COST OF CAPITAL FOR PR19

Report for Wessex Water

August 2019

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EXECUTIVE SUMMARY

Wessex Water has commissioned Frontier Economics to estimate the cost of capital for water and wastewater companies for PR19, following publication of Ofwat's Draft Determination (DD).

Frontier's estimate addresses questions of methodology which have arisen as part of the Draft Determination, and provides market updates in relation to Ofwat's view at Draft Determination on 28 February 2019 (based on updated information to the end of July 2019).

Frontier derive a point estimate of 2.67% for the vanilla weighted cost of capital (WACC) in RPI terms for the wholesale price controls. This is 59 bps higher than Ofwat's Draft Determination.

The differences in our point estimate are driven entirely by differences in methodology, with all market data being derived in line with Ofwat's cut-off date at Draft Determination of 28 February 2019. These methodological differences are as follows:

- Total market return. Ofwat is proposing not to focus on DGM analysis, but to put equal weight on ex-post, ex-ante and forward- looking approaches. While we agree with this view, we estimate a slightly updated estimate range of 6.5%-7.2% (in real CPIH terms). We propose a point estimate at the top of this range, having regard to regulatory consistency, reflecting the absence of evidence to support a material change from PR14, and to preserve neutrality from the switch to CPIH.
- Risk-free rate: Ofwat has changed its approach, and relies on the average of spot yields for 10- and 20-year index-linked gilt yields. We maintain an approach in line with that taken by Ofwat at its early view, and use the six-month average of 15-year nominal gilts.
- Asset beta: While Ofwat rely on a single point estimate based on two-year daily data, we estimate a range using different estimation windows and data frequencies in line with recent regulatory precedent. We adopt Ofwat's updated debt beta estimate. It is our view that the traditional approach to the EV/RCV gearing adjustment is the most reasonable approach.
- Ratio of embedded to new debt: We use resubmitted business plan table data and find a lower estimate of 16% new debt in comparison with that used by Ofwat at Draft Determination of 20%.
- Cost of embedded debt: Our methodology does not include the reduction from expected outperformance (the so-called 'halo' effect) on the cost of new issuance up to 2020, as we do not see sufficient evidence of its existence. We also adopt an updated approach to estimating forward uplift adjustment.
- Cost of new debt: As for embedded debt, we have removed Ofwat's halo adjustment and apply an updated approach to estimating the iBoxx rate and forward uplift..

Figure 1 below compares Frontier's updated estimates with Ofwat's Draft Determination on the key parameters of the WACC at Ofwat's cut-off date of 28 February 2019. We also include an updated WACC estimate based on more recent

information up to 31 July 2019. This updated figure is effectively unchanged from the February estimate. This stability of this estimate contrasts with the volatility of the Ofwat method, where the estimated WACC declines by nearly 0.4% between February and July. In our view this level of volatility is not consistent with a robust method for setting a WACC for a five year regulatory control and further highlights the weakness with Ofwat's approach.

Figure 1 Comparison of WACC components (real RPI)

Component	Frontier	DD	Reason for difference (if any)
Gearing	60%	60%	Adopted Ofwat's estimate
Total market return (TMR)	6.16%	5.47%	Evidence of higher TMR and appropriate interpretation of data
Risk-free rate (RFR)	-1.05%	-1.42%	Rely on nominal rather than index-linked gilts
Equity risk premium (ERP)	7.21%	6.89%	Evidence of higher TMR and RFR
Debt beta	0.125	0.125	Adopted Ofwat's estimate
Asset beta (including debt beta)	0.39	0.36	Evidence of higher asset beta
Notional equity beta	0.79	0.71	
Cost of equity (including debt beta)	4.63%	3.46%	
Ratio of embedded to new debt	84:16	80:20	APP19 tables from resubmitted business plans evidence of a lower proportion of new debt
Nominal cost of embedded debt	1.61%	1.46%	No halo reduction on new issuance by 2020, updated approach to estimating forward uplift
Nominal cost of new debt	0.63%	0.35%	No halo reduction, updated approach to estimating iBoxx rate and forward uplift
Issuance and liquidity costs	0.10%	0.10%	Adopted Ofwat's estimate
Real overall cost of debt	1.55%	1.34%	
Appointee WACC (vanilla)	2.78%	2.19%	
Retail net margin deduction	0.11%	0.11%	Adopted Ofwat's estimate
Wholesale WACC (vanilla)	**2.67%**	**2.08%**	
Incl. market updates	***2.66%***	**n/a**	

Source: *Frontier analysis and Ofwat, Appendix 12: Risk and return December 12 2017. Excluding market updates does not update the market data since Ofwat's early view on the cost of capital.*

Note: *All estimates taken as of 28 February 2019. 'Including market updates' updates the market data since Ofwat's Draft Determination on the cost of capital*

As shown in the figure, Frontier has found differences with Ofwat due to market movements and methodological approaches. The cost of equity difference is primarily due to updates to the total market return (TMR) and the asset beta. While we adopt a different approach to Ofwat on the risk-free rate, the impact on the

WACC is relatively small. The cost of debt difference is largely driven by our removal of Ofwat's outperformance (halo) adjustment.

Our estimated range for the wholesale WACC, based on this bottom-up CAPM assessment, is 2.22% to 2.83%. This range is relatively wide and we consider that a credible and narrower range for the WACC is 2.5% to 2.8%, focussed around our central estimate of 2.67%. This narrower range reflects the following factors:

- Our assessment of the forward-looking risk factors, including Brexit and the additional risks in the regulatory methodology, which point to a WACC at the upper end of the range.
- Evidence from the DGM cross-check, which indicates that the cost of equity lies above the CAPM range. Although we attach less weight to this evidence than to the CAPM results, it supports a view that the bottom end of the CAPM range is not credible.
- The further cross-checks on the overall WACC set out in this paper. This includes market-asset ratios and comparison of debt and equity premium. These cross-checks also support a value in the upper end of the range.

1 INTRODUCTION

Wessex Water has commissioned Frontier Economics to provide an update on the weighted cost of capital (WACC) for PR19, following publication of Ofwat's Draft Determination (DD).

Based on Ofwat's Draft Determination, it is our view that a number of issues remain in Ofwat's WACC and that certain aspects of Ofwat's updated methodology raise further concerns over regulatory consistency and stability in the WACC. It is our view that the changes that Ofwat has made in its methodology are unjustified and inconsistent both with its early view and regulatory precedent.

We have therefore reviewed Ofwat's methodology and assumptions for estimating the WACC and have applied adjustments where we believe this to be appropriate. This includes:

- Total market return. Ofwat is proposing not to focus on DGM analysis, but to put equal weight on ex-post, ex-ante and forward-looking approaches. While we agree with this view, we estimate a slightly updated estimate range of 6.5%-7.2% (in real CPIH terms). We propose a point estimate at the top of this range, having regard to regulatory consistency, reflecting the absence of evidence to support a material change from PR14, and to preserve neutrality from the switch to CPIH.
- Risk-free rate: Ofwat has changed its approach, and relies on the average of spot yields for 10- and 20-year index-linked gilt yields. We maintain an approach in line with that taken by Ofwat at its early view, and use the six-month average of 15-year nominal gilts.
- Asset beta: While Ofwat relies on a single point estimate based on two-year daily data, we estimate a range using different estimation windows and data frequencies in line with recent regulatory precedent. We adopt Ofwat's updated debt beta estimate. It is our view that the traditional approach to the EV/RCV gearing adjustment is the most reasonable approach.
- Ratio of embedded to new debt: We use resubmitted business plan table data and find a lower estimate of 16% new debt. This is lower than the ratio used by Ofwat at Draft Determination of 20% new debt.
- Cost of embedded debt: Our methodology does not include the reduction from expected outperformance (the so-called 'halo' effect) on the cost of new issuance up to 2020, as we do not see sufficient evidence of its existence. We also adopt an updated approach to estimating forward uplift adjustment.
- Cost of new debt: As for embedded debt, we have removed Ofwat's halo adjustment and apply an updated approach to estimating the forward uplift.

We set out clearly where a change in a component of the WACC is due to an update of market data or difference in methodology. We have also adopted the Ofwat approach without review in a few areas, where Ofwat's approach is a relatively standard one and / or the impact on the estimated WACC is not material. This is summarised in the figure below.

Figure 2 Differences with Ofwat's view on components of the WACC

Component of the WACC	Comparison to Ofwat's DD
Gearing	Adopted Ofwat's estimate
Total market return (TMR)	Evidence of higher TMR and appropriate interpretation of data
Risk-free rate (RFR)	Rely on nominal rather than index-linked gilts
Equity risk premium (ERP)	Evidence of higher TMR and RFR
Debt beta	Adopted Ofwat's estimate
Asset beta (given assumed debt beta)	Evidence of higher asset beta
Ratio of embedded to new debt	APP19 tables from resubmitted business plans evidence of a lower proportion of new debt
Nominal cost of embedded debt	Excluded the reduction from expected outperformance (the 'halo' effect) on the cost of new issuance up to 2020 Updated approach to estimating forward uplift
Nominal cost of new debt	Excluded the reduction from expected outperformance (the 'halo' effect) Updated approach to estimating iBoxx rate and forward uplift
Issuance and liquidity costs	Adopted Ofwat's estimate
Retail net margin deduction	Adopted Ofwat's estimate

Source: Frontier analysis and Ofwat, Appendix 12: Risk and return December 12 2017

We provide our WACC estimation at the cut-off date at Draft Determination of 28 February 2019 on the basis of both our methodology (where different from those from Ofwat), and based on market updates up until 29 July 2019.

This report is structured as follows:

- Section 2 discusses the estimation of the cost of equity, including reviewing the evidence we have found regarding the relevant elements mentioned above;
- Section 3 explores the estimation of the cost of debt, including updates to the data and our finding on the ratio between new and embedded debt; and
- Section 4 summarises our resulting estimates on the cost of capital, in comparison with Ofwat's 2019 Draft Determination.

The annex provides details of the calculations for components of the cost of equity.

2 COST OF EQUITY

KEY CONCLUSION

Our estimated overall cost of equity is 4.63%, which is higher than Ofwat's at Draft Determination of 3.46% (both real RPI).

Our TMR figure is based on historic average and is higher than Ofwat's estimate.

We disagree with Ofwat's decision to change the method used to estimate the risk-free rate to index-linked gilts, as we do not believe that there is sufficient evidence regarding the size of the inflation risk premium. We instead rely on 15-year maturity nominal gilts.

We disagree with Ofwat's raw equity beta, and we adopt Ofwat's debt beta and gearing estimate. We disagree with Ofwat's sole reliance on two-year daily betas in estimating the raw equity beta. We have reviewed the EV/RCV gearing adjustment and the RAR versus RER adjustments, as proposed in Ofgem's December sector consultation, and conclude that neither is appropriate to be applied to the water sector cost of equity.

Consistent with Ofwat, we use the Fisher equation when moving between different indices. We use inflation forecasts consistent with Ofwat of 2% for CPIH and 3% for RPI.

This section addresses the estimation of the parameters of the CAPM cost of equity: total market return, risk-free rate and beta. It also considers estimates of the cost of equity based on the dividend growth model (DGM).

2.1 Total Market Return

KEY CONCLUSION

Ofwat's DGM analysis which underpinned its early view, now results in a much higher figure, driven by movements in the stock market. Ofwat is now proposing not to focus on the DGM analysis, but put equal weight on ex-post, ex-ante and forward-looking approaches. The decision to disregard evidence that was previously relied on could be regarded as opportunistic and could undermine regulatory credibility.

Ofwat's now relies on the ex-post approach (which is the approach we have always advocated, but which Ofwat rejected at its early view). Its estimate under this method appears to be based on a selective assessment of both the inflation series and the averaging method. We do not consider that there is robust analysis to support these choices.

Ofwat has, in effect, failed to deliver on its commitment of NPV neutrality for the switch from RPI to CPIH, as the majority of its decrease on the nominal TMR comes from the switch from RPI to CPIH. Ofwat is moving from a 6.75% RPI to a 6.5% CPIH TMR without substantial evidence to support an underlying decrease in the market data.

We acknowledge the emerging debate on DMS inflation series, and present a balanced view taking this into account, which results in a range of 6.5%-7.2% CPIH real, using Ofwat's own calculations. We propose a point estimate at the top of this range, of 7.2% CPIH.

2.1.1 Ofwat's approach at early view

Ofwat's early view on the TMR was mainly focused on a forward-looking Dividend Growth Model (DGM) based approach using short-term market data. Although Ofwat made references to two alternative methods that the CMA has used in the past, i.e. the ex-post and the ex-ante approach, it did not rely on these. When assessing the estimates from the ex-post method, Ofwat stated that it did not consider that some of the estimates from this method, particularly the method using DMS long-term historic return, would be appropriate because of the current low interest environment. Ofwat stated:

> *"Our early view is that, based on the evidence set out in section 5.4.1, for the period 2020-25, the TMR used for our cost of equity would be too high if we placed too much weight on the 'ex post' approaches. We summarise the evidence we have assembled from different approaches together with our point estimate in figure 7 and explain the evidence we have considered in the rest of this section. Our point estimate lies within the range of estimates provided by 'ex-ante' and 'forward-looking' approaches, but lower than some of the range of 'ex-post' approaches."*

Ofwat's final estimate of the TMR in its early view was solely based on its forward-looking estimate (which suggested a nominal TMR of 8.6%), based on the DGM analysis conducted by PwC).

