Addendum to the methodological review of the cost of capital estimation

Prepared for Autorità di Regolazione per Energia Reti e Ambiente (ARERA)

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Contents

Figures and tables

Executive summary

In June 2021, Oxera published a methodological report,[1] commissioned by ARERA, which detailed the best practice in estimating the weighted average cost of capital (WACC) in a regulatory context in Italy. Following publication of the Oxera report alongside ARERA's consultation document (308/2021/R/COM),[2] ARERA issued a second consultation document (488/2021/R/COM)[3] and a Decision document (614/2021/R/COM)[4] responding to the points raised by the network operators.

This report serves as an annex to the 2021 methodological paper and reflects the technical aspects of the cost of capital estimation that were raised during the consultation period.

The following paragraphs detail the methodology and technique used to estimate specific parameters of the cost of capital, as well as the relevant evidence.

Risk-free rate (RfR)

- **Use of benchmark and latest evidence:** in the Oxera 2021 report, we explained that the RfR measures the expected return on an investment free of default and systematic risk, and that, in economies with low sovereign default risk, the RfR is typically estimated with reference to the yield to maturity on government-issued bonds.

  Based on data available on 30 September 2021, the one-year average of nominal yields of AAA/AA rated bonds (Germany, Belgium, France, Netherlands) is -0.22%.

- **Convenience premium, CP:** in the Oxera WACC methodology paper, we show that even the highest-rated corporate debt instruments trade at a yield significantly higher than that on government bonds. This difference is consistent with the existence of a convenience premium (CP), the premium attributed to the additional demand for highly rated government bonds over and above the coupon payments they offer.

  Academic evidence suggests that the premium on US Treasury bonds is approximately 50–100bps over the medium to long term.

  Empirical evidence between eurozone corporate and government bonds has been estimated at 30 September 2021 with respect to different ratings. The spread between AAA rated euro denominated corporate bonds and government bonds has been between 40bps and 100bps since 2014. The one-year average spread has been between 50bps and 120bps since 2014. These ranges are consistent with ARERA's final decision, in which the CP has been set at 1%.

- **Forward premium, FP:** since the cost of capital is fixed for a future regulatory period, it is necessary to consider evidence on expected future interest rates. One possible option for estimating the forward premium in place over the first three years of the PWACC period is to use the spot yields and calculate a two-year premium.

[1] Oxera (2021), 'Methodological review of the cost of capital estimation', June.
[2] ARERA (2021), 'Decision 308/2021/R/COM', July.
[3] ARERA (2021), 'Decision 488/2021/R/COM', November.
[4] ARERA (2021), 'Decision 614/2021/R/COM', December.

Based on evidence from the ECB on 30 September 2021, the two-year forward premium estimated for AAA rated government bonds was 0.25%.

The inclusion of AA bonds in the sample used to estimate the FP would not result in a significantly different FP estimate. The FP estimated using AAA and AA bonds is between 0.22% (evidence at 30 March 2021) and 0.25% (evidence at 30 September 2021). This range is consistent with ARERA's final decision, in which the FP has been set at 0.25%.

- **Uncertainty premium, UP:** An additional premium could be added to the benchmark to account for the risk that spot rates will rise faster than the forward rates, which could create a financeability problem. In practice, there is no defined methodology nor an explicit allowance made by regulators to reflect this uncertainty. The Oxera 2021 report estimated this premium with reference to 55 regulatory Decisions made in the UK. Specifically, by estimating the difference between the allowed RfR and the yield on the ten-year UK government bonds at the time of the Decision. Because the sample includes a few outliers, the distribution was truncated at the 25th and 75th percentiles. After controlling for the FP and the CP, the additional unexplained premium observed ranged from -0.4% to 0.5%, with an average value of 0.1%. This range is consistent with ARERA's final decision, in which the UP has been set at 0.50%.

Country risk premium (CRP)

- **Use of benchmark and estimation of the government bond 'spread':** in the current regulatory framework, ARERA allows a CRP. The Oxera 2021 paper proposed a simplification of the current regulatory framework: estimating the CRP with reference to the spread between the yield on Italian bonds and the average yield on the bonds of Germany, France, Belgium and the Netherlands, which is used as a benchmark for the estimation of the RfR. Based on a one-year average, the nominal spread between AAA/AA rated EU governments (Germany, France, Belgium and the Netherlands) and Italy is 0.92% at 30 September 2021. This estimate has been used by ARERA in the final determination.

- **Forward premium, FP:** we investigated whether the addition of a forward premium to the CRP would be consistent with the current framework and computationally feasible. For consistency with the RfR, the CRP forward premium should reflect the mid-period forward rate, and the benchmark level of the CRP should reflect the current market conditions—i.e. spot or short-term average of the spread. The forward premium on the CRP can therefore be decomposed into two factors:

  - RfR forward premium (FP);
  - the additional forward-looking risk premium embedded in Italian bonds.

  The first is reflected in the RfR analysis and estimated with reference to ECB data on AAA government bonds. The second can be estimated as the difference between the implied forward premium on Italian bonds and the RfR forward premium.

  The implied FP on Italian bonds in September 2021 was 48bps. After deducting the updated RfR FP based on EU AAA government bonds (25bps), the additional risk forward premium is 23bps. This value has been used by ARERA in the final determination. Therefore, an appropriate level of the forward-looking nominal CRP would be approximately 1.1%.

Total market returns (TMR)

- **Overall estimation approach.** As explained in the Oxera 2021 report, the ERP can be estimated directly or as a residual from an overall TMR, as the difference between the TMR and the RfR. Forming a precise view on the real expected total market return is made challenging by the wide range of estimates from the various sources of evidence. ARERA's view is that the expected TMR is much more stable over time, and that changes in the RfR are largely offset by changes in the ERP.

