ECONOMIC
CONSULTING
ASSOCIATES

Recommendations for the Weighted Average Cost of Capital 2020 - 2025

Final Report

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Submitted to the Consumer Council for Water by:

Economic Consulting Associates

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Abbreviations and acronyms

AMP	Asset management plan period (the period for which prices are set)
APR	Annual performance report
BT	British Telecom
CAA	Civil Aviation Authority
CAPM	Capital Asset Pricing Model
CC	Competition Commission
CCWater	Consumer Council for Water
CMA	Competition and Markets Authority
CPIH	Consumer price inflation including owner-occupiers' housing costs
DDM	Dividend discount model
ECA	Economic Consulting Associates
ERP	Equity risk premium (also known as the Market risk premium)
EV	Enterprise value
E&W	England and Wales
FTSE	Financial Times Stock Exchange
MRP	Market risk premium (also known as the Equity risk premium)
NI	Northern Ireland
NIE	Northern Ireland Electricity
ODI	Outcome delivery incentive
ORR	Office of Rail and Road
PR14	Price Review 2014
PR19	Price Review 2019
R_D	Cost of debt (return on debt)
R_E	Cost of equity (return on equity)
R_f	Risk-free rate
R_M	Return on the market
RCV	Regulatory capital value
RPI	Retail price index
SCP	Small company premium
SHE	Scottish Hydro Electric Transmission
SIM	Service incentive mechanism
SSE	Scottish and Southern Electricity
UK	United Kingdom
UKRN	United Kingdom Regulators Network

UR	Utility Regulator (Northern Ireland)
US	United States
WACC	Weighted average cost of capital
WASC	Water and sewerage company
WOC	Water only company

1 Introduction and summary

The Consumer Council for Water (CCWater) commissioned Economic Consulting Associates (ECA) to provide a recommendation as to the appropriate Weighted Average Cost of Capital (WACC) to apply to the England & Wales (E&W) water companies in the period from 2020 to 2025. Our recommendation comes in advance of Ofwat's early indication on the WACC to be published in December 2017, as part of its decision on the methodology for the price review (PR19).

This report provides our recommended range for the vanilla WACC[1] in PR19 (section 2) and details the underlying evidence we used in the developing this recommendation (Annexes A1 to A6).

Summary

Ten years ago, WACCs set by regulators were typically around 5%. Since then, they have been on a general downwards trend, with one of the most recent determinations (in July 2017 by Utility Regulator (UR) for Northern Ireland Electricity (NIE)) setting a WACC of 3.19%. We consider that this trend reflects both a fall in some of the factors determining the underlying WACC and a gradual approach by regulators in bringing allowed WACCs to be closer in line with the underlying WACC.

At PR14, Ofwat set a real (RPI) vanilla WACC of 3.74%[2], incorporating expectations that some components would increase over the course of the price control (e.g. the cost of new debt and the risk-free rate). Forecasting over the duration of a price control is challenging, and these expectations have proved wrong. For example, the prevailing cost of new debt and the risk-free rate are lower than at PR14. These factors point to a lower cost of capital at PR19, and Ofwat's Chairman, Jonson Cox, has stated that PR19 is likely to set "*a new record for the lowest ever cost of capital for water*"[3].

Our estimate of the real (RPI) vanilla WACC for PR19 is in the range 1.8% to 2.5%. This is notably lower, by over 1%, than the WACC for PR14 and reflects both:

- a lower cost of new and embedded debt; and
- a lower cost of equity driven mainly by a lower equity beta.

[1] The vanilla WACC is calculated taking pre-tax debt rates (since interest charges are tax deductible) and post-tax equity returns (since dividends are paid post tax). Unless stated otherwise, references to WACC in this report are to the vanilla WACC.
[2] This is the WACC covering water companies' retail and wholesale activities (i.e. at an appointee level). Ofwat set a wholesale WACC of 3.6% after a deduction for companies' retail activities. See section A1.2.1 for details. In this report we estimate the WACC at an appointee level, ie before the deduction of a retail margin.
[3] https://www.ofwat.gov.uk/pn-1717-ofwat-boss-talks-decade-falling-bills/

In producing this estimate at a relatively early stage of the price control process, there remains scope for values underlying the WACC estimate to change ahead of final determinations in December 2019.

Our WACC estimate, and its component parts, are summarised in Table 1 below.

Table 1 Vanilla WACC estimate for PR19

Paramater	Value
Nominal cost of new debt	3.10%
Nominal cost of embedded debt	4.60% - 4.90%
Ratio of new : embdedded debt	25:75
Nominal cost of debt	**4.23% - 4.45%**
Nominal Total Market Return	9.00% - 9.53%
Nominal risk free rate	3.00% - 4.03%
Equity beta	0.5-0.6
Nominal cost of equity	**6.00% - 7.33%**
Gearing	62.5%
Nominal vanilla WACC	**4.89% - 5.53%**
RPI inflation assumption	3.00%
Real (RPI) vanilla WACC	**1.84% - 2.46%**

2 Analysis of the appropriate WACC

2.1 Overview of approach

Our approach to estimating the WACC builds on our prior work for CCWater, both during PR14[4] and in the build up to PR19[5]. We have undertaken both top-down and bottom-up assessments:

- In the top-down assessment, we examined regulatory precedents on the WACC in the water and other network sectors, as well as considering market evidence on recent transactions and share price returns.
- In the bottom-up analysis we examined each of the components of WACC, with a particular focus on the equity beta – which at PR14 we estimated to be significantly lower than the value used by Ofwat.

We estimate a WACC at the appointee level, i.e. inclusive of both retail and wholesale activities. In practice, Ofwat will make a (relatively small) deduction from the appointee WACC for the margin it will allow on retail activities (see Annex A1.2.1).

Ofwat intends to create four separate wholesale price controls in PR19 (for water resources, water network plus, wastewater network plus, and bioresources). Ofwat has stated that the WACC could vary across these price controls if there are differences in (systematic) risk, but that it expects the same WACC to apply across the price controls. Within the scope of this study, we have not considered any potential differences in systematic risk across these four activities.

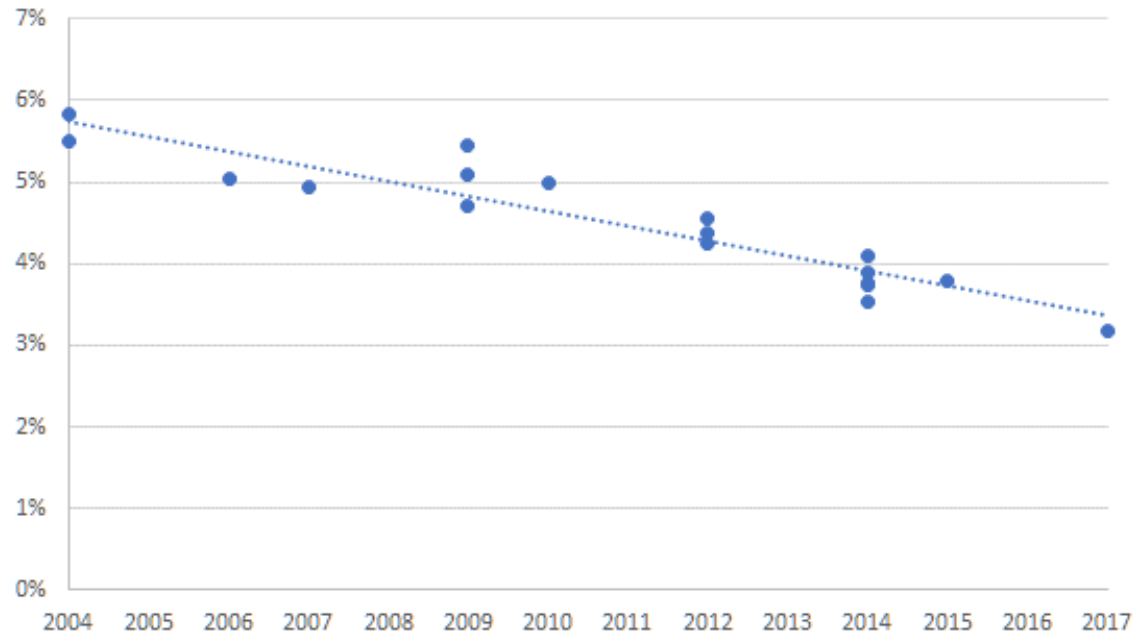
2.2 Top-down analysis

Evidence from regulatory precedents

There has been a general downward trend in WACC determinations, as shown clearly in Figure 4. It has been our contention that the cost of capital has previously been set at too high a level for some time and that regulators (and the Competition Commission and now Competition and Markets Authority) have only slowly reduced allowed cost of capitals to a more realistic level.[6]

[4] *Recommendations for the Weighted Average Cost of Capital 2015-20: Summary Report*, for CCWater, February 2014.
[5] *The cost of capital – setting the scene for PR19,* ECA report for CCWater, May 2017.
[6] E.g. see *Recommendations for the Weighted Average Cost of Capital 2015-20: Summary Report*, for CCWater, February 2014.

Figure 1 Vanilla WACC - energy and water regulatory determinations 2004 - 2017



Source: Various regulatory determinations

A number of the WACCs presented in Figure 4 are not fixed for the duration of the price control; rather they change each year according to changes in indices of debt costs. This is the case for all the network price controls set by Ofgem. For example, Ofgem set a WACC of 4.24% for gas distribution networks in 2012, but linked the allowed cost of debt to a trailing average of an index of debt costs. Reductions in the debt cost indices mean that the allowed cost of debt has fallen from the original 4.24% to 3.79%. Similarly, the WACC for electricity distribution networks, set by Ofgem in 2014, has fallen from 3.76% to 3.59%.[7]

Ofwat set its appointee WACC of 3.74% in December 2014. Two of the more recent determinations were:

- 3.78% for Bristol Water set by Competition and Markets Authority (CMA) in October 2015. Although this was set above Ofwat's WACC, it included a small company premium in the cost of debt of 0.4%. Adjusting for this would result in a WACC lower than Ofwat's. CMA also allowed a higher cost of embedded debt, but a much lower cost of new debt, largely reflecting the then prevailing market conditions.

- 3.18% for NIE set by UR. UR estimated both a lower cost of debt and equity compared to Ofwat's, with the lower cost of equity driven largely by a lower equity beta (as a result of lower level of gearing).

[7] These are the WACCs for the electricity distribution networks subject to 'slow-track' determination. The electricity distribution networks that were subject to the 'fast track' determination (similar to Ofwat's enhanced status) were originally set a slightly higher WACC of 3.90%, which has now fallen to 3.68%.

Evidence from transactions

In a previous study for CCWater,[8] we reviewed the returns to equity holders in water companies in transactions of major shareholdings or full ownership since PR14 started. Across seven transactions in PR14, the premia[9] for all were in excess of 20% and the average around 38%. Whilst not bearing directly and unequivocally on the WACC, this evidence suggests that bidders saw substantial outperformance opportunities. This could arise from cost allowances and/or the cost of capital being too generous in PR14 and/or an expectation amongst investors that this will be the case in future price controls.

A summary of the transactions, and the premia, is presented in Table 11, in Annex A2.2.

Evidence from share price returns

Given that, in PR14, Ofwat estimated an equity beta of 0.80, on a market risk premium of 5.50%, water company investors should get a return 1.1% points lower than the investor in the diversified market portfolio, commensurate with the volatility (risk) of the underlying investment.

For the four listed water companies (Severn Trent, Pennon, United Utilities and Dee Valley[10]) we have examined evidence from their annualised returns. In summary, we found that for investors who bought shares in 2002, and reinvested dividends, the water companies generally outperformed the FTSE All Share Index (our market proxy), with only United Utilities dipping below in 2017.

We also looked at annualised returns to investors who bought shares in 2014 and held them for 1, 2 or 3 years, to reflect the PR14 price control period. This showed that investors would have received returns in excess of the market if they had sold in 2015 or 2016. However, this was not the case for 2017, following a decline in share prices of the water companies (with Dee Valley the exception). It is unclear whether this reversal in the tendency for water companies to outperform the market will persist; it may reflect the indications from Ofwat of a lower WACC and tougher settlement in PR19 (see section A1.3). Our analysis is presented in Annex A2.3

2.3 Bottom-up analysis

2.3.1 Cost of debt

In PR14, Ofwat set a *real* cost of debt of 2.59% (based on a cost of new debt of 2% and embedded debt of 2.75%). This value is at the high end of recent regulatory precedents. For

[8] *The cost of capital – setting the scene for PR19,* ECA report for CCWater, May 2017.
[9] Premia are measured as the effective Enterprise Value (EV) (from the perspective of the acquirer) over the Regulatory Capital Value (RCV).
[10] We have included Dee, but note that it was purchased in February 2017 by Severn Trent and it was significantly smaller than the others and has lower trading volumes. Inferences from Dee Valley should, therefore, be treated with some caution.

example, in July 2017, UR set a real cost of debt for NIE of 1.63% while the current allowed real costs of debt used in the different energy network price controls are 2.22% and 2.29%.

Since 2015, water companies have issued a mixture of fixed-rate and index-linked bonds.[11] These debt issuances have generally been at rates below Ofwat's allowed cost of new debt. For example, water companies index-linked debt issuances have a median coupon of 0.38% compared to Ofwat's real cost of new debt of 2%, and fixed rate debt issuances have a median coupon of 3.54%, compared to Ofwat's allowance of 4.86% (in nominal terms)

We also note that water companies' new debt costs have been on a general downward trend over the current and previous price control periods. There has been a steady decline in the rates at which water utilities have been able to sell their fixed-rate bonds, falling to roughly 3% lately (with a couple of outliers). A similar downward trend exists for index-linked bond issues; multiple bonds have even been set at base coupons of near-zero. The yields of other non-financial companies with similar credit ratings (A and BBB) have similarly fallen, with a currently prevailing average around 3.1%.

For the purposes of estimating the cost of debt for PR19, we:

- Use a **nominal cost of new debt of 3.1%**, based on the currently prevailing nominal yields for non-financial companies with credit ratings A and BBB. As Ofwat propose to link the allowed cost of new debt to these indices, the allowed cost of new debt can be expected to change over the duration of the price control.[12] We further consider the consequences of Ofwat's proposed index-linking of new debt in Annex A1.2.5.

- Use an **embedded nominal cost of debt in the range of 4.6% to 4.9%**. The high-end of the range has been informed by the 10-year trailing average of the yields for non-financial companies with credit ratings A and BBB, and the low-end by nominal debt costs reported in the companies' latest Annual Performance Reports (APRs). We consider these conservative assumptions. Not least, the 10-year period over which we have calculated the trailing average includes the time of the financial crisis. Unless yields were to increase sharply, as these values drop out, the average will reduce. Also, it has been observed that water companies have tended to raise debt at lower costs than the yields for non-financial companies with credit ratings A and BBB.[13]

- Retain the assumption of a **25:75 split between new debt and embedded debt**. In 2016/17, on average, around 22% of companies' debt is due to mature within 5 years (ie within the duration of a price control period).

Based on the above, we estimate the nominal cost of debt for PR19 to be in the range 4.23% to 4.45%, as presented in Table 2.

[11] We have identified 35 issuances, of which only two were for Water Only Companies (WOCs).
[12] In estimating the risk-free rate (which, unlike the cost of new debt, is fixed for the duration of PR19) we have incorporated an increase from current values (see section A4.2). This increase is not reflected in our cost of new debt, which is the currently prevailing cost.
[13] For example, Chapter 2 of *Alternative approaches to setting the cost of debt for PR19 and H7*, A report for Ofwat and CAA by CEPA, August 2016.

Table 2 Cost of debt (nominal terms)

Paramater	Value
New debt	3.1%
Embedded debt	4.6% - 4.9%
Ratio of new : embedded debt	25:75
Cost of debt	**4.23% - 4.45%**

Further details on our analysis and estimate of the cost of debt are provided in Annex A3. This includes assessment of the cost of capital adjustment we consider would be appropriate to make for small companies (Annex A3.5).

2.3.2 Cost of equity

Our approach to estimating the cost of equity uses the Capital Asset Pricing Model (CAPM), which is the conventional approach used by Ofwat and other regulators:

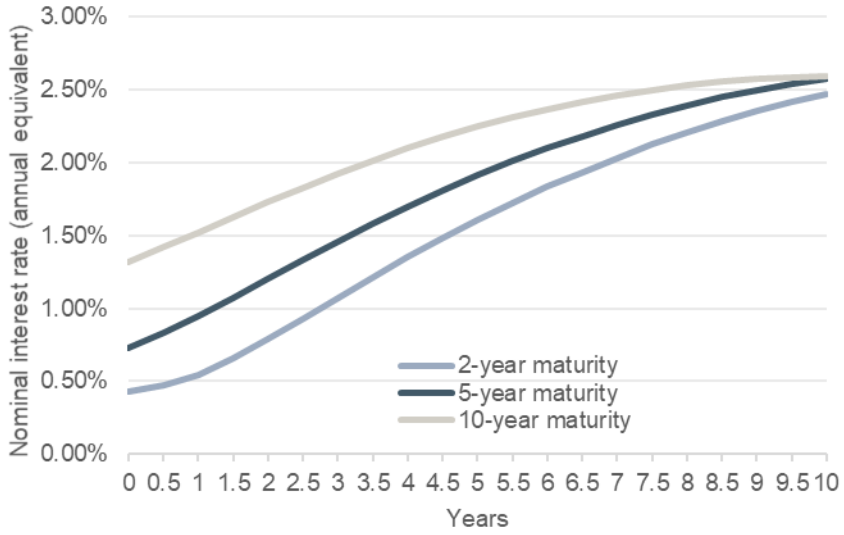
$$R_E = R_f + \beta_E(R_M - R_f)$$

Where:

- R_E is the cost of equity,
- R_f is the risk-free rate,
- β_E is the equity beta for the nominated company or industry,
- R_M is the estimated total return on a market portfolio of shares, and
- the term $(R_M - R_f)$ is the estimated market risk premium (MRP).

In our estimate of the R_f, we consider the Bank of England forward curve for UK Government gilts, presented in Figure 2. We also consider the unusual market conditions which have contributed to unusually low interest rates and high inflation, and a diversion of the correlation with US risk-free rates, which are not anticipated to continue through the next AMP. From this evidence, we adopt an assumed **real R_f rate of 0.0-1.0%**. Adjusting this for inflation provides a **nominal R_f estimate of 3.00-4.03%.**

Figure 2 Nominal forward yield curve for UK Government yields



Source: Bank of England, ECA analysis

Reports published in recent months by consultants advising Ofwat and water companies have debated the forward-looking approach to estimating R_M. These forward-looking approaches consider views from the market that we are in a 'lower for longer' environment, and that future returns to equity are unlikely to match historical returns. While we believe there is merit in these views, we do not feel there is sufficient robustness in the analytical approaches to calculating a forward-looking R_M to justify its use as the primary measure of R_M. Our estimated R_M using a historical approach looks at long-term (116 years) equity returns in the UK market, combined with a consideration of estimates of a 'lower for longer' environment. We have adopted a range, comprising a combination of geometric and arithmetic returns, and regulatory precedent, for a **real R_M of 6.00-6.50%**. Adjusting for inflation provides a nominal **R_M of 9.00-9.53%**. These estimates provide a **MRP of 5.50-6.00%**, after adjusting for the R_f.