2.1.2 Regulatory precedent for using short-term data

We consider that the focus on a short-term approach that Ofwat applied at the early view WACC was not appropriate and not consistent with established regulatory practice. We note that no recent regulatory determination in the UK involved estimating the equity return by DGM analysis alone. The CMA's 2014 determination for NIE stated explicitly that it did not rely on the DGM analysis for its estimate but used it as a cross check.

> *"We use historical approaches (both ex ante and ex post) as our primary sources for estimating the equity market return, with forward-looking approaches being used only as a **cross-check** on our resulting ERP estimates."*[1]

The CMA explained why it did not rely on the forward-looking DGM approach (our emphasis):

> *"A limitation of this [DGM] approach is that it is necessary to make an assumption about future long-term growth of dividends (which has a major effect on the calculation since dividends beyond year 4 or 5 account for a large part of present value at plausible discount rates). We think such approaches, since they are based on current market data and short-run forecasts, are likely to be **more suitable for estimating the short-run ERP** and less so for estimating the long-run equilibrium ERP. Since we are concerned with the latter, we **place less weight** on results derived from this approach."*[2]

We agree with the CMA's view and see the DGM method as appropriate for a cross-check, as DGM-implied equity returns are known to be highly volatile on a daily basis and can be considered unstable even when averaged across a number of years. The CMA's decisions for both NIE in 2014 and Bristol Water 2015 considered the evidence on current and forward looking TMR and concluded that little weight could be attached to them.

Finally, the UKRN paper published in 2018 confirms the preferred approach on estimating the TMR using a long-term historic average, and expressed concerns on relying on methods such as DGM.

> *We can illustrate the difficulties that may arise here with reference to one recent application of the DDM: PWC's 2017 report to Ofwat, although we note Ofwat referred to a wide evidence base and placed limited weight on DDM. PWC's Figure 26 is reproduced below (Figure 4.9). This shows sensitivities of their EMR (here denoted TMR) estimates to changes in assumptions feeding into their model. These are very wide ranges indeed: considerably wider than the range of long-run historic average returns.* [3]

1 Competition Commission, Northern Ireland Electricity Limited Final Determination, March 2014, p.13.26.

2 Competition Commission, Northern Ireland Electricity Limited Final Determination, March 2014, p.13.30.

3 Wright S. et al (2018) Estimating the cost of capital for implementation of price controls by UK Regulators, An update on Mason, Miles and Wright (2003).

2.1.3 Ofwat's updated approach at Draft Determination

For 2019, PwC has renewed its DGM analysis, which suggests a nominal TMR range of 8.9% - 10.4% (compared to a range of 8.0% - 8.5%). This is consistent with our view that forward-looking approaches are likely to result in volatile estimates over time. At the same time we would note that this estimate does not support a low expected equity return.

As noted above the UKRN report advocates an ex-post approach to estimate the TMR, based on the long-term historic equity return series from DMS Credit Suisse Global Investment Returns Yearbook. It is worth noting the long-term historic average from DMS is the ex-post approach that Ofwat rejected at its early view.

However, the UKRN report applied a questionable inflation series to DMS's long-term nominal average return, to derive an arguably under-estimated CPI-real TMR for the UK. Due to this inflation adjustment, UKRN report proposes a CPI-real TMR range of 6% - 7%.

With these two new developments, Ofwat no longer proposes to rely on the forward-looking approach alone for the Draft Determination, but is now putting equal weight on all three approaches, including the other two that Ofwat did not rely on at its early view when the forward-looking approach suggested lower estimates. Ofwat states in its Draft Determination:

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

Regardless of which approach is more appropriate and what estimates are more reasonable, Ofwat's switch of methodology between the early view and the Draft Determination raises questions about regulatory consistency and potential impact on perceptions of regulatory risk. In this context, the CMA, as part of its decision for Bristol Water in 2015, noted that:

> *"An important part of this analysis is the application of a consistent approach to setting the assumptions which form the basis of the calculation of the cost of capital. Both debt and equity investors make long-term financing decisions, including debt financing of up to 30 years' maturity. This reflects investors' expectations not just in respect of the immediate regulatory period, but of a consistent approach over the longer term.*
>
> *This is reflected in the estimated scale of returns for regulated networks, which are relatively low in comparison to many commercial businesses. We understand, for example, drawing on statements from credit rating agencies, that this reflects the stable regulatory environment. In particular, the financing environment is influenced by the stable approach to the estimation of the cost of capital, applied by both sector regulators and also in previous CC/CMA decisions."*

2.1.4 Criticism of Ofwat's ex-post approach

We believe that the most reliable way to estimate the TMR is the long-term historic average (i.e. the ex-post approach). However, we do not share Ofwat's interpretation of the DMS data, in particular regarding inflation and averaging technique (geometric versus arithmetic average). These differences are discussed below.

Inflation index

The DMS data on equity returns is compiled in nominal terms and needs to be converted into real terms for setting the WACC. The challenge is that none of the official inflation series extend as far back as the data on nominal returns. Ofwat considers three inflation series to apply to DMS's nominal long-term average TMR:

- DMS's own inflation index;
- Millennium dataset "original" CPI inflation; and
- Millennium dataset "preferred" CPI inflation.

Ofwat points out that due to the way price levels between the years 1914 and 1947 are recorded in the DMS inflation index, which depends on the Cost Of Living Index, DMS inflation is likely to underestimate the inflation levels for those years. As a result, Ofwat considers that DMS's average inflation for the UK for the entire sample period between 1900 and 2018 might be under-estimated. This would lead to an overestimation of the real TMR.

Ofwat prefers the Millennium Dataset which uses an implied consumers' expenditure deflator constructed through analysis of the unofficial national accounts of the UK. Ofwat considers this to be closer to CPI than RPI by design.

Because the average inflation from the Millennium Dataset is higher than that in the DMS inflation series, the real TMR implied by the Millennium Dataset is lower. This is the result Ofwat relies on. There is little evidence in Ofwat's Draft Determination to indicate that it was able to make a full and detailed assessment of the relative merits of the alternative measures of inflation.

We do not see sufficient evidence to favour one inflation series over others. We find it hard to justify the complete disregard of DMS's inflation series while putting full confidence on its nominal average return. We consider that given the uncertainty and the ongoing debate on this topic, both inflation series need to be given some weight.

We note, however, that in its early consultation on the switch from RPI to CPI(H) indexation for PR19, Ofwat has stated that should such a switch of indexation take place, it would be done in an NPV neutral way. In other words, it would not be the case that Ofwat keeps to its real allowed cost of capital while changing the indexation on the RCV from RPI to CPI. In practice, however, this is the implication of the Draft Determination.

The market evidence on the TMR has had little or no change from PR14. Both the ex-post and ex-ante evidence on the TMR are largely unchanged from when the CMA last looked into it at NIE 2013 determination. The forward-looking evidence which used to support lower estimates at early view no longer supports a lower

estimate. Therefore, without any substantial supportive evidence to indicate lower equity returns, Ofwat's real TMR estimate has reduced from 6.75% RPI at PR14 to 6.5% CPI.

Averaging technique

In interpreting the ex-post historic average equity return, there is a question on which average is the most appropriate. DMS provides an arithmetic average as well as a geometric average.

The arithmetic average is a simple average across all yearly returns within the entire sample of 118 years. The geometric average measures the total compounded growth from the first year (1900) to the last year (2018) in the sample and converts it into an effective annual growth rate.

A straightforward interpretation of the arithmetic average is that it measures what equity return is likely to be in any single year if the investment is made at the beginning of the year and withdrawn at the end of the year, averaged across the past 118 years. A straightforward interpretation of the geometric average is that it measures the effective annual growth rate if an investment was made in 1900 and held until 2018.

There is compelling consensus among finance academics and practitioners that the approach basis for estimating the WACC is the forward looking arithmetic return. At the same time the historical data on annual arithmetic returns may overstate the forward looking figure if the typical holding periods are longer than one year. We acknowledge that an appropriate holding period of an equity investment in a water company could be between 5 and 10 years, which implies that the arithmetic average may also need some adjustment.

Ofwat discusses different average techniques to adjust the arithmetic and geometric averages from DMS into an unbiased estimator. It presents two methods, both of which have been previously discussed in the CMA decision for NIE. Ofwat presents the results of its analysis on these two approaches for different inflation series and different holding periods in Table 3.5 in its Cost of Capital Technical Appendix. We reproduce the relevant parts of the table below.

Figure 3 Ofwat's Table 3.5 on ex-post estimates of TMR

Holding period	Inflation series	Blume unbiased estimator	JKM optimal estimator
5 years	DMS	7.19%	7.08%
	BOE	6.83%	6.71%
10 years	DMS	7.11%	6.84%
	BOE	6.75%	6.48%

Source: *Ofwat, Table 3.5 in Cost of Capital Technical Appendix, PR19 Draft Determination*

Note: *To keep the table focused, we do not include the 1, 15, and 20-year holding periods, which Ofwat discards, nor the unadjusted arithmetic and geometric averages*

As can be seen, without favouring one inflation index over the other, over the 5- and 10-year holding periods, Ofwat's own estimates show a range of 6.48%-7.19%.

However, Ofwat chooses to rely on the JKM optimal estimator and discards the Blume unbiased estimator. Equally, Ofwat favours the inflation series from the BOE over the DMS series. Both of these two choices result in lower estimates of real TMR, and in combination produce a range of 6.5% to 6.7%.

It appears that Ofwat, where there are valid alternative methods for the estimation of the parameter, has adopted the method that supports a lower value. We note that CMA considered both the Blume unbiased estimator and the JKM optimal estimator in its NIE determination (and indeed in its earlier determination for Bristol Water in 2010) and did not discard the estimate from either of the two, which resulted in a RPI-real TMR of 6.5% (or roughly 7.5% CPIH).

2.1.5 Frontier estimate of TMR

We believe that the ex-post historic average approach remains the primary and most reliable method to estimate the expected equity returns. We have not seen any market evidence to suggest that the nominal returns in recent years have decreased compared to the historic average. In fact, the average nominal returns for the UK in the DMS database have barely moved within recent years, as shown in the table below.

Figure 4 DMS UK equity returns

	Nominal geometric	Nominal arithmetic
2014	9.4%	11.2%
2015	9.3%	11.1%
2016	9.4%	11.2%
2017	9.4%	11.2%
2018	9.2%	11.0%

Source: DMS Credit Suisse Global Investment Returns Yearbooks (2015-2019)

We acknowledge the ongoing challenge on the inflation series used in the DMS database, although we do not consider that this in itself is sufficient to discredit the DMS inflation series completely and rely solely on a dataset from an unofficial Bank of England (BoE) study published to mark the end of the millennium. A more balanced approach would be to take into account both inflation series in the estimation.

Equally, we do not consider the JKM optimal estimator is the only valid way to adjust the geometric and arithmetic averages for the holding period, and that other methods such as the Blume unbiased estimator merit considerations.

In conclusion, apart from the debate on the inflation index, Ofwat has not presented any real evidence to support a lower real TMR compared to PR14. Without robust evidence, to drastically decrease the real TMR from 6.75% RPI to 6.5% CPIH significantly undermines Ofwat's stated position of NPV neutrality on the switch from RPI to CPIH indexation.

In our view the range of 6.5% to 7.2% from Figure 3 above can be considered the most balanced view on the long-term real TMR, having taken into account the new debate on DMS inflation series versus that from BoE. It takes into account of Blume and JKM averaging adjustment, and it considers DMS and BoE inflation.

In terms of selecting a point estimate from this range, we take account of the following factors:

- regulatory precedent, including Ofwat's PR14 figure of 6.75% RPI;
- the lack of evidence to support any material change in expected equity returns since PR14; and
- the importance of consistency and stability of regulatory decisions, and reflecting Ofwat's stated position that the shift to CPIH should be neutral for investors.

These factors indicate an estimate at the top of the range, **7.2% CPIH**, to be the most reasonable point estimate for the real TMR. This represents a reduction of over 0.5% compared to PR14, driven largely by attaching weight to the alternative estimates of historic inflation.

2.2 Risk-free rate

KEY CONCLUSION

Ofwat's assessment that the estimation of the risk-free rate should be based solely on index-linked gilts is based on insufficient evidence of the existence of an inflation risk premium, and ignores the (albeit relatively low) liquidity premium inherent in current index-linked gilts.

Ofwat's reliance in applying a strict mechanistic approach to the use of the average of 10- and 20-year gilts does not address the risk that this leads to an inappropriate estimate of the risk-free rate.

On this basis, we maintain that the previously adopted approach of relying on nominal gilt yields, based on the six-month average of 15-year gilts, should be used to estimate the risk-free rate. This results in a risk-free rate in real RPI terms of -1.05%, lower than Ofwat's early view but 37 bps higher than Ofwat's value at Draft Determination.

2.2.1 Ofwat's approach at Draft Determination

In its early view, Ofwat proposed estimating the risk-free rate using the short-term (six-month) average of 10- and 20-year nominal gilt yields, with an uplift to reflect the forward curve's upward movement into the future.

As part of its PR19 Draft Determination, Ofwat has adopted an alternative approach, and now relies solely on the average of 10- and 20-year index-linked gilt yields, based on the spot rate on 28 February 2019, to reach an updated estimate of the risk-free rate of -1.42% (in real RPI terms) and -0.45% (in real CPIH terms). This approach has been adopted against the recommendations of Europe Economics, who advised using both index-linked and nominal gilts in estimating the risk-free rate.[4]

[4] Europe Economics, The Cost of Capital for the Water Sector at PR19, 18 July 2019

While UKRN recommend the use of index-linked gilts at the given horizon,[5] and regulators have adopted this approach historically to both a greater and lesser degree, there is no clear evidence that one approach should be favoured over the other.