- **Geometric and arithmetic averaging.** The Oxera 2021 report shows that there is a material difference between geometric and arithmetic averages. Geometric averages are, by construction, lower than arithmetic averages as they do not take into account the volatility of annual returns over the averaging period. Furthermore, the report explains that while there is a debate about which method is more appropriate for various applications, in standard corporate finance textbooks the arithmetic average is generally adopted for estimating the ERP to use when computing required equity returns for capital budgeting and valuation purposes.

  In the round, however, the question of how much weight to place on the arithmetic and geometric averages of historical data is different to the question of how much weight to put on the 'stable ERP' or 'stable TMR' or to the question of how much weight to put to the different methodologies that can be used to estimate the TMR and ERP. Recent regulatory decisions (e.g. in the Great Britain, Netherlands and Germany) adopt a TMR that is a function of various sources of evidence and lies below the arithmetic average of historical returns.

  The Oxera 2021 report presented a historic ex post TMR of 6.58% on the basis of arithmetic averages of returns for the same sample of countries used to estimate the RfR. As these returns were generated in an environment where interest rates were on average higher than today, attaching some weight to the 'stable ERP' view would imply that the expected TMR is currently lower than the historical average.

Cost of debt (CoD)

- **Setting the notional credit rating of iBoxx indices.** Oxera's analysis of 175 bonds of Italian utilities shows an average credit rating of BBB+. As explained in the Oxera 2021 report, when estimating the CoD of a notional operator the regulator is required to set a notional credit rating. This is standard practice in incentive regulation and avoids a 'pass-through' of inefficient debt costs and capital structure decisions. The level of the notional credit rating can be informed by regulatory precedent. For instance, in the UK, Ofgem and Ofwat target a BBB+ credit rating. In the Netherlands, the ACM targets an A credit rating. The majority of the bonds issued by Italian operators are rated BBB+ and BBB, which provides further support for adopting a notional credit rating of BBB+.

  For the iBoxx A series (7–10 and 10+), the weighted average credit rating of the constituents (based on the amount outstanding) is A. For the iBoxx BBB series (7–10 and 10+), the weighted average credit rating of the constituents (based on the amount outstanding) is BBB+.

  Since the average maturity at issuance of the sample of Italian bonds is 11 years, an average between the 10+ and the 7–10 series could be used to calculate the embedded CoD for a hypothetical operator.

- **Nominal cost of debt estimates.** Oxera's analysis considered spot values and period averages of the iBoxx BBB indices. The average nominal spot value of the iBoxx BBB indices (7–10 and 10+) observed on 30 September 2021 is 0.97%. The ten-year average is 2.35%. These numbers have been used by ARERA in the final determination.

- **Empirical evidence on the size of the Italian operators and their CoD.** In setting the allowed revenues, there is a question regarding whether the size of the operators influences their cost of debt and overall WACC. An empirical analysis was conducted to assess if such relationship is observed in the Italian market. The coefficient estimates and their respective p-values indicate that there is no statistically significant relationship between size and cost of debt.

Overview

- **Summary of key estimates (RfR, CRP, CoD).** The table below summarises the estimate of the nominal RfR, CRP and cost of debt parameters covered in the methodological review of the PWACC II control period (in nominal terms).

Summary table

Variable	Estimation
RfR benchmark [a]	-0.22%
Forward premium [b]	0.25%
Convenience premium [c]	1.00%
Uncertainty premium [d]	0.50%
Nominal RfR estimate [a + b + c + d]	**1.53%**
One-year average spread, (AAA/AA government bonds vs Italy) [e]	0.92%
CRP forward premium [f]	0.23%
Nominal CRP estimate [e + f]	**1.15%**
Spot BBB [g]	0.97%
Ten-year average BBB [h]	2.35%
Forward premium [b]	0.25%
Uncertainty premium [d]	0.50%
Weighting of new debt [i]	15.00%
New debt [j = g + b + d]	1.47%
Embedded debt [k = h]	2.35%
Additional costs [l]	0.25%
Nominal CoD (before graduality) [j*i+k*(1-i)+l]	**2.51%**

Note: The cut-off date is 30 September 2021.

Managing uncertainty

- Uncertainty mechanisms could be used to account for unexpected changes in specific cost of capital parameters, especially at times of high market uncertainty. Specific options are available, including trigger mechanisms (whereby some parameters are adjusted only if some clearly defined benchmark moves beyond a pre-determined threshold), re-openers (subject

to the discretion of the regulator and company), indexation and pass-through.

- In evaluating the options and determining the frequency of the adjustment, the regulator should consider the efficient allocation of risk—that is, whether the company or customer is best placed to manage the risk.
- ARERA's approach in the final determination for the 'cross-sector' parameters (that is, excluding the gearing level and the beta) is the following:
  - setting some parameters (TMR, transaction costs, weights for embedded and new debt, CP and UP) constant over the entire WACC period (i.e. over six years);
  - setting the parameters used to account for taxes every three years. A cost of debt graduality mechanism is also in place.[5]
- For the first three-year period (i.e. 2023, and 2024), ARERA decided to implement a within-period trigger mechanism, whereby the WACC level is updated only if the cumulated impact of updating individual parameters is above a pre-determined threshold (50bps).

  If the re-estimation of $RF_{nominal}$, isr, SPREAD and the iBoxx indices leads to a revised WACC within 50bps of the allowed level relative to the previous year, ARERA will not make changes to the original determination. Otherwise, ARERA will update the allowed WACC, also considering new evidence for parameters ia, FP and FP^{CRP}.