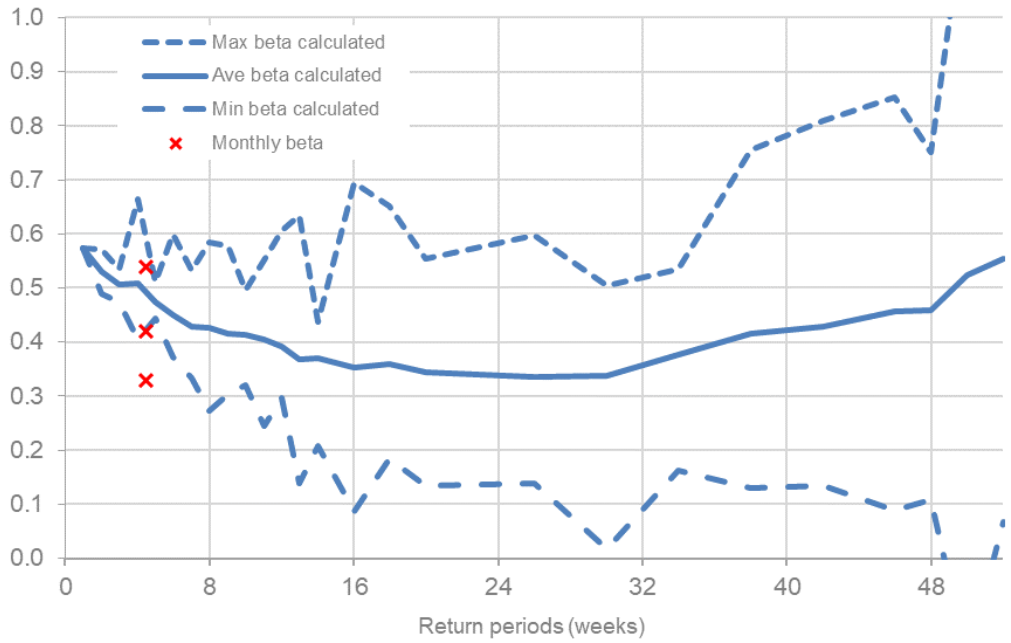
Our estimation of the 'true' equity beta for water companies in England and Wales is based on pricing data from the last 14 years for the three large listed water companies: Severn Trent, United Utilities, and Pennon. Our methodology accommodates a range of approaches, with simulations varying the key inputs of length of period for price data, length of return periods, and return period starting date. We note that varying these inputs, while still conforming with academic approaches to calculating an equity beta, will produce different estimates of the 'true' equity beta.

Figure 3 presents one of our estimation simulations, with a range of estimates of the 'true' equity beta for water companies. All calculations in this analysis use 14 years of data to derive single point estimates of the equity beta (not a trailing average). We measured returns across those 14 years over increasingly long periods, from 1 week returns to 52 week returns, and included monthly returns. That is, the 4-weekly betas are calculated from four different series of returns, each measured over a 4-week period but starting at weeks 0, 1, 2 and 3 in our series[14]. Correspondingly, the 5-weekly beta is measured in five separate 5-weekly return periods starting at weeks 0, 1, 2, 3 and 4, up until the 48-weekly beta with 48 different

[14] Including a series starting at the 4th week will be identical to starting in Week 0, except that it won't include the first data point.

starting points[15]. We calculate the average of all the companies' betas for each starting point, giving a series of beta estimates for each return period.

Figure 3 Sector equity betas with variable return periods and 14 years of data



Source: Yahoo Finance and ECA analysis

We feel there is compelling evidence from our analysis that **the 'true' equity beta lies in the range 0.5-0.6**.

Based on the above, we estimate the nominal cost of equity for PR19 to be in the range 6.00% to 7.33%, as presented in Table 3. Further details are presented in Annexes A4 and A5.

Table 3 Cost of equity (nominal terms)

Paramater	Value
Total Market Return	9.00% -9.53%
Risk-free rate	3.00% - 4.03%
Equity beta	0.5 – 0.6
Cost of equity	**6.00% - 7.33%**

2.3.3 Gearing

For the gearing in our WACC estimate, we propose retaining the assumption used in PR14 of notional gearing across all companies of 62.5%. This value is towards the top-end of

[15] One exception to this was for monthly returns, where our estimates were based on 31 simulations, measuring returns from every day of the month.

recent regulatory precedent. We note, however, that companies have increased their gearing in the PR14 regulatory period compared to the end of PR09, and that the average level of gearing is above Ofwat's notional gearing for PR14 of 62.5%. There is, therefore, a case for considering whether there should be a (slight) increase in the level of notional gearing. In considering this case, a key test would be whether companies are financeable, which is not within the scope of this study. Accordingly, we retain the notional gearing structure of 62.5%.

2.4 WACC estimate

We estimate a nominal vanilla WACC for PR19 in the range 4.89% to 5.53%, as shown in Table 4, based on the preceding analysis. This estimate comes at a relatively early stage of the price control process and the values underlying it are subject to change ahead of Ofwat's final determinations in December 2019.

Table 4 Vanilla WACC estimate (nominal terms)

Paramater	Value
Cost of debt	4.23%- 4.45%
Cost of equity	6.00% - 7.33%
Gearing	62.5%
Vanilla WACC	**4.89% - 5.53%**

In Table 5 we convert our nominal WACC into real WACCs, one based on RPI forecasts and one on CPIH.[16] For these purposes, we have used the following inflation assumptions:

- 3% RPI inflation. This assumption was informed by the Office for Budget Responsibility's RPI inflation forecast of 3% for 2022, the average RPI inflation forecast of 3% for 2021 across a range of independent forecasters (as published by HM Treasury), and the implied RPI from forward yield curves of around 3% for the period of the PR19 price control.
- 2% CPIH inflation. We have assumed a 1% wedge between RPI and CPIH.[17]

[16] The calculation to convert from real to nominal rates is the Fisher Equation: $R^n = (1+R^r) \times (1+I^r) - 1$, where R^n is the nominal rate, R^r is the real rate and I^r is the rate of inflation.
[17] http://budgetresponsibility.org.uk/box/revised-assumption-for-the-long-run-wedge-between-rpi-and-cpi-inflation/

Table 5 Vanilla WACC estimate (real terms)

Paramater	RPI	CPIH
Inflation forecasts	3.00%	2.00%
Cost of debt	1.19% - 1.41%	2.18% - 2.40%
Cost of equity	2.91% - 4.20%	2.94% - 4.24%
Vanilla WACC	**1.84% - 2.46%**	**2.47% - 3.09%**

One influence on the WACC that we have not separately considered is from the financeability of the companies. Once companies' business plans are developed, we would expect Ofwat to consider financeability, taking into account the level of notional gearing, the cost of capital allowance, and the various financial levers that are available (most notably the pay as you go ratio and the RCV run-off rate). An assessment of financeability could, therefore, be an additional factor influencing the range of WACC values.

ANNEXES

A1 Components of the Cost of Capital

The WACC comprises several component parts, and values are required for each of these to be able to derive a WACC. This Annex provides an overview of these component parts, whilst subsequent Annexes provide evidence as to their values. This Annex also describes some relevant developments for the WACC in PR19, and Ofwat's management of expectations for the WACC.

A1.1 WACC and CAPM

The cost of capital is applied as a percentage to the Regulatory Capital Value (RCV) to determine the return that companies require on their investment. It may alternatively be described as the revenue that a company may be allowed to collect from customers to cover the costs of financing its asset base. It represented some 23% of the overall revenue requirement in Ofwat's PR14 (2015-20) final determinations.

The cost of capital is a weighted average of the separate costs of debt and equity, with debt and equity being the two sources used to finance a company's asset base:

- The cost of debt (R_D) is the interest payable to lenders.
- The cost of equity (R_E) is the level of expected profit or return on their equity investment that shareholders require to invest in the company.

The weighted average cost of capital (*WACC*) can be calculated from the R_D, the R_E and a company's gearing, the proportion of a company's value (V) that is made up of debt (D):

$$WACC = \frac{D}{V}R_D + \left(1 - \frac{D}{V}\right)R_E$$

R_D is typically based on a combination of relatively observable historical evidence and forecasts of future interest rates[18].

R_E is typically derived by regulators by using the Capital Asset Pricing Model (CAPM), a generally accepted technique of financial theory. This model determines the expected return of a given investment relative to the return an investor might receive from investing in a portfolio of investments fully diversified for unsystematic risk. Its calculation comprises a risk-free rate (R_f), an estimated return for the diversified market portfolio (R_M) and an equity beta (β_E) associated with the specific investment, reflecting the characteristics of systematic risk that shareholders are exposed to:

$$R_E = R_f + \beta_E(R_M - R_f)$$

[18] We discuss the estimation of R_D in Annex 28. Its estimation is increasingly left 'open' to changes in future interest rates, as this reflects the nature of company financing which is itself increasingly indexed to floating interest rates or inflation.

Each of these variables needs to be estimated, and it is probably fair to say they are all contentious. However, R_f and R_M are generic across all businesses and UK regulators have a broadly accepted, if evolving, approach to estimating them.

We refer in this report to 'vanilla' WACC. This is the weighted average of the pre-tax cost of debt and the post-tax cost of equity. Ofwat typically uses the vanilla WACC because it doesn't require an estimation of effective tax rates, which can vary by company; interest costs/rates are observed before tax, and returns on equity are paid after tax has been deducted. When using a vanilla WACC, a company's allowed revenue should include a specific allowance for tax expenses.

We focus in particular in this report on the factors which are specific to the water sector: the cost of debt, the equity beta for water sector companies and the appropriate gearing level. We provide only a high-level analysis of the risk-free rate and the market risk premium as these elements are generic across industries and have been well covered elsewhere; consequently we review regulatory precedents for these elements.

The remainder of this report provides our analysis for the appropriate assumptions about each of these variables. We also include a section describing recent precedents and then conclude with our summary of appropriate, consistent assumptions for the elements of WACC and hence a recommendation for the appropriate range for WACC for PR14.

A1.1.1 PR14 WACC

At PR14, Ofwat estimated an appointee WACC (ie covering all of a company's regulated activities) of 3.74%.[19] The component parts of this estimate are shown in Table 6.

[19] Ofwat set a higher WACC for 'enhanced status' companies (Affinity Water and South West Water), as well as for Portsmouth Water and Bournemouth Water (as a small company uplift on the cost of debt).

Table 6 Comparison between PR14 WACC calculations

Paramater	Ofwat (December 2014)
Real risk-free rate	1.25%
Equity market risk premium	5.5%
Gearing (net debt/RCV)	62.5%
Equity beta	0.80
Real cost of equity (post-tax)	5.65%
Ratio of embedded:new debt	75%:25%
Real cost of new debt	2.0%
Real cost of embedded debt	2.75%
Overall real cost of debt (pre-tax)	2.59%
Real vanilla appointee WACC	3.74%

A1.2 PR19 developments

Ofwat has stated that it will provide an early indication as to the WACC to apply to the E&W water companies, from 2020 to 2025, in December 2017, as part of its decision on the methodology for PR19. However, Ofwat has already taken some decisions and indicated a direction of travel for some aspects of the WACC through its Water 2020 Programme and its consultation on the methodology for PR19.

Of relevance to a consideration of the components of WACC and our approach to this assignment are Ofwat's approach and decisions on the:

- ❑ treatment of retail margins;
- ❑ creation of four wholesale price controls;
- ❑ move to CPIH indexation (from RPI);
- ❑ treatment of companies with exceptional business plans; and
- ❑ indexation of the cost of new debt.

A1.2.1 Appointee WACC and retail margins

At PR14, Ofwat decided to implement separate price controls for the retail and wholesale activities of the water companies. However, Ofwat estimated the WACC at an appointee level (ie inclusive of both retail and wholesale activities), rather than at the wholesale level. It did this for several reasons, including that company financing is undertaken at an appointee level, and that it is the total bill which matters to customers (rather than the retail or wholesale elements in isolation).

In creating separate retail and wholesale price controls, Ofwat decided to transfer the entire RCV to the wholesale business and to provide a return on retail activities through a margin. Ofwat established two retail price controls:

- a household retail price control - which would not be subject to competition; and
- a non-household retail price control - which would be subject to competition in England.

Given Ofwat's allocation of risks from the wholesale to retail price controls (such as bad debt management), it considered that the wholesale WACC should be permanently lower than the appointee WACC. In particular, with the household retail price control not subject to competition, or any significant new risks, Ofwat decided to deduct the margin on the household retail price control (set at 1%) in its entirety from the WACC. Ofwat's calculation of the wholesale WACC from the appointee WACC is shown in Table 7.

Table 7 Conversion from appointee to wholesale WACC at PR14

Paramater		Point estimate	Comment
Appointee WACC	A	3.74%	Derivation shown in Table 6
Retail net margin	B	0.90%	1%margin net of 10% effective tax rate
Revenue requirement (2015-20 year average)	C	£10,812m	
RCV (2015-20 year average)	D	£63,072m	
Retail return on RCV	E = B*C	£97m	
Return on replaced retail assets not added to RCV	F	£7m	Assumes that new retail assets replace depreciated assets, with no retail assets in wholesale RCV by 2020.
Retail return deduction from apointee return	G = D - F	£90	
Adjustment from appointee to wholesale WACC	H=G/D	0.14%	
Wholesale WACC	G = A-H	3.6%	

Adapted from Table A7.9, *Final price control determination notice: policy chapter A7 – risk and reward*, Ofwat, December 2014.

For PR19, Ofwat has proposed that it will continue to calculate a wholesale WACC as the industry WACC, net of the retail margin adjustment.[20] For the purposes of this report, we focus on estimating WACC at the appointee level, and do not assess the appropriate retail margin. We note, however, that the adjustment to the appointee WACC at PR19 would not need to include the impact of retail assets assumed to have been in the wholesale RCV at PR14 (parameter F in the above table), as these will have been fully depreciated.

[20] Pg 203-4, *Delivering Water 2020: Consulting on our methodology for the 2019 price review,* Ofwat, July 2017.

A1.2.2 More wholesale price controls

At PR14, Ofwat introduced two separate wholesale price controls: one for water activities and one for wastewater activities. Each of these price controls has the same wholesale WACC. For PR19, Ofwat has stated that there will be four wholesale price controls, covering:

- water resources;
- water network plus;
- wastewater network plus; and
- bioresources.

This further separation of wholesale prices controls is intended to help promote competition in the water resources and bio-resources parts of the water value chain. Ofwat confirmed in its PR19 methodology consultation that a different WACC *could* be set for each of these four wholesale price controls *if* there are differences in systematic (undiversifiable) risk between the four activities. However, following previous work, Ofwat expects that companies will have the same WACC across the four wholesale price controls. Our focus in this report is on deriving an appointee level WACC, rather than a detailed consideration of the differences in systematic risk between the four wholesale price controls.

A1.2.3 CPIH Indexation of wholesale price controls

In May 2016, Ofwat confirmed that it would move away from using the RPI for the indexation of companies' revenues and assets.[21] In its July 2017 consultation on the PR19 methodology Ofwat proposed indexing revenues to CPIH from the start of the PR19 price control period, with the intention of confirming this decision by January 2018. Ofwat is taking a transitional approach, with 50% of the RCV as at 1 April 2020 indexed to RPI and all other RCV (including all additions) indexed to CPIH. This transitional approach means Ofwat has decided to state a single nominal WACC, with separate real WACCs for RPI and for CPIH to apply separately to the RCVs that are indexed by RPI and CPIH.

A1.2.4 Financial rewards for exceptional business plans

In PR14, two companies (Affinity Water and South West Water) received a higher WACC after Ofwat assessed their business plans to be high quality. Ofwat has confirmed its intention to provide financial rewards to companies that submit 'exceptional' plans in PR19. Ofwat has stated that the threshold for achieving exceptional status is higher than at PR14, as it also includes an assessment of the ambition and innovation in the plans. For any company that has a business plan assessed by Ofwat to be exceptional, Ofwat has proposed

[21] This followed the recommendation of the Johnson Review of 2015 that "*Government and regulators should work towards ending the use of the RPI as soon as practicable.*" This followed the removal of RPI's status as a National Statistic, because a formula used in its calculation does not meet international standards.

an addition of 0.2% to the cost of equity. We have not included this additional reward for exceptional business plans in our WACC estimate.

A1.2.5 Index linking of new debt

In its price controls to date, Ofwat has set a fixed cost of debt for the duration of the price control. For PR19, Ofwat has confirmed its intention to change this approach, by linking the cost of new debt (but not embedded debt) to a market index, such that the cost of new debt allowed will vary within the price control period.

Under Ofwat's current approach companies carry the risk of the cost of debt being greater or less than Ofwat's fixed allowance. By linking companies' cost of new debt to a market index, customers, rather than companies, will be carrying the risk of changes in the cost of new debt. It is reasonable for customers to expect a reduction in the return required by equity investors (e.g. through a lower beta) for this reduced risk.

In practice, when setting the cost of debt for the duration of a price control, UK regulators have tended to set it at levels that have looked generous in retrospect. Companies have generally outperformed Ofwat's cost of debt allowance. This reflects the challenge for regulators of accurately forecasting debt costs. Under Ofwat's new approach the risks associated with Ofwat incorrectly forecasting a cost of new debt is removed and, to the extent that its forecasts would continue to have been greater than the outturn cost of debt, the cost to consumers is also removed.

For its choice of market index, Ofwat prefers the use of the iBoxx non-financials index for A and BBB credit ratings. These are the same indices used by Ofgem for energy networks. Ofwat has indicated that it may make a downward adjustment to this index if there is evidence that efficient companies can outperform it. Ofwat has stated it will make a decision on this in its final determinations.

A1.3 Ofwat management of expectations

Ofwat has been signalling that PR19 will be a challenging price control review for the companies. As early as October 2015, just six months after the start of the price control, Cathryn Ross, Ofwat's Chief Executive, stated "*PR19 will be tough*" and that, even with the reduction in the cost of capital in PR14, that a lower cost of capital at PR19 could not be ruled out.[22]

In March 2017, at the Water UK City Conference, Jonson Cox, Ofwat's Chairman, pointed to a number of factors, including a lower cost of capital, creating "significant headroom" in the next price control period. He also highlighted a reference by Moody to a WACC of 2.5%, as well as the WACC of 2.497% for the Thames Tideway Tunnel.

[22] *Sector challenges and Water 2020*, Cathryn Ross speech, 15 October 2015.

More recently, Cox stated that he sees the upcoming price review as likely to set "*a new record for the lowest ever regulated cost of capital for water*" and that it could be the start of "*the decade of falling bills*".[23]

[23] https://www.ofwat.gov.uk/pn-1717-ofwat-boss-talks-decade-falling-bills/

A2 Evidence from regulatory precedent and market activity

In this Annex, we consider some relevant 'top-down' evidence - this includes regulatory precedents, as well as evidence from market transactions and share price returns of water companies.

