

# COST OF EQUITY – RESPONSE TO RIIO ED2 DRAFT DETERMINATIONS

A report prepared for WPD

23 AUGUST 2022

# CONTENTS

1	Introduction and background	7
2	Risk free rate	9
3	TMR	11
4	Beta	16
5	Aiming up	22
6	Overall cost of equity	25



# EXECUTIVE SUMMARY

Frontier Economics has been commissioned by Western Power Distribution (WPD) to update our estimate for the cost of equity from our Nov 2021 report prepared for WPD as a part of its Business Plan submissions for RIIO ED2 price controls.<sup>1</sup> The update serves to inform WPD's response to Ofgem's Draft Determinations on the cost of equity for ED2.

This report retains the approach we used to estimate the parameters for the cost of equity in our Nov 2021 report, while taking into account up to date data on all parameters, including the Risk-Free Rate, the Total Market Return, and beta. We conclude that the updated range for the cost of equity is **4.64% - 5.90%**, with a midpoint of **5.27%** before our recommended aiming up. This compares with our old range of 4.37% - 5.54% with a midpoint of 4.96% from our 2021 report.

## Risk free rate

For the risk free rate, we continue to recommend the approach taken in the CMA PR19 redetermination. This considers both Bank of England index linked gilts and corporate bonds using the iBoxx AAA index to provide a lower and upper bound, both averaged over a 6-months period.

This provides a range from **-0.95% to 0.43%** in CPIH real terms, based on the 6 months to July 2022, though further changes are expected by the time the price control is finalised.

## Total market return

For the total market return, we rely on the historic ex post approach, considering a number of averaging methods, holding periods and two methods for deflating nominal historical returns. Considering all of the resulting estimates from these different approaches, and using the latest equity return data and the new ONS back-cast CPIH data starting from 1950, we identify a wide range of 6.3% - 7.4%.

As per our Nov 2021 report, in order to provide a more focused range to support WPD's business plan submission, we have attenuated this TMR range. We continue to put less weight on the Cooper and DMS average methods, following the CMA PR19 precedent. In addition, we have also excluded the CED/RPI inflation series, reflecting the CMA's concern of the reliability of this data at the RIIO GD2/T2 appeals. Finally, we have also excluded what appears to be an outlier from the lower end that supports the 6.3% value.

As a result of these considerations, our attenuated TMR range, for the purpose of WPD business plan submissions, is **6.7% to 7.3%** in CPIH real terms.

## Beta

In estimating the unlevered beta, we consider three main elements – i) the set of publicly listed comparators, ii) the data frequency and iii) the estimation windows and averaging period. Our approach can be summarised as follows:

---

<sup>1</sup> Frontier Economics, Cost of equity assessment for RIIO ED2 – An updated report prepared for WPD, 16 November 2021

- We first draw on GB utilities for our sample group of comparators which includes water companies as well as National Grid (the closest to GB pure play energy network). We note however that water companies tend to display lower risk exposure than energy networks (as per the consistently lower beta estimates). NG is the closest comparator to WPD, although NG UK until recently only operated electricity and gas transmission businesses (and gas distribution businesses before the 2017 divestment). The latest NG's strategic repositioning means that it now operates both electricity transmission and distribution networks (WPD).<sup>2</sup> Given the small sample size of the GB group, we expand our comparator sample to also include European regulated energy networks.
- With regards to data frequency, we consider that overall daily betas tend to be sufficiently reliable, do not suffer from reference day issues and tend not to produce a large amount of outliers. We therefore use daily estimates.
- We present estimates covering 2, 5 and 10 year windows, and averaging periods covering spot rates, 2 year averages, 5 year averages and 10 year averages, following recent practice from the CMA and Ofgem.

Based on the range of unlevered betas, we base the lower bound on the estimates for GB water networks which tend to be exposed to less risk than energy networks (as per the CMA PR19 redetermination). This gives a lower bound of 0.29. To locate the upper bound, we then look at NG and other European comparators, which produce an unlevered beta range of 0.33 to 0.34.

We therefore identify a range of 0.29 to 0.34 for the unlevered beta. However, as we did with the TMR range, we have attenuated the unlevered beta range, landing on an attenuated range of **0.30 - 0.33**. This compares to the old range of 0.31 - 0.34 in our Nov 2021 report. The decrease is due to the general decrease in beta in the past two years due to the volatile market caused by the COVID pandemic.

We adopt the debt beta assumptions as per the midpoint of CMA PR19 decisions, 0.075. The resulting equity betas based on these estimations are 0.73 to 0.80 respectively, at a notional gearing level of 60%.

## Aiming up

Regulators generally aim up when setting a point estimate for the WACC allowance, rather than selecting the mid-point of the range. This is due to the fact that estimating WACC involves a considerable amount of uncertainty, and costs associated with under- or over-estimating the WACC are asymmetric.

Given the CMA's latest precedent of aiming up for the water sector by 25 bps, we consider that for the electricity distribution networks, where both the need to attract investment and the harm from failure to invest are likely to be greater than in water, at least 40 bps of aiming up could be considered appropriate for ED2.

## Overall cost of equity

To summarise all of the parameters, we consider the appropriate range for the cost of equity over RIIO ED2 is 4.64% to 5.90%, with a mid-point of 5.27%. This compares to Ofgem's proposal of 4.75% for ED2. Our estimates are summarised in the table below.

---

<sup>2</sup> NG PLC also operates network businesses in the US.

**TABLE 1 SUMMARY OF COST OF EQUITY**

	LOW	HIGH
<b>Gearing</b>		
Notional gearing	60%	60%
Observed gearing	50%	45%
Risk-free-rate	-0.95%	0.43%
Equity risk premium	7.65%	6.87%
Total market return	6.7%	7.3%
Unlevered beta	0.30	0.33
Debt beta	0.075	0.075
Equity beta	0.73	0.80
Post-tax cost of equity	4.64%	5.90%
Mid-point	5.27%	
Aiming up	>0.4%	

*Source: Frontier analysis*

We observe that our mid-point is 52 bps higher than the 4.75% presented by Ofgem's DD estimate. This reflects the updated figures on the RFR and TMR that Ofgem needs to take into account in the ED2 FD. We continue to consider that the central point of our range provides a valid point of triangulation with Ofgem's stated position, when Ofgem's estimate is adjusted to take account of the need to aim up.