[5] For the cost of debt allowance, ARERA distinguishes between three periods: 2022–24 (fist sub-period), 2025–27 (second sub-period), and 2028 onwards. Over 2022–24, the cost of debt will be based on the weighted average between the current cost of debt, based on the old methodology (2.40% real) and the cost of debt resulting from the new methodology, with a weight of 33.3% given to the new methodology. Over 2025–27, a weight of 66.6% given to the new methodology. Starting from the new PWACC (PWACC III), the cost of debt will be entirely based on the new methodology,

1 Introduction

1.1 Context for the current technical review

With Decision 380/2020/R/com,[6] ARERA launched the proceeding for updating the criteria for the determination of the allowed rate of return in the electricity and gas sectors for the regulatory period starting from 1 January 2022 (2PWACC).

In setting the allowed rate of return, the Authority is guided by the objectives of predictability and certainty of the regulatory framework for both investors, who can earn adequate levels of returns on invested capitals relatives to the risk, and service users, who benefit from reasonable and stable levels of regulated charges.[7]

In this context, this addendum to the Oxera 2021 report aims at clarifying and improving the methodology proposed to estimate specific parameters of the weighted average cost of capital (WACC). Consistent with ARERA's final decision (614/2021/R/com), all the market evidence contained in this report is at 30 September 2021.

1.2 Structure of the report

The report is structured as follows.

- Section 2 focuses on the cost of equity parameters, covering the risk-free rate and its premia, the country risk premium, and the total market return.
- Section 3 focuses on the cost of debt estimation.
- Section 4 focuses on the issue of managing uncertainty and mechanisms for updating the WACC parameters.

[6] ARERA (2021), 'Decision 380/2021/R/com', October.
[7] Ibid., p. 9.

2 Cost of Equity (CoE)

2.1 Risk-free rate (RfR)

In the Oxera 2021 report, we explained that the RfR measures the expected return on an investment free of default and systematic risk, and that, in economies with low sovereign default risk, the RfR is typically estimated with reference to the yield to maturity on government-issued bonds. These bonds are assumed to be notionally free of default and systematic risk.[8]

In the 2015 Determination, ARERA used a sample of AAA and AA rated bonds to estimate the RfR.[9] This sample is composed of the ten-year bonds of Germany, Belgium, France and the Netherlands.

Table 2.1 summarises the observed nominal yields of the sample of bonds selected, based on evidence available in September 2021.

Table 2.1 AAA and AA rated EU government bond yields

	Germany	Belgium	France	Netherlands	Average AAA/AA	Italy	Spread
Spot	-0.19%	0.12%	0.16%	-0.08%	0.00%	0.86%	0.86%
Three-month average	-0.37%	-0.05%	-0.03%	-0.25%	-0.17%	0.67%	0.85%
One-year average	-0.39%	-0.11%	-0.10%	-0.29%	-0.22%	0.70%	0.92%
Five-year average	-0.01%	0.34%	0.34%	0.12%	0.20%	1.75%	1.55%
Ten-year average	0.55%	1.11%	1.00%	0.75%	0.85%	2.57%	1.72%

Source: Oxera analysis based on Thomson Reuters data. The cut-off date is 30 September 2021.

Based on data available on 30 September 2021, the one-year average of nominal yields of AAA/AA rated bonds is -0.22%.

Highly-rated government bonds provide the starting point for a forward-looking RfR estimate to use in the Capital Asset Pricing Model (CAPM). Because the regulator is using the CAPM to set the WACC for a period of three years, it is important to consider any additional premiums that might be required by private investors and evidence on expected future interest rates. We discuss those in the following subsections.

2.1.1 Convenience premium (CP)

The capital asset pricing model (CAPM) framework states that the RfR is equal to the expected rate of return on a zero beta asset. Moreover, the CAPM assumes that both borrowers and lenders can undertake risk-free transactions at this rate. In the Oxera WACC methodology paper, we show that even the highest-rated debt instruments trade at a yield significantly higher than that on government bonds.[10] This difference is consistent with the existence of a convenience premium (CP), the premium attributed to the additional demand for highly rated government bonds over and above the coupon payments they

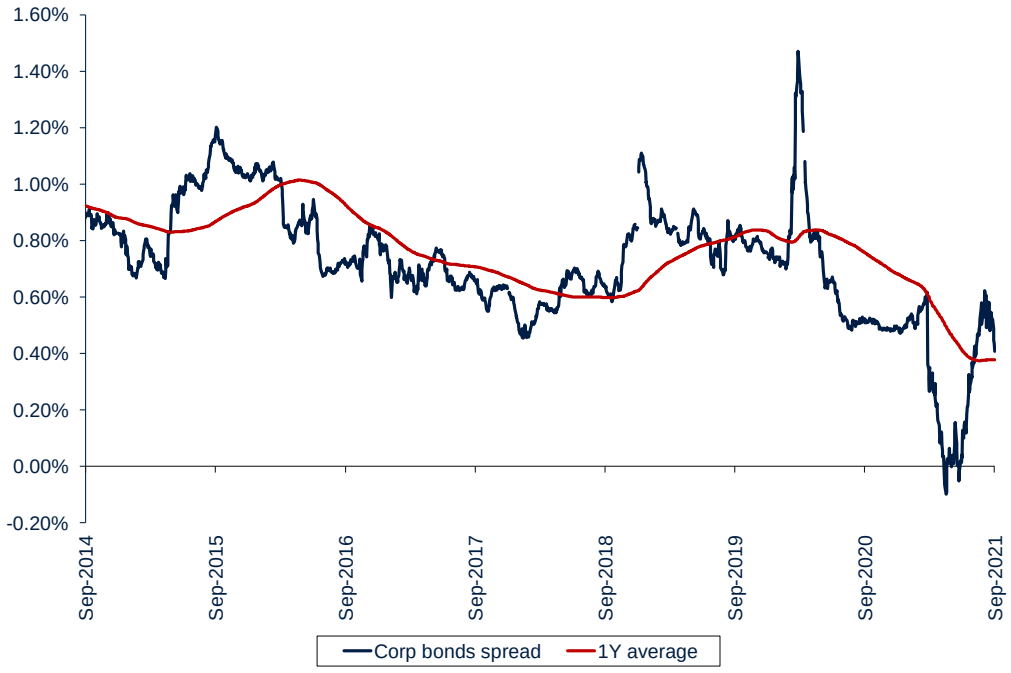
[8] Oxera (2021), 'Methodological review of the cost of capital estimation', June, section 2.2.
[9] ARERA (2015), 'Decision 583/2015/R/com', December, https://www.arera.it/it/docs/15/583-15.htm (last accessed 14 January 2022).
[10] Oxera (2021), 'Methodological review of the cost of capital estimation', June, section 2.2.2.