A2.1 Regulatory precedents for WACC

A2.1.1 Overview of WACC determinations

In this section we look at regulatory precedents on WACC. We have focused on energy, as well as water, network precedents (rather than, say, airports, rail and communications) as they have broadly similar characteristics in terms of, for example, risk and gearing.

The following table summarises regulator precedents from 2004 to date.

Table 8 Regulatory Precedent on WACC – energy and water networks

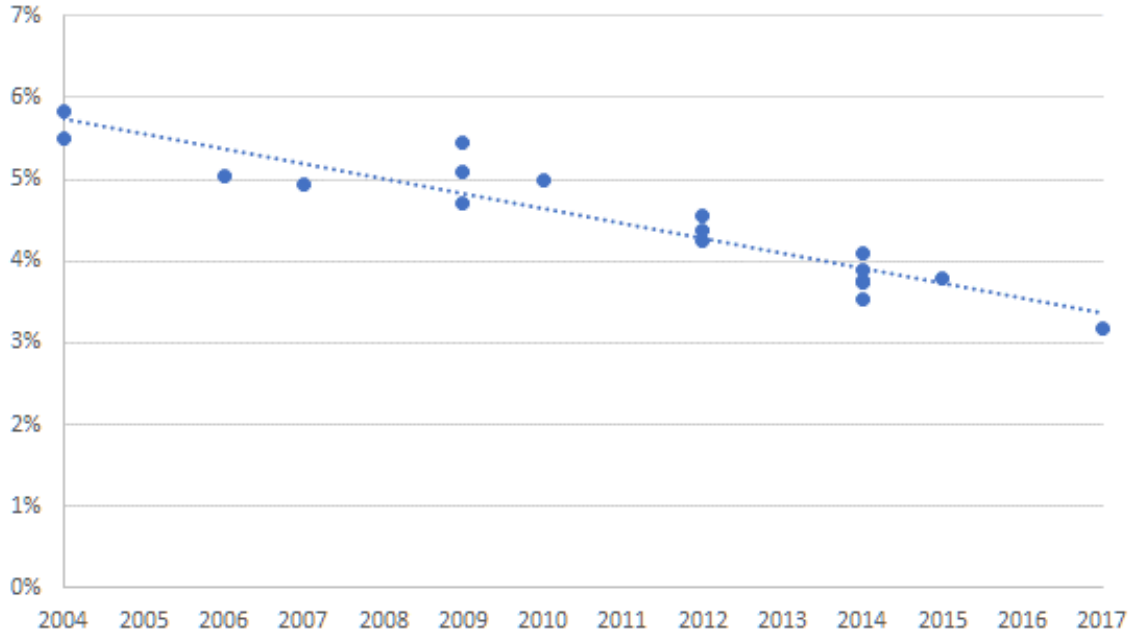
Organisation	Sector / company	Year	Vanilla WACC
UR	NIE	2017	3.18%
CMA	Bristol Water	2015	3.78%
Ofwat	Water	2014	3.74%
UR	Water	2014	3.53%
CC	NIE	2014	4.10%
Ofgem	Electricity distribution (Slow-track)	2014	3.76%
Ofgem	Electricity distribution (Fast-track)	2014	3.90%
Ofgem	Gas distribution	2012	4.24%
Ofgem	Gas transmission	2012	4.38%
Ofgem	Electricity transmission	2012	4.55%
CC	Bristol Water	2010	4.98%
Ofwat	Water	2009	5.08%
Ofwat	Water (small cos)	2009	5.45%
Ofgem	Electricity distribution	2009	4.70%
Ofgem	Gas distribution	2007	4.94%
Ofgem	Transmission	2006	5.05%
Ofwat	Water	2004	5.83%
Ofgem	Electricity distribution	2004	5.50%

Source: Various regulatory determinations

A2.1.2 Trend in WACC determinations

There has been a general downward trend in WACC determinations, as shown clearly in Figure 4. It has been our contention that the cost of capital has previously been set at too high a level for some time and that regulators (and the Competition Commission and now Competition and Markets Authority) are only slowly reducing allowed cost of capital to a more realistic level.[24] This 'correction' might be exacerbating the slope of the downward trend (and would mean that the downward trend cannot be simply projected as it does not necessarily reflect the underlying trend in real WACC).

Figure 4 Vanilla WACC - energy and water regulatory determinations 2004 - 2017



Source: Various regulatory determinations

A2.1.3 Recent WACC determinations

There are two WACC determinations presented in Table 8 that occurred after PR14: the CMA's determination for Bristol Water and the Northern Ireland Utility Regulator (UR)'s determination for Northern Ireland Electricity (NIE).[25] The various component parts of these WACC decisions are shown in Table 9.

[24] E.g. see *Recommendations for the Weighted Average Cost of Capital 2015-20: Summary Report*, for CCWater, February 2014.

[25] We have excluded the Thames Tideway Tunnel (of 2.497% from 2015) as well as UR's WACC for their gas distribution networks (of 4.26% and 4.32% from 2016). There are specific characteristics of both of these that mean they may not be suitable reference points.

Table 9 Comparison between PR14 WACC and recent determinations

Paramater *(real terms, unless stated otherwise)*	**Ofwat (December 2014)**	**CMA – Bristol Water (October 2015)**	**UR – NIE (June 2017)**
Real risk-free rate	1.25%	1.25%	1.25%
Equity market risk premium	5.5%	5.25%	5.25%
Gearing (net debt/RCV)	62.5%	62.5%	45%
Equity beta	0.80	0.85	0.59 *
Cost of equity (post-tax)	5.65%	5.73%	4.45%
Ratio of embedded:new debt	75%:25%	75%:25%	48%:52%
Cost of new debt	2.0%	1.6%	3.5% (nominal)
Cost of embedded debt	2.75%	2.95%	6.6% (nominal)
Overall cost of debt (pre-tax)	2.59%	2.61%	4.99% (nominal) 1.63% (real)
Vanilla (appointee) WACC	3.74%	3.78%	3.18%
Vanilla (wholesale) WACC	3.60%	3.67%	n/a

* UR cite an asset beta of 0.38 and a debt beta of 0.1.

Sources: *NIE Transmission and Distribution 6th Price Control (RP6) Final determination*, June 2017, Utility Regulator, *CMA Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991*, Report, October 2015, and *Final price control determination notice: policy chapter A7 – risk and reward*, Ofwat, December 2014.

There was a small difference between the WACC determined by Ofwat (of 3.74%) in December 2014 and by CMA for Bristol Water (of 3.78%) in October 2015. Despite the small difference overall, there were differences in the component parts that are notable:

- CMA assumed a slightly higher equity beta (0.85 compared to 0.8) than Ofwat, but a slightly lower equity market risk premium (5.25% compared to 5.5%). The net effect was CMA estimated a slightly higher cost of equity than Ofwat (5.73% compared to 5.65%)

- CMA's estimate of the cost of debt (of 2.61%) was only slightly higher than Ofwat's estimate (of 2.59%). However, this masks significant differences in the component parts. CMA had a notably lower cost of new debt than Ofwat (1.6% compared to 2%), reflecting, in large part, that the CMA had access to more recent data on market conditions. CMA also allowed a small company premium for Bristol Water, unlike Ofwat.[26] CMA's cost of embedded debt was 2.95% compared to Ofwat's 2.75%.

There is a relatively large difference between Ofwat's PR14 WACC of 3.74%, determined in December 2014, and the Utility Regulator's WACC for NIE of 3.18%, determined in June 2017. This reflects large differences in both the costs of debt and equity:

[26] Ofwat allowed Portsmouth Water and Bournemouth Water an uplift on the cost of debt of 0.25%, which uplifted their cost of capital by 0.15% to 3.75%.

- UR estimated a cost of debt of 1.63% compared to Ofwat's 2.59%. This difference arises both from a much lower cost of new debt and a higher percentage of new debt in total debt (52% compared to 25%)
- UR estimate a cost of equity of 4.45% compared to Ofwat's 5.65%. UR used the same risk-free rate and equity market risk premium as Ofwat, but had a much lower level of gearing (and consequently equity beta).

A2.1.4 WACCs with index-linked debt

Several of the price controls listed in Table 8 have linked the cost of debt component of the WACC to an index. This means that the WACC will change over the duration of the price control if the cost of debt index changes. Table 10 shows the changing level of WACC for the energy price controls set by Ofgem.[27] These show a downward trend, reflecting the downward trend in debt costs.

Under Ofwat's proposals to index the cost of new debt (as described in A1.2.5) water companies vanilla WACC would similarly change in the price control period as the index changes.

Table 10 Changes in Vanilla WACC of Ofgem's energy network price controls

Sector	y/e 31/3/14	y/e 31/3/15	y/e 31/3/16	y/e 31/3/17	y/e 31/3/18
Gas Distribution	4.24%	4.11%	4.00%	3.89%	3.79%
Gas Transmission	4.38%	4.25%	4.14%	4.04%	3.94%
Electricity Transmission (National Grid)	4.55%	4.43%	4.33%	4.23%	4.13%
Electricity Distribution – Fast track			3.90%	3.79%	3.68%
Electricity Distribution – Slow track			3.76%	3.67%	3.59%

Source: Ofgem Price Control Financial Models for AIP17 (Annual Iteration Process 2017)

In subsequent Annexes, we further consider regulatory precedent on the individual component parts of the WACC, focusing on determinations since PR14.

A2.2 Evidence from market transactions

In a previous study for CCWater,[28] we reviewed the returns to equity holders in water companies in transactions of major shareholdings or full ownership since PR14 started.

Across seven transactions in PR14, the premia[29] for all were in excess of 20% and the average around 38%. Whilst not bearing directly and unequivocally on the WACC, this evidence

[27] The Utility Regulator have also linked NIE's cost of debt to an index, but this price control was only finalised this year, so the WACC value has not yet been updated.
[28] *The cost of capital – setting the scene for PR19,* ECA report for CCWater, May 2017.
[29] Premia are measured as the effective Enterprise Value (EV) (from the perspective of the acquirer) over the Regulatory Capital Value (RCV).

suggests that bidders see substantial outperformance opportunities. This could arise from cost allowances and the cost of capital being too generous in PR14 and/or an expectation amongst investors that this will be the case in future price controls.

A summary of the transactions, and the premia, is presented in Table 11. We estimated and analysed the prices paid relative to the RCV.

Table 11 Premia paid for water companies in corporate transactions

Target	Acquirer	Date	Transaction equity value (£m)	Effective enterprise value (£m)	RCV (£m)	Premium (%)
Bournemouth	Pennon	April 2015	105	192	149	28.7%
Southern (17.1%)	Hermes	May, 2016	*Undisclosed*			
Bristol (50%)	iCON Infrastructure Partners III	December, 2016	*Undisclosed*			
Bristol (50%)	iCON Infrastructure Partners III	December, 2016	116	536	441	21.5%
Thames Water (26.3%)	Borealis Infrastructure and Kuwait Investment Authority	March, 2017	1,350	17,106	12,256	39.6%
Thames Water (2.4%)	Aquila	March, 2017	120	16,973	12,256	38.5%
South East Water (50%)	Hastings Funds Management	March, 2017	400	1,347	1,116	20.7%
Dee Valley	Severn Trent	February, 2017	85	135	76	77.6%
Affinity Water	Allianz Capital Partners, HICL Infrastructure, DICF	May 2017	735	1,589	1,156	37.5%

Source: Company announcements, media reports, company financial statements, ECA analysis

A2.3 Evidence from share price returns

We analyse trends in the annualised returns for the four quoted companies (Severn Trent, Pennon, United Utilities and Dee Valley).[30] The purpose of this analysis is to observe and compare these returns relative to:

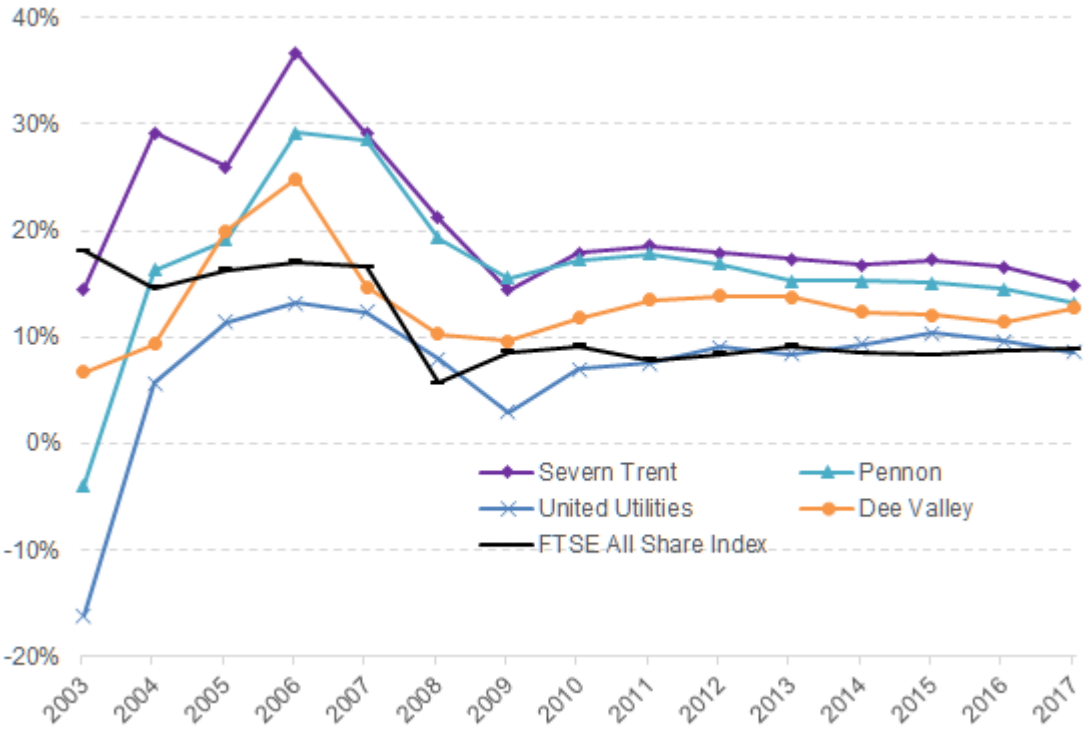
[30] We have included Dee, but note that it was purchased in February 2017 by Severn Trent and it was significantly smaller than the others and has lower trading volumes. Inferences from Dee Valley should, therefore, be treated with some caution.

- Ofwat's estimate of the cost of equity in PR14, which should reflect the returns an investor expects to receive. In their final determination for PR14, **Ofwat determined a cost of equity of 5.65%**, which is post-tax and real.

- The market, or returns received by an investor in a fully diversified share portfolio that reflects the risks of the market overall. The WACC formula benchmarks the returns to investors in the listed water companies through the equity beta. In PR14, Ofwat estimated an equity beta of 0.80, on a market risk premium of 5.50%, which suggests that **water company investors should get a return 1.1% points lower than the investor in the diversified market portfolio**, commensurate with the volatility (risk) of the underlying investment.

Figure 5 displays the annualised returns to a water company investor who had bought shares on 11 October 2002 and held them until 17 October, reinvesting all dividends. Over the past 15 years, water companies have outperformed the rest of the market, with only United Utilities just dipping below the FTSE All Share Index in 2017.

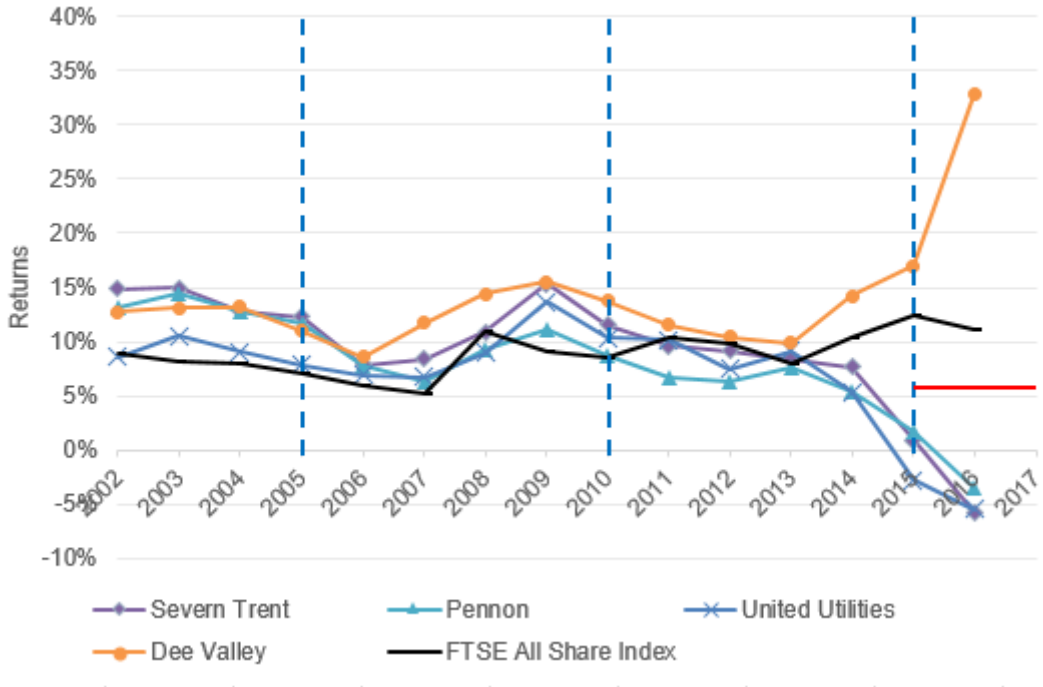
Figure 5 Annualised returns to investors in water companies *since* 2002



Source: Yahoo Finance, ECA analysis

Figure 6 presents the returns an investor would have received for buying shares in the listed companies, compared to the FTSE All Share index (as our market proxy), in a given year and holding them until 11 October 2017. For example, the returns for year 2002 are for purchasing the shares on 11 October 2002, and holding these until 11 October 2017, reinvesting all dividends.