## 1 INTRODUCTION AND BACKGROUND

Frontier Economics has been commissioned by Western Power Distribution (WPD) to update our estimated range for the cost of equity from our Nov 2021 cost of equity report.

This report first provides an explanation of the parameters required to estimate the cost of equity. Each of these parameters is then addressed in turn, with an explanation on our proposed range provided for each component. Consistency across price control periods is important to ensure that investors' exposure to regulatory risk is minimised. However, Ofgem's final determination for gas distribution and gas and electricity transmission for RIIO-2 are materially different from RIIO-1 and have been subject to CMA appeal. Ofgem's Draft Determination for ED2 follows closely the methodology deployed in its GD2/T2 Final Determinations.

Our previous cost of equity report written in November 2021 for WPD took into account into account the most recent CMA RIIO GD2/T2 appeals outcome, as well as relevant previous precedent and market data up to November 2021. This report represents a further update on the market data as of July 2022, while maintaining the methodology proposed in the November 2021 report.

We continue to follow the CAPM approach for estimating the cost of equity. This describes the relationship between the risk and expected return for an investment, and consists of three main components:

- i) the risk free rate (RFR) which shows the rate of return an investor could expect to make from investing in risk-free assets;
- ii) the total market return (TMR) which shows the return over the entire market portfolio; and
- iii) the equity beta which represents the exposure to an asset's systematic risk relative to the overall market.

Together, the TMR minus the risk free rate provides the equity risk premium, which shows the premium an investor would expect to earn were they to hold a portfolio of shares across the market.

The relationship between these parameters can be formalised as follows:

$$r_e = RFR + \beta(TMR - RFR)$$

Where:

- $r_e$  represents the cost of equity;
- $RFR$  represents the risk free rate;
- $\beta$  represents the equity beta; and
- $TMR$  represents the total market return.

Whilst the RFR and TMR are a single estimated value, the equity beta is formed of both the asset beta and the debt beta. As highlighted, the equity beta reflects an investor's exposure to an asset's systematic risk relative to the overall market, at a particular gearing level. The asset beta is comprised of an unlevered equity beta (assuming zero gearing level) and a debt beta. The Harris-Pringle formula is used to express the relationship between the equity, asset and debt beta:

$$\beta_E = \frac{\beta_A - g \times \beta_D}{1 - g}$$

Where:

- $\beta_E$  is the cost of equity;
- $\beta_A$  is the asset beta;
- $\beta_D$  is the debt beta; and
- $g$  is the notional gearing.

For companies which are publicly listed, the equity beta can be directly estimated by regressing the company specific return against the return from the overall market. To the extent that the observed market gearing differs from the notional gearing, we use the Harris-Pringle formula to de-gear the estimated equity beta to infer an asset beta and then re-gear it back to the notional equity beta at the notional gearing level. However, for companies which are not publicly listed, such as WPD, we need to do this exercise using a sample of comparable companies which are listed.

Further explanation on how this has been done for WPD is provided in Section 4. The remainder of this report addresses each of the RFR, beta and TMR parameters, concluding with the resulting overall cost of equity estimate.

## 2 RISK FREE RATE

The RFR represents the rate of return an investor could expect from investing in a riskless asset. Whilst it is not possible to measure the RFR directly, government bonds or AAA-rated corporate bonds are generally considered to be the closest to a risk-free investment. The following section summarises recent regulatory precedent before setting out our proposed approach for the RFR.

### 2.1 REGULATORY PRECEDENT

At RIIO GD2/T2 FD, Ofgem based the RFR on 20-year index linked gilts on the basis that government bonds “are very low risk”<sup>3</sup> and opted not to consider AAA-rated corporate bonds.<sup>4</sup> The RFR was therefore based on current yields across October 2020, converted into CPIH using a RPI/CPI wedge of 0.8%. The RFR will be updated throughout the price control period, however Ofgem’s approach provided a value of -1.58% at the time the final determination was published. This decision has been subject to a CMA appeal, and the CMA Final Determination has found Ofgem not wrong in its assessment of the cost of equity estimate.

In its PR19 redetermination, however, the CMA included AAA-rated corporate bonds in its estimate of the RFR. The CMA provided a range for the RFR with the lower bound based on the 6-month average of 20-year index linked gilts, and the upper bound based on the 6-month average of the iBoxx GBP non-gilt AAA 10+ and 10-15 indices.<sup>5</sup> Corporate bonds were included on the basis that they represent a rate that is close to risk-free but also a rate that “is available to all (relevant) market participants.”<sup>6</sup> This gave a range of -1.63% to -1.05% with a mid-point of -1.34%. It should be noted that the CMA used an updated RPI CPI wedge estimate of 0.9% when converting the index linked gilts into a CPIH real estimate.

### 2.2 ESTIMATING THE RFR

We believe it is reasonable to include AAA-rated corporate bonds in the estimation of the RFR given the CMA’s assessment in PR19 that this reflects the lowest risk investment, which is available to all relevant market participants. We note the potential downward bias of the ILG yield as a proxy for estimating the RFR, due to the unique features of the government bond which could lead to a convenience premium. We also recognise the potential upward bias of the AAA corporate bond yield due to possible default risk premium, inflation premium and/or liquidity premium.

We note that even though the CMA did not find Ofgem’s estimate of the RFR at RIIO GT2/T2 to be wrong, in that appeal the CMA did not need to opine on precisely how it would estimate the RFR. We therefore defer to the approach consistent with the CMA PR19 determination where the CMA described carefully the method that it considered to be clearly superior when estimating RFR.

- We estimate the lower bound using the 6-month average of 20-year Bank of England index linked gilts. As the Bank of England gilts are indexed to RPI inflation, we use the OBR’s RPI-CPI wedge of 0.7% (based on latest OBR year 5 forecast) to convert into CPIH real terms. This gives a value of -0.95%.