2.2.2 Use of index-linked rather than nominal gilts

Ofwat has justified its change in approach to using index-linked gilt by arguing that the wedge between the nominal and index-linked gilts (which it estimates to be 37 bps) is largely driven by an inflation risk premium in the nominal gilts, thus overstating the risk-free rate. It further finds that the liquidity risk premium in the index-linked gilts is relatively small and stable (below 10 bps).

We raise the following issues with the approach that Ofwat has adopted and its arguments for doing so:

- Ofwat dismisses the existence of a liquidity premium on index-linked gilts, despite estimating that there is an (albeit relatively small) premium of 8 bps.
- Ofwat then infers that the remaining 29 bps difference between the market implied rates for the nominal and index-linked gilts is entirely attributable to the inflation risk premium on nominal gilts, without providing sufficient evidence to support this claim.

While we accept Ofwat's analysis and estimate of the liquidity risk premium (of 8 bps), we disagree with Ofwat's conclusion that, given that this is 'low and stable', it should be dismissed altogether. A risk-free rate based on the average of the nominal and index-linked gilt yields should therefore be considered.

Ofwat have then attributed the remaining difference between the nominal and index-linked gilts (accounting for 29 bps) as an inflation risk premium, However, it does not provide sufficient evidence to support this claim, or explain any other factors that might be contributing to the difference in the gilt yields.

One such factor is likely to relate to the (inelastic) demand for index-linked gilts by institutional investors (such as pension funds) to protect against the risk of inflation increases. This demand has been driven by changes in the regulatory and accounting framework, which encourage the holding of these types of inflation-protected assets by such investors, irrespective of their underlying risk preferences. This is illustrated by the fact that such investors continue to hold UK index-linked gilts, despite current yields being negative.[6]

The effect is to reduce observed yields on index-linked bonds below the 'true' risk-free rate by the amount that pension funds are willing to pay to meet these regulatory requirements. Since there is no clear methodology to correct for such distortions, index-linked gilts provide no clear evidence of the 'true' risk-free rate.

We therefore disagree with Ofwat's sole use of the index-linked gilts for estimating the risk-free rate. The available evidence does not support Ofwat's claim that this is largely driven by an inflation risk premium, and if this exists at all. Even if the difference in nominal and index-linked gilts is largely being driven by an inflation

[5] UKRN, Estimating the cost of capital for implementation of price controls by UK Regulators, 2018

[6] https://www.cii.co.uk/learning/learning-content-hub/articles/just-say-no-to-negative-real-yields/72691

risk premium, we disagree with Ofwat's conclusion that the liquidity risk premium, albeit relatively low, not be accounted for in the estimation of the risk-free rate at all.

Furthermore, in changing its approach between its early view and Draft Determination, Ofwat has disregarded evidence that was previously relied upon, which could be seen to be opportunistic.

It is therefore our view that a range on the risk-free rate be estimated using a both index-linked and nominal gilt yields and a reasonable estimate chosen from this range.

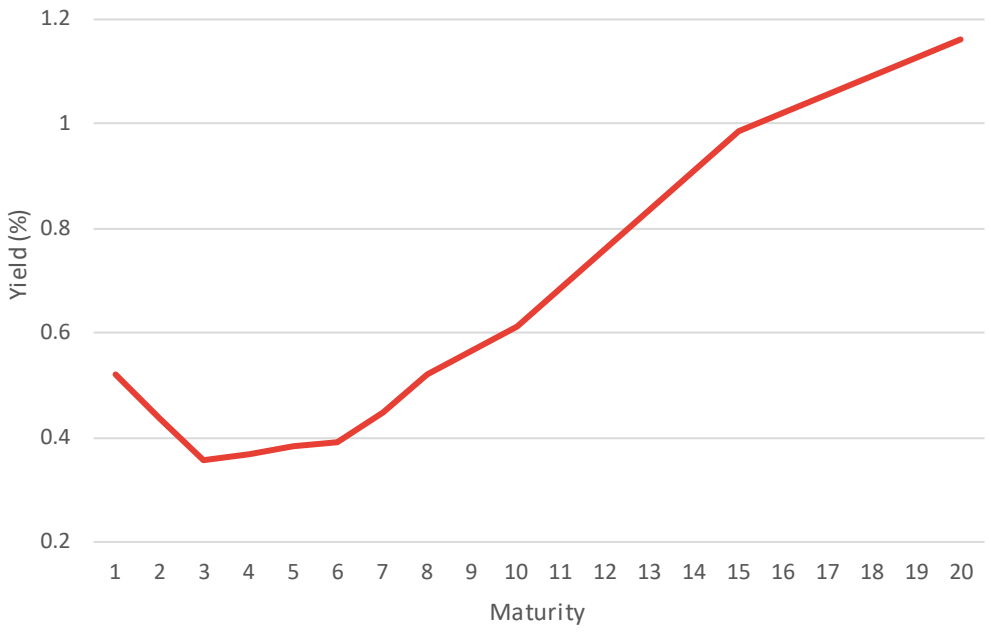
2.2.3 Choice of gilt maturities for estimating the risk-free rate

In applying its revised methodology, Ofwat has chosen to rely on a mechanistic approach to estimating the risk-free rate. That is, it relies on the average of 10- and 20-year gilts in estimating the risk-free rate over a 15-year horizon. This reliance on accepting market information risks not taking into account other macroeconomic factors that might be driving market outcomes.

This feature is borne out in Ofwat's use of the 10-year gilts based on current market information.

Figure 5 below shows the current yield curve on nominal gilts.

Figure 5 Yield curve on nominal gilts



Source: *Bloomberg*
Note: *Yield curve taken as of 31 July 2019*

This shows that the current nominal yield curve is inverted on gilts with maturities up until the 8-year gilt implying that, faced with uncertainty over various market factors (such as those related to Brexit), investors may be holding onto longer-term

gilts and driving down the yield on these relative to shorter-term gilts. This means that the 10-year gilt is likely to be understated relative to its 'true' value.

Therefore, while in principle we do not disagree with using the average of 10- and 20-year gilt yields to estimate the risk-free rate, based on an informed judgement of current market outcomes, we do not believe that the 10-year gilt provides a reliable value on which to base the risk-free rate.

Furthermore, Ofwat no longer propose to use the six-month average of gilt yields, but rather the spot rate on the cut-off date (currently 28 February 2019). Given that the risk-free rate exhibits significant movement on a daily basis, the spot rate on any given day is likely to capture very short-term market movements that are not relevant in the context of setting a risk-free rate for a future period. The issue is particularly pronounced amid the current economic uncertainty.

We therefore use the six-month average of 15- and 20-year gilt yields to reach an updated estimate of our risk-free rate range.

2.2.4 Frontier estimate of the risk-free rate

Based on the above arguments, we have estimated an updated range for the risk-free rate using the six-month average prior to 28 February 2019 of a combination of 15- and 20-year nominal and index-linked gilts. These we present in Figure 6 below.

Figure 6 Updated estimated range for the risk-free rate on 28 February 2019

	Yield (six-month average on 28 Feb 2019	Market-implied rate rise	Implied yield		
			Nominal	RPI	CPIH
15-year nominal gilt	1.58%	0.35%	1.92%	-1.05%	-0.08%
Average 15-and 20-year nominal gilt	1.69%	0.24%	1.93%	-1.04%	-0.07%
Average 15-year nominal and 20-year index-linked gilt*	-0.05%	0.24%	1.67%	-1.30%	-0.33%
Average 15-and 20-year nominal and index-linked gilt**	0.00%	0.19%	1.67%	-1.29%	-0.33%

Source: Frontier analysis, based on Bloomberg and BoE data

*Note: * Data was not available for the 15-year RPI-linked gilt. We have therefore taken the average of the 15-year nominal gilts, and the 20-year index-linked gilt*
*** Data was not available for the 15-year RPI-linked gilt. We have therefore taken the average of the 15 and 20-year nominal gilts, and the 20-year index-linked gilt*

This gives a range for the risk-free rate of -1.30% to -1.04% in real RPI terms. It is our view that the estimate given by the six-month average of 15-year nominal gilt yields best represents a reasonable estimate of the risk-free rate. Adjusting for a forward uplift of 35 bps, this results in a risk-free rate of **1.92%** in nominal terms. In real RPI terms this is **-1.05%,** and in real CPIH terms this is **-0.08%**.

This view is based on the fact that Ofwat has provided insufficient evidence to justify the change in methodological approach in estimating the risk-free rate between its early view and Draft Determination. In changing its approach, Ofwat has disregarded evidence that was previously relied upon, which could be seen to be opportunistic and risk undermining regulatory credibility.

Recent market updates

We have also assessed data up until 31 July 2019 to reflect any changes in the risk-free rate due to market updates since the cut-off date on 28 February 2019.

Using 15-year nominal gilts as above results in a risk-free rate of -1.26% (in real RPI terms). This is 21 bps lower than the updated 28 February 2019 estimate above.

2.3 Gearing

KEY CONCLUSION

We adopt Ofwat's gearing assumption of 60%.

Ofwat confirmed their early view of 60% gearing for the notional companies. Ofwat reached this conclusion from evidence on:

- Reduced gearing by some companies compared to 2014 levels; and
- A downward trend to debt to enterprise value in recent years.

Given the above points, we do not consider this estimate to be unreasonable. For simplicity, we adopt Ofwat's 60% gearing estimate.

We note that given the cost of equity estimate in the Draft Determination the notional gearing level of 60% raises some material questions around the financeability of the Determination. In our view this relates to the estimate of the cost of equity rather than the level of gearing itself.

2.4 Asset beta

KEY CONCLUSION

The issue with the largest impact on asset beta is the adjustment to the gearing level used to de-lever the raw equity beta, informed by Indepen's research and considered by Ofwat at Draft Determination. We do not believe that this is an appropriate adjustment, and believe that the traditional approach remains the most appropriate to apply.

We consider that a beta range should be established by assessing two, five and ten-year data, on a daily, weekly and monthly basis.

We adopt Ofwat's updated debt beta at Draft Determination of 0.125.

Our updated asset beta range (including debt beta) at the cut-off date of 28 February 2019 is 0.36 – 0.41, and our point estimate is 0.39. This is above Ofwat's Draft Determination estimate of 0.36.

2.4.1 Raw equity betas

Ofwat has relied on a single point estimate in arriving at a raw equity beta at Draft Determination, of 0.64. This has been based on the weighted average of the 2-year daily betas for two regulated water companies, Severn Trent Water and United Utilities.

In its early view, Ofwat argued that this approach was based on the fact that:

> *"Asset betas derived using a short trailing window may be distorted by specific events (for example any uncertainty associated with the price review process itself). However, a trailing window which is too long risks including historic data with limited relevance to a forward-looking estimate of beta (for example data from price control periods with different regulatory frameworks)."*[7]

Furthermore, Ofwat rely solely on daily data, positing that *"daily data are better than those derived using weekly or monthly data as they rely on larger sample sizes and are more precise"*

The choice of the estimation and frequency of data used is a widely debated topic, and as such, we do not advocate the use of one estimation window or data frequency over another. The UKRN study also notes that:

> *"the estimation of beta is the one component of the cost of equity where the regulator must use its judgement and discretion. This places an obligation on regulators to examine the evidence as a whole, not simply relying on a single approach that results in outlying estimates, in order to retain the benefits of a stable and transparent approach to setting the RAR."*[8]

[7] Ofwat, Delivering Water 2020: Our methodology for the 2019 price review. Appendix 12: Aligning risk and return, 2017, p. 60.

[8] UKRN, Estimating the cost of capital for implementation of price controls by UK Regulators, 2018.

Ofwat's approach at PR19 departs from that used by Ofwat in previous price controls and by other regulators, and may misrepresent the beta estimate as follows:

- Asset betas derived using a shorter (two-year) estimation window may be distorted by specific near-term events, and therefore a longer estimation window (or five or ten years) may help to overcome any short-term bias.
- Conversely, a longer estimation window risks including historic data which is distorted by events that are not relevant to estimating a forward-looking beta.

Therefore, a beta range based on assessing the raw equity beta over shorter and longer time periods, and using varying data frequencies, is likely to minimise any distortions in the betas more appropriately than relying on a single point.

This is in line with various reports and recommendations made by other regulatory bodies, including:

- Ofwat PR14 Final Determination. As part of the previous price control, PwC calculated observed asset betas at PR14 based on 5-year monthly and two-year daily data. The asset beta was then set in line with the Draft Determination range and at the mid-point of the observed range at Final Determination.
- CMA for Bristol Water appeal at PR14. The CMA, in reviewing the asset beta estimation at PR14, used "*a wide range of sampling frequencies and looked across a range of periods in estimating the beta of comparator companies*". In doing so, it considered betas estimated using daily, weekly and monthly data, over time periods ranging from the latest day to five-years.[9]
- The UKRN study recommends using a full range of beta estimates derived from daily, weekly and monthly data, and across 2-,5- and 10-year estimation windows.[10]
- NIE RP5 Final determination. The Competition Commission (CC) adopted an approach based on assessing 10-year average over a series of overlapping two-year windows, noting that "*beta can vary over time we think that it is right to base our estimate on a relatively long run of data*". [11] It further considered NIE's own range of beta estimates using annual windows over a 10-year period.
- Economic Consulting Associates (ECA) recommendations to CCWater for PR19. ECA note that *"[e]ach 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."*[12]

[9] Bristol Water plc reference under section 12(3)(a) of the Water Industry Act 1991 report in October 2015, para. 10.148

[10] UKRN, Estimating the cost of capital for implementation of price controls by UK Regulators, 2018

[11] Competition Commission, Northern Ireland Electricity Limited Final Determination, March 2014, para. 13.183

[12] Economic Consulting Associates for CCWater, Recommendations for the Weighted Average Cost of Capital 2020 – 2025, 27 November 2017, and re-iterated in its updated report of 29 January 2019

We consider that Ofwat's departure from precedent is not justified and is out of line with the methodology adopted historically and in other regulated sectors. Based on its own estimation[13], betas across different estimation and data frequencies are as set out in Figure 7 below.