Figure 6 Annualised returns to investors in water companies for periods *ending* in 2017

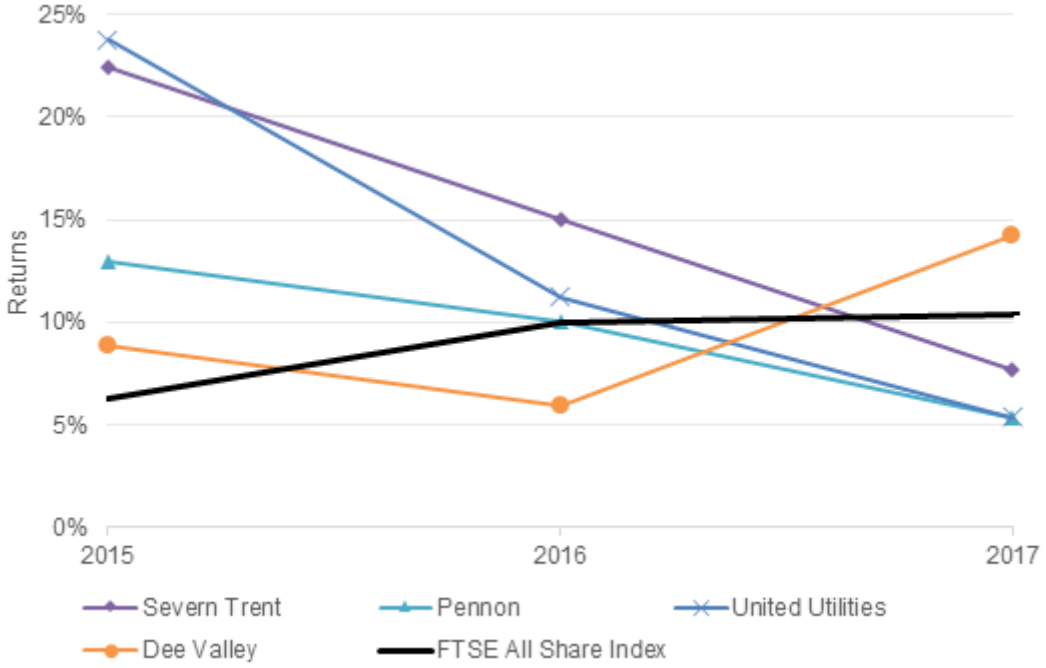


Source: Yahoo Finance, ECA analysis

The analysis in Figure 6 shows that investors would have outperformed the market return buying up until 2010. However, Dee Valley aside (whose share price includes the premium returns resulting from its takeover by Severn Trent), water companies have underperformed compared to the FTSE for purchasers over the past couple years. Severn Trent, Pennon, and United Utilities saw an average share decline of 4.9% between 11 October 2016 and 11 October 2017. Investors' in each company had exceeded Ofwat's estimate of the return for the companies (shown by the straight red line; only applying for the period from 2014) up to 2014, but have since fallen short.

Our second analysis, taking the inverse of the first, looks at returns for investors who bought shares on 11 October 2014, and held them until 11 October in 2015, 2016, or 2017. This period is selected to reflect the period since PR14. This is presented in Figure 7.

Figure 7 Annualised returns to investors in water companies for periods *starting* in 2014



Source: Yahoo Finance, ECA analysis

This analysis shows that 11 October 2014 investors would have received returns in excess of the market if they had sold on 11 October 2015 or 11 October 2016. However, the 2017 decline in share prices has seen the market pull ahead as of 11 October 2017 (with Dee Valley the exception).

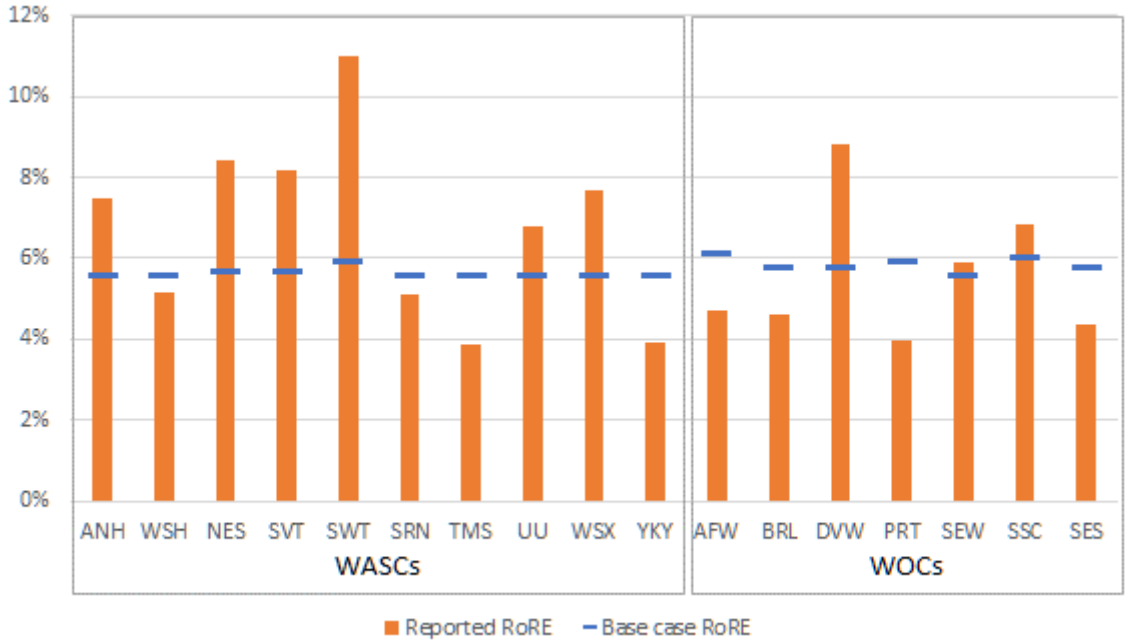
In summary, Figure 5 shows that over a long period (from 2002) returns to water companies have generally outperformed the market (as well as the lower return expected as a result of Ofwat setting their beta below 1). However, Figure 7 shows that for PR14, whilst returns to water companies (with the exception of Dee Valley) were doing better than the market up to 2016, this changed in 2017. This change in share price returns in 2017 could reflect the strong indications from Ofwat on the lower WACC for PR19 (see section A1.3).

A2.4 RoREs

RoRE is intended as a measure of the returns available to shareholders over the duration of a price control. In PR14, Ofwat uses RoRE as a key metric, requiring companies to publish it in their Annual Performance Reports. Ofwat's guidance identifies a number of components for RoRE, including cost out- or under-performance, ODI or SIM rewards or penalties, and differences between actual and allowed interest rates on debt.

Figure 8 shows water companies' RoREs in PR14 (over the first two years). Overall nine of the seventeen companies are reporting a RoRE in excess of their base case, with most of these being WASCs (six out of the nine).

Figure 8 Return on Regulatory Equity (2015/16- 2016/17)



Source: Annual Performance Reports 2016/17

A3 Cost of debt

In this section, we analyse the cost of debt; this includes regulatory precedents, the costs of new and embedded debt and the weights attributed to each of these.

A3.1 Regulatory precedent on cost of debt

Ofwat set a real cost of debt of 2.59% at PR14 for all WASCs and most WOCs.[31] This is at the higher end of the range of recent regulatory precedent for UK energy and water networks, shown in Table 12. Ofwat's cost of debt was calculated from a real cost of new debt of 2% and a cost of embedded debt of 2.75%, with new debt assumed to be 25% of total debt.

Table 12 Regulatory precedent on real cost of debt

Regulator	Sector / company	Year	Cost of debt (real)
UR	NIE	2017	1.63%
Ofgem	Electricity distribution (Fast-track)	2017	2.29%
Ofgem	Gas distribution, Gas transmission, Electricity distribution (slow-track) Electricity transmission	2017	2.22%
CMA	Bristol Water	2015	2.61%
Ofwat	Water	2014	2.59%

Source: Various

In July 2017, UR set a real cost of debt of 1.63% for Northern Ireland Electricity (NIE), a value lower than most other precedents. This was based on a cost of embedded debt of 3.19% and new debt of just 0.19%,[32] with respective weighting of 48% and 52%. Embedded debt costs were based on NIE's average interest costs, which are higher than is typical for E&W water companies. The cost of new debt is a 'holding assumption', as it will be updated based on an index as and when NIE enters into new borrowing arrangements.

Ofgem uses an index to set the cost of debt for its network price controls. In Ofgem's case, the cost of debt is updated each year (through an Annual Iteration Process, which updates base allowed revenues). Current costs of debt range from 2.22% to 2.29% (although SHE Transmission has a lower value, of 1.49%).

The first Ofgem price controls to index link the cost of debt (gas and electricity transmission and gas distribution) used a ten-year trailing average of bonds.[33] The more recent electricity

[31] Portsmouth Water and Bournemouth Water received uplifts of 0.25% on the cost of debt. See section A3.5 for further details.
[32] UR expressed embedded and new debt costs in nominal terms. We have converted these to real terms using the Fisher equation and UR's forecast inflation rate of 3.3%.
[33] Ofgem used iBoxx bonds with ten or more years to maturity for non-financial companies with credit rating of A or BBB.

distribution price control also adopted a trailing average, but with the averaging period increasing each year ('trombone' like). Ofgem changed their approach as their analysis showed that it would better protect distribution companies from exposure to market interest rate uncertainty.

A3.2 Cost of new debt

In PR14, Ofwat determined a real cost for new debt of 2.0% (with the exceptions of Portsmouth Water and Bournemouth Water who were allowed a small company uplift on the cost of debt of 0.25%). With Ofwat's inflation assumption of 2.8%, that gave an assumed nominal cost for *new* debt of 4.86%[34].

Ofwat based its estimate of a 2% real cost of new debt on real market yields prevailing in December 2014 of around 1.35% to 1.55%,[35] with an uplift of 60 basis points to reflect the then expectation of an increase in interest rates.

For PR19, Ofwat will index the cost of new debt, as described in section A1.2.5. As a consequence, the cost of debt is not a value fixed for the duration of the price control, as currently. Rather, it will vary as the market index varies. This means it is no longer necessary to consider the expectations of future increases in debt costs, but only to look at currently prevailing rates. Notwithstanding, to provide context we first update our prior analysis of water companies' debt issuances in recent years, before looking at prevailing market rates.

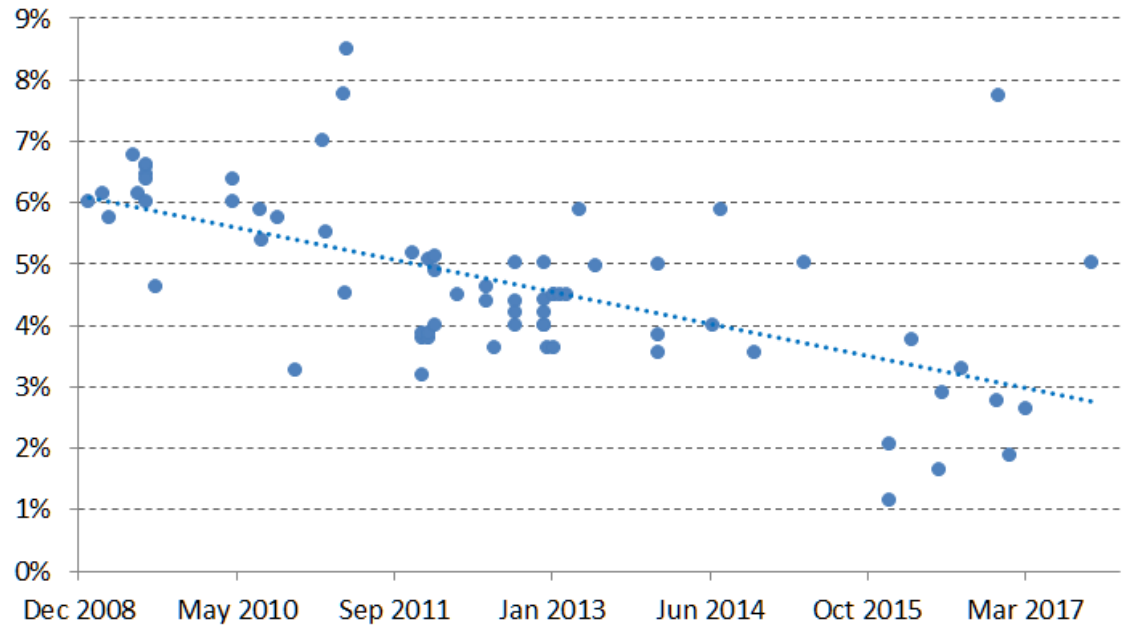
A3.2.1 Evidence on new debt issuance

Trends in new debt issuances

Water companies' new debt costs have been on a general decline over the current and previous price control (PR09), as shown in the Figures below. Figure 9 shows the coupon on fixed-rate bond issues by water utilities since the start of 2009. We can observe a steady decline in the rates at which water utilities have been able to sell their bonds, falling to roughly 3% lately, with a couple outliers. Figure 10 shows the same downward trend for index-linked bond issues; multiple bonds have even been set at base coupons of near-zero.

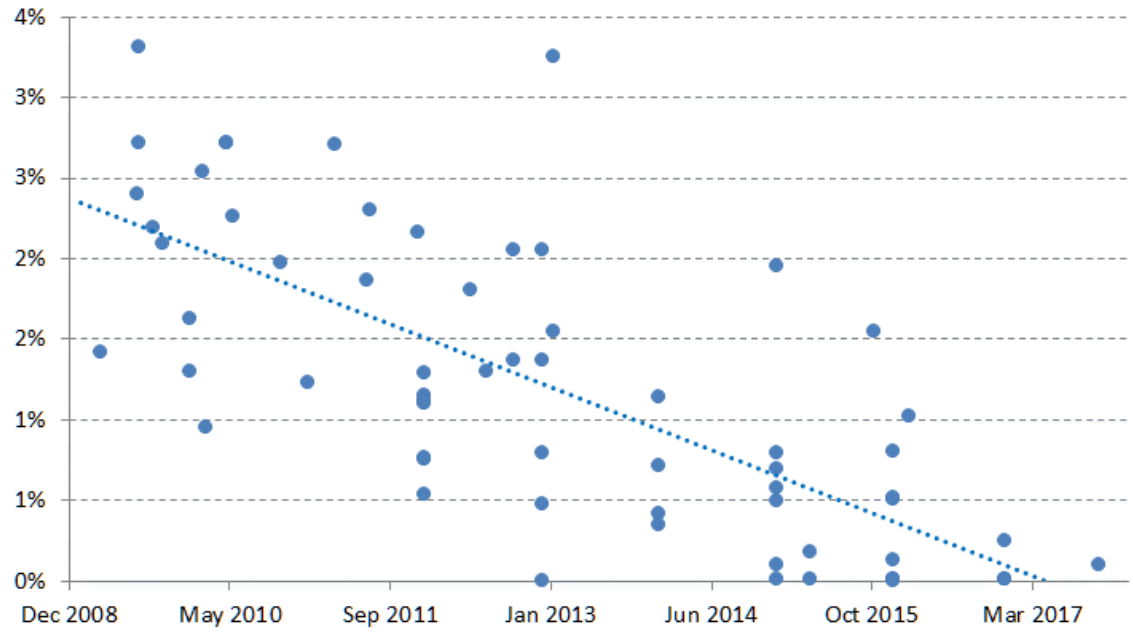
[34] The calculation to convert from real to nominal rates is the Fisher Equation: $R^n = (1+R^r) \times (1+I^r) - 1$, where R^n is the nominal rate, R^r is the real rate and I^r is the rate of inflation.
[35] http://www.ofwat.gov.uk/wp-content/uploads/2015/10/det_pr20141212riskreward.pdf.

Figure 9 Water utility fixed-rate bond issues



Source: ISIN Analytics, CBonds, company annual reports.

Figure 10 Water utility index-linked bond issues



Source: ISIN Analytics, CBonds, company annual reports.

Water company new debt issues compared to PR14 allowance and market rates

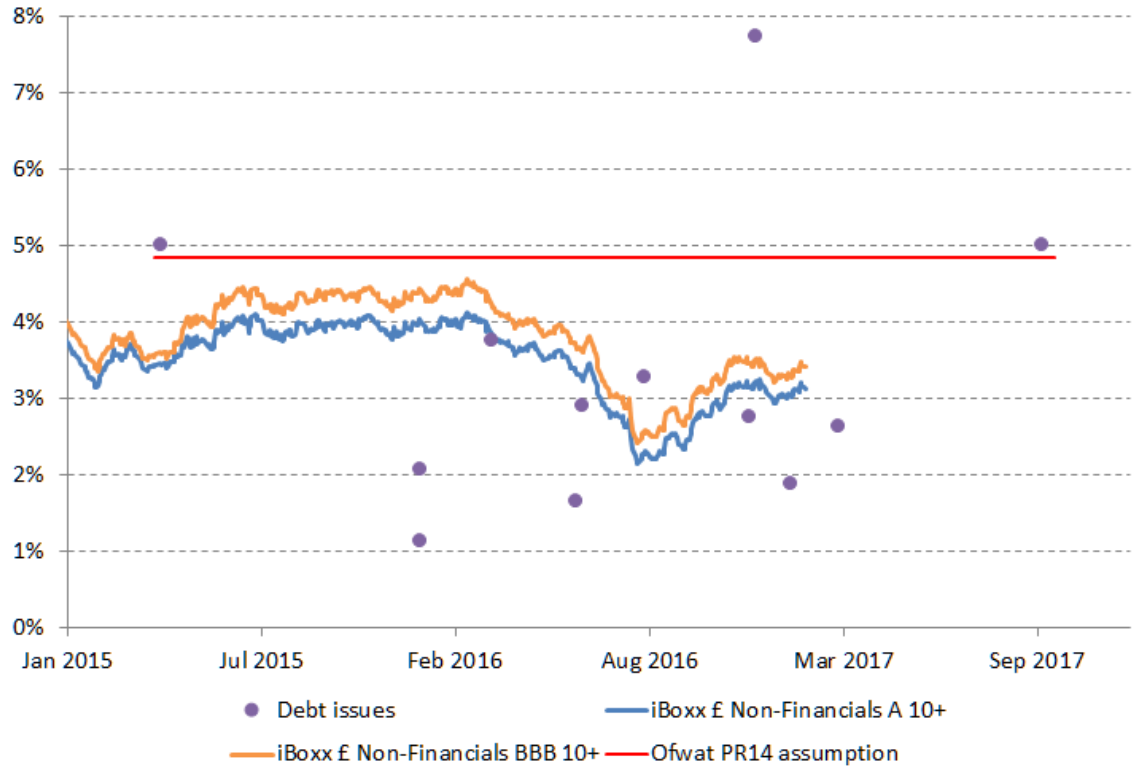
Within the current price control period, water companies have (generally) been able to issue debt at a lower cost than Ofwat allowed for new debt. Compared to Ofwat's real cost of new debt of 2%, water companies index-linked debt issuances have been in the range of 0% to 1.95%, with a median of 0.38%. In nominal terms, Ofwat's allowance was 4.86%, whereas

companies have issued fixed rate debt in the range 1.13% to 7.74% (with the value of 7.74% something of an outlier, as shown in Figure 11), with a median of 3.54%. Further details are provided below.

Our analysis has identified 35 debt issues for the Water Only Companies (WOCs) and Water and Sewerage Companies (WASCs), since 2015, with a mixture of fixed-rate and index-linked issues, since our previous study for CCWater.

The fixed rate issues are presented in Figure 11, with comparisons provided with iBoxx market rates for A and BBB non-financial 10+-year instruments, and Ofwat's PR14 assumption. The data suggest that, overall, the water companies have followed the general decline in market interest rates (as indicated by the iBoxx rates shown). The data also indicate that, largely as a result of the decline in market interest rates, water companies have accessed debt markets at rates below Ofwat's PR14 estimation for new debt issues, benefitting the companies.