offer. This additional demand is caused by regulatory requirements and the use of government bonds in hedging strategies (i.e. interest rate hedging). Therefore, to satisfy the CAPM framework, an RfR based on government bonds must be adjusted to a level that reflects the return expected on a risk-free, zero beta asset.[11]

The CP is the premium attributed to this excess demand. Academic evidence suggests that the premium on US Treasury bonds is approximately 50–100bps over the medium to long term.[12]

Figure 2.1 presents the spread between AAA rated euro denominated corporate bonds and AAA and AA rated government bonds. The one-year average spread has been between 40bps and 100bps since 2014.

Figure 2.1 AAA rated corporate bonds spread relative to AA and AAA rated European government bonds



Note: The breaks in the series are due to a lack of data on the yield of AAA corporate bonds.

Source: Oxera analysis, based on Thomson Reuters data of the iBoxx AAA index.

The data suggests that non-sovereign institutions with even the highest creditworthiness (i.e. close to risk-free) face higher borrowing rates than those faced by governments.

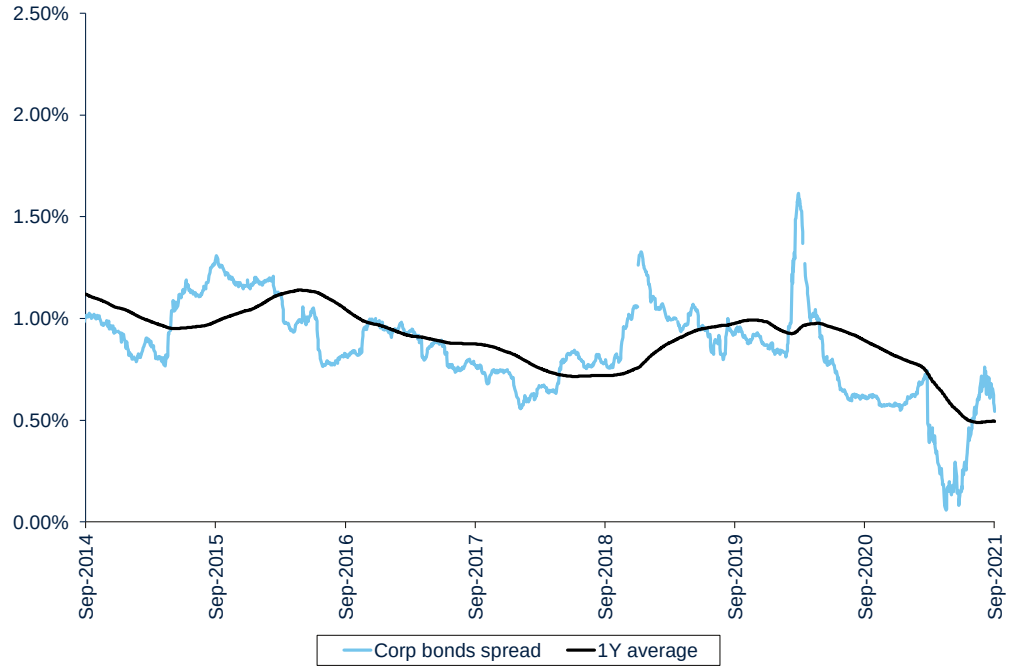
Finally, it is important to note that the convenience yield should capture the difference between the highest-rated securities. In this case, the spread between AAA/AA government bonds and AAA corporate bonds is used to be consistent with the RfR benchmark used by ARERA. An alternative to that

[11] Krishnamurthy, A. and Vissing-Jorgensen, A. (2012), 'The Aggregate Demand for Treasury Debt', *Journal of Political Economy*, **120**:2, April, pp. 233–67.

[12] For example, Feldhutter and Lando (2008) suggest that the convenience premium on US treasury bills is 0.3% to 0.9%. See Feldhütter, P. and Lando, D. (2008), 'Decomposing swap spreads', *Journal of Financial Economics*, **88**:2, pp, 375–405. Similarly, Krishnamurthy and Vissing-Jorgensen (2012) estimated the average of the liquidity component of the convenience yield to be 46bps from 1926 to 2008. See Krishnamurthy, A. and Vissing-Jorgensen, A. (2012), 'The Aggregate Demand for Treasury Debt', *Journal of Political Economy*, **120**:2, April, pp. 233–67. Empirical analysis shows that between 1998 and 2005, spreads of AAA rated corporate bonds relative to government bonds range from 52–176bps. Feldhütter and Lando (2008) covered the period of 1996–2005. However, the data for iBoxx GBP Corporate AAA 15+ index became available on 1 January 1998.

would be to estimate the difference between AAA government and corporate bonds only, as shown in the following figure.

Figure 2.2 AAA rated corporate bonds spread relative to AAA rated European government bonds



Note: The breaks in the series are due to a lack of data on the yield of AAA corporate bonds.

Source: Oxera analysis, based on Thomson Reuters data of the iBoxx AAA index.

The one-year average spread has been between 50bps and 120bps since 2014.