<sup>3</sup> Ofgem, RIIO-2 Final Determinations – Finance Annex, paragraph 3.12.

<sup>4</sup> Ofgem, RIIO-2 Final Determinations – Finance Annex, paragraph 3.14.

<sup>5</sup> CMA, *Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations: Final report*, paragraph 9.241.

<sup>6</sup> CMA, *Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations: Final report*, paragraph 9.149.

- For the upper bound, we update the CMA's approach of using the average of the iBoxx GBP non-gilt AAA 10+ and 10-15 indices. The average for these across the past six months is 2.51% and 2.36% respectively in nominal terms. Converting to CPIH real (using long term assumption of 2%) and taking an average of these values provides an upper bound estimate of 0.43%.

Bringing these estimates together provides an overall range for the RFR of **-0.95% to 0.43%** in CPIH real terms. This is higher than the figures in our Nov 2021 report due to latest market data, even though our methodology has remained the same.

### 3 TMR

The total market return (TMR) represents the expected return over the entire market portfolio. Typically, regulators tend to place weight on long-run historic ex post equity market returns, which are considered to provide a reasonable indicator of current expectations on returns. These are usually taken from the Dimson, Marsh and Staunton (DMS) Credit Suisse Global Investment Returns Yearbook (DMS). This covers the period of 1900 to present day and can be used to calculate the average long-run return.

It is important to note that there are a number of methodological choices to be made when using this data, such as the averaging method used, the holding period (referring to how long an investor holds their assets for) and the measure of inflation used to deflate nominal historic returns. The combination of different approaches will impact the overall average long-run return estimate.

There are additional supporting methods that can be used in conjunction with the historic ex post approach, such as considering investment manager forecasts, or using an ex ante rather than ex post approach, which try to distinguish between historical realised returns and historical return expectations. We first set out recent regulatory precedent in this area before outlining our own approach for estimating the TMR.

#### 3.1 REGULATORY PRECEDENT

Prior to the RIIO-2 consultations, Ofgem stated that “a long-run average outturn market returns is the best single objective measure of investor expectations of the TMR”.<sup>7</sup> For RIIO-T2 and RIIO-GD2, Ofgem looked at the historical long-run returns, using geometric returns with an uplift for arithmetic averaging,<sup>8</sup> but also considered additional sources as cross-checks, such as a Dividend Growth Model and investment manager forecasts.<sup>9</sup> This provided an estimate of 6.5% in CPIH real terms.

In its Final Determination of the RIIO GD2/T2 appeal the CMA found Ofgem not wrong in its estimate on the TMR, even though Ofgem’s number was lower than the estimate made by the CMA in its PR19 determinations.

#### 3.2 ESTIMATING THE TMR

Our preferred approach is to place most weight on the historical ex post approach, which we believe is the least dependent on assumptions and therefore most objective and reliable. As outlined above, there are a number of key choices which must be made when calculating the TMR based on average long run returns from the DMS yearbook data. These are

- the averaging method used,
- the assumed holding period, and
- the treatment of historic inflation.

Given numerous combinations of these assumptions could be used, which would all result in different estimates of the TMR, we consider a reasonable approach is to take account of a wide variety of different

<sup>7</sup> Ofgem, *RIIO-2 Sector Specific Methodology Annex: Finance*, paragraph 3.12.

<sup>8</sup> Ofgem, *RIIO-2 Final Determinations Finance Annex Revised*, paragraph 3.88.

<sup>9</sup> Ofgem, 2019, *RIIO-2 Sector Specific Methodology Decision: Finance Annex*, paragraph 3.103.

methodologies. We can then infer a range from this evidence. We provide further explanation of each of the assumptions required, before presenting the resulting estimates.

### 3.2.1 THE AVERAGING METHOD USED

When averaging stock market returns over time, either an arithmetic average or a geometric average can be observed. Using an arithmetic average would assume that the historical return in each year is independent from all other years, and would therefore be in line with an investor who rebalances their portfolio each year. The geometric mean takes into account the compounding effect of investors holding their investments for multiple years, which would imply that investors buy and hold equity for the entirety of the relevant period.

Whilst the geometric mean is less susceptible to market volatility, the arithmetic mean has often been considered to be a better predictor of future returns in the context of the very long historic returns. A number of estimators have been developed which account for some of the issues associated with the arithmetic mean, including the Blume unbiased estimator, the JKM estimators and the Cooper estimator. Each one of these methods seeks to estimate an arithmetic mean from the geometric mean and the sample of the historic return data. As there is no academic consensus on which one is the most appropriate, and all of these produce different levels of estimates, we consider all of them in our analysis before taking a balanced view in the round to inform a reasonable range.

### 3.2.2 THE ASSUMED HOLDING PERIOD

As outlined above, investors can hold shares over a number of years and the assumption around this impacts the average return. 10-year and 20-year holding periods are considered in the CMA's PR19 determination, and Ofwat considered 5 and 10 years holding period in its PR19 determinations.<sup>10</sup>

In our view, although we recognise the CMA's preferred holding period of 10 and 20 years, there is evidence to support the consideration of a 5-year holding period. Based on Bloomberg data, when looking at publicly listed UK utility companies, we observe that the average holding period is 4.4 years.

We therefore consider 5, 10 and 20 year holding periods in our analysis.

### 3.2.3 THE TREATMENT OF INFLATION

The RPI inflation measure was introduced in 1947 and CPI in 1997. However the DMS yearbook data begins in 1900 and there is therefore no consistent measure of inflation which matches the period covered by the returns data.

Before the RPI measure was introduced, there were two other inflation measures – the cost of living index (COLI) and the consumption expenditure deflator (CED). Both the CMA and the Office for National Statistics note that the CED is the preferred measure on the basis of the greater coverage it provides.<sup>11</sup> This can be combined with the RPI or CPI measures to allow returns to be deflated over the entire period the DMS covers; we refer to these as CED/RPI and CED/CPI respectively.

---

<sup>10</sup> Ofwat, *PR19 Final Determinations – Allowed Return on Capital Technical Appendix*, p.41.

<sup>11</sup> CMA, *Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations: Final Report*, paragraphs 9.293 to 9.294.