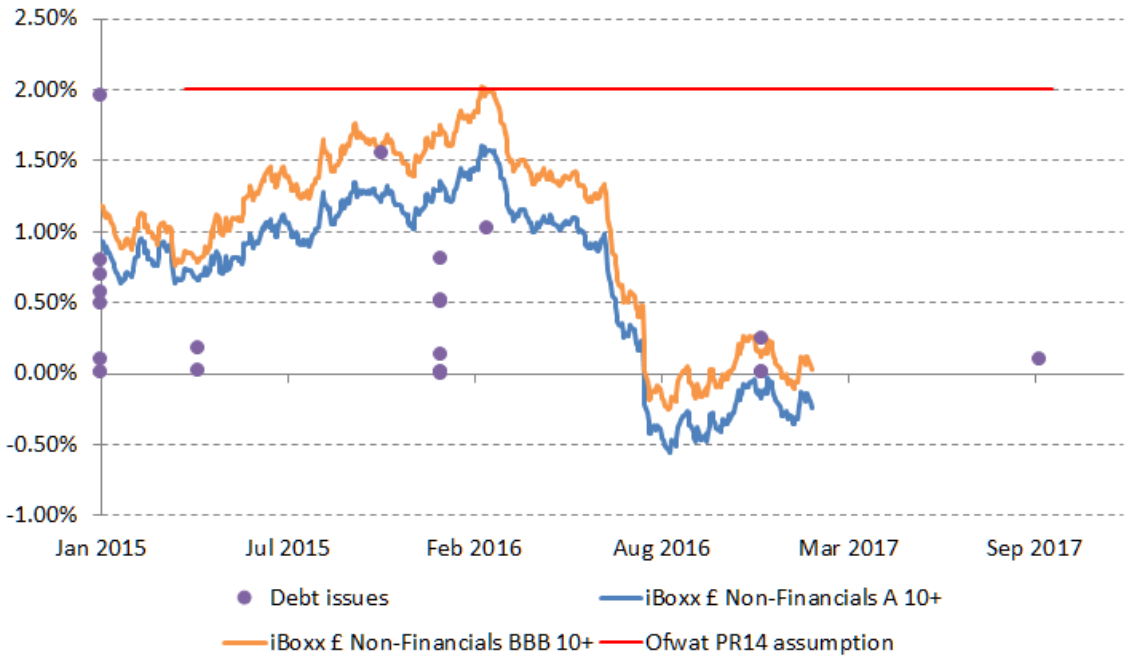
Figure 11 WOC and WASC fixed-rate debt issues since 2015 with market and Ofwat benchmarks



Source: Company financial statements, iBoxx, Cbonds. ISIN Analytics, Ofwat, market reports

Figure 12 presents a similar analysis for index-linked debt issues, showing the premium over the index. Similar to the fixed issues, the data in this figure show out-performance against the Ofwat determination in PR14, they also show an apparent degree of out-performance, in general, against the market benchmark.

Figure 12 WOC and WASC index-linked debt issues since 2015 with market and Ofwat benchmarks[36]



Source: Company financial statements, iBoxx, Cbonds, ISIN Analytics, Ofwat, market reports

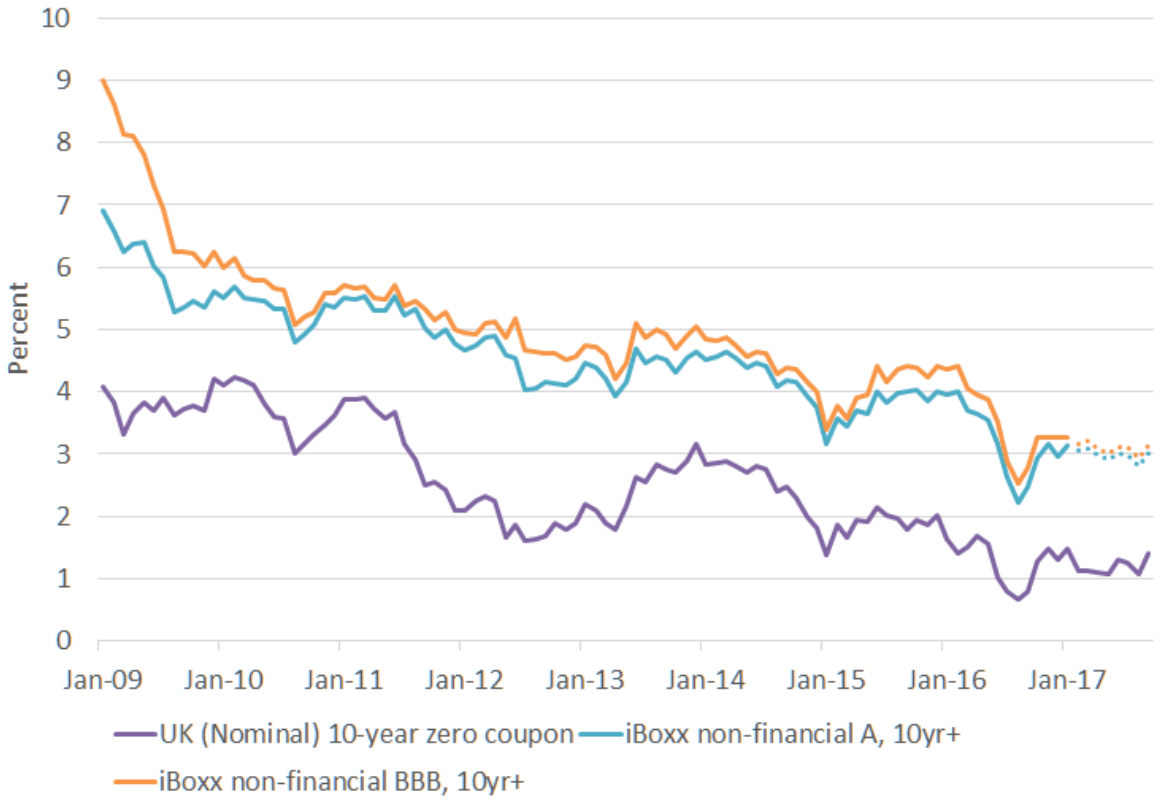
Companies also generally outperformed Ofwat's cost of debt allowance in PR09. This outperformance reflects a wider trend across UK regulators of setting cost of debt allowances that have looked generous in retrospect. At least in part, this has been a consequence of the general downward trend in debt costs, illustrated in Figure 13. In the wake of the financial crisis, quantitative easing put some downward pressure on government bond yields. There was an expectation at the time that the lower yields would not persist and that they would revert to more 'normal' levels. However, after a brief uptick at the end of 2016, yields have remained low.

A3.2.2 Market evidence

Figure 13 shows the general downward trend in market benchmark and government benchmark yields since 2009. The currently prevailing market benchmark (of yields on 10 year+ non-financial companies with A and BBB credit ratings) is around 3.1%.

[36] Many of the new issues were private issues, and so were picked up from financial statements rather than market announcements. The dates for such issues have been given as 1 January for that year.

Figure 13 Trends in market benchmark and government benchmark yields



Source: BoE, iBoxx

A3.2.3 Conclusion on the cost of new debt

For the purposes of our WACC estimate, we propose using a cost of new debt of 3.1%, based on the currently prevailing market benchmark that Ofwat propose to use. As Ofwat intends to link the allowed cost of new debt to the index, this value can be expected to change in advance and over the duration of the price control. We have not included any adjustment to this current value for future potential changes (unlike for the risk-free rate – see section A4.2).

A3.3 Cost of embedded debt

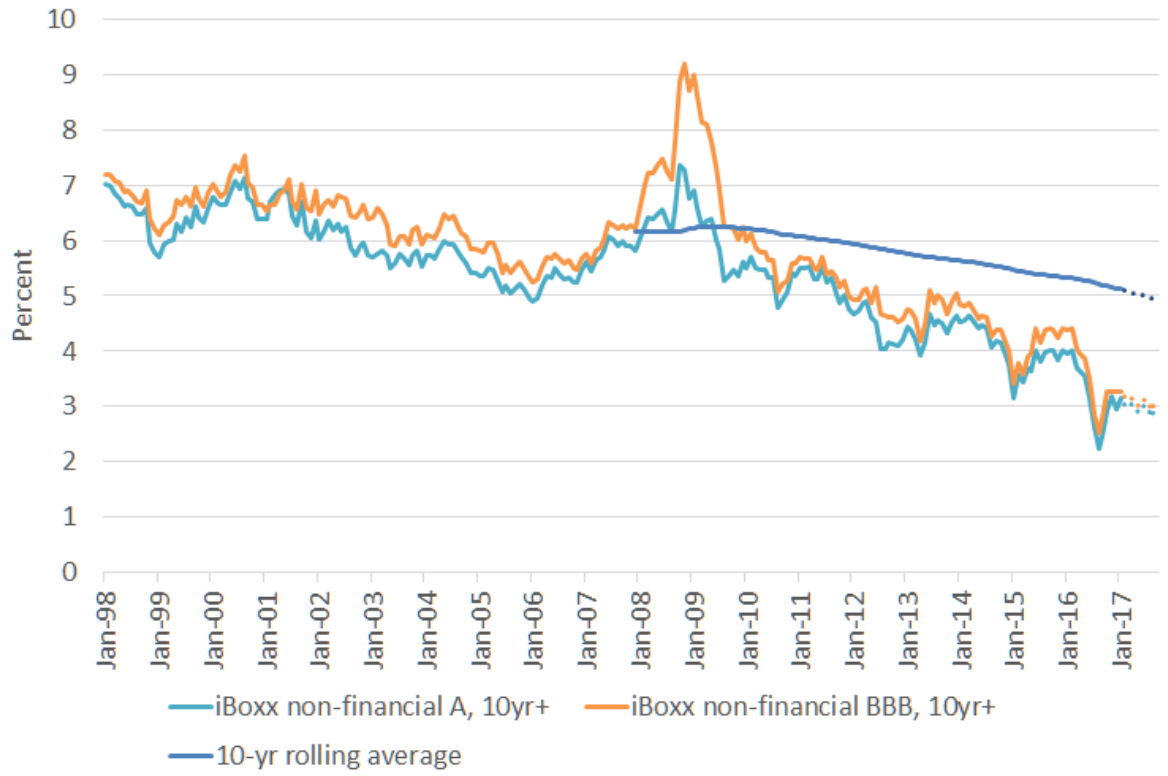
In PR14, Ofwat set a cost of embedded debt of 2.75% (real). This comprised Ofwat's estimate of embedded debt costs of 2.65%, with 0.1% allowed for issuance fees. Ofwat's point estimate was based on taking the top end of the range in the ten-year average of the iBoxx indices of A and BBB non-financial bonds of 10+ years (2.6% to 2.8%), and making a deduction of 0.15% for the sectors outperformance against these indices. Ofwat also made reference to the yields on water company debt, of around 2.2% in real terms.

In the following we look at the nominal yields of the iBoxx indices and the nominal cost of debt reported by the water companies.

A3.3.1 Market debt costs

The 10-year trailing average of the iBoxx benchmark yields (as shown in Figure 14) is just under 5%. This period includes the large increases seen, particularly in the BBB bonds, around the time of the financial crisis. Recent values in the indices are below the 10-year trailing average, meaning that the average has been reducing. If the indices maintain a similar level in the run up to the final decision for PR19, then the average will continue to reduce.

Figure 14 iBoxx benchmark yields and 10-year rolling average



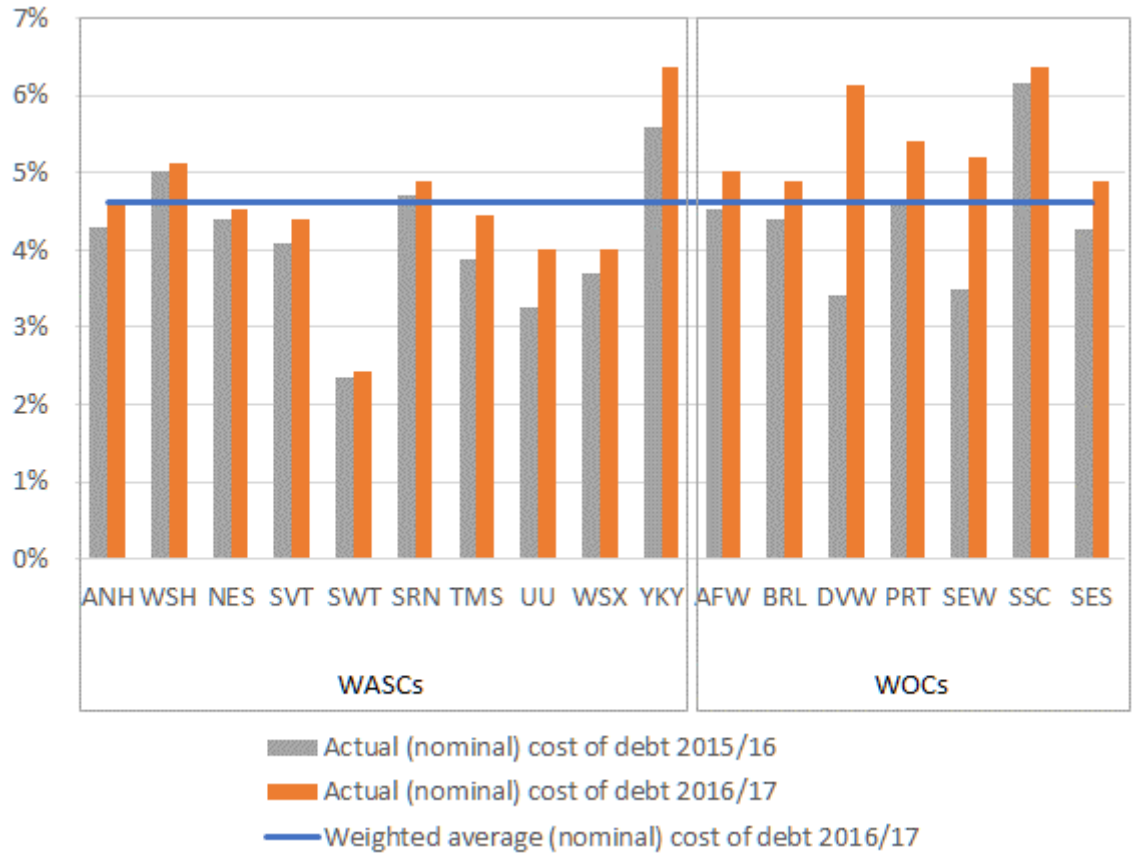
Source: iBoxx

A3.3.2 Water company debt costs

The weighted average of the nominal cost of debt reported in companies' Annual Performance Reports (APRs) across 2015/16 and 2016/17 is just under 4.4%, as shown in Figure 15. The weighted average across companies in 2015/16 was a little over 4.1% and in 2016/17 was 4.6%. The higher value in 2016/17 was largely the result of the higher inflation rate[37] in that year increasing the value of the principal on index-linked debt. This increase was more pronounced for WOCs as they held a higher proportion of index-linked debt than WASCs.

[37] The March to March change in RPI(CHAW) was 1.6% in 2015/16, compared to 3.1% in 2016/17.

Figure 15 Nominal cost of debt – 2015/16 and 2016/17



Source: Annual Performance Reports 2015/16 and 2016/17, PR14 Final Determination, ECA calculations

A3.3.3 Conclusion on the cost of embedded debt

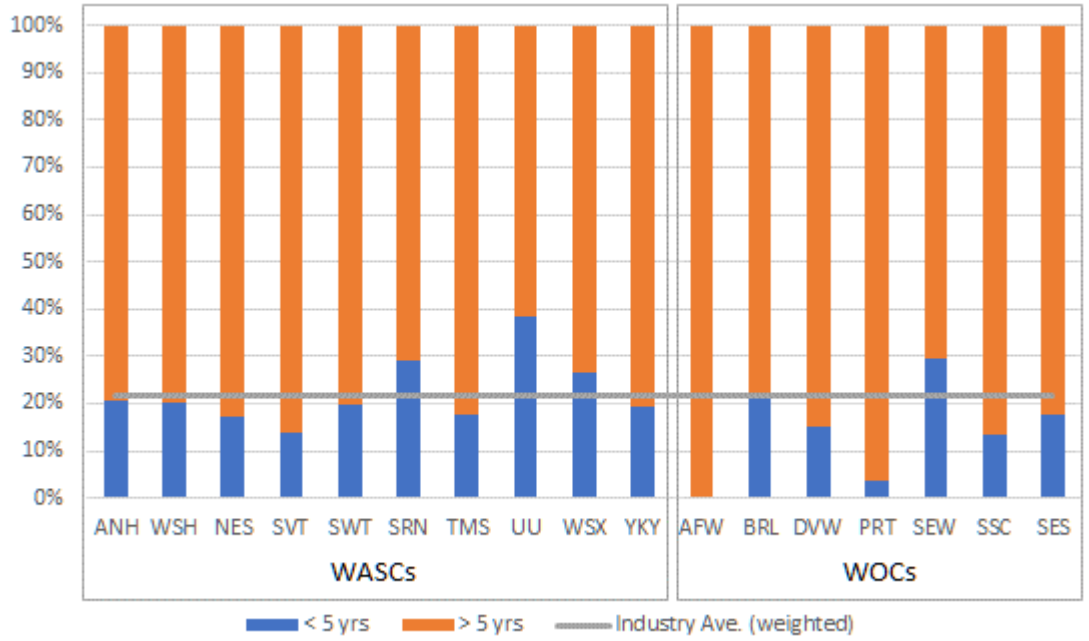
For the purposes of our WACC estimation, we propose using an embedded cost of debt in the range of 4.6% to 4.9% (nominal terms). The high-end of the range has been informed by the 10-year trailing average of the iBoxx benchmark yields (Figure 14), and the low-end by nominal debt costs reported in the latest APR (Figure 15).

A3.4 Weighting of new and embedded debt

At PR14, Ofwat set a weighting on embedded debt of 75% and on new debt of 25%. Ofwat set it at this level having considered companies proposals, which ranged from between 6% and 40% for the weighting on new debt, with an average of 28%.

For the purposes of our WACC estimate, we retain the assumption of a 25%:75% split between new debt and embedded debt. We note that, as at 2016/17, on average, around 22% of companies' debt is due to mature within 5 years (ie within the duration of a price control period) – see Figure 16.

Figure 16 Maturity of debt as at 2016/17



Source: Annual Performance Reports 2016/17

A3.5 Small Company Premium

For PR14, Ofwat determined there to be a Small Company Premium (SCP) of 0.25%, which was a reduction from the SCP of 0.4% set out in PR09. Ofwat came to its 0.25% estimate by comparing the cost of Artesian finance (monoline-insurer wrapped debt issuances used by a number of WOCs to access bond markets) issues for WOCs to the average iBoxx index, which found WOCs underperforming by 11 basis points, and adding this to WASC outperformance relative to iBoxx of 15 basis points, rounding to 25.