Figure 7 Ofwat asset beta results by rolling time period for estimation and frequency of data – as of 28 February 2019

Frequency of data	1 year	2 years	5 years
Daily (trading days)	0.56	0.64	0.68
Weekly	n/a	0.59	0.67
Monthly	n/a	n/a	0.77

Source: Ofwat PR19 Draft determinations Cost of Capital technical appendix, July 18 2019

Based on this, the beta range would be 0.56 - 0.77, with a mid-point value of 0.67, higher than Ofwat's point estimate using 2-year daily data of 0.64 (which translates into a higher asset beta, including the debt beta of 0.125, of 0.37).

We further note that it is possible that general market volatility over the shorter term, driven by factors such as Brexit uncertainty, has meant that investors have viewed water company stocks as a "flight-to-safety".[14] This may have led to water company betas being lower on average in the short-term than if viewed over a longer time period. Capturing only the two-year daily beta is therefore likely to understate the 'true' beta for water company stocks.

Based on this evidence, an estimate of the raw equity beta based on a point in the range of the 2,5 and 10 year daily betas, assessed on both a daily, weekly and monthly basis would be more in line with the precedent set by Ofwat in previous price controls, and with regulatory precedent.

2.4.2 EV/RCV gearing adjustment

Ofwat has presented three options regarding de-levering and re-levering of the equity beta. Alongside the traditional approach, where de-levering is based on market-gearing and re-levering on RCV gearing, Ofwat discuss two alternatives:

- one approach where de-levering and re-levering are both based on market gearing (as proposed by Indepen); and
- a further approach where both de-levering and re-levering are based on RCV gearing (Ofwat calls this the book-value approach).

Ofwat has retained its traditional approach, but invites comments on these two alternative approaches.

Our view is that the traditional approach remains the most appropriate because the beta observed in the market needs to be de-levered using market gearing and the beta used to construct a notional cost of equity to be applied on a proportion of the RCV needs to be re-geared using a RCV gearing. This is an internally consistent methodology.

[13] Ofwat additional information related to its beta estimation, shared with Wessex Water via email on 1 August 2019

[14] This is the argument that during times of uncertainty, regulated equities have an increased demand as they are viewed as safer and more certain investments.

We consider that the Indepen approach (if applied correctly throughout the rest of the WACC calculation) would be an alternative approach, but is based on a strong assumption. The book value approach, on the other hand, is simply wrong. We explain this in more detail below.

The Indepen approach

We do not consider it is right to say that using market value to de-lever and using RCV gearing to re-lever is internally inconsistent, as suggested by Indepen. However, we would not argue that the Indepen approach is wrong if the market-value gearing is then also used as the notional gearing level for the rest of the cost of capital calculation. Indepen's study does not directly address this, as it focuses solely on the cost of equity, and not the WACC.

If the cost of equity using the Indepen approach is used in conjunction with a market value based notional gearing in the rest of the WACC calculation, this would constitute an alternative approach to the traditional approach.

The remaining question becomes whether or not the cost of capital for a notional company whose capital base is the RCV would have the same cost of capital as the actual company whose capital base is different (in this case higher) than the RCV. The Indepen approach effectively assumes this.

In our view, it would be more reasonable to assume that the cost of capital (i.e. asset beta) would change according to the size of the capital base for a given operational level. This is similar to the operational gearing argument that the CMA has used on Bristol Water 2010, where an asset beta uplift was applied. This was because, in relation to the size of revenues and costs of the company, it had a smaller RCV compared to the notional company.

In conclusion we believe that the traditional approach is the most reasonable approach, while the Indepen approach (if applied correctly) is an alternative approach with a relatively strong assumption.

The book value approach

Our view on the book value approach is much more straightforward. It is wrong and is in direct conflict with finance theory and practice.

The stock returns for the firm (which are used to estimate the raw beta) reflect all of the assets and all of the debt. There is no basis for using stock returns that reflect all of the assets in one step of the approach, and then de-gearing using a gearing estimate that reflects only a portion of those assets.

Under the book value approach, it is implicitly assumed that the level of debt has precisely the same effect on 'gearing up' equity returns regardless of how high or low the equity is valued in the market. This is a very troubling implication that is inconsistent not only with corporate finance theory, but also with common sense. The effect that the debt has on residual equity returns must, of course, depends on whether there is a small or large amount of equity.

The book value approach implicitly assumes that it is only the notional book value equity that supports debt – that all of the debt finance is referred to the RCV and that no other cash flow stream supports any debt.

The rationale for using market value estimates of gearing is clearly explained in leading textbooks. For example, Koller et al (2005), an applied practitioner textbook, begins by noting that the very derivation of the WACC formula begins with market value definitions of the value of debt and equity. It follows that book values, including regulatory book values such as RCV, have no place in WACC calculations:

> *"Using market values rather than book values to weight expected returns follows directly from the formula's algebraic derivation (see Appendix B for a derivation of free cash flow and WACC). But consider a more intuitive explanation: the WACC represents the expected return on a different investment with identical risk. Rather than invest in the company, management could return capital to investors, who could reinvest elsewhere. To return capital without changing the capital structure, management can repay debt and repurchase shares, but must do so at their market value. Conversely, book value represents a sunk cost, so it is no longer relevant."*

A version of the classic Brealey and Myers textbook is even more explicit about the need to adopt market value gearing:

> *"[After presenting a book value balance sheet for an example company called Geothermal]…Why did we show the book value balance sheet? Only so you could draw a big X through it. Do so now. We hope this will help you remember that book values are not relevant to estimating the cost of capital. When estimating the weighted average cost of capital, you are not interested in past investments but in current values and expectations for the future. Geothermal's true debt ratio is not 50 per cent, the book ratio, but 40 per cent [the market value ratio]."*

In conclusion, it is clear that the book value approach is incorrect and should be not be used.

2.4.3 Frontier beta estimation results

Our beta estimation method uses OLS techniques consistent with the method that the CMA adopted for its determination on NIE in 2014.[15] As Ofwat also uses OLS estimations, the methodological differences are minimal. For simplicity, we have adopted Ofwat's debt beta assumption of 0.125.

We have included data up until Ofwat's cut-off date for Draft Determination on 28 February 2019. Our results are shown in the table below, where we identify a range of 0.31 - 0.41.

[15] Competition Commission, Northern Ireland Electricity Limited Final Determination, March 2014

Figure 8 Asset beta results by rolling time period for estimation and frequency of data – as of 28 February 2019

Frequency of data	2 years	5 years	10 years
Daily (trading days)	0.35	0.39	0.32
Weekly	0.32	0.41	0.33
Monthly	n/a	0.41	0.31

Source: Frontier analysis of Bloomberg data

We estimated asset betas for different combinations of frequency and estimation windows for data up to 28 February 2018. A full description of the data and methodology can be found in Annex A.1.

2.4.4 Assessment of forward looking risk profile

In order to establish a point estimate for the beta value from the above range, we consider whether the forward looking risk profile for the water sector differs from the risk profile in the past. We consider three factors: Brexit, climate change and stronger incentives and risks within the regulatory method.

Brexit

At the time of writing, the outcomes of Brexit remain highly uncertain with the prospect of a disruptive exit from the EU increasing in recent weeks.

The uncertainty is twofold as we do not know what the form of the exit will be nor the eventual impacts of this change to the status quo. Regardless of the form of Brexit, the economy will likely be impacted to some extent (for an unknown period) and this could affect the cost of equity and cost of debt. The Bank of England concluded that Brexit will likely reduce the growth rate and increase inflation in the short term.[16]

The Bank has modelled four different scenarios for the form of Brexit. In order of declining openness and integration with the EU it considered:

- Close Economic Partnership;
- Less Close Economic Partnership;
- Disruptive; and
- Disorderly scenarios.

Due to the current uncertainty, the overall effect of Brexit on the future cost of equity of water companies is ambiguous. This is partly because the different components may be affected in opposite directions and the magnitudes of effect are not known.

Figure 9 below summarises the potential effect of Brexit on the relevant parameters of the WACC.

[16] Bank of England, 2018: "EU Withdrawal Scenarios and Monetary and Financial Stability"

Figure 9 Potential Brexit impacts of the components of the cost of equity

Component	Direction of effect	Argument
Beta	Ambiguous	▪ Could decrease, similar impact to during the Financial Crisis, consistent with the *flight to safety* theory. ▪ Could increase due to Brexit and other risks such as nationalisation offsetting the flight to safety effect (as the safety haven status of water stocks may become undermined and flight-to-safety can shift outside of UK).
RFR	Ambiguous	▪ The Bank's reasoning for the Base Rate rising or falling is that it views Brexit as a negative supply shock, but demand could also fall due to reduced trade and uncertainty[17]. ▪ Whether the Bank will have to increase or decrease the Base Rate therefore depends on the magnitude of the effects of Brexit on demand and supply. ▪ Real rates are eroded by higher inflation[18]. □ Inflation forecasts peak at 6.25% and 4.25% in disorderly and disruptive Brexits. □ Inflation forecasts peak at 2.25% in Close and Less Close Brexits: these are the forms the Bank views as most likely.
TMR	Ambiguous but unlikely to change materially	▪ Higher volatility may increase required return on equity. ▪ Fall in economic growth could reduce equity returns. ▪ Real returns are eroded by higher inflation (as above). ▪ But due to the long-term nature of expected TMR, there is unlikely to be material change.

Source: Frontier Economics analysis

We note that the potential withdrawal of European Investment Bank (EIB) loans will not directly affect the cost of equity. It may impact the equity returns as stock prices may go down, but this does not necessarily directly translate into a change in the underlying risk.

This combination of lower growth and general uncertainty could also increase the risk of a political or regulatory intervention in the water sector, because of concerns over low performance. This would increase the beta, as interventions in the market increase the overall uncertainty about future interventions and their effects on companies' performance.[19] This kind of overall uncertainty can make the UK a less

[17] Bank of England, 2018: "EU Withdrawal Scenarios and Monetary and Financial Stability". Text states "In such circumstances [of negative supply shocks], the appropriate monetary policy response will depend on whether the hit to demand is more than that to supply." p56

[18] Bank of England, 2018: "EU Withdrawal Scenarios and Monetary and Financial Stability"

[19] The Back in Balance report from Ofwat has a similar effect of increasing regulatory uncertainty, according to Moody's. We discuss the implications for the cost of debt in 3.1.2.

attractive choice for international infrastructure investors as compared to utilities in other countries.

Climate change

The uncertainty around the effects of climate change should be considered as an additional element to the potential higher risk for future price control periods. The effect may not have been fully reflected in the observed longer-term beta estimates of publicly traded water companies.

The pace and effects of climate change are uncertain. Climate change poses a risk to water companies through severe weather affecting supply. While water companies can mitigate against the risk of severe weather to some extent, they cannot fully hedge against a risk that is out of their direct control.

Therefore, water companies are more likely to miss Outcome Delivery Incentives (ODIs) and Performance Commitments (PCs), leading to the associated financial penalties and reputational risks. Climate change may push the likely outcome of ODI into a more asymmetric distribution than envisaged in business plans. This suggests that the true cost of equity for AMP7 may lie towards the higher end of our estimated range.

Climate change will likely also lead to additional costs for companies. There is a risk that these costs would not be fully funded, particularly since the impacts of climate change would not be uniform across companies. One company may experience severe weather changes more than another because of geographical and meteorological differences.

PR19 regulatory methodology

We next consider the risks embodied in the regulatory model through the analysis of RoRE returns.

Figure 10 shows the upside and downside RoRE range for the industry as a whole, for PR14 Final Determination and PR19 Draft Determination. The figure highlights that the range of risk facing the industry has widened since PR14. The range has increased from 7.19% to 7.78%[20] and the negative skew in returns has increased from -0.67% to -1.20%.

Figure 10 RoRE upside and downside

		PR14	PR19 DD
Industry	Upside	2.93%	2.69%
	Downside	-4.26%	-5.09%
	Midpoint	-0.67%	-1.20%
	Range	7.19%	7.78%

Source: Ofwat DD, Frontier calculations

We acknowledge that there are challenges in interpreting and comparing the RoRE data, given that:

[20] These figures differ slightly from the industry averages presented in Ofwat summary documents. Our figures are based on the individual company ranges set out in the Ofwat company specific determinations, weighted by current RCV values.

- Each company is responsible for generating its own P10 and P90 values. These are reviewed by Ofwat but there may remain some inconsistencies in approach.
- At PR19, Ofwat has adopted more stretching targets for cost efficiency and service performance than at PR14. Ofwat has stated that it is confident that an efficient company can achieve the targets. However, the methods used to set the targets are more stretching that at PR14.
- At PR19, Ofwat has intervened on some P10 and P90 values submitted by the companies, where it has amended the target level or to address outliers. This level of intervention did not occur at PR14.