It should be noted that given the CPI measure was only introduced in 1997, when using the CED/CPI measure, backward looking estimates are needed to cover the period 1947 to 1997. Therefore a “back-cast” model is needed to estimate this.<sup>12</sup> This results in significant uncertainty around the CED/CPI approach. However the RPI measure has also received considerable criticism as there is an argument that the current RPI index is an unreliable index and diverges from historic RPI methodology and therefore using historic RPI average for forward looking real TMR might create bias. There is therefore no consistent view on either the CED/CPI or CED/RPI approach being the best for deflating historical nominal returns.

### 3.3 OUR APPROACH

In order to account for the different assumptions outlined above, we use the latest 2022 DMS yearbook and consider a range of averaging methods, holding periods and CED/CPIH inflation index. We note that DMS 2022 year does not directly publish the nominal returns series, therefore we have constructed our own DMS-compliant series using FTSE All Share total return index gross dividend.<sup>13</sup>

We acknowledge that the CMA has expressed its concerns over the reliability of the CED/RPI inflation series both in its RIIO GD2/T2 appeals and PR19 appeals, we have therefore focused on the CED/CPIH inflation series. The conversion of historical time series to CPIH-deflated terms back to 1950 has been made substantially simpler by the recent publication of new ONS back-casts of CPIH data back to 1950 (previously data was only available to 1988). We consider this new back-cast series should be used as the basis for deflating historical equity returns from the present to 1950.

For data prior to 1950 there has been substantial discussion of the different inflation indices that are available. For data prior to 1950 we use the CED (Consumption Expenditure Deflator) series as this is consistent with past approaches of regulators.

Within averaging methods, we look at the results from using the Blume, JKM unbiased, JKM (MSE) and Cooper estimators, as well as overlapping and non-overlapping averages. With regards to holding periods, we look at 5, 10 and 20 years.

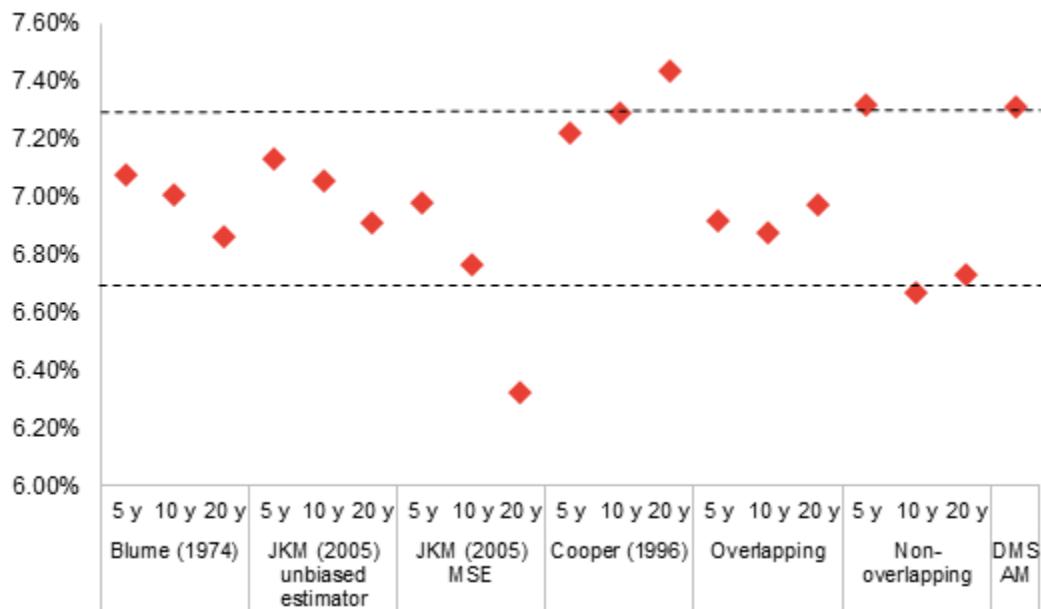
Figure 1 shows each of the resulting TMR estimates, which sit in a wide range of 6.3% -7.4% in CPIH real terms.

---

<sup>12</sup> CMA, *Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations: Final Report*, paragraphs 9.295.

<sup>13</sup> Data from 1900 to 2019 is drawn from the Credit Suisse Yearbook, data for 2020 and 2021 is nominal total returns from the FTSE All-Share index. In recent years nominal total returns from the FTSE All-Share index have tracked the nominal returns from the Credit Suisse Yearbook extremely closely.

**FIGURE 1 EVIDENCE FOR TMR RANGE**



Source: DMS Yearbook 2021, Bloomberg, ONS, Bank of England, Frontier analysis

Note: Data on UK nominal equity return for 2021 and 2022 calculated from FTSE All Share Total Return Index.

Such a wide range is, however, unhelpful for the purpose of identifying an appropriate level for the allowed equity returns at the ED2 price control. We therefore look more closely into the evidence base at both the higher and lower ends of the range, in order to identify and deemphasise on any estimates that may be supported by thinner evidence or evidence subject to more contention.

At the lower end, we identify the JKM (MSE) estimator assuming a 20-year holding period at 6.3% as being an outlier relative to the other values. We therefore exclude this data point which results in a low end value of 6.7%, which is supported by three other data points.

At the higher end, we acknowledge even though we see merit in including evidence from a wide range of estimators, including the Cooper and DMS averaging methods, we note that these have received less attention from the CMA. We are therefore careful in selecting a high end value that is supported by numerous data points - as we did with the lower end of the range. Based on the outputs in Figure 1, **Error! Reference source not found.** we therefore select a high end value of 7.3%.

We therefore estimate a CPIH-deflated TMR range of 6.7% to 7.3%. A key reason that this range is higher than previous ranges estimated by regulators is that the CPIH series from 1950 to 1988 from the ONS produces a lower annual inflation rate than the superseded estimates of back cast CPI figures that were previously used by regulators. This means that CPIH deflated returns are greater than CPI deflated returns. This CPIH series was not available at the time of the PR19 CMA redeterminations or RIIOGd2/T2 Final Determinations.