While Ofwat acknowledged that a SCP existed, it also ruled that companies had to demonstrate that this extra allowance was in customers' interests through a benefits test. The test had to demonstrate that the customer benefits from providing the uplift more than offset the incremental financing. Ofwat assessed customer benefits by estimating the value of smaller companies as a comparator (using an approach based on the Competition Commission's approach to the South Staffordshire Water and Cambridge Water merger), and considering companies' Service Incentive Mechanism (SIM) and Outcome Delivery Incentives (ODI).

Portsmouth Water and Bournemouth Water were the only WOCs to receive the SCP allowance for PR14. Ofwat accepted that other small WOCs - such as Bristol Water – had a higher cost of debt, but it deemed there was no robust evidence of an offsetting customer benefit.

Ofwat's customer benefits approach was criticised by the CMA, who were "unconvinced that there was a causal link between the cost of debt required to finance the companies, and

the benefits outlined by Ofwat".[38] The CMA contended that Ofwat's customer benefits test was too focused on the particular scenario of a merger, arguing that the actual results of any merger are highly uncertain. The CMA was not persuaded by an implicit Ofwat assumption that smaller companies should be expected to reduce their financing costs through merging if they do not pass Ofwat's customer benefits test.[39] The CMA also argued that not granting a SCP "ran contrary to the reasonable expectation of investors that they could, on average over time, recover the cost of efficiently incurred debt".[40]

In reviewing Bristol Water's PR14 appeal, the CMA conducted a similar analysis, comparing the difference between WOC and iBoxx to the difference between WASC and iBoxx, coming to a figure of 0.37%, rounding to 0.4%.[41]

For PR19, redoing the above analysis gradually comes into question given the Artesian Finance that many WOCs utilised occurred back in 2002 and its share of embedded debt is gradually declining. Since 2009, there have only been two public bond issues by WOCs (a £130m issue by South East in February 2010 and a £40m issue by Bristol Water in March 2011), which limits any potential analysis of the 'current state' of debt costs for small WOCs.

Alternatively, we can look at companies' incurred interest costs to try and determine the magnitude of the SCP for PR19.[42] For WASCs, the weighted-average of debt costs was 4.14% in 2015/16 and 4.57% in 2016/17. For WOCs, these figures were 4.23% and 5.22%.[43] This implies a SCP of 0.10% in 2015/16 and 0.65% in 2016/17, or an average of 0.37%.

While caution is appropriate given the paucity of recent evidence on small WOC borrowing costs, a SCP of 0.4% appears to still be appropriate for PR19.

[38] Competition and Markets Authority, 2015, 'Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991', Report, Presented to Ofwat 6 October 2015, paragraph 10.72, page 309.
[39] Ibid, pages 309-311.
[40] Competition and Markets Authority, 2015, 'Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991', Report, Presented to Ofwat 6 October 2015, paragraph 10.72, page 309.
[41] Competition and Markets Authority, 2015, 'Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991', Report, Presented to Ofwat 6 October 2015, paragraph 10.69, page 308. The difference compared to Ofwat's figure of 0.25% is largely due to adopting a lower notional WASC level of 2.5% rather than 2.65%.
[42] As ECA did in its WACC review for CCWater for PR14: Economic Consulting Associates, 2014, 'Ofwat PR14 review: Recommendations for the Weighted Average Cost of Capital 2015-20', submitted to the Consumer Council for Water, page 43. Available online here: https://www.ccwater.org.uk/wp-content/uploads/2014/07/ECA-CCWater-Cost-of-Capital-summary-report.pdf
[43] Weighted by average net debt across 2014/15 and 2015/16.

A4 Market risk premium

Our approach to estimating the cost of equity uses the CAPM, the formula for which is as follows:

$$R_E = R_f + \beta_E(R_M - R_f)$$

The market risk premium ($R_M - R_f$; MRP) is the difference between the total market return (R_M) and the risk-free rate (R_f), both of which may be observed in, or calculated from, market data.

In the report 'Refining the balance of incentives' prepared by PwC for Ofwat, published in June 2017, the consultants give significant attention to the calculation of the MRP. Reports published subsequently by consultants acting for water companies ('A review of Ofwat's proposed approach to total market returns' by KPMG, and 'The cost of equity at PR19' by Ernst & Young, both published in August 2017) give similar attention to this, in response to PwC's report. We consider the analysis presented in these reports in our analysis. However, we stress that we do not set out to provide a detailed critique of the reports in the way KPMG and EY have done, but to take the relevant parts of the discussion in the presentation of our own view.

In the remainder of this section, we discuss:

- the regulatory precedent for each of these components,
- our estimation of R_f, and
- our estimation of MRP.

The section concludes with a summary of the key variables.

A4.1 Regulatory precedent

Table 13 details UK regulatory decisions on R_f and MRP since 2013. Real values for R_f have ranged between 0.50% and 1.75%, and values for MRP have ranged between 4.80% and 5.77%. The R_M values have a tighter range of 6.10% to 6.75%. We discuss further in Section A4.3.2 the observation of stability in the MRP and R_M.

Whilst not yet determined (and therefore not reported in the below table), we also note Ofcom's preliminary conclusion for a R_M of 6% (with a R_f of 0.5% and MRP of 5.5%),[44] slightly below the range of regulatory precedent below.

[44] https://www.ofcom.org.uk/__data/assets/pdf_file/0035/99638/Annexes1-19.pdf

Table 13 UK regulatory precedents on total market returns since 2013 (real terms)

Date	Regulator	Sector	Risk-free rate	Market Risk Premium	Total Market Return
October 2013	ORR	Rail network	1.75%	5.00%	6.75%
February 2014	CAA	Airports (Heathrow)	0.50%	5.75%	6.25%
February 2014	CAA	Airports (Gatwick)	0.50%	5.77%	6.27%
February 2014	CAA	Air traffic control	0.75%	5.50%	6.25%
March 2014	CC	NI electricity	1.50%	5.00%	6.50%
June 2014	Ofcom	Telecoms (Openreach)	1.30%	4.80%	6.20%
June 2014	Ofcom	Telecoms (Rest of BT)	1.30%	4.80%	6.20%
November 2014	Ofgem	Electricity distribution (slow-track)	1.50%	5.00%	6.50%
December 2014	Ofwat	Water & sewerage	1.25%	5.50%	6.75%
December 2014	UR	Water & sewerage	1.50%	5.00%	6.50%
February 2015	Ofcom	Telecoms	1.00%	5.10%	6.10%
October 2015	CMA	Water (Bristol Water)	1.25%	5.25%	6.50%
April 2016	Ofcom	Telecoms (Openreach)	1.00%	5.10%	6.10%
April 2016	Ofcom	Telecoms (Other UK telecoms)	1.00%	5.10%	6.10%
September 2016	UR	Gas	1.25%	5.25%	6.50%
June 2017	UR	NI electricity	1.25%	5.25%	6.50%

Source: UKRN, 'Cost of Capital – Annual Update Report', 31 May 2017, Section 3; UR 'Price Control for Northern Ireland's Gas Distribution Networks GD17: Final determination', 15 September 2016. Northern Ireland Electricity Networks Ltd, 'Transmission & Distribution 6th Price Control (RP6): Final determination', 30 June 2017.

A4.1.1 Ofwat PR14 and CMA Bristol Water 2015 risk-free rate and market risk premium assumptions

In PR14, Ofwat set a real R_f of 1.25% and a MRP of 5.50%. R_f was estimated to be in the range of 0.75% to 1.25% adjusting current yields to forward-looking expectations, coming to a point estimate of 1.25%.[45]

In arriving at an estimate for MRP, Ofwat reviewed a range of evidence and regulatory precedents on the real R_M. The water companies submitted an average of 7.0%, which was in line with historical estimates. Ofwat brought up three arguments for reducing R_M:

- Historically achieved equity returns may have been caused by factors which are unlikely to be repeated.
- A combination of monetary policy and investor appetites have reduced government and corporate bond yields, suppressing returns across most asset classes. This environment is receding, but forward rates do not suggest a quick return to the pre-financial crisis environment
- The increase in the RPI formula will increase nominal returns on RPI-linked assets, meaning a higher RPI assumption will be used, so a lower real equity return is required to achieve a given nominal return

Ofwat settled on a range of 6.25% to 6.75%, with a point estimate of 6.75%.[46] Combined with the R_f point estimate of 1.25%, this implies a MRP of 5.50%.

In its review of the Bristol Water dispute, the CMA considered the 1.25% R_f to still be appropriate, citing unchanged market conditions.[47] The CMA considered NIE's 2014 point estimate of R_M of 6.50% to be an appropriate and up-to-date estimate. Combined with the R_f of 1.25%, this implies a MRP of 5.25%.

A4.2 Risk-free rate

The risk-free rate (R_f) is the return an investor would expect to receive from an investment with zero risk (over a given period). It is typically proxied by the yield on a government-backed security. Figure 13 on p34 presents the historical trend in nominal interest rates, including a UK Government-backed 10-year security with zero coupon. The trend is generally downwards, to a current (nominal) level around 1.3%. Given prevailing inflation rates this implies current (real) yields are negative. As we are seeking to estimate a risk-free rate that is applicable over the period of the price control, we consider whether current circumstances (and levels) will change.

[45] Ofwat, 2014, 'Setting price controls for 2015-20 – risk and reward guidance', January, page 15.
[46] Ofwat, 2014, 'Setting price controls for 2015-20 – risk and reward guidance', January, pages 12-14.
[47] Competition and Markets Authority, 2015, 'Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991', Report, Presented to Ofwat 6 October 2015, paragraph 10.72, pages 329-330.

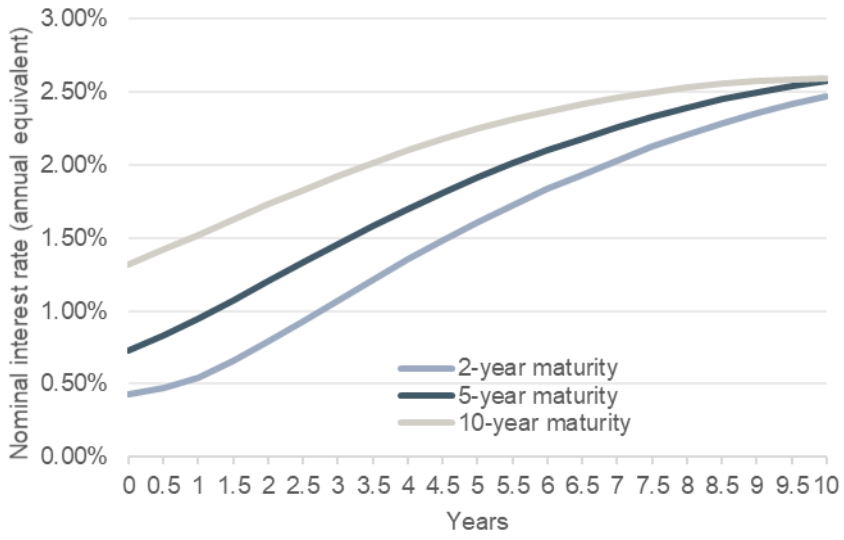
In their report for Ofwat (published in June 2017), PwC presents an argument that interest rates are in a 'lower for longer' period. This suggests that we shouldn't expect to see a major upward shift in rates soon, but a more sustained period of rates at close to current levels.

Somewhat contrary to PwC's expectation, perhaps given the time that has passed since June 2017, and the market evidence of inflation that is higher than expected, on 2 November 2017, the Bank of England increased its Bank Rate from 0.25% to 0.50%. In their announcement accompanying the increase, they note the higher than expected inflation, largely because of the impact on the Sterling exchange rate that followed the decision to leave the European Union, and higher energy prices. The statement goes on to say:

> *On balance, inflation is expected to fall back over the next year and, conditioned on the gently rising path of Bank Rate implied by current market yields, to approach the 2% target by the end of the forecast period.*

Therefore, we expect a continued increase in interest rates, although not at a sharp rate. Forward-looking analysis presents anticipated increases in nominal yields with maturities up to 10 years (based on UK Government gilts), as shown in Figure 17.

Figure 17 Nominal forward yield curve for UK Government gilts



Source: Bank of England, ECA analysis

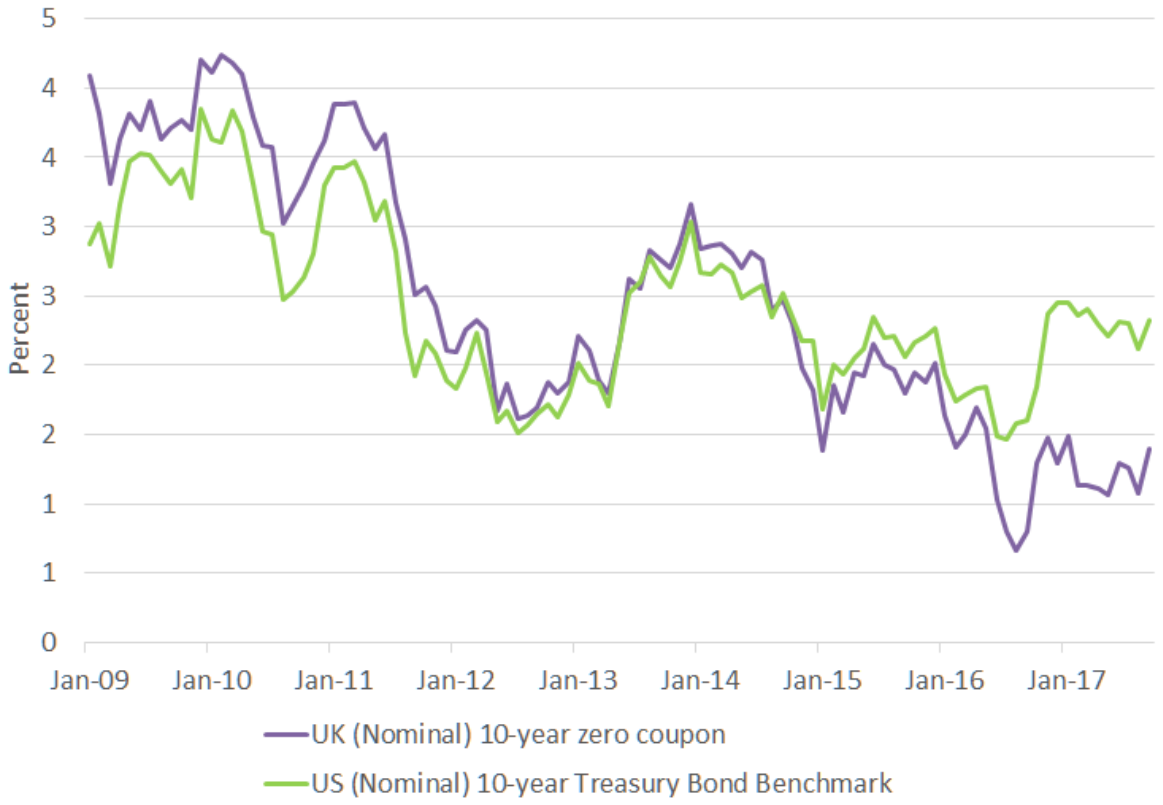
The data in Figure 17 suggest an increase of nominal rates to around 0.75-1.75% by the start of the next AMP, with increases continuing almost throughout the entire period, to a peak of 2.0-2.5% by the end of the period.

In addition to the Bank of England's forecasts, we note the October 2017 report from the EY ITEM Club also forecasts interest rates rising to approximately 2.25% by the middle of the period.

As noted in the Bank of England's statement, inflation has been higher than expected, in large part because of the depreciation in sterling following the Brexit referendum. KPMG notes that this period has also been accompanied by expansionary monetary policy. The Bank of England anticipates inflation to reduce from this unusually high level, as interest rates increase and its monetary policy contracts.

KPMG also references the International Fisher Effect (which says that real rates of interest should be identical across countries where free movement of capital exists). Figure 18 presents the historical trend in both countries' interest rates over the last nine years. At least visually, there is a correlation between the rates up until the middle of 2016 (coinciding with the decision to leave the European Union). Thereafter, rates have diverged and been around 100 basis points apart. US real rates remain around 0.5% (10-years) to 0.85% (30 years), and we would anticipate UK rates returning to this level as the UK's unusual market conditions unwind.

Figure 18 Nominal yields on UK and US nominal government bonds



Source: Bank of England

The recent interest rate increase, and signs from the Bank of England of further rate increases and contracting monetary policy, signal that by the time the next AMP starts, real interest rates will be higher than they are today. In addition, current unusual market conditions, particularly quantitative easing and a possible flight to safer assets, deflating prices, and evidenced by the distortion from the International Fisher Effect, suggest that the current low rates may be temporary. By considering the observed forward nominal rates and an adjustment by our anticipated level of (RPI) inflation of 3.0% over the period, and considering the unusual market conditions, **we estimate a forecast R_f of 0.0-1.0%**. This range of 1% on the Rf is greater than the range on the other components in our estimate, reflecting the challenge in estimating a Rf in current circumstances.

A4.3 Total market returns

A4.3.1 Ofwat consultation and alternative approaches

As noted in the introduction to this section, the determination of a value for the total market return (R_M) has already led to robust discussion in reports by consultants representing Ofwat and a selection of the water companies. We do not intend to recreate the debate here, but identify some of the salient points that are relevant for our estimation of MRP.

As already noted, in their report for Ofwat, PwC presents an argument that anticipated returns for equity investors are in a 'lower for longer' environment. That is, relatively high historical returns should not necessarily be the best guide for future returns, which may be expected to remain low for the near future. To support this, they present the views of a range of market analysts, giving an argument that investors do not anticipate returns in the next five years to be at levels seen over the last 30-40 years. They therefore focus on future returns as the best estimate for determining R_M, using a range of approaches to estimate this:

- The dividend discount model (DDM)
- Inferred cost of equity from water company premia to RCV in transactions and in the market value of equity
- Additional transaction data, eg Thames Tideway Tunnel
- Survey data
- Multiple of corporate bond spreads

PwC dismisses the fifth approach, and so we haven't considered this. KPMG and EY provide robust criticism of the four other approaches, identifying the sensitivity of the DDM to changes in assumptions on growth (first approach), of the weakness of using data specific to the water sector to represent the whole market (in the second and third approaches), and of the uncertainty of the survey data around the exact nature of questions used (fourth approach). These arguments are consistent to us, suggesting a lack of robustness in the forward-looking approaches to give reliable estimates of future market returns, and we therefore rely primarily on the evidence provided by historical market returns. However, we remain sensitive to the views of market analysts presented by PwC that future returns may not necessarily persist at levels seen historically, at least in the next five years.

The consideration of historical data requires methodological assumptions:

- That only one or other of the R_M or MRP is constant over time, and can therefore be adopted in our calculation.
- A clear methodology for measuring returns, including the period of price information, and the calculation approach.

We discuss each of these considerations in the following sections.