We also note that these figures are based on a standard cost sharing rate of 50%. Ofwat has signalled that it will apply differential sharing rates to most of the non fast-track companies in the Final Determination. This will have the effect of decreasing the upside potential and increasing the downside potential. The overall effect will be to widen the RoRE range further.

Despite these issues, the RoRE remains a relevant source of evidence, and arguably the best evidence, on the relative risk profile at PR19 compared to PR14.

The other material change has been the reduction in the base level of returns, from 5.65% at PR14 to 4.21% at PR19 DD. This is caused by the reduction in WACC, only partially offset by the switch to CPIH indexation for 50% of the RCV. The combined impact of the lower base returns and a greater RoRE range is an increased risk of very low equity returns over the next period.

The table below illustrates this under two scenarios. First, assuming that downside returns are normally distributed with a mean equal to the base RoRE. Second, assuming that returns are normally distributed with a mean halfway between the P10 and P90 (i.e. the midpoint of the RoRE range). The table shows the probability that equity returns over the five years would be below 0%.

Figure 11 Probability of RoRE return below 0%

	PR14	PR19 DD
Base RoRE	5.65%	4.21%
Mid-point of RoRE range	4.98%	3.02%
Probability of RoRE <0% assuming normal distribution around base RoRE	4.46%	14.46%
Probability of RoRE <0% assuming normal distribution around midpoint RoRE	3.84%	16.11%

Source: Ofwat Determinations, Frontier calculations

This shows that the probability of a return on equity of less than zero has increased by a factor of around four. This calculation is illustrative and does not take account of non-regulatory risks. Neither does it reflect Ofwat's more stretching approach to setting targets at PR19. It does however highlight the greater risk that equity investors are exposed to.

The wider RoRE range at PR19 will result in a greater variance of returns for equity investors. This would feed through into a higher asset beta unless it was the case that all of the additional risk was diversifiable. The CMA considered this argument

in Bristol Water and concluded that it would be unrealistic to assume that all the additional risks were diversifiable. Therefore, it is reasonable to conclude that the forward looking beta values for the sector would be increased as a result of the higher risk profile.

The asymmetry of the RoRE would also be a concern for investors, who require that expected returns should be at least equal to the WACC. Faced with a negative skew to expected returns, one option would be to set the rate of return above the WACC to compensate for this. However, we consider that it is more appropriate to address this issue through the process for setting targets and incentives, rather than through an arbitrary adjustment to the rate of return that might further undermine confidence in the regulatory regime.

2.4.5 Conclusion on range and point estimate for the beta

The factors outlined above indicate that the risk profile of the sector has increased looking forward. At the same time we do not consider that these additional risks fundamentally change the position of the sector as a relatively stable and low risk segment of the economy.

On this basis we consider that the range for the beta based on the historic data is likely to be appropriate but that the point estimate should lie towards the top of the range.

We adopt a value in the mid-point of the upper range of 0.36 - 0.41, and therefore adopt an updated point estimate of **0.39**. We note that assuming a debt beta of zero this implies an asset beta of 0.316. This compares to Ofwat's early view asset beta on the same basis of 0.32 and the PR14 asset beta of 0.30. Therefore even with our proposed adjustment in the range to reflect forward looking risk the asset beta is in line with previous regulatory judgements.

2.4.6 Recent market updates

We have also assessed data up until 29 July 2019 to reflect any changes in the asset beta due to market updates since the cut-off date on 28 February 2019.

Our results are shown in the table below, where we identify a range of 0.30 - 0.43, with a midpoint value of 0.37.

Figure 12 Asset beta results by rolling time period for estimation and frequency of data – as of 29 July 2019

Frequency of data	2 years	5 years	10 years
Daily (trading days)	0.32	0.39	0.32
Weekly	0.30	0.39	0.32
Monthly	n/a	0.43	0.30

Source: Frontier analysis of Bloomberg data

This shows that the beta range has increased since Ofwat's cut-off date on 28 February 2019. Adopting an updated beta to account for these market movements would therefore result in a point estimate of 0.40 (as the midpoint of the upper range of 0.37 - 0.43).

2.5 Cross checks on the cost of equity

Ofwat has built up its estimate of the cost of equity based on the individual parameters of the CAPM. As outlined above although we have important reservations about the specific values that Ofwat has applied to some of these parameters, the methodology that Ofwat has followed is a standard one and well-established in regulatory practice.

However, one important concern with how Ofwat has implemented this methodology is that it has not applied any checks on the overall cost of equity that it has estimated using this bottom-up approach. This is a potential significant weakness given the uncertainty in estimating some of the parameters and the challenge with ensuring that the different estimation approaches are consistent with each other.

One important element of this is the consideration of how to combine the use of long-term and short-term data. Using evidence from different time horizons is not unreasonable in itself but does raises the importance of being able to check that the evidence is being applied in a consistent way. The WACC paper identifies a number of areas where this is a concern.

The second element is to consider how the regulator is taking account of new evidence from the perspective of regulatory consistency and transparency. Given the nature of RCV-based regulation, the methodology for setting returns and its evolution over time has an impact on the perceptions of risk and the returns that investors demand.

Applying top-down cross-checks to the estimate of the cost of equity is an important way for Ofwat, or any regulator, to follow best practice regulation and minimise unnecessary regulatory risk. In our view Ofwat has not adequately applied this overall check at the Draft Determination.

The rest of this section considers the potential range of approaches or evidence that can feed into this cross-check. One important consideration is that all of these methods are subject to their own uncertainties or drawbacks in estimation and we would not suggest that they are more robust or accurate than a bottom-up estimate. However, we do consider that they can provide relevant evidence, and given the uncertainties in all methods, there is a clear case for a 'triangulation' approach to the estimation of the cost of equity.

2.5.1 Dividend growth model

We have estimated the cost of equity directly for the traded water companies, Pennon (South West Water), Severn Trent and United Utilities, using the Dividend Growth Model (DGM). This is an accepted alternative method to the CAPM.

For this analysis we use:

- dividend yield data from Bloomberg;
- short-run dividend forecasts from Bloomberg data; and
- long-run dividend growth forecasts: upper bound is real GDP growth (RPI) and lower bound is -0.5%

Figure 13 DGM results for the cost of equity – notional gearing

Long-term dividend growth rate	-0.5%	Long-term GDP: 1%
United Utilities	**4.52%**	**5.85%**
Severn Trent	**4.94%**	**6.33%**
Pennon	**6.40%**	**7.90%**
Average	5.28%	6.70%

Source: Frontier analysis

Note: Average is a simple mean

The results are RPI real, with a mid-point estimate of 5.99%. It is 5.41% if Pennon is excluded (Ofwat do not include Pennon in their beta estimation as Pennon Group includes some non-regulated activity along with South West Water).

These DGM results is significantly above Ofwat's point estimate of 3.46% RPI real. The range we estimate here is broadly similar to the our range of 5.20% to 7.01% we calculated for South West Water in January 2018.

These results illustrate there is volatility in the estimate over time, particularly for individual companies though the overall volatility is lower. We would also note that the volatility in estimates appears no greater, and in fact somewhat less, than that shown in Ofwat's CAPM approach based on short-term Betas and current risk-free rate data. The results also provide no support for Ofwat's assessment that the cost of equity has reduced between the early view and now.

Full results and details of the approach are set out in Annex A.2.

2.5.2 Comparison of premium on equity and debt

Water companies are financed through a mix of equity and debt finance and in setting the WACC, Ofwat assumes a notional gearing level of 60%. The risks of the business are shared between the equity and debt investors and these investors demand a return over the risk-free rate for bearing these risks. As is the case for all companies operating at investment-grade credit rating, the equity investors bear a greater proportion of the risk and therefore earn a higher premium than debt investors.

In addition, given that the overall risk profile and financing structure of the industry[21] has been fairly stable over time, we would not expect the relative premium between debt and equity investors to have changed significantly. Therefore, one way to cross-check the estimate of the cost of equity is to compare the relativity of the debt and equity premium over time.

To consider this we have compared the debt premium to the equity premium assuming the company is 100% equity financed. This helps to control for the modest changes in gearing over time. The steps in the calculation are as follows.

- The cost of equity is calculated assuming 0% gearing, using the parameters published by Ofwat or CMA.

[21] Subject to the assessment in this paper of the change in risk profile looking forward.

- The equity premium is calculated as the cost of equity minus the risk-free rate. As it is based on 0% gearing we refer to this as the Asset Risk Premium or ARP.
- We do not use the allowed cost of debt as that could be distorted by embedded debt decisions. Our calculation uses nominal spot iBoxx yield at the cut-off date of the analysis for the respective determinations, or in the case of CMA, the publication date. Therefore, our analysis compares the allowed asset risk premium with the concurrent market debt risk premium (using the regulator's decision on the risk-free rate).

Figure 14 Premium for equity risk (RPI real)

	PR19 DD	PR14 FD	CMA NIE
TMR	5.47%	6.75%	6.5%
RFR	-1.42%	1.25%	1.5%
Implied ERP	6.89%	5.5%	5%
Asset beta	0.28	0.30	0.38
Cost of equity at 0% gearing	0.51%	2.9%	3.4%
Asset Risk Premium	1.93%	1.65%	1.9%
Nominal spot iBoxx A/BBB yield	3.30%	4.27%	4.73%
Assumed RPI inflation at determination	3.0%	2.8%	3.25%
Real iBoxx average	0.29%	1.43%	1.43%
Debt Risk Premium	1.71%	0.18%	-0.07%
ARP – DRP differential	**0.22%**	**1.47%**	**1.97%**

Source: Ofwat determinations, CMA NIE determination, iBoxx indices from Markit,

Note: Nominal spot iBoxx yield for PR19 DD taken as of 28-02-2019, as per Ofwat's cut-off date, for PR14 as of 31-10-2014 as per PwC cut-off date for the analysis it carried out for Ofwat PR14 FD, and as of 26-03-2014 as per date of publication of CMA FD.

Asset betas converted to the equivalent of zero debt beta, as debt betas from the determinations were appropriate for the notional gearing levels and not for 0% gearing level.

The table above shows that both PR14 and CMA NIE decisions the differential were well above 1%. However, at PR19 DD, this has shrunk to 0.22%.

Not only is this low compared to previous determinations, it appears to be too low in absolute terms. Ofwat's determination is effectively implying that the cost of equity of a 100% equity funded water company is only 0.22% higher than the cost of debt. This does not appear reasonable given the higher risks that equity investors are exposed to, and the fact that the debt premium is based on investment-grade rating, where the risk of default is assessed to be very low.

We also note that if Ofwat moves to a lower beta of 0.26, as it suggested that the June data would suggest, then this differential would shrink to 0.08%.

This method of cross-check implies that the cost of equity in the Draft Determination is too low.

2.5.3 Evidence from notional financeability assessment

Another method that builds on the relationship between debt risk and equity risk, but approaches it in a very different way, is to consider the results of the notional financeability assessment.

The logic behind this is straightforward. If the assessment of credit metrics at the notional gearing used for the WACC shows that the metrics do not meet the target levels, then this provides evidence that the cost of equity is insufficient. The target metrics should be those consistent with maintaining the credit rating that is used to estimate the cost of debt in the WACC calculation.

To be clear, this is a different exercise to applying an uplift to the WACC to address a financeability issue (as was applied in the early years of UK utility regulation, e.g. PR04). The issue is not about allowing the companies to earn more than the WACC, but rather whether the financeability assessment provides evidence on whether the assessment of the WACC is correct.

There is regulatory precedent for this approach. In Bristol Water (2015) the CMA considered whether setting the WACC in the middle of its estimated range was reasonable. It stated:

> *"The financeability assessment we conducted (including the impact of downside shock) indicated that Bristol Water was in a position to avoid financial distress with the WACC set at the mid-point of the range."*

Therefore the financeability assessment was one of the tools used to calibrate the WACC.

There are specific concerns relating to the notional financeability assessment that Ofwat has undertaken at the Draft Determination. If these concerns are taken into account, Ofwat's assessment indicates that the correct credit metrics are not consistent with the rating of Baa1/A3 assumed in the cost of debt estimate. The concerns are as follows:

- Ofwat uses a different definition of adjusted interest cover ratio than Moody's. Using the Moody's definition gives an industry AICR of 1.3, compared to Ofwat's figure of over 1.6. The figure of 1.3 is below Moody's indicated range of 1.5 – 1.7 for a Baa1 rating.
- PAYG rates that are misaligned to the opex / capex split and are overstating cashflow metrics.

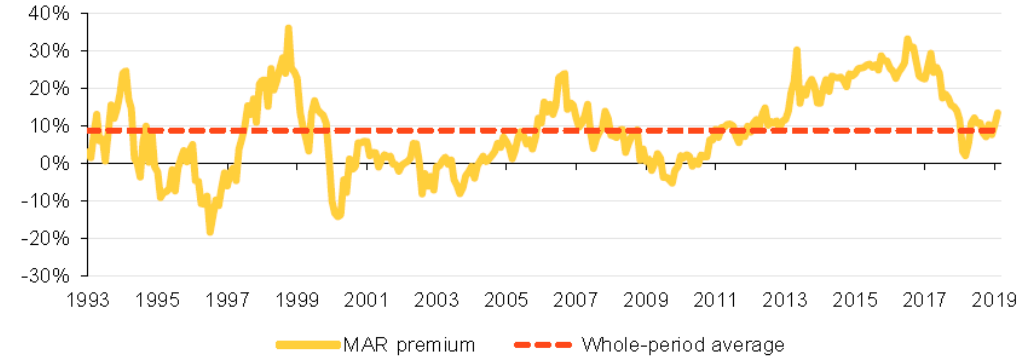
This approach also indicates that the cost of equity allowance is too low. One difference between this method and the comparison between debt premium and equity premium is that this method includes the impact of embedded debt. In other words, the notional financeability test could be stretched by the impact of high cost embedded debt, even if the relationship between the equity premium and the debt premium on new debt was satisfactory.

