis – and find it unconvincing for the following reasons:

- **Low number of WaSC comparator bonds:** KPMG compared WoC borrowings using a sample of only 43 WaSC bonds. The number of WaSC bonds actually being compared to WoC borrowings reduced to as low as eight bonds under KPMG's preferred selection criteria.
- **Inconsistencies with other KPMG evidence:** KPMG's analysis assessed Artesian borrowing as exhibiting spreads to gilts in the range 156-206bp. However, its separate analysis of Artesian accounts cited a range of spreads for Artesian tranches in the range 52-85bp.[113]
- **Aggregation of Artesian tranches:** KPMG's analysis assumed that all Artesian issuance occurred in three tranches (Artesian I, Artesian II, and Artesian III). Correctly reflecting the drawdown of multiple tranches by companies in the analysis essentially reduces the KPMG range to within or below our IAP view of 25-40bps, as set out in Table A1.3.

Table A1.3: Estimates of small company premium from KPMG model before and after disaggregation of Artesian tranches

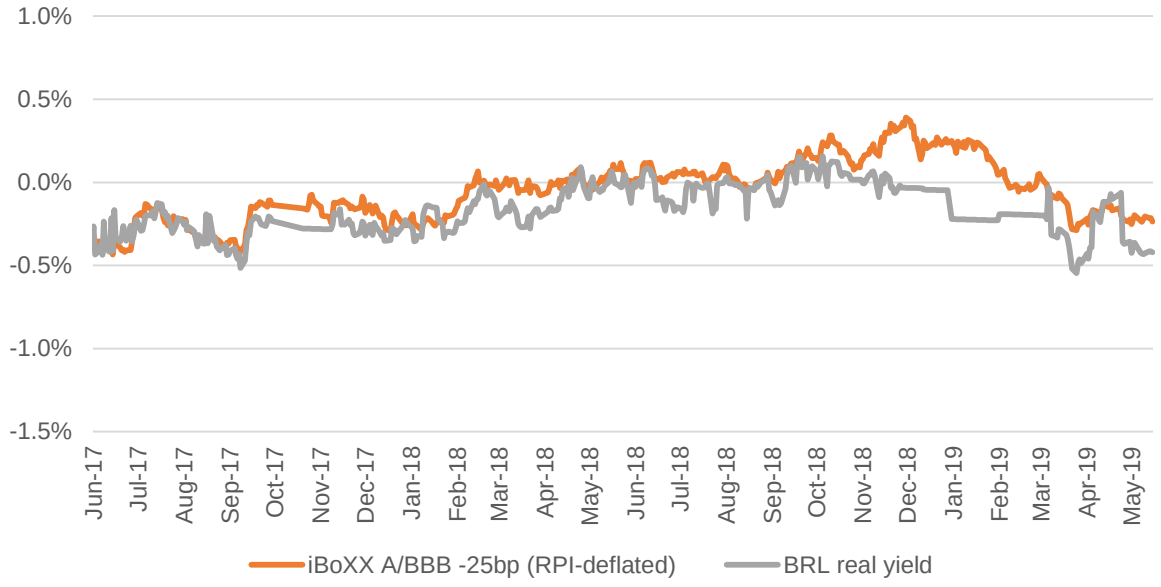
Approach:	Consolidated Artesian tranches	Disaggregated Artesian tranches
Spread to gilts approach – unweighted	65bp	23bp
Spread to gilts approach – weighted	57bp	13bp
Spread to iBoxx approach – unweighted	71bp	43bp
Spread to iBoxx approach - weighted	53bp	30bp

The yield of debt instruments in secondary markets can be a useful guide to the borrowing costs faced by the same entity for new debt. Comparing observed yields for Bristol Water's £40m index-linked bond with our benchmark (the iBoxx A/BBB 10yrs+ nonfinancials adjusted for 25bp of outperformance), we find no evidence that

[113] KPMG, 'Benchmarking Bristol Water's embedded debt', Report prepared for Bristol Water, 10 March 2015

the inferred cost of new debt faced by the company is systematically higher than our benchmark (Figure A1.1). We therefore agree with the company's decision to remove its assumption of a premium on its cost of new debt.

Figure A1.1: Yield of Bristol Water's 2011 £40m debt instrument and our efficient benchmark



Source: Ofwat analysis of Refinitiv data

Note: iBoxx index has been deflated using our long-term assumption of 3.0% (based on CPIH of 2.0% plus a 100bps wedge)

Overall we conclude that Bristol Water has not provided convincing evidence for its proposed uplift to embedded debt cost of 55 basis points. It has not therefore passed this assessment.