We therefore identify for this report a TMR range of 6.7% - 7.3% in CPIH real terms. This compares to Ofgem's range of 6.25% - 6.75%, the CMA's PR19 range of 6.2% - 7.2%, and our Nov 2021 report range of 6.3% - 6.9%, all of which predate the publication of the new back cast CPIH series by the ONS that increase the CPIH real TMR by roughly 20 bps all else being equal.

Our range is now significantly higher than that of Ofgem's range, as well as the latest CMA precedent on PR19. We now have strong evidence to believe that Ofgem's range used in ED2 Draft Determination is underestimated. We note that this update represents purely market data on the nominal average returns as well as better historic inflation series, as we have used the same method which produced the 6.3%-6.9% range in our Nov 2021 report. We are confident that were the CMA to update its PR19 analysis, it would also likely find a higher range than its PR19 FD estimate.

Finally, this increase in the TMR estimate does not come as a surprise to us. As we have set out in our Nov 2021 report TMR section:

*'We believe that 2020 equity returns, which were significantly negative, reflect a low point in the historic average and that updated data from DMS 2022 edition is likely to show higher values when Ofgem makes the final decision on ED2 cost of equity parameters. Therefore these values should be duly updated in due course.'*

## 4 BETA

Since WPD is not a listed company, we cannot directly estimate its unlevered equity beta. Instead, we estimate an implied unlevered beta based on a set of comparators which is then used to inform the asset and equity beta for WPD. This is done using the following steps:

- We first calculate raw equity betas for a sample of listed companies which are comparable to WPD. This is done by regressing the return for each company against the overall stock market return;
- Secondly, we then remove the impact of the sample companies' gearing using the Harris-Pringle formula, obtaining the sample companies' unlevered betas. This provides a range of unlevered betas which we can use to inform our estimate of the level of unlevered beta most relevant for WPD;
- Finally, we use these inputs to compute the implied asset beta for WPD, which is then re-gearied by the notional gearing levels to calculate WPD's notional equity beta.

When calculating the raw equity and unlevered betas, we have to make a number of technical decisions. These are i) the choice of comparator sample, ii) the frequency of data to use, and iii) the estimating window and averaging periods to use. We can draw on finance text book best practice as well as recent regulatory precedent to help inform these methodological choices. Below, we set out the regulatory precedent on beta estimation, and outline our approach.

### 4.1 REGULATORY PRECEDENT

#### 4.1.1 DEBT BETA

In recent price control determinations, there has been relatively less focus on the debt beta, compared with the unlevered beta for example. The debt beta represents the relative risk of the return on debt relative to the market portfolio.

In PR19, Ofwat commissioned Europe Economics (EE), who used a decomposition approach to provide an estimate of the debt beta. This resulted in a point estimate of 0.125. Although the CMA took account of this evidence, it noted that “the debt beta is difficult to measure and has a relatively small effect on the overall WACC”.<sup>14</sup> Based on the evidence presented by both Ofwat and the disputing companies, the CMA set a range for the debt beta of 0.05 to 0.10, with a point estimate of 0.075.<sup>15</sup>

Ofgem also recognised the uncertainty with setting the debt beta, stating that “estimating the debt beta involves considerable regulatory judgement”,<sup>16</sup> and considered evidence from the UKRN report, as well as company business plans and regulatory precedent.<sup>17</sup> Ofgem ultimately concluded on a point estimate of 0.075, noting that this was the midpoint of CMA’s PR19 provisional findings range.

---

<sup>14</sup> CMA, *Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations: Final report*, paragraph 9.517.

<sup>15</sup> CMA, *Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations: Provisional findings*, paragraph 9.315

<sup>16</sup> Ofgem, *R110-2 Final Determinations Finance Annex Revised*, paragraph 3.67.

<sup>17</sup> Ofgem, *R110-2 Final Determinations Finance Annex Revised*, paragraph 3.64.

#### **4.1.2 UNLEVERED BETA**

UK regulators have taken a broadly consistent approach with regards to estimating the unlevered beta for a notional company, with minor differences around comparator sample, data frequencies and averaging periods.

Ofwat and the CMA both limited their samples to Severn Trent and United Utilities, with Ofwat noting that including Pennon and other utilities would introduce “a component of non-water sector risk to returns”.<sup>18</sup> Ofwat then used daily, weekly and monthly data frequencies with 1, 2 and 5-year estimation windows. In determining a point estimate, Ofwat relied on the 2-year daily estimate on the basis that this would provide sufficient data points and include recent data. It also noted that this approach had historically been a good indicator of betas in the succeeding 5 year period.<sup>19</sup>

Conversely, the CMA disagreed with relying on a 1-year estimation window on the grounds that this could be too short-term and subject to noise.<sup>20</sup> It therefore considered daily, weekly and monthly frequencies, using 2, 5 and 10-year estimation windows and 1, 2 and 5-year rolling averages. Both the CMA and Ofwat concluded on a point estimate for the unlevered beta of 0.29.

Ofgem considered a wider sample, looking at National Grid and Pennon, in addition to Severn Trent and United Utilities. It also presented unlevered beta estimates for SSE, but chose not to include these in the beta averages due to SSE’s estimates also capturing the higher risk of its retail supply and generation businesses.<sup>21</sup> Consistent with the CMA, Ofgem also used 2, 5 and 10 year estimation windows and a range of averaging periods, deciding on a range of 0.285 to 0.335, with a point estimate of 0.311.

### **4.2 ESTIMATION APPROACH**

#### **4.2.1 DEBT BETA**

Given the challenges of estimating the debt beta are widely recognised, we follow regulatory precedent to inform our range here. In its PR19 redetermination, the CMA used a range of 0.05 to 0.10, with a point estimate of 0.075, and as Ofgem also used this point estimate. Although in our view this is likely to be an over-estimate, in recognising the high level of uncertainty involved in debt beta estimation and the relatively immaterial effect of debt assumption in the overall cost of equity calculation (as long as the assumption is consistently employed in both the de-gearing step and the re-gearing step), we have followed the regulatory precedent and recommend to take the midpoint of debt beta for both the higher and lower end of the asset beta. This represents a continuation of the approach we took in our Nov 2021 report.