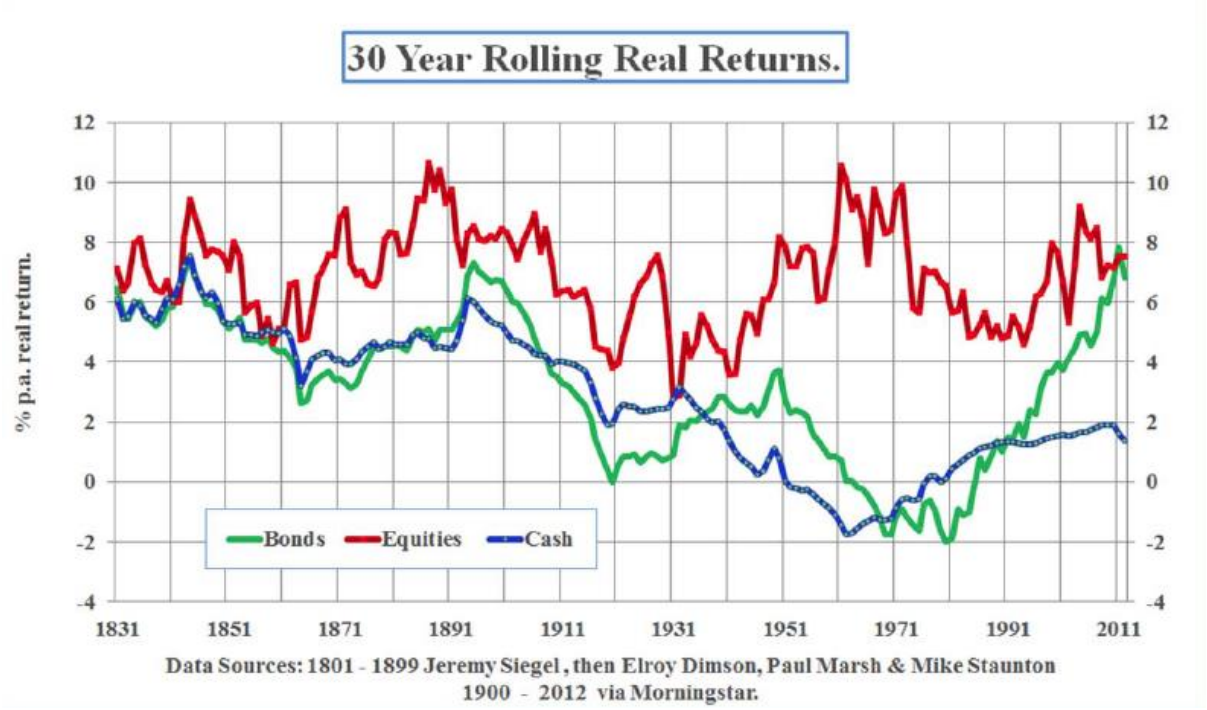
A4.3.2 Constant MRP v constant equity return

We know that R_f changes over time, so if MRP is relatively stable, then R_M will also change, in line with shifts in R_f. However, if R_M is relatively stable, then MRP will change.

- Some academics consider the **R_M is constant** and MRP is inversely correlated with the R_f
- Others argue that the **MRP is constant** and so R_M is positively correlated with R_f

We cite evidence to support our view that R_M is constant. Firstly, Figure 19 provides historical evidence of returns on cash, bonds, and equities from US data[48] going back to 1831.

Figure 19 Returns on cash, bonds, and equities from US data



Source: Smithers & Co Ltd

These data allow us to make a visual comparison between the total returns to equity investors (R_M; in green), and MRP (represented by the gap between the green and red lines). Such a comparison suggests that the absolute level of R_M is more stable than the gap between the equity and bond lines.

Secondly, in a 2012 paper[49], Professor Stephen Wright makes a supporting observation:

> *the key point is that, while the historic real market return on equity has been stable in most major markets (providing indirect evidence that the expected return has been stable), this has not been the case for the risk-free rate, which has had no obviously stable historic mean. Since*

[48] We see no compelling reason to suggest that UK data is distinctly different from US data

[49] 'Review of Risk Free Rate and Cost of Equity Estimates: A Comparison of UK Approaches with the AER', Stephen Wright (2012)

> *the MRP is the difference between the (stable-mean) market return and the (no-stable-mean) risk-free rate, the MRP in turn does not have a stable historic mean.*

Thirdly, in a 2014 blog[50], Andrew Smithers cites a range of evidence to support the notion that there is no correlation between the returns to equity and cash/bonds, neither in historical data nor in realised forecasts of returns (measured as the lack of a stable relationship between expected bond returns and a rationally expected return from equities). He concludes:

> *It is therefore clear that the evidence is overwhelmingly against the ERP being stable, either when bond yields are measured by their historic out-turns or in terms of rationally expected returns.*
>
> *The absence of a stable relationship between real bond and equity yields does not mean that there is no relationship at all. But, if there is one, its exponents are yet, as far as I am aware, to set out what it is in a way that can be tested and be shown to be robust when tested.*

Finally, the regulatory precedents cited in Table 13 in Section A4.1 have a narrower range of estimates for R_M than for MRP. Values for MRP have ranged between 4.80% and 5.77% (a range of nearly 1%). The resulting assumed R_M estimates have a tighter range of 6.10% to 6.75% (0.65%).

These four pieces of evidence suggest that R_M is more stable, and we calculate our MRP on this basis.

A4.3.3 Time period for measuring

Our consideration of the time period for measuring R_M involves a trade-off between the strengths and weaknesses of long-term and short-term data. These trade-offs are presented in Table 14.

Table 14 Comparison of approaches for measuring the equity market risk premium

	Longer-term returns	Shorter-term returns
✓	❑ Reduces the impact of extreme events, eg 1929 Great Depression, 2008 Global Financial Crisis	❑ Captures market information more akin to the current market, and more in line with short-term investor preferences
✘	❑ Assumes markets (and R_M) are comparable over time, but which markets?[51]	❑ May be overly influenced by a lot of noise, including financial crises and market corrections

Source: ECA

[50] 'The problem of the equity risk premium', Andrew Smithers, Financial Times https://www.ft.com/content/15a56d48-dd8e-3497-8070-37cd398b9839, downloaded on 1/11/2017.

[51] Evidence presented by Dimson, Marsh, and Staunton in 'Triumph of the Optimists' (December 2002) and the FTSE All-World Index Series highlights major shifts in the make-up of global and national equity markets. At the global level, the contribution of US and UK equity markets have changed from 15% and 25%, respectively, in 1899, to 53% and 6%, respectively, in 2016. In the UK, shares in rail companies made up close to 50% of all equity in 1900, and now don't feature on a market break-down.

From the arguments provided above, we prefer to base our analysis on longer-term returns with more market data; we would assume, *a priori*, that investors in water companies are seeking steady returns over a long-term.

A4.3.4 Historical evidence

Table 15 presents a summary of real returns to equity investors from 1900-2016 from the UK and markets, and from the world both excluding and including the US.

Table 15 Long-run real total equity returns (1900-2016)

	Geometric mean (%)	Arithmetic mean (%)	Standard error (%)
UK	5.5	7.3	1.8
US	6.4	8.4	1.9
World (ex-US)	4.3	6.0	1.7
World	5.1	6.5	1.6

Source: Dimson, Marsh, and Staunton, cited in the Credit Suisse Yearbook

We can look further into the returns over different periods, for different asset classes, as presented in Table 16.

Table 16 Annualised real returns to different UK assets over different return periods

	Equities	Bonds	Bills
2000-2016	2.4	4.6	0.7
1967-2016	6.9	3.8	1.7
1900-2016	5.5	1.8	1.0

Source: Dimson, Marsh, and Staunton, cited in the Credit Suisse Yearbook

These data[52] show the importance of the choice of return period in determining a market return, as indicated by the variability in approaches to returns. Of interest is the higher return for bonds (4.6%) over equities (2.4%) in the 2000-2016 period, which we would assume, *a priori*, to be the opposite way around. This piece of evidence supports our approach to using a longer return period as the basis for our calculation of R_M.

To identify an appropriate estimation of R_M, we need to understand whether we should use the geometric or arithmetic mean return. Box 1 provides a definition of each, and rationale for using each.

Box 1 Arithmetic v geometric averages

Equity returns are typically calculated in one of two ways: arithmetic or geometric.

Arithmetic returns assume no correlation between returns, which is what a perfectly efficient market would suggest. Without correlation, it is possible to average the returns for a range of periods. For example, if consecutive years have returns of 10%, 8%, 5%, 6%,

[52] These returns are geometric averages

and 4%, the arithmetic average will simply calculate an average of the five returns, which is 5.2%.

Geometric returns reflect an annual equivalent return from the 'opening price' to the 'closing price', without consideration of the movements in between. From our same series of returns, the geometric average is 5.1%. Rather than demonstrating convincing evidence of being perfectly efficient, markets show evidence of mean reversion (and correlation between returns), which would favour using a geometric average.

Source: ECA

We consider the arguments for both approaches to be valid (that markets exhibit both a degree of efficiency without correlation between returns, and a degree of mean reversion), which suggests that the appropriate measure for the real historical R_M is between 5.5% and 7.3%. We narrow this range by also considering the regulatory precedents of a range of estimates for R_M of 6.00% to 6.75%.

Considering both the long-run historical evidence, and regulatory precedents, to estimating a historical R_M, and the views of future returns being 'lower for longer', **we have adopted a range for the real R_M of 6.00-6.50%**.

A4.4 Conclusions

In this section, we have presented evidence and discussion of alternative approaches to calculating the MRP, following an approach of determining R_f, R_M, and thereby allowing calculation of the MRP.

- In our estimate of the **R_f**, we consider the Bank of England forward curve for UK Government gilts. We also consider the unusual market conditions which have contributed to unusually low interest rates and high inflation, and a diversion of the correlation with US risk-free rates, which are not anticipated to continue through the next AMP. From this evidence, we adopt an assumed **real R_f rate of 0.0-1.0%**.

- We have reviewed the **forward-looking approach to estimating R_M** proposed by PwC in their advice to Ofwat, and the critiques of this by KPMG and EY on behalf of water companies. We acknowledge the views of market analysts that we may be in a 'lower for longer' returns environment. However, we do not feel there is sufficient robustness in the analytical approaches to calculating a forward-looking R_M to justify its use as the primary measure of R_M.

- Our estimate of the historical approach to R_M looks at long-term (116 years) equity returns in the UK market. We have combined this calculation, comprising a combination of geometric and arithmetic returns, and regulatory precedent, with an acknowledgment of market analysts' views of a 'lower for longer' returns environment, giving an estimated range for a **real R_M of 6.00-6.50%**.

Our estimate of the MRP is therefore a difference between R_f and R_M: **5.50-6.00%.**

A5 Beta

The presence of a beta factor, and thus a risk premium in the cost of equity, is due to the presence of different exposure to risk for different types of companies/sectors within the market. Returns to investors are uncertain. Some of those uncertainties will vary with uncertainties present in the generality of investments in the public equity market, and financial theory says it is such covariance that leads shareholders to require a risk premium in expected returns to make an investment worthwhile. Estimating a beta for the water sector requires consideration of how much covariant uncertainty (often called systematic or non-diversifiable risk) exists in a water business.

In section A2.2, we have provided evidence of returns to bidders from transactions of water companies (transaction value premia over asset values), which may in part be explained by purchasers' anticipation of future outperformance[53]. In section A2.3, we have provided evidence of returns to holders of shares in listed water companies that have exceeded market returns (if holding from 2014 – 2016), and exceeded returns to the return on equity allowed by Ofwat in PR14.

In this Annex, we consider evidence as to the beta to use in the cost of equity for water companies from regulatory precedents and from our estimates of equity betas for the listed water companies. First, however, we explain the difference between equity and asset betas.

Equity and asset betas

The equity beta of a listed firm can be measured as the covariance between the firm's share price and the equity market as a whole. However, many regulated companies are not listed, and their equity betas cannot be directly estimated. It is for this reason that regulators will often set the beta for unlisted regulated companies informed by the betas of comparable companies that are listed.

In making this comparison, regulators typically adjust the equity beta to take account of different levels of gearing between the listed and unlisted firms. This is because higher gearing results in a higher equity beta. To adjust for differences in gearing regulators use the equity beta and gearing of the listed company to calculate an 'asset' beta, which is a construct intended to measure beta assuming no debt (deleveraging). This asset beta is then leveraged used the gearing level of the unlisted firm. An asset beta cannot be observed, and therefore must be derived from observed equity betas.

[53] In their report, ('A review of Ofwat's proposed approach to total market returns', KPMG note that this premium may, at least in part, be driven by growth in the RCV, and non-regulated activity profits. We do not believe that growth in the RCV can be value accretive to shareholders, unless there is a positive revaluation of existing assets. Returns from inflation adjustments are not retained by shareholders. Growth in the RCV resulting from the purchase of new assets requires either new capital or a draw-down of existing cash reserves. New capital will dilute existing shareholders' ownership share while keeping their own investment value constant. Drawing down existing cash reserves has no impact on shareholder value. Non-regulated activity profits may create an additional premium, but tend to be a small component of profitability for companies, and therefore are not anticipated to be a sufficient explanation for premia as large as those observed.

The correct formula for leveraging and deleveraging betas is below. Typically, the tax term is omitted and, often, the debt beta is assumed to be zero (a reasonable assumption for investment grade debt, but less realistic otherwise).

$$\beta_E = \beta_A + (\beta_A - \beta_D) \times (1 - t) \times \frac{D}{E}$$

β	Beta
A	Asset
E	Equity
D	Debt
t	Rate of corporate tax applicable to tax shelter on interest costs

We see little merit in calculating an asset beta for water companies. While the gearing levels of the listed water companies (using company enterprise values as the denominator) are typically lower than Ofwat's allowed notional gearing level for the sector, and the level of gearing we propose to use in determining the WACC (see Annex A6), the variance is not large. To de-lever the calculated equity betas using actual gearing (to enterprise value) and then apply a slightly higher gearing level (to RCV) to convert back to an equity beta will arrive at a similar starting point, regardless of the assumptions on tax and debt (which will be constant across firms).

A5.1 Regulatory precedent

At PR14, Ofwat set an asset beta of 0.3, equating to an equity beta of 0.8.[54] Ofwat's choice was informed by having observed a range for asset betas of water companies of 0.2 to 0.3 since the turn of the millennium and the beta of other regulated UK network in the range 0.27 to 0.46.

Alongside their PR19 methodology consultation, Ofwat published a report it had commissioned from PwC that included beta estimates, using data to end-2016. PwC found that asset betas had increased since PR14, but that "*it may be too soon into AMP6 to propose an adjustment to the 0.3 assumed industry asset beta.*"[55] For the purposes of their analysis, PWC retained an asset beta of 0.3 and equity beta of 0.8 for its indicative cost of equity calculations.

Recent regulatory precedent for the betas of water and energy distribution networks on betas is shown in Table 17.

[54] At the efficient notional gearing of 62.5% and assuming no debt beta.
[55] Pg 95, *Refining the balance of incentives for PR19*, June 2017.

Table 17 Regulatory precedent on beta

Regulator	Sector / company	Year	Gearing	Asset beta	Equity beta	Debt beta
UR	NIE	2017	45%	**0.38**	**0.61**	0.1
CMA	Bristol Water	2015	62.5%	**0.32**	**0.85**	0
Ofgem	Electricity distribution (slow track)	2014	65%	**0.38**	**0.90**	0.1
Ofwat	Water	2014	62.5%	**0.30**	**0.80**	0
Ofgem	Gas distribution	2012	65%		**0.90**	

Source: Various

In their Bristol Water decision, the CMA used a variety of sampling frequencies and periods to come up with a range for the asset beta and noted that half of observations were in the narrow range of 0.27 to 0.3. For their estimate of Bristol Water's asset beta, CMA uplifted this beta range by 13%, to give a range of 0.3 to 0.34, with a mid-point of 0.32. CMA's uplift (which it had applied in its previous investigation into Bristol Water) was based on Bristol Water's operational gearing relative to that of the WASCs.

A5.2 Our estimates of beta

There is no single approach to calculate an equity beta from market data. As the calculation is based on the covariance of returns over a given period, we can change our calculation by changing any one of three variables:

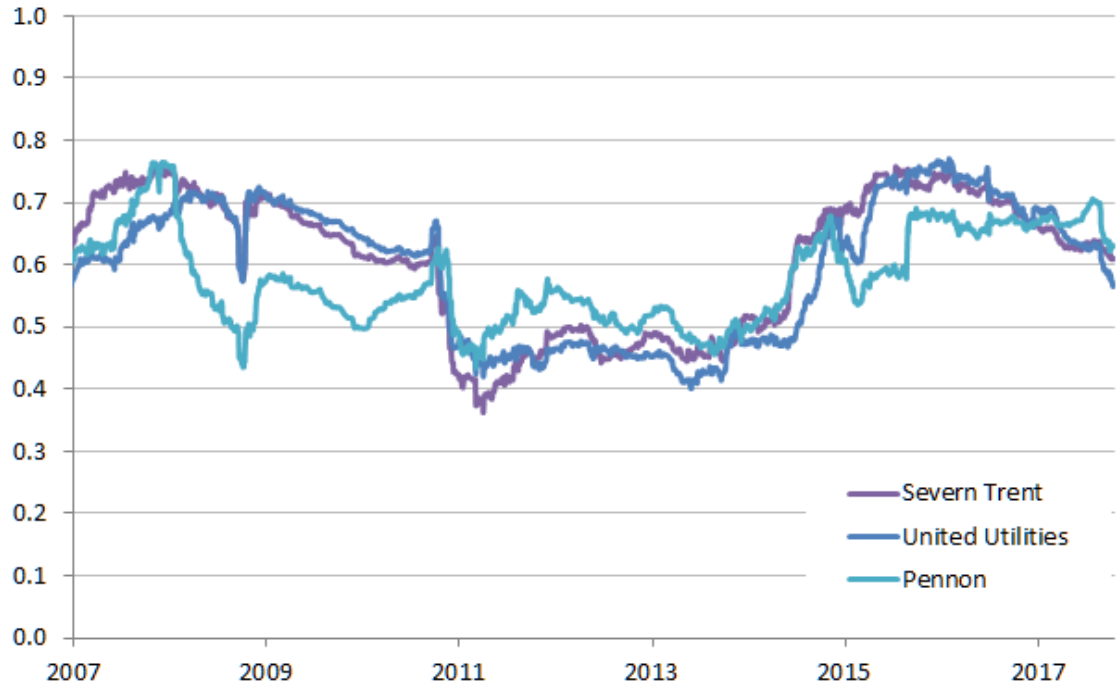
- The length of the measurement period, eg. returns over a 2-year, 5-year, 10-year period,
- The length of the return period, eg. daily, weekly, monthly returns, or
- The starting date for each measurement of a return, eg. if monthly returns, by, say, measuring on the 1st, 10th, or 20th of each month.

An equity beta can be calculated as a trailing average, where the measurement period shifts over time, giving different estimates along a timeline. Alternatively, it can be measured as a single point estimate over a longer period.