A1.5 Benefits assessment

For our benefits assessment we focus primarily on the forward-looking benefits to our benchmarks, across many periods. This is based on our assessment that not providing an uplift increases merger probability, with attendant impacts on our benchmarks – but that any such impacts would only manifest themselves at price controls beyond PR19.

We consider there to be benchmarking impacts only in areas of the price control where we make comparisons between companies to increase the amount of efficiency or service challenge faced by companies in their incentive framework.

Bristol Water argue that there were additional customer benefits outside the above framework implicit in either strong historical relative performance on particular outcomes (e.g. leakage) or on forecast performance for outcomes where we do not propose a comparative benchmark (e.g. unplanned outages). We already take account of leakage in our assessment. If increased focus is placed on historic metrics or forecast outcomes that are not subject to comparative benchmarks, the assessment should take account of performance across all metrics rather than be selective - we are not convinced that this evidence of selective additional benefits should be included in our assessment.

We provide below a brief description of the approach we have followed to estimate benchmarking impacts in each area of the price control.

- **Base water totex:** We use a model which forecasts a company's efficiency rank at future price controls based on its current position and historical rank changes. For each control the model uses forecast rank to generate an estimate of the benchmarking benefits provided by that company. The model is unchanged from our IAP version, save for reflecting the updated efficiency data from our latest cost assessment analysis. More details on the model are available in our IAP document.[114]
- **Retail totex:** We base our estimate of retail benchmarking benefits on a static analysis of retail efficiency scores, considering by how much the efficiency challenge implied in the current level of the upper quartile would reduce if we removed the company of interest.
- **Supply interruptions:** We are intervening to build into company business plans the assumption that their performance will attain at least the level of a glide path defined as the straight-line change between the upper quartile performance level for 2019-20 and that for 2024-25. Our estimate of benchmarking benefits provided by a given company is based on comparing the implied improvement in service commitment levels in this scenario with a counterfactual whereby the upper quartiles informing the glide path were calculated without that company's data.
- **Leakage:** We set out an expectation that companies should achieve upper quartile performance on leakage or at least a 15% reduction over 2020-25. Five companies resubmitted plans that showed their proposed leakage had converged towards the sector upper quartile, relative to their initial submission. We also intervened to impose a more stretching assumption of a 25% reduction in 2024-25 leakage for Thames Water. We estimate that the benchmarking benefit provided by a given company is captured by the difference between proposed service levels for the companies which have

[114] Ofwat, 'IAP Technical Appendix 4: Company-specific adjustments to the cost of capital', January 2019

converged towards the upper quartile and those implied by the same percentage of convergence towards an upper quartile derived without that company's data.

- **Water Quality Contacts:** For Draft Determinations we are intervening for four companies whose proposals on reducing unwanted contacts about water quality lagged behind the rest of the sector. We are imposing a service commitment which implies that they will achieve the upper quartile percentage level of reduction (34%) between 2019/20 and 2024/25. Our estimate of benchmarking benefit is derived by monetising the difference in implied service levels from the intervention when calculating the upper quartile percentage reduction with and without the company of interest.
- **Unplanned outages:** For Draft Determinations we are intervening to challenge seven companies to achieve a level of performance informed by the sector median. Our estimate of benchmarking benefit is derived by monetising the difference in implied service levels from the intervention when calculating the sector median benchmark; with and without the company of interest.

Table A1.5 draws together our latest single-period assessment of the contribution the two companies have made in terms of increased efficiency and service challenge for the PR19 price control process, affecting the period 2020-25. This suggests strongly negative net benchmarking impacts provided by both companies. We do not consider the cost of providing an uplift in our calculation, as the benchmarking impacts for 2020-25 are based on already-submitted data, and would persist irrespective of any impact on merger probability from providing an uplift.

Table A1.5: 'Single-period approach' –benchmarking benefits for 2020-25 (£m, 2017/18 prices and values)

	Bristol Water	SES Water
Base water wholesale totex	-194.1	-194.1
Retail totex	-1.1	-1.1
Supply Interruptions	-1.5	3.5
Leakage	3.7	0.4
Water Quality Contacts	1.2	-0.2
Unplanned Outages	14.1	14.1
Single-period net impacts	-177.5	-191.5

Source: Ofwat analysis of PR19 business plan data

As in our January exercise, we have placed most weight on our forward-looking approach. This is firstly as we consider that any decisions on company-specific adjustment would affect our benchmarks in future price controls, but also to reflect that the benchmarking benefit of a company to our controls may change over time. Our results are presented in Table A1.6.