---

<sup>18</sup> Ofwat, *PR19 Final Determinations – Allowed Return on Capital Technical Appendix*, p.62.

<sup>19</sup> Ofwat, *PR19 Final Determinations – Allowed Return on Capital Technical Appendix*, p.65.

<sup>20</sup> CMA, *Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations: Final report*, p.859.

<sup>21</sup> Ofgem, *R110-2 Final Determinations Finance Annex Revised*, p.42 to 43.

#### 4.2.2 UNLEVERED BETA

As noted above, there are three main areas in which we have to make technical decisions when estimating the unlevered beta which cover the comparator set used, the data frequency and the estimation windows and averaging periods.

#### SELECTING THE COMPARATOR SET

With regards to the comparator set, we aim to select comparators that are reasonably similar to WPD but still ensure a sufficient sample size. Given there are only two publicly listed energy companies that own energy networks in GB, Ofgem included the listed water companies in its sample for the recent RIIO-2 determinations.

Whilst it is useful to include the three water companies in the sample given that they are GB utility companies, water networks tend to be subject to lower risk than energy companies. This is evident from the lower water betas in Ofgem's estimates which persisted across all estimation approaches.<sup>22</sup> However, given the limited number of available companies, it is reasonable to construct a sample using all GB comparators which includes National Grid as the pure play energy network, and the three water companies, Severn Trent, Untitled Utilities and Pennon. However, we note that given water companies tend to be lower risk, this could result in underestimating the unlevered beta for WPD. Additionally, whilst NG is the closest comparator to WPD, it did not operate in the electricity distribution sector prior to the recent purchase of WPD.<sup>23</sup> To reduce the risk of underestimating the beta for WPD, and to ensure sufficient similar comparators, we can expand the comparator sample to also include European companies.

When widening the sample to include European comparators, we need to ensure that the level of risk these companies are exposed to is comparable to the GB companies. In a report prepared for National Grid,<sup>24</sup> we identified a number of criteria that could be used to assess the suitability of the European networks for inclusion. This assessed each potential comparator on the basis of

- the comparability of its regulatory regime to GB,
- the liquidity of the company, and
- its share of regulated activities.

We draw on this assessment here to provide a final comparator sample consisting of the companies listed in the table below.

**TABLE 2 UNLEVERED BETA COMPARATOR SET**

COMPARATOR	NETWORK TYPE	COUNTRY
National Grid	ET/GT/ED	Great-Britain
Severn Trent	Water	Great-Britain

<sup>22</sup> Ofgem, *RIIO-2 Sector Specific Methodology Annex: Finance*, Table 10.

<sup>23</sup> NG previously owned gas distribution networks before it sold those businesses to the owner of Cadent.

<sup>24</sup> <https://www.nationalgrid.com/uk/electricity-transmission/document/134626/download>

COMPARATOR	NETWORK TYPE	COUNTRY
United Utilities	Water	Great-Britain
Pennon Group	Water	Great-Britain
Elia	ET	Germany
Red Electrica	ET	Spain
Enagas	GT	Spain
Endesa	ED	Spain
REN	ET	Portugal
Terna Rete	ET	Italy
Snam	GT	Italy
Enel	ED	Italy

Source: Frontier analysis

When presenting our estimates we show the simple average of the unlevered beta estimates with the comparator set split into the following samples:

- the overall comparator set listed above;
- the sample of European energy networks only;
- the sample of GB water companies only; and
- the sample of the GB energy network only (i.e. National Grid).

## DATA FREQUENCY

The data used in the estimation can be based on different frequencies such as hourly, daily, weekly or monthly. It is important to ensure that the data provides a sufficient sample size and is not influenced by factors such as reference day issues. For example, using monthly data would result in a smaller sample size and there would be challenges with ensuring the same reference days are available in each month. We consider that daily betas tend to avoid these issues and this is consistent with what Ofgem uses.

## ESTIMATION WINDOWS AND AVERAGING PERIODS

Selecting estimation windows (i.e. the time period over which data will be included for the regressions) and averaging periods (i.e. whether estimates coming out of the regression are then averaged over a certain period of time) also suffers from similar challenges as the data frequency decision. There is trade-off between capturing recent market conditions and having estimates that are subject to short-term market volatility, which may be unreflective of the market more generally. Spot estimates for example, vary between days and weeks so using a short term averaging period or estimation window, such as one year, can impact the beta estimations. Likewise, there are also limitations with using longer windows, such as 10 years. Long windows avoid the issue of short term volatility but may also be unreflective of the market today. Given that there are advantages and disadvantages associated with both short and long-term estimation windows and averaging periods, it is reasonable to consider a range of estimation approaches before coming to a conclusion. This is in line with the approach we took in our Nov 2021 report. We

therefore present 2, 5 and 10 year windows covering spot rates, 2, 5 and 10 year averages for the samples listed above.

#### 4.3 ESTIMATION RESULTS

Table 3 below shows the resulting unlevered beta estimates using data up to 30<sup>th</sup> June 2022. The sample which only includes National Grid (NG), has an average of 0.33 across all estimation windows and averaging periods. This is similar for the sample of EU energy networks, also at 0.33. Consistent with Ofgem's analysis, we find that the water companies exhibit evidence of being lower risk than the energy networks, with an average unlevered beta of 0.29 from a range of 0.25 to 0.32.

The lowest figures in the table reflect the most short term window and is likely driven by the recent bear market caused by the war in Ukraine which, like the GFC and dotcom periods, should be interpreted with caution due to the short-term flight to safety effect in these market conditions. If we simply take the lower beta at face value, but do not increase the estimation of the expected equity return (which is true in the short term volatile market), then we would produce perverse results where the cost of equity for utilities decreases in volatile markets, which clearly is implausible.