Each approach is consistent with the academic theory for measuring an equity beta. Given the potential for variability in the equity betas derived through the different approaches, we have used multiple simulations, varying each of the variables and approaches, to give a wider range of estimates. From these, we generate a wider perspective of where a 'true' equity beta may lie.

Our first approach to estimating the 'true' equity beta uses returns measured daily, with a return period of two years, and a return period window that shifts over time. This generates a trailing average of equity beta estimates, as presented in Figure 20.

Figure 20 Daily equity beta with 2-year trailing data



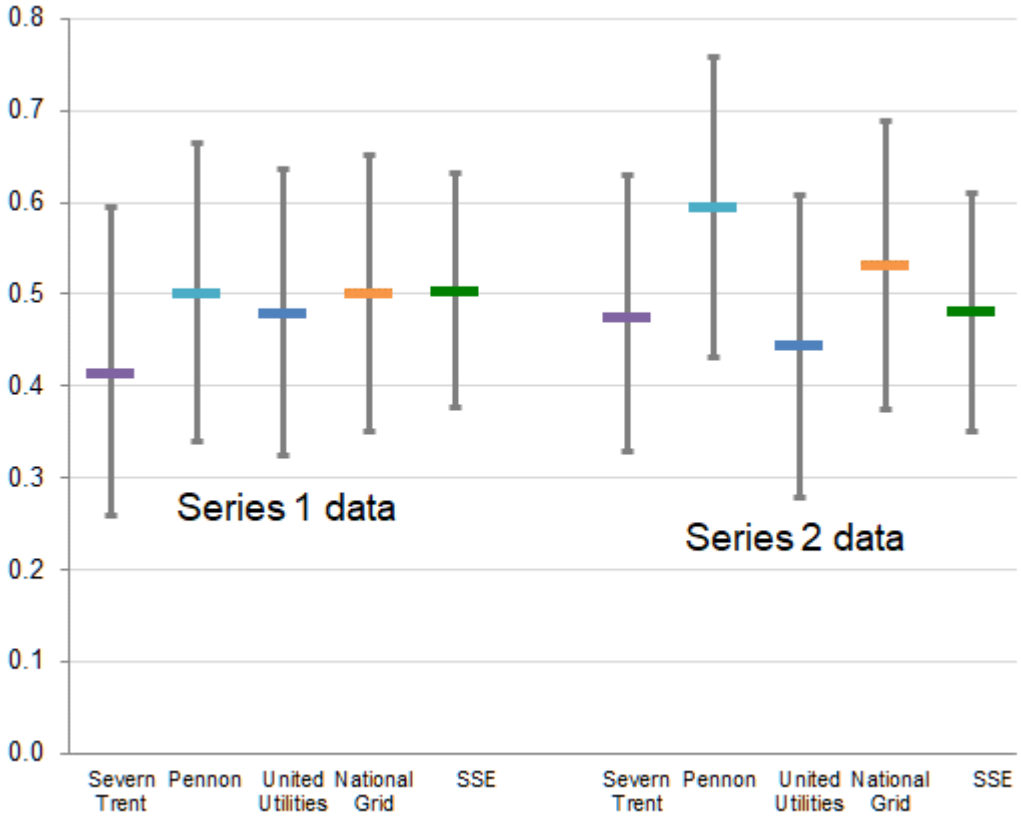
Source: Yahoo Finance, ECA calculations

These data show there is a relatively wide range of possible 'true' values for beta, depending on when it is measured. It also suggests that trends may be observed in historic values for the equity beta, which could be extrapolated forward to determine a future 'true' equity beta. We see no compelling reason that a 'true' equity beta should be as volatile as the data suggest (noting United Utilities equity beta increasing from 0.4 to 0.75 over three years). We also see difficulties in giving predictions of how the equity beta will move over a forecast period. However, the data are useful in giving different estimates of where the 'true' equity beta will sit.

In addition to the difficulties of using a trailing average approach, we have difficulties with using daily price returns. We suggest that water companies are largely insulated against market shocks owing to the protection provided by regulation. However, investors can make quick decisions on the announcement of market news, before correcting for this insulation effect. Therefore, measuring returns over a period longer than one day should provide a more robust view of investor expectations.

Following these arguments against relying on trailing averages and daily returns, we have made further estimations of the 'true' equity beta using longer return periods, measured over 14 years, to give single point estimates of the 'true' equity beta. Our first analysis, presented in Figure 21, shows beta estimates and 95% confidence intervals for the three large listed water companies, plus those for National Grid and SSE. The analysis uses 4-weekly return periods, with 14 years of return data (184 observations of returns). The difference between the two series is simply that the measurements of returns are made two weeks apart. That is, the first series measures its first return from day 1 to day 29 of our price series (and every four weeks thereafter), whereas the second series measures its first return from day 15 to day 43.

Figure 21 Comparison of two 4-weekly equity betas with 14 years of data



Source: Yahoo Finance and ECA analysis

These data show the variability that may be observed from the same data set, and therefore the importance of not relying on a single approach for estimating the 'true' equity beta. We highlight here the large differences between estimates for Severn Trent and Pennon. A reason for these differences may be that one series of returns has captured some unusual event(s) that caused a short-term price shock that is then unwound before the next price point in the other series.

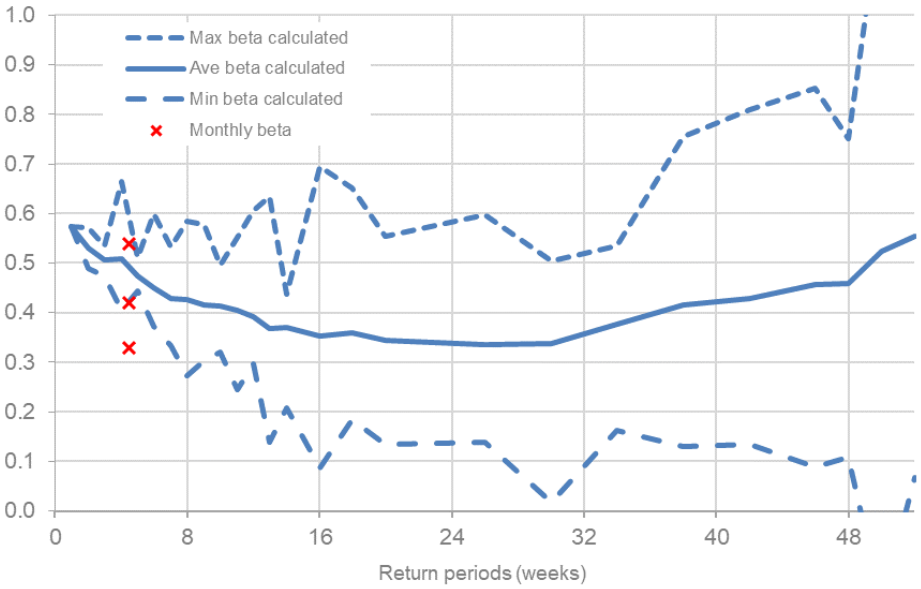
To increase the robustness of our estimations, we have developed multiple simulations of our estimates of the 'true' equity beta, using price data for the three large listed water companies[56]. These estimates are presented in Figure 22, with the average, maximum and minimum of the set of beta estimates for each of the three companies, calculated at different starting points. All calculations in this analysis use 14 years of data to derive single point estimates of the equity beta (not a trailing average). We measured returns across those 14 years over increasingly large periods, from 1 week returns to 52 week returns, and included monthly returns. That is, the 4-weekly betas are calculated from four different series of returns, each measured over a 4-week period but starting at weeks 0, 1, 2 and 3 in our series[57]. Correspondingly, the 5-weekly beta is measured in five separate 5-weekly return periods starting at weeks 0, 1, 2, 3 and 4, up until the 48-weekly beta with 48 different

[56] We removed Dee Valley from our analysis owing to its thing trading, price spike during its takeover offer period, and its eventual delisting

[57] Including a series starting at the 4th week will be identical to starting in Week 0, except that it won't include the first data point.

starting points[58]. We calculate the average of all the companies' betas for each starting point, giving a series of beta estimates for each return period.

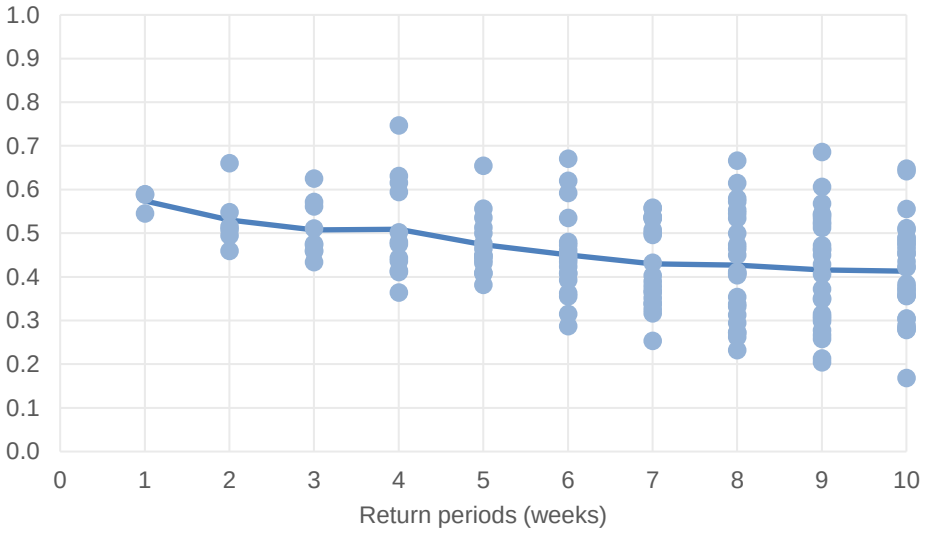
Figure 22 Sector equity betas with variable return periods and 14 years of data



Source: Yahoo Finance and ECA analysis

Figure 23 presents the spread of the various beta estimates from the analysis in Figure 22, only for return periods up to 10 weeks.

Figure 23 Spread of equity beta estimates



Source: Yahoo Finance and ECA analysis

We make a few observations from these data:

[58] One exception to this was for monthly returns, where our estimates were based on 31 simulations, measuring returns from every day of the month.

- Beta estimates become more volatile with longer return periods (as shown by the increasing gap between the dotted maximum and minimum lines).
- Taking a single approach to estimating a true equity beta may draw from the extremities of a plausible range of estimated values.

We assume that market information should be reflected in share prices within a month, and therefore the estimates at the left-hand end of the chart should be the most reliable.

A5.3 Conclusions

The data presented in this section provide estimates of the 'true' equity beta for water companies. From these analyses, we provide the following conclusions:

- The calculation for estimating beta accommodates a range of methodologies, varying key inputs.
- Different approaches to estimating beta can provide different estimates.
- We have presented multiple simulations of beta calculations to accommodate the various methodological approaches.
- We feel there is compelling evidence that the 'true' equity beta lies in the range 0.5-0.6.

A6 Gearing

A6.1 Notional gearing

Ofwat, in common with most other regulators, uses a notional capital structure in determining the allowed WACC; that is, Ofwat assumes a level of gearing, based on an assessment of an efficient level, that is common across companies, rather than using companies' actual levels of gearing.

Notional gearing tends to be preferred by regulators because it leaves the risk of managing a regulated company's finances with the company's management and not with consumers (as is this case under an actual gearing approach). Companies' managements are best placed to manage financing risks (e.g. timing, type of debt, maturity of debt, etc.), rather than the regulator. When a regulator uses notional gearing, based on an assessment of an efficient level, customers only bear the cost of a notionally efficient company; they do not bear the costs of inefficient financing structures. A notional approach will also provide a stronger incentive for the regulated company to seek to outperform, as it allows the company to retain the benefits from securing a lower cost of debt, which can be passed through to shareholders, via increased dividends, in the short term and to consumers at subsequent price controls.

Ofwat has set steadily increasing level of notional gearing across its price controls, as follows:

- 50% from 1996 to 2005
- 55% from 2006 to 2010
- 57.5% from 2011 to 2015
- 62.5% from 2016 to 2020.

This increase in notional gearing has followed the upward trend in companies' actual gearing. In 1997, companies average gearing was just 32%, substantially below Ofwat's assumed level of gearing of 50%. In the subsequent years, actual gearing increased, with average actual gearing exceeding notional gearing around 2004.

There is a common but simplistic analysis that debt is cheaper than equity so higher gearing will lead to a lower weighted average cost of capital. It is simplistic mainly because it overlooks an interaction between gearing and the equity beta. If a company increases its gearing (the share of its capital represented by debt), the business risk will be more concentrated on a smaller value of equity, and shareholders will therefore require higher rates of return (equity beta will increase). Lenders are also liable to require higher interest rates since higher levels of debt would mean less financial headroom in the business and a higher risk of default. Modelling the optimum gearing ratio is quite complex. It involves, among other things, making assumptions about the drivers of interest rates and the tax status of marginal investors in equity and debt markets. This means it is not at all clear how changes in the level of gearing will impact on the overall cost of capital. Hence there needs

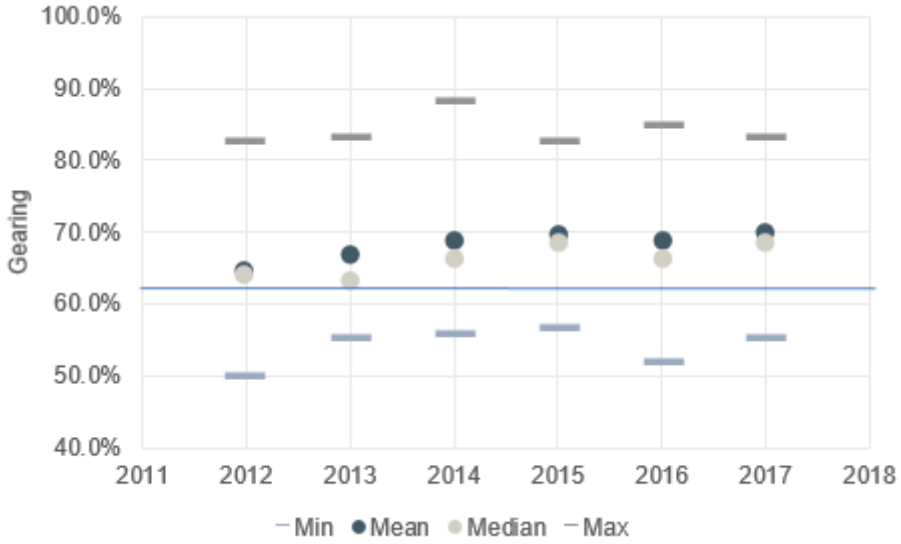
to be caution about using a higher gearing in the CAPM model without adjusting other variables.

We consider recent actual gearing immediately below.

A6.2 Actual company gearing

Figure 24 presents a summary of company gearing from just before and following PR14.

Figure 24 WOC and WASC reported gearing



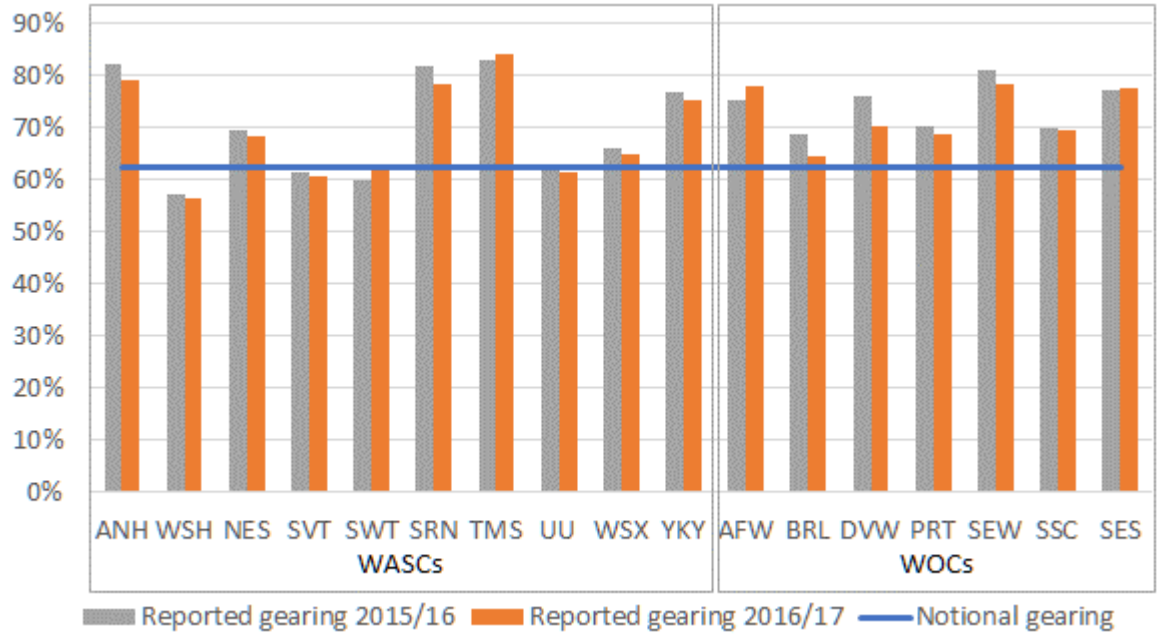
Source: Company financial statementes, Ofwat.

These data show that the companies have gradually increased their gearing in the PR14 regulatory period compared to the end of PR09, and that the average level of gearing is above Ofwat's notional gearing for PR14 of 62.5%.

Figure 25 shows gearing by company, for 2015/16 and 2016/17, compared to the notional level of gearing for PR14 of 62.5%. 13 of the 17 remaining[59] water companies reported gearing levels higher than Ofwat had allowed for its PR14 determination.

[59] After Bournemouth completed its merger with South East Water.

Figure 25 Reported gearing by company in PR14



Source: Ofwat, Monitoring Financial Resilience, Nov 2016 (updated May 2017).

A6.3 Regulatory precedent

At PR14, companies' proposed notional gearing in the range 60% to 70%, with an RCV weighted average of 61.1%. Ofwat's analysis of financeability suggested that notional gearing should be towards the bottom end of this range, settling on 62.5%

Ofwat's current notional gearing of 62.5% is towards the higher end of recently regulatory precedent, with only Ofgem having set a higher value for its gas (in 2012) and electricity (in 2014) distribution price controls.

Table 18 Regulatory precedent on gearing

Regulator	Sector / company	Year	Gearing
UR	NIE	2017	45%
Ofgem	Electricity distribution	2014	65%
CMA	Bristol Water	2015	62.5%
Ofwat	Water	2014	62.5%
UR	NI Water	2014	50%
Ofgem	Electricity transmission	2012	60%
Ofgem	Gas transmission	2012	62.5%

Source: Various

A6.4 Conclusions

For the purposes of our WACC estimate, we propose using a notional gearing assumption across all companies of 62.5%. This value is towards the top-end of recent regulatory precedent. However, average actual gearing across the sector is greater than this notional level and there is a case for considering whether there should be a slight increase. In considering this case, a key test would be whether companies are financeable, which is not within the scope of this study. Accordingly, we retain the notional gearing structure of 62.5%.