Table A1.6: 'Forward-looking' estimates of costs and benefits of providing an uplift, 2025-2050 (£m, 2017/18 prices and values)

	Bristol Water	SES Water
Base totex benefits	7	-4
Non-base totex benefits	12	12
Cost of uplift	23	8
NPV	-5	0

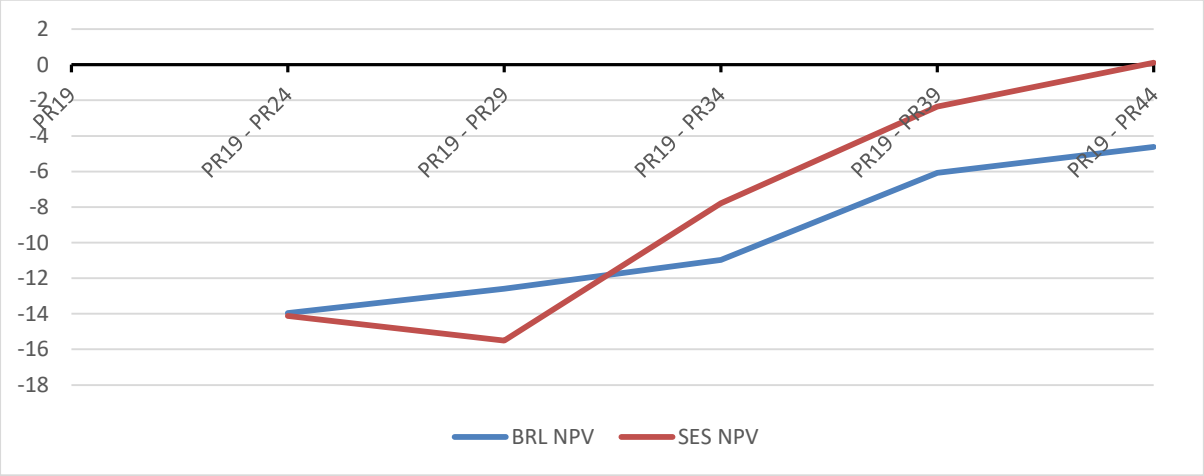
One important difference relative to our January approach from our initial assessment of business plans is that we have explicitly attempted to project forward non-base totex benefits modelled using our single-period methodology. We have applied a simplifying assumption that these impacts halve relative to their PR19 single-period value at each subsequent control, reflecting the incentive for poorer-performing companies to catch-up and so reducing the benchmarking benefits of upper quartile performers.[115] We note finally, that any estimate of benefits used to derive the NPVs from this exercise should be considered an upper bound, as we

[115] This is consistent with the tendency in our botex model for both high and low-ranked companies' average rank to gravitate towards the middle of the pack.

have not applied a scaling factor to benefits (as we did at PR14) to reflect the possibility that companies not receiving an uplift may not merge (or vice versa).

We have conducted a sensitivity analysis on our results to assess the impact of varying the forecast horizon used in our estimation. Figure A1.2 plots our estimate of NPV including all benchmarking benefits[116] as the number of price controls included in our analysis increases:

Figure A1.2: NPV of providing companies' requested cost of capital uplift at different forecasting horizons (£m, 2017/18 values and prices)



We note that for all horizons, net present value for both companies does not reach positive levels. This informs our conclusion that there is no compelling evidence of benefits that adequately compensate customers for the additional cost of providing an uplift. We consider therefore that neither Bristol nor SES Water has passed this assessment.

A1.6 Customer support assessment

For our IAP assessment in January we concluded that both Bristol Water and SES Water did not pass our assessment.

- Bristol Water's assessment that the majority of customers accepted (70-78%) the proposed uplift was conditional on features of the business plan that we could not reconcile to the plan which had been submitted. For instance, 40% of surveyed customers supported funding an uplift as long as the company's

[116] i.e. base totex directly estimated by our multi-period model, and single-period non-totex benefits extrapolated forward with our 50% decay factor.

estimate of £4.50 per year of benefits per household exceeded the cost, and 53% of customers were supportive as long as the company introduced a sharing mechanism putting at risk 100% of its uplift. We were not convinced by the evidence supporting the £4.50 benefits figure, and the company's initially submitted plan proposed to put only 50% of its uplift at risk. In the round, we considered that this evidence did not represent compelling customer support for funding the uplift, as some customers might plausibly have changed their answer based on the contents of the actual business plan.