2.1.2 Forward premium (FP)

Since the cost of capital is fixed for a future regulatory period, it is necessary to consider evidence on expected future interest rates. The expected future interest rates can be estimated using spot rates of bonds with different maturities. Specifically, the expected interest rate of a bond with maturity $(t_a - t_b)$ in t_b years, can be estimated according to the following formula:

$$Forward\ rate = \left[\frac{(1 + i_a)^{t_a}}{(1 + i_b)^{t_b}}\right]^{\frac{1}{t_a - t_b}} - 1$$

where:

- i_a = the yield on bond a of t_a periods;
- i_b = the yield on bond b of t_b periods.

The forward premium is then computed as the difference between the forward curve and the spot rate of a bond with the same maturity.

In the Oxera 2021 report, we proposed that the forward premium reflects the yield on the RfR at the mid-point of the control period. This is because the aim is to approximate the average RfR of the entire control period, assuming that capital investment will be spread approximately evenly across that period.

Assuming that the RfR will be updated every three years and that the control period starts in January 2022, the mid-point is around 1.5 years from the start. Therefore, one possible option for estimating the forward premium in place over the first three years of the PWACC period is to use the spot yields and calculate a 2Y premium.

In the Oxera 2021 report, we used data available in March 2021. Specifically, to calculate the 2Y forward premium on a ten-year maturity bond, we use the yield on the two- and 12-year government bonds as illustrated below.

Table 2.2 2Y forward premium (ECB AAA)

Parameter	Yield
Two-year bond yield $[i_b]$	-0.71%
Twelve-year bond yield $[i_a]$	-0.14%
Forward rate [A = $\left[\frac{(1+i_a)^{12}}{(1+i_b)^2}\right]^{\frac{1}{10}} - 1$]	**-0.02%**
Ten-year bond yield [B]	-0.26%
Forward premium [A – B]	0.24%

Source: Oxera analysis based on ECB data. See European Central Bank (2022), 'Euro area yield curves', https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/euro_area_yield_curves/html/index.en.html (last accessed 8 February 2022). The cut-off date is 30 March 2021.

The 2Y forward premium was then updated following the publication of the ARERA consultation in September 2021. The results are summarised in Table 2.3 below.

Table 2.3 2Y forward premium (ECB AAA), March vs September

	Forward premium
30 March 2021	0.24%
30 September 2021	0.25%

Note: Due to data limitations, the forward premium is estimated with reference to the AAA euro denominated government bonds.

Source: Oxera analysis based on ECB data. See European Central Bank (2022), 'Euro area yield curves', https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/euro_area_yield_curves/html/index.en.html (last accessed 8 February 2022). The cut-off date is 30 September 2021.

Based on evidence from the ECB on 30 September 2021, the two-year forward premium estimated for AAA rated government bonds was 0.25%.

In the update, we investigated whether the inclusion of AA bonds in the sample used to estimate the FP would result in a significantly different FP estimate. Specifically, the ECB AAA index was compared to the average forward premium embedded in a sample of AA (France and Belgium) and AAA rated (Netherlands and Germany) government bonds. The result is summarised in Table 2.4 below.

Table 2.4 2Y forward premium AAA/AA bonds

	Germany	Belgium	France	Netherlands	Average AA/AAA	ECB AAA
30 March 2021	0.23%	0.21%	0.29%	0.15%	0.22%	0.24%
30 September 2021	0.22%	0.23%	0.30%	0.22%	0.25%	0.25%
Average 30 March–30 September 2021	0.21%	0.22%	0.28%	0.19%	0.23%	0.23%

Source: Oxera analysis based on Thomson Reuters data. The cut-off date is 30 September 2021.

The FP estimated using AAA and AA bonds is between 22bps and 25bps. It is important to note that the data on AA bonds is limited to one- to ten-year maturity bonds and 15-year maturity bonds. Therefore, to estimate the two-year forward premium some interpolation is required.

2.1.3 Uncertainty premium (UP)

The Oxera 2021 report discussed the concept of an uncertainty premium (UP). An additional UP could be added to the benchmark to account for the risk that spot rates will rise faster than the forward rates, which could create a financeability problem.[13] In practice, there is no defined methodology nor an explicit allowance made by regulators to reflect this uncertainty. The Oxera 2021 report estimated this premium with reference to 55 regulatory Decisions made in the UK,[14] specifically by estimating the difference between the allowed RfR and the yield on the ten-year UK government bonds at the time of the Decision. Because the sample includes a few outliers, the distribution was truncated at the 25th and 75th percentiles. After controlling for the FP and the CP, the additional unexplained premium observed ranged from -0.4% to 0.5%, with an average value of 0.1%.

Given that the financeability problem would only arise if the difference between actual and allowed rates is positive, we presented a range in the upper end of the distribution—i.e. 25–50bps.

2.1.4 RfR estimate

Allowing for a CP of 50–100bps and a UP of 25–50bps, Table 2.5 below provides a range of RfR estimates.

[13] Oxera (2021), 'Methodological review of the cost of capital estimation', June, p. 12.
[14] The regulatory Decisions were made between 2001 and 2021 in the energy, water, transport and telecom sectors.

Table 2.5 RfR estimates

	Average AAA/AA nominal yields	CP	FP	UP	Nominal RfR
Low					
Spot	0.00%	0.50%	0.25%	0.25%	1.00%
Three-month average	-0.17%	0.50%	0.25%	0.25%	0.83%
One-year average	-0.22%	0.50%	0.25%	0.25%	0.78%
Five-year average	0.20%	0.50%	0.25%	0.25%	1.20%
Ten-year average	0.85%	0.50%	0.25%	0.25%	1.85%
High					
Spot	0.00%	1.0%	0.25%	0.50%	1.75%
Three-month average	-0.17%	1.0%	0.25%	0.50%	1.58%
One-year average	-0.22%	1.0%	0.25%	0.50%	1.53%
Five-year average	0.20%	1.0%	0.25%	0.50%	1.95%
Ten-year average	0.85%	1.0%	0.25%	0.50%	2.60%

Source: Oxera analysis based on Thomson Reuters data.