**TABLE 3 UNLEVERED BETA ESTIMATES**

Estimation window	Averaging period	Overall sample	EU networks	GB water	NG
2 years	Spot rate	0.27	0.28	0.25	0.25
2 years	2 years	0.34	0.37	0.27	0.33
2 years	5 years	0.34	0.35	0.29	0.34
2 years	10 years	0.33	0.33	0.30	0.34
5 years	Spot rate	0.33	0.35	0.26	0.32
5 years	2 years	0.34	0.36	0.28	0.34
5 years	5 years	0.34	0.34	0.32	0.36
5 years	10 years	0.31	0.32	0.30	0.32
10 years	Spot rate	0.32	0.33	0.29	0.34
10 years	2 years	0.33	0.34	0.29	0.33
10 years	5 years	0.31	0.32	0.29	0.32
10 years	10 years	0.30	0.31	0.29	0.32
<b>Average</b>		<b>0.32</b>	<b>0.33</b>	<b>0.29</b>	<b>0.33</b>

Source: Frontier analysis of Bloomberg data

Note: Data is as of 30 June 2022. Spot rates are also based on 30<sup>th</sup> June August data.

In our Nov 2021 report, we started by looking at the averages across the above table and identified the lowest average out of the four columns and set it as the lower bound, which was 0.29. Then we excluded what we considered to be the most problematic periods (those were the periods that contained data from the GFC years) and recalculated the average and took the higher estimate from the sample to set our higher bound, which was 0.36. The resulting range was 0.29 – 0.36. Finally, we estimated an attenuated range for the unlevered beta at 0.31 – 0.34.

The updated data above does not show a significant difference from our November 2021 table for most of the estimates. The lowest average from the columns is still 0.29. However, now the most problematic

periods that are prone to under-estimation bias is no longer the GFC period but the recent 2 years which include volatility from the COVID crisis as well as the bear market caused by the war in Ukraine. Consequently, we set our upper bound from a sample that does not contain the 2 year spot rates (i.e. all of the data apart from the first row in the table). This sample provides the highest average at 0.34. The means that our range is now 0.29-0.34. We attenuate this range to **0.30-0.33**.

We note that our range is now lower than our November 2021 report by 0.01, due to the current short-term market turbulence, which we caution against putting too much weight on although we do recognise its existence. This means that our midpoint is now 0.315. We note that this is still above (albeit only slightly) Ofgem's ED2 DD proposal of 0.311.

#### 4.4 OVERALL BETA ESTIMATE

Based on the inputs above, we can use the Harris-Pringle formula to estimate an overall equity beta range for WPD of 0.73 to 0.80, compared to 0.76 to 0.82 in our Nov 2021 report. This is shown in the table below.

**TABLE 4 BETA ESTIMATE**

PARAMETER	LOWER BOUND	UPPER BOUND
Unlevered beta (A)	0.30	0.33
Debt beta (B)	0.075	0.075
Observed gearing across the sample (C)	50%	45 %
Asset beta (D = A + B*C)	0.338	0.364
Notional gearing (E)	60%	60%
Equity beta (F = [D - E*B] / [1-E])	0.73	0.80

*Source: Frontier analysis*

## 5 AIMING UP

Regulators generally aim up when setting a point estimate for the WACC allowance, rather than selecting the mid-point of the range. This is due to the fact that estimating the WACC involves a considerable amount of uncertainty, and costs associated with under- or over-estimating the WACC are asymmetric. This is due to the consequences of setting the WACC too low, which is likely to cause under-investment in the network and potentially disruption to service, are greater than the consequences of setting the WACC too high, which leads to marginally higher tariffs for consumers.

For RIIO-T2 and RIIO-GD2, Ofgem chose not to explicitly include aiming up. It argued that the companies operating within RIIO-2 were not exposed to “perfectly asymmetric risks”, and the design of RIIO-2 already includes uncertainty mechanisms to protect companies.<sup>25</sup> However, this decision is not consistent with the majority of GB regulatory precedent. For its PR19 determination, the CMA also published a working paper on aiming up. It outlined three main areas due to which aiming up is likely to be necessary. These covered the following:

- The level of investment in the water sector could be affected by the WACC point estimate.
  - It is important that there is a cautious approach to setting the cost of capital so that long-term investors in infrastructure are attracted to the sector; the WACC should therefore be set in a way that does not respond too quickly to fluctuating market conditions.
  - The right level of investment needs to be encouraged and if the WACC is set too low, the incentive for companies to identify new investment programmes is reduced.
- Uncertainty around the distribution of the different WACC parameters.
  - There may be asymmetry within the choice of parameters. The CMA noted that some parameters are subject to greater uncertainty around the correct estimation approach, such as the RFR or TMR, and there is judgement involved with where to set the range. The CMA considered each of the cost of equity parameters and whether the chosen range is likely to be symmetric. It concluded that *“outside of the TMR there may be a mild bias for the assumptions that indicate a higher cost of equity than suggested by the midpoint of our range”*.<sup>26</sup>
- Financeability.
  - The CMA noted that the CAPM model could be used to provide a wide range of outcomes for the cost of equity which could result in obtaining a WACC which is too low to ensure investment-grade credit metrics, and that financeability should therefore remain a consideration.<sup>27</sup>

Taking all of the above into account, in its final PR19 decision, the CMA concluded that “there are a number of benefits from choosing a point estimate of the cost of equity above the middle of the range.”<sup>28</sup> It concluded with aiming up 25bps above the mid-point of the range on the cost of equity.

In addition to the arguments put forward by the CMA above, there is strong evidence of previous GB regulatory decisions including an element of aiming up, either within the cost of equity, or the overall WACC range. Table 5 provides a list of these previous determinations. It should also be noted that these

<sup>25</sup> Ofgem, *RIIO-2 Final Determinations Finance Annex Revised*, p.67 to 68.

<sup>26</sup> CMA, *Water redeterminations: Choosing a point estimate for the cost of capital - Working Paper*, paragraph 73.

<sup>27</sup> CMA, *Water redeterminations: Choosing a point estimate for the cost of capital - Working Paper*, paragraphs 95 to 98.

<sup>28</sup> CMA, *Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determinations: Final report*, paragraph 9.1402.

decisions are supported by academic evidence. Two main papers have been published in this area which have studied when it is optimal to aim up. The papers by Wright, Mason and Miles (2003)<sup>29</sup> and Dobbs (2011)<sup>30</sup> both found that it is optimal to aim up when demand is inelastic, which is particularly relevant to utility companies.