At the same time, Ofwat's established regulatory methodology is to take account of an efficient level of embedded debt costs. Given that is a core part of the methodology, Ofwat should also consider the implications for the cost of equity, i.e. taking a longer-term view on the cost of equity could be a natural consequence of the longer-term approach on the cost of debt.

2.5.4 Market to asset ratios

Ofwat's analysis of market-to-asset ratios is reproduced below in Figure 15. It shows that MARs have generally fallen since the early view of the cost of capital.

Figure 15 Market to Asset Ratios



Source: Ofwat analysis of Thomson Reuters data

In the Draft Determination, Ofwat do not attach weight to the MAR evidence, citing the impact of Labour Party proposals to re-nationalise the industry. While this is a relevant consideration and points to a general weakness in the MAR evidence, it does not mean that this evidence should be completely disregarded. After all, political risk has always been a valid and material risk factor in the sector.

While we do not consider that material weight should be placed on the MAR evidence, we note that the data does not support a conclusion that the WACC has declined since the early view, or that a further reduction from the DD level is warranted.

2.5.5 Summary of evidence from cross-checks

All of the potential cross-checks on the WACC have their drawbacks as methods. Nevertheless, it is appropriate to take account of this evidence. Three of the four methods considered here indicate that Ofwat's DD view on the cost of equity is too low. None of the evidence supports a reduction in the cost of equity compared to the early view WACC.

2.6 Frontier estimate of cost of equity

2.6.1 CAPM estimation

To calculate the cost of equity, we use the CAPM equation:

$$Cost\ of\ equity = RFR + \beta * ERP,$$

where $ERP = TMR - RFR$.

The table below presents our estimates from the outlined changes in the methodology and market updates, compared with Ofwat's early view. We also

present results that exclude market updates but reflect only methodological differences, recognising that when Ofwat comes to estimate these later market data will have moved further.

Figure 16 Estimates of components of CAPM

Component	Nominal	Real (CPIH)	Real (RPI)	Range (real RPI)
Gearing		60%		
Total market return (TMR)	9.34%	7.2%	6.16%	6.5% to 7.2%
Risk-free rate (RFR)	1.92%	-0.08%	-1.05%	
Incl. market updates	*1.70%*	*-0.29%*	*-1.26%*	
Equity risk premium (ERP)	7.42%	7.28%	7.21%	
Incl. market updates	*7.64%*	*7.49%*	*7.42%*	
Debt beta		0.125		
Asset beta (including debt beta)		0.39		0.36-0.41
Incl. market updates		*0.40*		*0.37-0.43*
Notional equity beta		0.79		0.71-0.84
Cost of equity (including debt beta)	7.77%	5.65%	4.63%	
Incl. market updates	7.91%	5.80%	4.77%	

Source: Frontier analysis

Our updated point estimate of the real (RPI) cost of equity based on our CAPM analysis is 4.63%, compared to 3.46% from Ofwat.

The DGM cost of equity range is 5.28%-6.70% in real RPI terms, which is higher than our CAPM range. The other cross-checks also support a cost of equity higher than Ofwat's CAPM estimate.

This evidence is consistent with our view that the true value might sit above the midpoint of our CAPM range due to the increased uncertainty and risk looking forward.

3 COST OF DEBT

KEY CONCLUSION

Our estimated cost of debt is 1.55%, compared to Ofwat's 1.34% (both RPI real). The difference arises from a different methodology. More specifically:

- we do not include a reduction to account for the 'halo' effect;
- we see evidence of a lower proportion of new debt; and
- we do not agree with Ofwat's approach to estimating the iBoxx 'central' estimate based on the spot rate on a given day, nor on its use of the average 10- and 20-year average forward uplift (in line with our arguments related to the implied market rate rise on the risk-free rate).

3.1 Cost of new debt

KEY CONCLUSION

Our methodology does not include the reduction from expected outperformance (the so-called 'halo' effect), as we still do not see evidence of this.

The negative outlook, warning on the regulatory regime and analysis on financial metrics by Moody's poses a risk for an increased cost of debt, further decreasing the likelihood of any future halo effect.

We adopt an alternative approach to Ofwat's in reaching a point estimate for the iBoxx rate and forward uplift.

We estimate the cost of new debt at 3.65% nominal.

3.1.1 Ofwat's view at Draft Determination

Ofwat's estimate of the cost of new debt has three components:

- spot iBoxx yield: 3.30%;
- forward uplift for by the middle of 2020-25: 0.30%; and
- reduction of 25 bps on the account of expected outperformance in debt cost.

This results in a cost of new debt of 3.36% in nominal terms (2.33% CPIH and 0.35% RPI).

3.1.2 Outperformance on the cost of debt

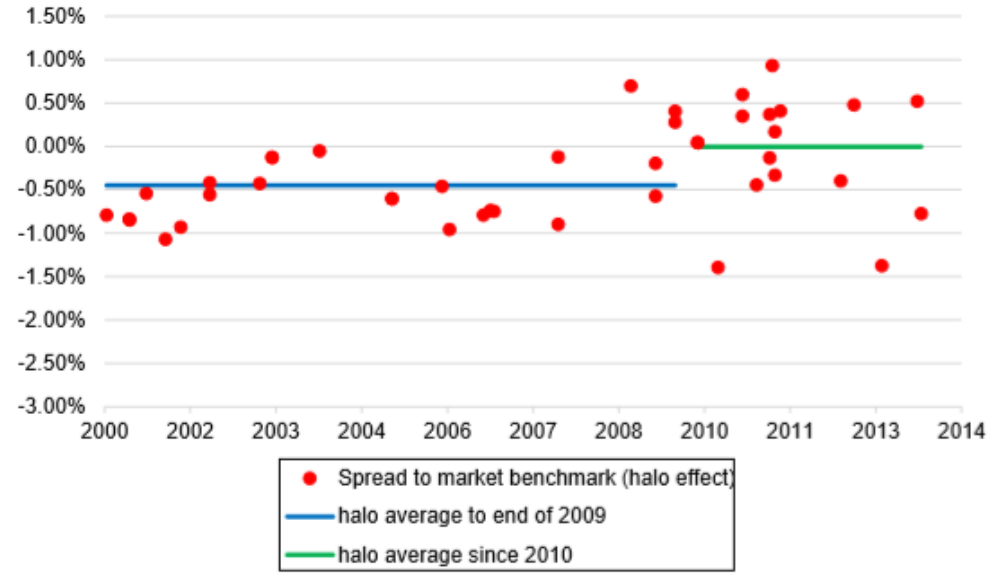
Ofwat believes that there is a systematic outperformance by water companies on the cost of debt, known as the 'halo' adjustment. This has increased from 15 bps in its early view to 25 bps in the Draft Determination. The existence of this halo for regulated utilities has been the subject of much analysis and debate and the evidence is conflicting. We are unconvinced that the evidence shows its existence and we therefore do not include the reduction in our cost of debt analysis.

There were two reviews by the CMA in 2015 which provide mixed evidence of potential debt outperformance.

British Gas Trading Limited v the Gas and Electricity Markets Authority final determination in September 2015, in the RIIO ED1[22]

One of the points of appeal for British Gas was to question the decision that there was no halo. The CMA conducted its own analysis of debt spreads to the benchmark to estimate this halo. The CMA found that there was no halo effect, although there may have been one before 2013. Its findings are presented in the figure below.

Figure 17 The CMA's analysis on halo effect pre and post period of financial volatility in markets



Source: CMA analysis of actual DNO debt positions and the iBoxx index.

Bristol Water plc reference under section 12(3)(a) of the Water Industry Act 1991 report in October 2015

Outperformance of debt was reviewed as part of the small company premium, not as a focus of the analysis. The CMA compared 22 WaSC bonds with over 10 years tenure to the iBoxx index, finding that the weighted average of the spread was 26 bps. This was used with the water-only company premium against the iBoxx to calculate the small company premium.

Outperformance analysis needs to consider the tenor and rating of bonds and the index they are compared to. Whether bonds are nominal, floating or index-linked, and what currency they are in are also important factors to control for.

[22] CMA - British Gas Trading Limited v The Gas and Electricity Markets Authority, Final determination. September 2015.

Further evidence

Analysis by CEPA in 2016 showed that from 2013 there was no longer a halo when looking at GBP nominal bonds[23]. CEPA then reviewed secondary yields and found water company yields are 27 bps lower for A rated debt and 40 bps lower for BBB rated debt. However, they caution that this analysis does not control for tenor, and they note the weighting of utility bonds in the iBoxx non-financial index affect the comparison and this weighting has varied significantly over time.

Anglian Water commissioned NERA to review the existence of a halo for water company bonds. Its report[24] found CEPA's analysis reflects rating differences, and that comparing A rated bonds directly with the iBoxx A rated index and B rated bonds with the iBoxx B rated index shows no evidence of a halo.

Frontier assessment

Ofwat's early view of the halo was 15 bps based on analysis by Europe Economics that compared iBoxx utilities and non-financial indices. However, according to subsequent analysis this estimate can be explained by differences in average ratings in the indices rather than outperformance[25]. Its analysis (and Europe Economics') for the Draft Determination relies on comparing yields at issuance to the iBoxx index, for nominal bonds. The average outperformance is 31 bps[26] for bonds with a tenure greater than 10 years.

Figure 18 Water bonds' performance relative to the iBoxx A/BBB index (2000-2019)

Source: Ofwat analysis of IHS Markit data

Note: As published in EE's cost of capital for the water sector at PR19 report

We note that much of the volatility has been in the past several years. We disagree with Ofwat's use of a post-2015 average as part of its evidence base because the average tenure of the bonds is around 15 years in the water sector. This volatility demonstrates how the time period chosen can significantly affect the results. We

[23] CEPA - Alternative Approaches to Setting the Cost of Debt for PR19 and H7, August 2016

[24] NERA - A response to Ofwat's halo effect for PR29: a report for Anglian Water, July 2018

[25] NERA - cost of capital for South East Water at PR19, September 2018

[26] 33 bps if 2019 data is included, according to analysis by Europe Economics

do not see that this analysis takes into account issues of tenor and credit rating, as described above.

Ofwat's response is that its approach sets an allowed cost of new debt which is reflective of observed borrowing costs without materially overcompensating for these, and that the benchmark is a reference point[27]. Our view is that the iBoxx is not being used appropriately as a benchmark for the reasons given above, and that it does not provide sufficient evidence of an outperformance halo.

Furthermore, any past halo existence does not guarantee that it will continue in the future and affect the cost of new debt, as noted by the CMA in its halo analysis for RIIO DE1[28]:

> *"An historical halo effect of around 20 basis points does not mean that this is the likely value for the future ED1 period. The halo effect could increase, either due to increased certainty over the ED1 settlement, or due to other changes in financial market conditions. However, our analysis of trends in the halo effect did not lead us to be overly concerned that high values were prevailing or would do so in the future."*

This combined with the recent credit warnings on the water sector following the Draft Determination, the December final methodology and the "Back in Balance" consultation makes it even more unlikely that there would be any halo remaining in the water sector. We explore this in more detail below.

3.1.3 Credit downgrade risk

Moody's analysis shows that the further cut to allowed returns in the Draft Determinations will "intensify pressure on companies' interest coverage ratios".[29] These metrics make up part of Moody's analysis of companies' credit ratings.

This follows from:

- negative outlook after Ofwat's final methodology was published;
- warning on the regulatory regime;
- further negative outlooks for four water companies after the 'Back in Balance' consultation in May 2018; and
- reiteration of the negative outlook after business plans were submitted in September 2018.

A credit downgrade would impact the WACC through increasing the cost of debt, further reducing any likelihood of a halo remaining in PR19.

3.1.4 Frontier's estimate of cost of new debt

As discussed in section 3.1.2, we have not included a halo adjustment in our estimate of the cost of new debt, as the evidence we have reviewed does not support its application.

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27 Ofwat, PR19 draft determinations: cost of capital technical appendix, July 2019

28 CMA - British Gas Trading Limited v The Gas and Electricity Markets Authority, Final determination. September 2015, p150 paragraph 8.54

29 Moody's, Ofwat tightens the screws further, sector in-depth report, July 2019

In reviewing Ofwat's approach to estimating the cost of new debt we note two further issues.

First, Ofwat has estimated a range for the iBoxx spot rate as of 28 February 2019 of 3.19% to 3.51%, based on the minimum and maximum rates over the previous two months. It then adopts a 'central' estimate based on the spot rate as of 28 February 2019, of 3.30%. This it takes as its point estimate.

This seems arbitrary approach to choosing the point estimate. The purpose of estimating the range would then be to take the actual mid-point of that range. To then adopt the spot rate at a particular date divorces the point estimate from the range.

This is made clear when assessing the iBoxx rate as of our updated date of 31 July 2019. At this point in time, the range on the iBoxx spot rate is lower, at 2.56%-2.96%. However, the minimum value occurs on the 31 July 2019, such that adopting this rate does not represent a 'central' estimate.

We therefore update Ofwat's approach and take the actual mid-point of the range.