A nominal risk free rate based on one-year average yields, and the higher end of the ranges for CP and UP, results in the value set by ARERA in the final determination.

2.2 Country risk premium (CRP)

In the current regulatory framework, ARERA allows a CRP. The Oxera 2021 paper proposed a simplification of the current regulatory framework: estimating the CRP with reference to the spread between the yield on Italian bonds and the average yield on the bonds of Germany, France, Belgium and the Netherlands, which is used as a benchmark for the estimation of the RfR.

Table 2.6 summarises the CRP estimates.

Table 2.6 EU government bond yields

	Average AAA/AA	Italy	Spread
Spot	0.00%	0.86%	0.86%
Three-month average	-0.17%	0.67%	0.85%
One-year average	-0.22%	0.70%	0.92%
Five-year average	0.20%	1.75%	1.55%
Ten-year average	0.85%	2.57%	1.72%

Source: Oxera analysis based on Thomson Reuters data. The cut-off date is 30 September 2021.

Based on a one-year average, the nominal spread between AAA/AA rated EU governments (Germany, France, Belgium and the Netherlands) and Italy is 0.92% at 30 September 2021.

Following the publication of the ARERA consultation document, we investigated whether the addition of a forward premium to the CRP would be consistent with the current framework and computationally feasible.

We note that the current CRP framework remunerates investors on an ex post basis. That is, the CRP level and the trigger are set based on the historical data. The inclusion of a FP on the CRP would imply a departure from the current model to an ex ante model, where investors would be remunerated according to their expectations about future rates.

For consistency with the RfR, the CRP forward premium should reflect the mid-period forward rate, and the benchmark level of the CRP should reflect the current market conditions—i.e. spot or short-term average of the spread. The forward premium on the CRP can therefore be decomposed into two factors:

- RfR forward premium (FP);
- the additional forward-looking risk premium embedded in Italian bonds.

The first is reflected in the RfR analysis and estimated with reference to ECB data on AAA government bonds. The second can be estimated as the difference between the implied forward premium on Italian bonds and the RfR forward premium:

$$FWD_{risk} = FWD_{Italian\ bonds} - FWD_{AAA\ bonds}$$

The implied FP on Italian bonds in September 2021 was 48bps.[15] After deducting the updated FP based on EU AAA government bonds (25bps), the additional risk forward premium is 23bps.

Therefore, an appropriate level of the forward-looking nominal CRP would be 1.15%, as shown in Table 2.7 below.

Table 2.7 Estimation of the nominal CRP

Variable	Value
One-year average spread, (AAA/AA government bonds vs Italy) [a]	0.92%
FP based on Italian bonds [b]	0.48%
FP based on EU AAA government bonds [c]	0.25%
Additional risk forward premium [d=b-c]	0.23%
Nominal CRP [e=a+d]	**1.15%**

Source: Oxera analysis based on Thomson Reuters data. The cut-off date is 30 September 2021.

2.3 Total Market Return (TMR) and Equity Risk Premium (ERP)

As explained in the Oxera 2021 report, the ERP can be estimated directly or as a residual from an overall TMR, as the difference between the TMR and the RfR. Forming a precise view on the real expected total market return is made challenging by the wide range of estimates from the various sources of evidence. One view is that the ERP is approximately constant over time and largely independent of the RfR. Under this method, the long-run average excess return of equity relative to bonds is used as a proxy for the ERP. An alternative view is that the expected TMR is much more stable over time, and that changes in the RfR are largely offset by changes in the ERP.

ARERA adopts the second view, estimating the TMR and the RfR first, and the ERP as a residual. Regardless of which option is chosen, it is important to consider the implications of the assumed ERP to ensure that the resulting TMR is reasonable.

[15] Due to data limitations, the implied FP is estimated using interpolated interest rates.

2.3.5 TMR and ERP estimation

In the Oxera 2021 report, we outlined three methodologies to estimate the TMR:[16]

- **a historic ex post approach**, which consists of averaging historical returns over a long period of time. The most widely cited source of historical evidence is the annual publication by Dimson, Marsh and Staunton (DMS), which estimates historical returns using data since 1900;
- **survey evidence**, which reflects the views of academics and practitioners on the TMR and/or ERP;
- **a forward-looking approach**. The basic concept behind forward-looking models is the assumption that the current market price of an asset represents the discounted value of all expected future cash flows to this asset. Therefore, a dividend discount model (DDM) can be used to infer the discount rate applied to future dividends. Under DDM theory, the expected market return is the discount rate at which the present value of future dividends is equal to the current market price.

In the 2015 Decision, ARERA estimated the TMR with reference to the historic ex post approach, adopting a weighted average of the geometric and arithmetic mean of historic returns.[17]

The Oxera 2021 report explains that there is a material difference between geometric and arithmetic averages. Geometric averages are, by construction, lower than arithmetic averages as they do not take into account the volatility of annual returns over the averaging period.[18] Furthermore, the report explains that while there is a debate about which method is more appropriate for various applications, in standard corporate finance textbooks the arithmetic average is generally adopted for estimating the ERP to use when computing required equity returns for capital budgeting and valuation purposes.

In the round, however, the question of how much weight to place on the arithmetic and geometric averages of historical data is different to the question of how much weight to put on the 'stable ERP' or 'stable TMR' or to the question of how much weight to put to the different methodologies that can be used to estimate the TMR and ERP.

Recent regulatory decisions (e.g. in the Great Britain, Netherlands and Germany) adopt a TMR (or ERP) that is a function of various sources of evidence and lies below the arithmetic average of historical returns.