**TABLE 5 EVIDENCE OF AIMING UP WITHIN PREVIOUS GB DECISIONS**

REGULATORY DECISION	COE RANGE (POINT) % <sup>1</sup>	COE PERCENTILE	WACC RANGE (POINT) % <sup>2</sup>	WACC PERCENTILE
<b>CMA</b>				
Bristol Water (Oct 2015)	5.45 – 6.01 (5.73)	50th <sup>3</sup>	3.63 – 3.93 (3.78)	50th <sup>3</sup>
NIE (Mar 2014)	3.4 – 5.0	-	3.3 – 4.1 (4.1)	100th
Bristol Water (Jun 2010)	3.6 – 6.6	-	3.8 – 5.0 (5.0)	100th
Stanstead (Oct 2008)	5.0 – 8.2	-	5.20 – 7.54 (7.1)	81st
Gatwick (Oct 2007)	5.0 – 8.4	-	4.9 – 6.8 (6.5)	84th
Heathrow (Oct 2007)	4.8 – 7.7	-	4.8 – 6.4 (6.2)	88th
<b>Ofgem</b>				
RIIO-ED1 (Nov 2014)	4.0 – 6.0 (6.0)	100th		
RIIO-GD1 (Dec 2012)	6.0 – 7.2 (6.7)	58th		
RIIO-T1 NGET (Dec 2012)	6.0 – 7.2 (7.0)	83rd		
RIIO-T1 NGG (Dec 2012)	6.0 – 7.2 (6.8)	67th		
DPCR5 (Dec 2009)	6.3 – 7.0 (6.7)	57th		
GDPCR	7.0 – 7.5	50th <sup>4</sup>		

<sup>29</sup> Wright, Mason and Miles, 2003, *A study into certain aspects of the cost of capital for regulated utilities in the UK*.

<sup>30</sup> Dobbs, 2011, *Modelling welfare loss asymmetries arising from uncertainty in the regulatory cost of finance*.

REGULATORY DECISION	COE RANGE (POINT) % <sup>1</sup>	COE PERCENTILE	WACC RANGE (POINT) % <sup>2</sup>	WACC PERCENTILE
(Dec 2007)	(7.25)			
TPCR4			2.8 – 4.8	80th
(Dec 2006)			(4.4)	
<b>Ofwat</b>				
PR19	3.16 – 5.11	53rd		
(Dec 2019) <sup>5</sup>	(4.19)			
PR14	4.9 – 5.7	94th		
(2014)	(5.65)			
PR09	3.5 – 7.2	97th		
(2009)	(7.1)			
<b>CAA</b>				
Q6 – HAL (2013)	5.68 – 7.61	85th		
	(7.33)			
Q6 – GAL	5.68 – 7.71	86th		
(2013)	(7.43)			

Source: Frontier Economics based on CMA, Ofgem, Ofwat and CAA decisions

Note: <sup>1</sup>COE range and point estimates are post-tax. <sup>2</sup>WACC range and point estimates for Bristol Water and NIE are vanilla WACC, the airports are pre-tax WACC, and TPCR4 is post-tax WACC as reported in decision documents. <sup>3</sup>Although the CMA did not aim up within the final range the CMA aimed up through its choice of the very top of the TMR range from the NIE (2014) decision <sup>4</sup>Although Ofgem aimed straight within its Final Proposals range, it aimed up to the 75<sup>th</sup> percentile within its Initial Proposals range of 6.5%-7.5%. <sup>5</sup>All figures are in RPI-real terms except for Ofwat's PR19 decision which is in CPIH-real terms.

Given the evidence available, the risks of setting the WACC too low combined with the uncertainty involved with setting the range for the cost of equity parameters suggest that an element of aiming up is appropriate. Following the CMA's approach where it aimed up 25 bps above the mid-point of its cost of equity range for the water companies, we consider that a higher amount of aiming up, at least 40 bps, would be more appropriate for the electricity distribution networks given the investment at stake in the context of government's net zero agenda. This is in line with our Nov 2021 report.

## 6 OVERALL COST OF EQUITY

The table below shows each of the parameters estimated above and the resulting estimate for the cost of equity. We consider the appropriate (attenuated) range for the cost of equity over RIIO ED2 is 4.64% - 5.90% with a midpoint of **5.27%**. This compares to our November report range of 4.37% to 5.54%, with a mid-point of 4.96%. The increase reflects updated market evidence.

**TABLE 6      OVERALL COST OF EQUITY**

	LOW	HIGH
Gearing		
Notional gearing	60%	60%
Observed gearing	50%	44%
Risk-free-rate	-0.95%	0.43%
Equity risk premium	7.65%	6.87%
Total market return	6.70%	7.3%
Debt beta	0.075	0.075
Unlevered beta	0.30	0.33
Equity beta	0.73	0.80
Post-tax cost of equity	4.64%	5.90%
Mid-point		5.27%
Aiming up		>0.4%

*Source: Frontier analysis*

Our midpoint of 5.27% is 31 bps higher than the 4.96% in our Nov 2021 report, due to update on market data. We also observe that it is also 52 bps higher than the 4.75% presented by Ofgem in its ED2 DD, although we would expect Ofgem's range and mid-point to increase, even before aiming up, reflecting more recent information on gilt yields, the long-term average equity return as well as the ONS's new CPIH back-cast series.

We continue to consider that the midpoint of our range provides a valid point of triangulation with Ofgem's stated position, when Ofgem's estimate is adjusted to take account of the need to aim up.



Frontier Economics Ltd is a member of the Frontier Economics network, which consists of two separate companies based in Europe (Frontier Economics Ltd) and Australia (Frontier Economics Pty Ltd). Both companies are independently owned, and legal commitments entered into by one company do not impose any obligations on the other company in the network. All views expressed in this document are the views of Frontier Economics Ltd.

**[WWW.FRONTIER-ECONOMICS.COM](http://WWW.FRONTIER-ECONOMICS.COM)**