- At 28 February 2019, this rate is 5 bps higher than Ofwat's estimate, at 3.35%.
- At 31 July 2019, this rate is 20 bps higher that it would be based on Ofwat's approach, at 2.76%.

Second, in assessing the forward uplift that Ofwat applies, we note that it has estimated this using the average of the 10- and 20-year gilt yields. However, in line with our arguments in section 2.2.3 above, given that the 10-year yield curve is currently inverted, we disagree with this approach and instead estimate the forward uplift using 15-year gilt yields. Given that this issue was not present as of 28 February 2019, we estimate apply an uplift of 30 bps, in line with Ofwat's estimate. At 31 July 2019, however, we apply a forward uplift of 0.32% (3 bps higher than what it would be if applying the average of the 10- and 20-year uplift).

Our estimate for the cost of new debt is therefore **3.65%** (nominal). If we include the market update based on the latest available data to 31 July 2019, this results in a lower estimate of the cost of new debt of 3.08% (nominal).

3.2 Cost of embedded debt

KEY CONCLUSION

We have removed Ofwat's halo adjustment as we do not see sufficient evidence of its existence.

We adopt an alternative approach to Ofwat's in adjusting for the forward uplift.

Our cost of embedded debt is 4.66% nominal.

3.2.1 Ofwat's view

Ofwat's Draft Determination of 4.50% is the iBoxx 15-year trailing average, with a downward adjustment of 25 bps for the halo. This is 2.46% CPIH and 1.46% RPI.

3.2.2 Frontier's estimate of cost of embedded debt

We have updated the estimate of the cost of embedded debt based on data up to Ofwat's cut-off date for Draft Determination on 28 February 2019. For this, we have updated the spot iBoxx and forward uplift as per Ofwat's methodology. Ofwat used the sector median in its early view of the cost of capital as the "most representative measure of embedded debt costs".[30] We adopt the same approach.

As discussed in section 3.1.2, we do not see sufficient evidence of systemic outperformance by water company bonds. We therefore do not include any halo adjustment in our cost of debt.

In the analysis through February 2019, the median sector cost of debt that Ofwat calculated is 4.65%. Ofwat used an average spot rate, adjusted for its 25 bps estimate of the halo, of 2.98%, for the remaining £2.8 billion of debt yet to be issued by 31 March 2020. We reverse the halo reduction, noting that this uplift is only applicable to the "new debt" proportion of the embedded debt (i.e. the debt companies will raise between now and the start of AMP7), which is 5.76% of embedded debt according to Ofwat's own figure.

This adjustment increases the cost of embedded debt by 1 bps, meaning our estimate is **4.66%** nominal.

Recent market updates

If we include updated market data to July 2019 in our estimate, then our estimate of the cost of embedded debt is 4.63%.

3.3 Ratio between new and embedded debt

KEY CONCLUSION

We use resubmitted business plan table data and find a lower estimate of 16% new debt. We use this in our analysis.

Ofwat has moved from its early view of a 70:30 ratio of embedded to new debt to a 80:20 ratio, which is supported by Europe Economics' analysis. While we agree that this move is in the right direction, we have updated the analysis of APP19 data in the resubmitted business plan tables (in response to Ofwat's initial assessment of plans).

APP19 in the (resubmitted) business plan tables reports opening, issued and repaid debt. We looked at the issued debt compared to the existing debt[31] of each year in PR19, and looked at the weighted and unweighted averages for the 5-year period. The unweighted average is 14.0% and the weighted average is 18.3%, and we take the mid-point of 16.18%.

[30] Ofwat, Appendix 12: Risk and return December 12 2017, p79

[31] The existing debt is the mid-point of the opening debt, debt repaid and indexation of index-linked debt. The range when taking the opening debt as the existing debt is 12.5% to 16.4%. When new debt is treated as cumulatively new (ie new debt in year 1 is still considered as new debt in year 2 etc), the range is 13.6% to 17.8%. We view taking the mid-point of opening, repaid and indexation in each year as the most appropriate method.

3.4 Frontier estimation of cost of debt

Our overall cost of debt is calculated using the components below, including estimates where the update on market data has been removed.

Figure 19 Estimates of cost of debt components

Component	Nominal	Real (CPIH)	Real (RPI)
Ratio of embedded to new debt		84:16	
Nominal cost of embedded debt		4.66%	
Incl. market updates		*4.63%*	
Nominal cost of new debt		3.65%	
Incl. market updates		*3.08%*	
Issuance and liquidity costs		0.10%	
Inflation	n/a	2.00%	3.00%
Nominal overall cost of debt		4.60%	
Incl. market updates		*4.48%*	
Indexed overall cost of debt	**4.60%**	**2.55%**	**1.55%**
Incl. market updates	*4.48%*	*2.44%*	*1.44%*

Source: *Frontier analysis.*

Note: *'Including market updates' updates the market data since Ofwat's Draft Determination on the cost of capital*

We adopt the same allowance for issuance and liquidity costs as Ofwat.[32]

[32] Detailed analysis of these parameters is not in the scope of this work

4 SUMMARY OF COST OF CAPITAL

4.1 Summary WACC estimate

The table below compiles our estimates on the WACC and its components for nominal, CPIH and RPI values at both 28 February 2019, and including market updates to 31 July 2019. We provide our range in real RPI. Our real RPI wholesale WACC estimate is **2.67%**.

Figure 20 WACC components – Frontier updated estimates

Component	Nominal	Real (CPIH)	Real (RPI)	Range (real RPI)
Gearing			60%	
Total market return (TMR)	9.34%	7.20%	6.16%	5.47%-6.16%
Risk-free rate (RFR)	1.92%	-0.08%	-1.05%	
Incl. market updates	1.70%	-0.29%	-1.26%	
Equity risk premium (ERP)	7.42%	7.28%	7.21%	6.77%-7.20%
Incl. market updates	7.64%	7.49%	7.42%	*6.97%-7.42%*
Debt beta			0.125	
Asset beta (including debt beta)		0.39		0.36-0.41
Incl. market updates		*0.40*		0.37-0.43
Notional equity beta		0.79		0.71-0.84
Incl. market updates		*0.81*		0.74-0.89
Cost of equity (including debt beta)	7.77%	5.65%	4.63%	3.52%-4.99%
Incl. market updates	*7.91%*	*5.80%*	*4.77%*	3.64%-5.43%
Ratio of embedded to new debt			84 : 16	
Nominal cost of embedded debt			4.66%	
Incl. market updates			*4.63%*	
Nominal cost of new debt			3.65%	
Incl. market updates			*3.08%*	
Issuance and liquidity costs			0.1%	
Overall cost of debt	4.60%	2.55%	1.55%	
Incl. market updates	*4.48%*	*2.44%*	*1.44%*	
Appointee WACC (vanilla)	5.87%	3.79%	2.78%	2.33%-2.94%
Incl. market updates	*5.85%*	*3.78%*	*2.77%*	*2.31%-3.01%*
Retail net margin deduction			0.11%	
Wholesale WACC (vanilla)	**5.76%**	**3.68%**	**2.67%**	**2.22%-2.83%**
Incl. market updates	***5.74%***	***3.67%***	***2.66%***	***2.20%-2.90%***

Source: *Frontier analysis.*

Note: *All estimates taken as of 28 February 2019. 'Including market updates' updates the market data since Ofwat's Draft Determination on the cost of capital*

The updated figure to July 2019 is effectively unchanged from the February estimate. This stability of this estimate contrasts with the volatility of the Ofwat method, where the estimated WACC declines by nearly 0.4% between February

and July. In our view this level of volatility is not consistent with a robust method for setting a WACC for a five year regulatory control and further highlights the weakness with Ofwat's approach.

Our estimated range for the wholesale WACC, based on this bottom-up CAPM assessment, is 2.22% to 2.83%. This range is relatively wide and we consider that a credible and narrower range for the WACC is 2.5% to 2.8%, focussed around our central estimate of 2.67%. This narrower range reflects the following factors:

- Our assessment of the forward-looking risk factors, including Brexit and the additional risks in the regulatory methodology, which point to a WACC at the upper end of the range.
- Evidence from the DGM cross-check, which indicates that the cost of equity lies above the CAPM range. Although we attach less weight to this evidence than to the CAPM results, it supports a view that the bottom end of the CAPM range is not credible.
- The further cross-checks on the overall WACC set out in this paper. This includes market-asset ratios and comparison of debt and equity premium. These cross-checks also support a value in the upper end of the range.

4.2 Comparison to Ofwat's Draft Determination

We review where our estimates are different to Ofwat's Draft Determination, and highlight where these are methodological differences, market updates or where we have taken Ofwat's position for simplicity.

Figure 21 Comparison of WACC components (real RPI)

Component	Frontier	Ofwat DD	Reason for difference
Gearing	60%	60%	Adopted Ofwat's estimate
Total market return (TMR)	6.16%	5.47%	Evidence of higher TMR and appropriate interpretation of data
Risk-free rate (RFR)	-1.05%	-1.42%	Rely on nominal rather than index-linked gilts
Equity risk premium (ERP)	7.21%	6.89%	Evidence of higher TMR and RFR
Debt beta	0.125	0.125	Adopted Ofwat's estimate
Asset beta (including debt beta)	0.39	0.36	Evidence of higher asset beta
Notional equity beta	0.79	0.71	
Cost of equity (including debt beta)	4.63%	3.46%	
Ratio of embedded to new debt	84:16	80:20	APP19 tables from resubmitted business plans evidence of a lower proportion of new debt
Nominal cost of embedded debt	1.61%	1.46%	No halo reduction on new issuance by 2020, updated approach to estimating forward uplift
Nominal cost of new debt	0.63%	0.35%	No halo reduction, updated approach to estimating iBoxx rate and forward uplift
Issuance and liquidity costs	0.10%	0.10%	Adopted Ofwat's estimate
RPI real overall cost of debt	1.55%	1.34%	
Appointee WACC (vanilla)	2.78%	2.19%	
Retail net margin deduction	0.11%	0.11%	Adopted Ofwat's estimate
Wholesale WACC (vanilla)	**2.67%**	**2.08%**	

Source: Frontier analysis.

Note: All estimates taken as of 28 February 2019

For simplicity, we adopt Ofwat's debt beta, gearing, issuance and liquidity costs, and retail net margin deductions at Draft Determination.

Our other components differ based on the methodologies adopted, as outlined in Figure 21 and throughout the report. Because of these, our wholesale vanilla WACC is 59 bps above Ofwat's estimate at Draft Determination in RPI terms. Including market updates, it is 57 bps above Ofwat's estimate.

ANNEX A COST OF EQUITY

A.1 Asset beta estimation

We updated Ofwat's beta analysis to include 2019 data. We found that Ofwat's point estimate is in the middle of our asset beta range, and that there has been limited movement in betas since Ofwat published their early view.

A.1.1 Methodology and data

Our methodology is consistent with CMA in the 2014 NIE determination. This methodology used the following raw data:

- *Total return data for water companies:* we used daily frequency data on the share price of United Utilities and Severn Trent (Bloomberg);
- *Total return data for FTSE All Share Index:* daily frequency data on total returns values for the FTSE All Share index (Bloomberg);
- *Net debt position of water companies:* daily frequency data on the net debt position of each of the three water companies (Bloomberg); and
- *UK nominal spot yield with 10 year maturity:* daily frequency data on the UK nominal spot yield with 10 year maturity, to proxy for values of the risk-free rate (Bank of England yield curve).

We then constructed a series of excess returns, for two, five and ten year windows. We use three different frequencies of data in the estimation:

- *Daily returns*: all trading days;
- *Weekly returns*: Tuesdays as the representative weekday; and
- *Monthly returns*: we use the midpoint of the month, unless it is not a trading day (in which case we use the16th, or the 14th if the 16th is also not a trading day).[33]

With these data series, we used an OLS model to estimate the asset beta for each water company, by regressing each companies excess return on the FTSE Allshare index excess return. Using a debt beta assumption of 0.125, we calculate the equity beta using the actual gearing. Finally, we used Ofwat's notional gearing of 60% to re-gear back to the asset beta.

The beta figures presented are a simple average of the water companies.

Figure 22 Asset beta results by rolling time period for estimation and frequency of data (as of 28 February 2019)

Frequency of data	2 years	5 years	10 years
Daily (trading days)	0.35	0.39	0.32
Weekly	0.32	0.41	0.33
Monthly	n/a	0.41	0.31

Source: Frontier analysis of Bloomberg data

[33] We did not estimate monthly on the two year window due to the small sample size.

A.1.2 Rolling beta estimates

We looked at how much variation there has been in asset betas for water companies over time, by varying the start date for the regressions.

We found that while there is variation over time, there has not been significant movement since Ofwat's Draft Determination based on February 2019 data. The betas tend to fall when the share prices go into volatile conditions.