The Oxera 2021 report presented a historic ex post TMR of 6.58% on the basis of arithmetic averages of returns for the same sample of countries used to estimate the RfR. As these returns were generated in an environment where interest rates were on average higher than today, attaching some weight to the 'stable ERP' view would imply that the expected TMR is currently lower than the historical average.

[16] Oxera (2021), 'Methodological review of the cost of capital estimation', June, section 2.6.
[17] ARERA (2015), 'Decision 583/2015/R/com', December.
[18] Oxera (2021), 'Methodological review of the cost of capital estimation', June, p. 25.

3 Cost of Debt (CoD)

3.1 Introduction

The Oxera 2021 report outlines two methods for estimating the CoD.

- The **market CoD** can be estimated with reference to current yields of comparable market-traded debt instruments, using similar credit ratings and debt tenors. For example, to estimate the CoD of a company rated BBB, one can refer to BBB rated bonds in the market or a BBB rated index such as the BBB iBoxx non-financial corporate bond index.
- The **actual CoD** can be calculated with reference to the company's existing debt obligations. This information is generally available in the financial statements of the company.

Further, the principle of 'cost recovery' means that the regulator should aim to set the allowed CoD so that the efficiently incurred cost of debt can be recovered. To provide efficiency incentives, the regulator should aim to set a notional CoD that reflects the credit rating of an efficiently financed firm.

The Oxera 2021 report concluded that the iBoxx EUR series could be used to estimate the CoD of a notional operator for the next regulatory control period. In the next subsection, we present new analysis of a sample of Italian bonds issued by utility operators and the iBoxx EUR series.

When setting the allowed CoD, it is important to consider the embedded CoD as well as the new CoD. That is, an operator should be able to recover the efficiently incurred costs through the embedded CoD allowance and, as the debt matures in the course of the control period and new finance needs to be arranged, it should be allowed to recover the costs of issuing new debt.

The following section provides a summary of the market data that can be used to estimate the cost of new as well as embedded debt. Finally, section 3.3 presents an empirical analysis on the relationship between the size of Italian operators and their cost of debt.

3.2 Estimating the CoD with reference to market parameters

In the Oxera 2021 report, we presented a summary of the analysis containing 175 bonds of Italian utilities that operate in at least one of the sectors to which the TIIWACC methodology is applied. The bonds were issued by:

- Snam;
- Terna;
- A2A;
- Enel;
- Edison;
- Hera;
- Italgas;
- ACEA;
- Iren.

The following tables summarise the average maturity at issuance and the distribution of the ratings of these bonds.

Table 3.1 Average maturity at issuance of Italian bonds (years)

	Observations	Mean	Standard deviation	Minimum	Maximum
Tenor	175	11.24	11.03	2.00	62.67

Note: The cut-off date is March 2021. Table available in Oxera (2021), 'Methodological review of the cost of capital estimation', June, p. 28.

Source: Oxera analysis based on Thomson Reuters data.

The average maturity at issuance of Italian bonds is 11 years.

Table 3.2 Fitch rating of Italian bonds

Fitch rating	Frequency	Percentage
A+	1	1.67%
A	1	1.67%
A-	9	15.00%
BBB+	35	58.33%
BBB	13	21.67%
BBB-	1	1.67%
Total	60	100.00%

Note: The total sample contains 175 bonds; however, only 60 are rated by Fitch. The cut-off date is March 2021. Table available in Oxera (2021), 'Methodological review of the cost of capital estimation', June, p. 29.

Source: Oxera analysis based on Thomson Reuters data.

The sample considered indicates an average credit rating of BBB+.

As explained in the Oxera 2021 report,[19] when estimating the CoD of a notional operator the regulator is required to set a notional credit rating. This is standard practice in incentive regulation and avoids a 'pass-through' of inefficient debt costs and capital structure decisions. The level of the notional credit rating can be informed by regulatory precedent. For instance, in the UK, Ofgem and Ofwat target a BBB+ credit rating. In the Netherlands, the ACM targets an A credit rating.[20] As presented in the table above, the majority of the bonds issued by Italian operators are rated BBB+ and BBB, which provides further support for adopting a notional credit rating of BBB+.

We review the composition of the iBoxx EUR series to find a benchmark index that would best represent a BBB+ rating with maturity of approximately 11 years. The analysis is summarised in Table 3.3 below.

[19] Oxera (2021), 'Methodological review of the cost of capital estimation', June, p. 28.
[20] Brattle Group (2021), 'The WACC for Drinking Water Companies in the Netherlands', August, Section E.

Table 3.3 iBoxx A and BBB constituents

	A 7–10	A 10+	BBB 7–10	BBB 10+
Number of observations				
A+	25	26	0	0
A	24	29	1	0
A-	47	40	22	26
BBB+	6	4	76	61
BBB	0	0	83	30
BBB-	0	0	25	11
Weights based on the amount issued				
A+	27.2%	26.8%	0.0%	0.0%
A	21.3%	26.9%	0.3%	0.0%
A-	44.4%	41.3%	12.0%	20.2%
BBB+	7.1%	5.0%	37.4%	51.2%
BBB	0.0%	0.0%	40.0%	21.0%
BBB-	0.0%	0.0%	10.3%	7.6%
Weighted average based on the amount issued	**A**	**A**	**BBB+**	**BBB+**

Note: The cut-off date is 15 October 2021, consistent with the analysis of the sample examined in Oxera (2021), 'Methodological review of the cost of capital estimation', June, p. 29.

Source: Oxera analysis based on Thomson Reuters data.

For the iBoxx A series (7–10 and 10+), the weighted average (based on the amount issued) of the constituents is A.

For the iBoxx B series (7–10 and 10+), the weighted average of the constituents is BBB+. The analysis suggests that the series that best proxies a BBB+ rating is the EUR iBoxx BBB non-financials.