- In the case of SES Water, we found in customer acceptability testing that the uplift was framed as an amount customers were already paying, rather than something which would cause bills to increase. We therefore concluded that a majority of supportive survey responses (82%) did not constitute compelling evidence of customer support for funding the uplift.

In response to our IAP, Bristol Water carried out further customer acceptability testing. It carried out a survey of 451 customers weighted to be representative of the company's customer base. This yielded a clear result that 87% of respondents were very or fairly content to unconditionally fund the estimated £1.80/yr cost of funding Bristol Water's proposed uplift. We now assess that Bristol Water has passed this assessment.

SES Water's resubmitted customer acceptability testing contained a survey of 539 customers. Respondents were asked: 'Overall, are you supportive of continuing to pay an additional £1.75 per year to be provided with water services from a small local company?'. While SES Water report that 86% of respondents gave positive responses, we consider that the question wording once again misleadingly presented the uplift as a bill item customers were paying for already, rather than an addition. For this reason we consider that SES Water has not passed this assessment.

A2 Aligning Risk and Return

Summary of issues raised in response to cost of capital

General issues raised in business plans			
Issue raised	**Who raised the issue?**	**Our consideration of the issue**	**Change to our proposals?**
Ofwat should consider changing market conditions and impacts on sector credit ratings before final determinations	WSH, TMS	We have considered market conditions (including forward-looking market evidence) in deriving our cost of capital estimate. We have also considered the impact of our estimate on notional company financeability. Following interventions, we assess that the draft determinations for all slow track and significant scrutiny companies are financeable on the basis of our assumptions for the notional company structure.	No change: We will continue to monitor market conditions and consider financeability in the approach to final determinations.
Ofwat provide no evidence to support a reduction in the notional gearing to 60%	SEW, NERA, EY	Our position at final methodology stage is that notional gearing has reduced to reflect greater revenue at risk and use of markets. It is also tracked by some evidence that companies have de-geared slightly.	No change

Cost of equity issues raised in business plans			
Issue raised	**Who raised the issue?**	**Our consideration of the issue**	**Change to our approach?**
The cost of equity allowance should be higher, placing more weight on historical average returns	WSX, SWB	Our revised TMR analysis point estimate suggests a range of 6.5-6.7% using long-term historical returns, and a range of 6.0-6.8% using more forward-looking approaches, hence it is not clear to us that placing more weight on the former would lead us to derive a higher point estimate. We note that several representations assumed that the real returns in the 2019 Credit Suisse Equity Handbook were RPI-deflated, and that the appropriate estimator is the arithmetic average. While using these assumptions points to a higher TMR range, we do not agree that there is convincing evidence which favours doing so. Moreover, our assumption lies in the midpoint of the UKRN Study's recommended 6-7% range for CPI-deflated TMR, based on historical averages.	No change
There is no evidence that expected market returns have fallen in the current low risk-free rate environment	SEW	For our updated view of the cost of capital, we cite various sources of evidence supporting a lower TMR assumption than our PR14 assumption of 6.75% (RPI deflated). Outputs from Europe Economics' GDP DDM have trended down since the 2000s. In addition, our analysis from section	No change

Cost of equity issues raised in business plans			
Issue raised	**Who raised the issue?**	**Our consideration of the issue**	**Change to our approach?**
		3.3.3. suggests that real returns may be lower due to the tendency of commonly used historical inflation series to understate inflation.	
The dividend growth models used in Ofwat's Final Methodology are downward biased, as it uses UK growth not world growth forecasts as its dividend growth assumption	SEW	The PwC-authored report, 'Updated analysis on the cost of equity for PR19' considered this challenge, making the following points (which we support): 1) We are setting a cost of capital allowance for a UK company, and so it makes most sense to use UK parameters. 2) For consistency, a global TMR should also use other global CAPM inputs (e.g. RFR, beta). Deriving these inputs comes with its own estimation issues (e.g. higher confidence intervals for global beta). 3) PwC found that a potentially higher TMR would be paired with a lower world beta, suggesting the overall cost of equity from adopting the alternative approach might not be significantly different.	No change