Figure 23. Daily 2 years

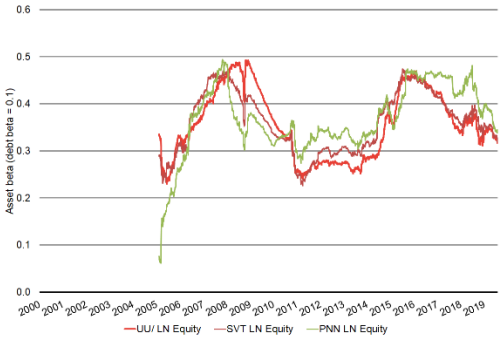


Figure 24. Daily 5 years

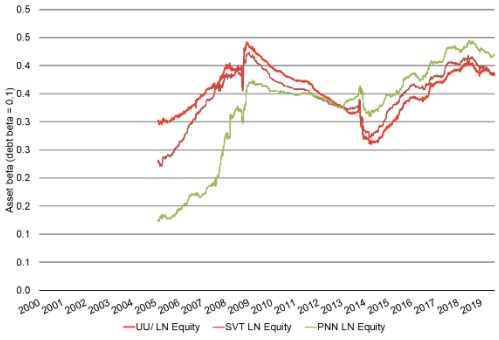


Figure 25. Weekly 2 years

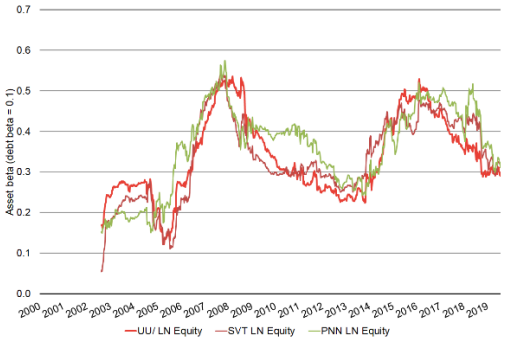


Figure 26. Weekly 5 years

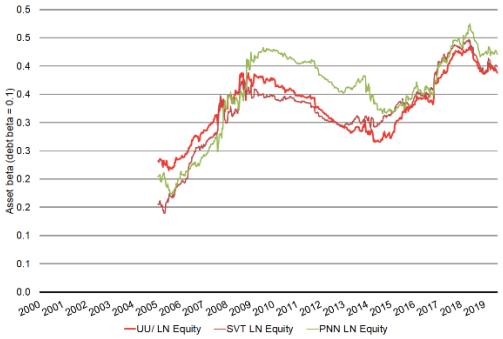


Figure 27. Monthly 2 years

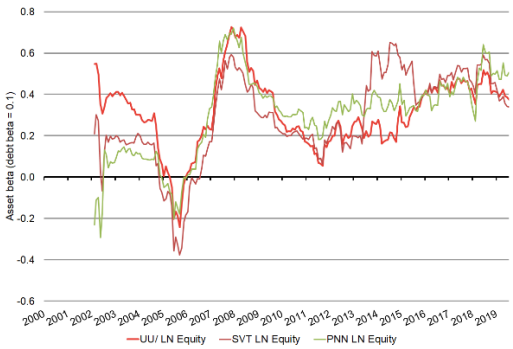
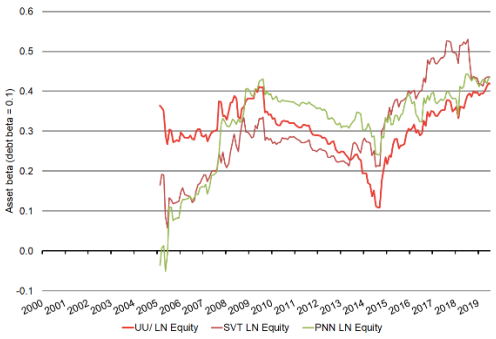


Figure 28. Monthly 5 years



Source: *Frontier analysis*
Note: *Bloomberg data*

A.1.3 Ofgem's beta components

Figure 29 summarises the assumptions underlying the calculations of equity beta in Ofgem's December 2018 report.

Figure 29 Ofwat and Ofgem equity beta assumptions

Component	Ofwat	Ofgem		
		Low	Midpoint	High
Raw equity beta	0.64	0.60	0.65	0.70
Observed Gearing	54.7%	56%	56%	56%
Debt beta	0.125	0.15	0.13	0.10
Asset beta	0.36	0.35	0.36	0.36
Notional gearing	60%	60%	60%	60%
Equity beta (re-geared)	0.71	0.65	0.70	0.76

Source: Ofwat PR19 Draft Determinations Cost of Capital technical appendix, July 18 2019; Ofgem RIIO 2 Sector methodology December 18 2018; Ofgem RIIO2 Finance annex December 18 2018; Frontier calculations

There are four main findings from this comparison.

1. Ofgem appears to have used the spot gearing level to de-gear rather than the average gearing level consistent with the raw beta estimation window, while the latter is commonly considered as the better practice. This explains a substantial difference in the resulting asset beta estimates, and we expect the network companies to pick up on this shortfall in Ofgem's methodology in its response to the consultation.
2. Ofgem uses an adjustment on the gearing level used for the de-gearing, which we comment on in section 2.4.2, and this explains the remaining discrepancy in the final equity beta estimates.
3. There are differences in the assumptions made for the debt beta, but the calculation of the re-geared equity beta is not sensitive to this assumption.
4. There are differences in the methods used to estimate the raw equity beta, but the statistical method employed is less important than the time period under consideration, and Ofwat and Ofgem arrive at a similar raw estimate.

A.2 DGM

A.2.1 DGM approach

As discussed in 2.1.1, the main challenge of estimating a DGM cost of equity is that expected dividends are not directly observable in the market and therefore must be assumed.

Assuming a constant growth (g) of the dividend per share (DPS), this leads to a cost of equity (r) equal to:

$$r = DPS_1/P_0 + g$$

Where P_0 is the price of the stock in the initial period.

In this section, we provide details of the methodology we have used to derive our cost of equity figures using DGM.

We have estimated the cost of equity for United Utilities, Severn Trent and Pennon[34]. We have applied a two-stage DGM approach, using Bloomberg's forecasts of dividends per share for the first three years and assuming a constant dividend growth rate after that. This formulation for the DGM has been commonly applied by regulators in the US. The rationale for this is that it is possible to obtain short-term estimates from analysts' reports and only assume a constant growth rate in the long-term.

This means that the cost of equity can also be estimated using the following formula:

$$P_o = \sum_{i=1}^{3} \frac{DPS_i}{(1+r)^i} + \left(\frac{DPS_3 * (1+g)}{r-g}\right)\left(\frac{1}{1+r}\right)^3$$

To estimate a range for the cost of equity we have used two alternative options for the long-run DPS growth rate: a) setting it equal to the GDP growth rate; and b) assuming it is -0.5% per year.

Additionally, we have considered the fact that the three water companies under consideration pay interim dividends in the middle of the year and that this interim dividend accounts for around 36% of the total annual dividend.

Therefore, our approach can be expressed mathematically as:

$$P_o = \frac{0.36 * DPS_1}{(1+r)^{0.5}} + \frac{0.64 * DPS_1}{(1+r)^1} + \frac{0.36 * DPS_2}{(1+r)^{1.5}} + \frac{0.64 * DPS_2}{(1+r)^2} + \frac{0.36 * DPS_3}{(1+r)^{2.5}} + \frac{0.64 * DPS_3}{(1+r)^3} + \left(\frac{DPS_3 * (1+g)}{r-g}\right)\left(\frac{1}{1+r}\right)^3$$

Where:

- P_0 is the share price data on the ex-dividend final date;
- DPS_i is the Bloomberg dividend forecast for year i;
- r is the cost of equity; and
- g is the expected DPS growth after the third year

The stock price and the DPS forecasts have been obtained from Bloomberg. As explained above, two options have been used for the long-run dividend growth: the long-run expected GDP growth (see A.2.3 for the methodology of this estimate) and a -0.5% growth rate.

We re-gear the actual results with Ofwat's notional gearing of 60%.

This re-gearing involves using the CAPM methodology with the Miller equation:

[34] We have not estimated the cost of equity for Dee Valley as it is a small water-only company and its risk profile may not be representative of the industry. In addition, it raises a practical difficulty because its stock is covered by only a few analysts. It is not possible to disaggregate the DGM and we therefore present cost of equity results only for Pennon group, and not separately for South West Water.

$$regeared\ r = risk\ free\ rate + \frac{1}{(1-notional\ gearing)*(1-\ actual\ gearing)*(r-risk\ free\ rate)}\ ,$$

where r is the cost of equity. Ofwat's risk-free rate of -1.42% RPI real is used for illustration purposes.

It is worth noting that we have calculated the cost of equity in real terms. For this reason, we deflate DPS forecasts using RPI inflation forecasts made on the year for which the cost of equity is calculated.[35]

Even under this formulation, the resulting estimation has a few caveats:

- analyst forecasts can have two problems: circularity and optimism bias; and
- if the number of years with reliable dividend estimates is small, the assumed long-term growth rate is still an important driver of results.

We discuss these in more detail in the following sections.

A.2.2 Short-term dividend forecasts

Analyst forecasts are the only direct source for future dividend estimates. However, the potential issues with the use of such forecasts are circularity and optimism bias.

The issue of circularity stems from the fact that i) analysts' dividend forecasts depend on their expectations of future regulatory provisions, which are going to be decided by the regulator and ii) the analyst projections can influence the regulatory determination through the DGM calculation.

In practice, the circularity issue is unlikely to be material, for the following reasons.

- DGM estimates are only one of the methods used by Ofwat to assess the cost of equity (and TMR). Therefore, any analyst is unlikely to perceive a material relationship between the dividend projections and the allowed return on equity, even with Ofwat's current greater emphasis on the DGM.
- Furthermore, the analyst dividend projection has a relatively small role in the DGM assessment. The more significant variables are the current dividend yield and the long-term dividend projection.

The second issue with using analysts' forecasts is possible optimism bias. There is some empirical evidence to show, on average, analysts forecasted higher dividends than the true dividends. In this case, using analysts' forecasts of dividend would lead to a higher allowed cost of equity than necessary.

It remains an open question if there is a significant optimism bias in the dividend projections for regulated utilities. Regulated utilities are usually characterised by more stable profits and dividends and less information asymmetry between management and investors than other sectors. Changes by the regulator which increase uncertainty may impact this.

[35] Interim dividends are deflated with half of the annual inflation rate.

A.2.3 Long-term dividend forecasts

Long-term dividend expectations by equity investors are also unobservable. In practice, there are several plausible options for setting the long-term dividend growth rate. It can be proxied by:

- historic dividend growth rates;
- analysts' forecasts of dividend growth in the short/medium-term;
- estimated long-term GDP growth rate;
- projected growth rate of the company's replacement cost value; or
- an assumption of 0% per year, or negative growth if feasible.

The first option can be particularly appealing in the case of a constant historic dividend growth rate, which could indicate a stable company policy. In this case, historic rates can be a good proxy but using them would undermine one of the advantages of DGM, which is the fact that it is forward-looking.

The second option has the advantage of relying on the closest possible estimate (especially if circularity and optimism bias have been corrected for to the extent possible). But it might lead to inconsistent results in the long-run.

The third option overcomes this consistency problem by setting the dividend growth rate equal to the GDP growth rate but at the risk of not reflecting accurately the situation of the company in question.

A growth rate that is sustainable and closer to the company's reality could be the expected growth rate of its regulatory capital value[36]. This is not necessarily a good proxy for future dividends because the size of a company increases does not mechanistically mean that the dividend per share grows. But it acknowledges the difficulty of dividend per share increasing systematically in the long run if the company does not grow.

In practice, it is common to test the results under several options to derive an appropriate range for the cost of capital. We have used a lower bound of -0.5% and an upper bound of long-term GDP growth of 1%; both real RPI. The negative growth rate in the lower bound reflects two factors. First, that the reduction in the overall WACC at PR19 may result in a transition to a lower dividend level. Second, that the indexation of RCV is transitioning to CPIH, which is expected to be lower than RPI.

There are many estimates of long-term GDP growth, some of which are summarised in the table below:

[36] The regulatory company value is equal to the amount that stakeholders and debt holders have invested in the regulated activity in question.

Figure 30 Long-term GDP growth estimates

Estimate	Source	Ofwat source	Date of estimate
0.7%	IMF		November 2017
0.9%	IMF	Europe Economics PR19 – Initial assessment of the cost of capital: final report	April 2017 (IMF) December 2017 (EE)
1.2%	Consensus Economics	PwC Refining the balance of incentives for PR19	October 2016 (CE) June 2017 (PwC)
0.4%	OBR	*Referenced by both Europe Economics and PwC*	November 2017

Source: Frontier analysis

Note: real RPI – where data was in real CPI a wedge of 1% was used to calculate the RPI real figures

Additionally, it is reasonable to use completed business cycles to inform forecasts of the long-term economic growth rate. Using data from the IMF, the average real RPI GDP rate of the past two complete business cycles (1982 – 1991 and 1992 – 2007) is 1.83%. Including the current partial business cycle since 2008 gives an average growth rate of 1.31%. Therefore, after reviewing this evidence it is reasonable to use 1% real RPI growth as the estimate for long-term GDP growth.

A.2.4 DGM results for the cost of equity

The tables below present our results for the re-geared cost of equity from this review and our January 2018 report on the cost of equity for South West Water.

Figure 31 Lower bound re-geared cost of equity

	Current estimate	January 2018
United Utilities	**4.52%**	4.80%
Severn Trent	**4.94%**	4.72%
Pennon	**6.40%**	6.08%
Average	5.28%	**5.20%**

Source: Frontier analysis

Note: Average is a simple mean

Figure 32 Upper bound re-geared cost of equity

	Current estimate	January 2018
United Utilities	**5.85%**	6.47%
Severn Trent	**6.33%**	6.51%
Pennon	**7.90%**	8.04%
Average	6.70%	**7.01%**

Source: Frontier analysis

Note: Average is a simple mean

These results illustrate there is volatility in the estimate over time, particularly for individual companies though the overall volatility is lower. We would also note that the volatility in estimates appears no greater, and in fact somewhat less, than that

shown in Ofwat's CAPM approach based on short-term Betas and current risk-free rate data.

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