Cost of equity issues raised in business plans			
Issue raised	**Who raised the issue?**	**Our consideration of the issue**	**Change to our approach?**
Ofwat should incorporate UKRN report's recommendation to base estimate of expected return on long-run historic averages	TMS	We have considered the UKRN report's recommendation carefully. While we consider that evidence from a range of different approaches should inform our point estimate for TMR, in practice our point estimate of 6.5% in CPIH-deflated terms is highly aligned with the UKRN's recommendation that regulators should use a TMR range of 6-7% in CPI-deflated terms.	No change

Cost of debt issues raised in business plans			
Issue raised	**Who raised the issue?**	**Our consideration of the issue**	**Change to our proposals?**
The 'halo effect' (systematic outperformance w.r.t. the iBoxx) does not exist in water companies	ANH, SEW	We consider it an appropriate fulfilment of our duties to calibrate our benchmark index if there is evidence of the ability of the sector to systematically outperform it. Section 3.2 sets out our evidence that this is the case. We consider that our current 'outperformance wedge' of 25 basis points is conservative given the evidence that on average across the instruments we have reviewed, outperformance may be higher.	Change – we adopt a higher assumption of 25 basis points.

Cost of debt issues raised in business plans			
Issue raised	**Who raised the issue?**	**Our consideration of the issue**	**Change to our proposals?**
Ofwat should consider bespoke cost of debt indexation mechanism to reflect company-specific ratios of new:embedded debt that are different to its notional assumption.	SEW	We have revised our new:embedded split assumption to be more in line with the sector's planned debt issuance profile. Using a company-specific assumption would be a move away from a notional cost of debt allowance – which would shift some risk from company choices around debt issuance to customers. It is not clear to us that this would be in customers' interests.	No change
Ofwat's proposal to conduct its cost of new debt reconciliation using an ex-ante inflation assumption of 2 per cent (CPIH) could over or under-remunerate companies relative to their real cost of debt. Instead, Ofwat should base the reconciliation on the measure of inflation used to index RCV.	SEW	The treatment of inflation risk on cost of debt is consistent with our approach at PR14, and was generally supported by water sector delegates at our January 2017 workshop. We did not consider SEW's alternative proposal would solve the issue of over or under-recovery as the costs faced by companies depend on inflation expectations, not outturn inflation.	No change
The 70:30 embedded debt/new debt split needs to be revisited, as it looks incorrect.	SEW, NES, SVE, TMS,	Our updated analysis based on company expectations on volume of debt issued and paid down over 2020-25 results in a ratio of 80:20.	Change – we adopt a lower assumption

Cost of debt issues raised in business plans			
Issue raised	**Who raised the issue?**	**Our consideration of the issue**	**Change to our proposals?**
			of 20% new debt.

UKRN recommendations			
Recommendation	**Who raised the issue?**	**Our consideration of the issue**	**Change to our proposals?**
Recommendation 1 (CAPM): The Capital Asset Pricing Model remains (despite numerous caveats) the best available model.	UKRN authors	We agree with this perspective. Our use of the CAPM is long established, and we consider it an implementable and defensible approach.	No change
Recommendation 2 (Horizon): On balance, we are in favour of choosing a fairly long horizon, for example, 10 years, in estimating the CAPM-WACC	UKRN authors	We agree there is merit in using the assumption of a 10+ year holding period when parametrising the CAPM. We do not agree that the recommendation should be interpreted as applying to the length of trailing window used in beta estimation.	No change
Recommendation 3 (Price Index): There is a strong case for regulators choosing a measure of	UKRN authors	We do not accept this recommendation. We agree with the view of the Office for National	No change

UKRN recommendations			
Recommendation	**Who raised the issue?**	**Our consideration of the issue**	**Change to our proposals?**
inflation for estimating the CAPM-WACC that is consistent with that chosen by HM Treasury and implemented by the Bank of England for inflation targeting (currently, CPI). Ideally, we would like to use the same index used in setting the Regulatory Allowed Return (RAR)		Statistics that RPI is a flawed inflation measure which overstates consumer price inflation, and whose use should be phased out as far as is possible. On the other hand, we consider that CPIH is a superior measure of consumer price inflation to CPI, due to its coverage of owner occupier housing costs, which are excluded from CPI. We observe in the historical data that the difference between CPI and CPIH tends to be low and not systematically lower or higher, such that the case for choosing either measure is finely balanced.	
Recommendation 4 (The Risk-Free Rate): Regulators should use the (zero coupon) yield on inflation-indexed gilts at their chosen horizon to derive an estimate of the risk-free rate at that horizon.	UKRN authors	We consider that we should consider the relative size of the distortions embedded in nominal and index-linked gilts (i.e. inflation risk and liquidity risk premia), when deciding how to derive our estimate of the risk-free rate. We do not agree that consistently using index-linked gilts will necessarily always give a more accurate estimate of the risk-free rate, particularly in periods where the liquidity risk premium is exceptionally high. We acknowledge that nominal gilts remain an important reference	No change

UKRN recommendations			
Recommendation	**Who raised the issue?**	**Our consideration of the issue**	**Change to our proposals?**
		point and that we should report the RFR estimate using both methods.	
Recommendation 5 (The Expected Market Return): We recommend that regulators should continue to base their estimate of the EMR on long-run historic averages, taking into account both UK and international evidence, as originally proposed in MMW. We suggest a modest downward adjustment of the original range proposed by MMW, to a range of 6-7%, primarily reflecting a smaller adjustment from geometric to arithmetic returns.	UKRN authors	We take the view that we must consider all evidence on Total Market Return which is available to us, rather than focusing narrowly on a single approach. An issue with using long-run averages is that they take a long time to reflect structural shifts in investor requirements for TMR. Failing to reflect more recent evidence of such shifts could jeopardise the sector's ability to raise capital or undermine customer faith in the regulatory framework by overcompensating companies. However, our evidence drawn from multiple approaches indicates that a 6-7% CPI-based range is a reasonable reflection of the latest available market evidence – we agree that long-term averaging approaches should place some weight on geometric returns.	No change
Recommendation 6 (Beta Estimation): Regulators should make more use of robust econometric estimates of equity beta. They should derive these estimates from sound econometric evidence and	UKRN authors	We accept this recommendation and use GARCH and OLS estimators with a wider range of frequencies and data windows than at our 'early view'.	Change – wider range of data and estimators used.

UKRN recommendations			
Recommendation	**Who raised the issue?**	**Our consideration of the issue**	**Change to our proposals?**
practice, utilising all available data for relevant listed companies. Betas for unlisted companies should be derived from estimated equity betas from the closest available comparator listed companies.			
Recommendation 7 (Adjusting beta estimates for leverage): Regulators should exercise care in allowing for the impact of leverage, in deriving asset beta estimates and in "re-gearing" to derive equity betas based on assumed levels of regulatory gearing.	UKRN authors	We recognise that our approach of de-gearing using enterprise value gearing and re-gearing using the notional gearing assumption may overstate equity beta for the notional company. This is because it assumes zero outperformance for the notional company, which may be an unsound conclusion. However, we have at present not made assumptions on outperformance given the difficulty in robustly underpinning such outperformance assumptions.	No change
Recommendation 8 (Estimating Default Risk on Corporate Debt): For consistency with the definition of the CAPM-WACC as an expected return, cost of debt estimates that feed into estimates of the CAPM-WACC should include an adjustment to corporate bond yields to convert these to expected returns.	UKRN authors	We agree with the argument but do not make an explicit adjustment to reflect this in the data that we used to calculate our cost of debt allowance. This is because of the low materiality of the adjustment and the potential that the study's methodology for default probability may overstate this for water companies, given the sector's regulatory protections. Since privatisation there have been no	No change

UKRN recommendations			
Recommendation	**Who raised the issue?**	**Our consideration of the issue**	**Change to our proposals?**
		defaults on water sector debt at the regulated company level.	
Recommendation 9 (The Cost of Debt): The term "cost of debt" should relate to the expected return (correctly adjusted for default risk) on a traded corporate bond, at the regulator's chosen horizon, and with risk comparable to regulated utilities at regulators' chosen leverage. It should be clearly distinguished from the *allowed return* on embedded debt.	UKRN authors	We agree with the importance of being clear about the distinction between expected returns and allowed returns.	No change
Recommendation 10 (The CAPM-WACC Methodology): The term "WACC" should be restricted to the concept of an expected market return on capital of a given degree of systematic risk. It should *not* be used to refer to an allowed return.	UKRN authors	We agree with the importance of being clear about the distinction between expected returns and allowed returns, but do not necessarily agree that the use of the term WACC to denote the latter is confusing.	No change

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