Since the average maturity at issuance of the sample of Italian bonds is 11 years, an average between the 10+ and the 7–10 series could be used to calculate the embedded CoD for a hypothetical operator. Table 3.4 below summarises the notional CoD benchmark estimates in nominal terms.

Table 3.4 iBoxx BBB (nominal)

	BBB 10+	BBB 7–10	Average
Spot	1.16%	0.77%	0.97%
One-year average	1.00%	0.62%	0.81%
Five-year average	1.71%	1.29%	1.50%
Ten-year average	2.67%	2.03%	2.35%

Note: The cut-off date is 30 September 2021.

Source: Oxera analysis based on Thomson Reuters data.

The average nominal spot value of the iBoxx BBB index observed on 30 September is 0.97%. The ten-year average is 2.35%. These numbers have been used by ARERA in the final determination.

Finally, Table 3.5 shows the notional, nominal CoD estimation, using cost of debt weights and transaction cost estimates applied by ARERA in the final determination.

Table 3.5 Notional cost of debt estimation (nominal)

	Estimation
Spot BBB [a]	0.97%
Ten-year average BBB [b]	2.35%
Forward premium [c]	0.25%
Uncertainty premium [d]	0.50%
Weighting of new debt [e]	15.00%
New debt [f = a + c + d]	1.47%
Embedded debt [b]	2.35%
Additional costs [g]	0.25%
Nominal CoD (before graduality)	**2.51%**

Note: The cut-off date is 30 September 2021.

Source: Oxera analysis based on Thomson Reuters data.

The parameter estimates presented above are before the application of the gradual approach to the CoD, where ARERA will set the allowed CoD of the next control period as a function of the CoD allowed in the PWACC I period and the notional CoD calculated using the iBoxx indices.

3.3 Empirical evidence on the size of the Italian operators and their CoD

The Italian regulated sectors comprise a large number of operators of different sizes and of unique corporate structures. In setting the allowed revenues, there is a question to whether the size of the operators influences their cost of debt and overall WACC and if this should be reflected in their overall allowance.

Although there is lack of consensus in academia on whether a risk premium exists as a direct result of company size, some regulators have allowed for a size premium in the past—for example, the CMA awarded Bristol Water an extra 5bps for higher issuance and liquidity costs. The CMA argues that those costs reflect the fewer market interactions made by a small company.[21] We therefore investigated whether such a relationship between size and CoD can be observed in the Italian market.

Using a dataset collated by ARERA, we regress the actual nominal interest rate of each operator on their respective RAB. We also regressed the actual nominal interest rate of each security reported by the operators on the total amount issued. The results are summarised in the table below.

[21] Competition and Markets Authority (2021), 'Anglian Water Services Limited, Bristol Water plc, Northumbrian Water Limited, and Yorkshire Water Services Limited price determinations', 17 March, pp. 999–1000.

Table 3.6 Regression results

RAB versus interest rate		
	Coefficient	**p-value**
RAB variable	0.02	0.83

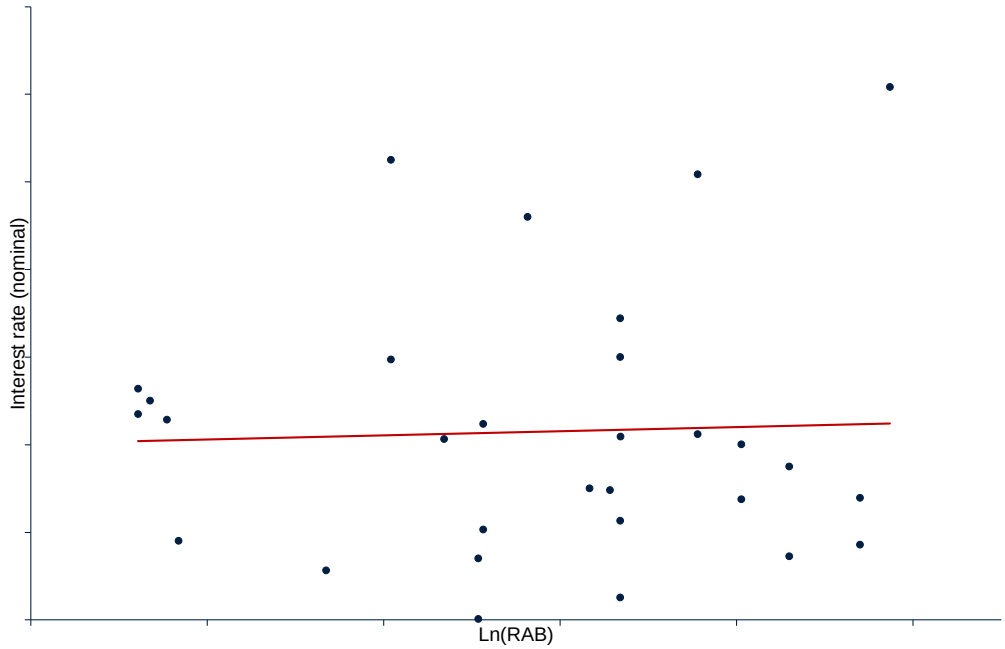
Amount issued versus interest rate		
	Coefficient	**p-value**
Amount issued variable	-0.01	0.92

Source: Oxera analysis, based on data provided by ARERA.

For the relationship between size and CoD to be statistically significant the p-value[22] should below 0.05. Furthermore, for size to negatively influence the CoD the coefficient associated with the independent variable should be below zero—i.e. the bigger the operator (RAB) or the amount issued the lower the CoD.

In both cases, the coefficient associated with the dependent variables is close to zero and the p-value is above 0.05. This shows that, statistically, the coefficients are not different from zero. Hence, in this particular dataset, the regression results show that there is no statistically significant relationship between size and CoD. The findings are supported by the visual representation of the regression as presented in Figure 3.1 and Figure 3.2.

Figure 3.1 Relationship between the companies' RAB and the interest paid

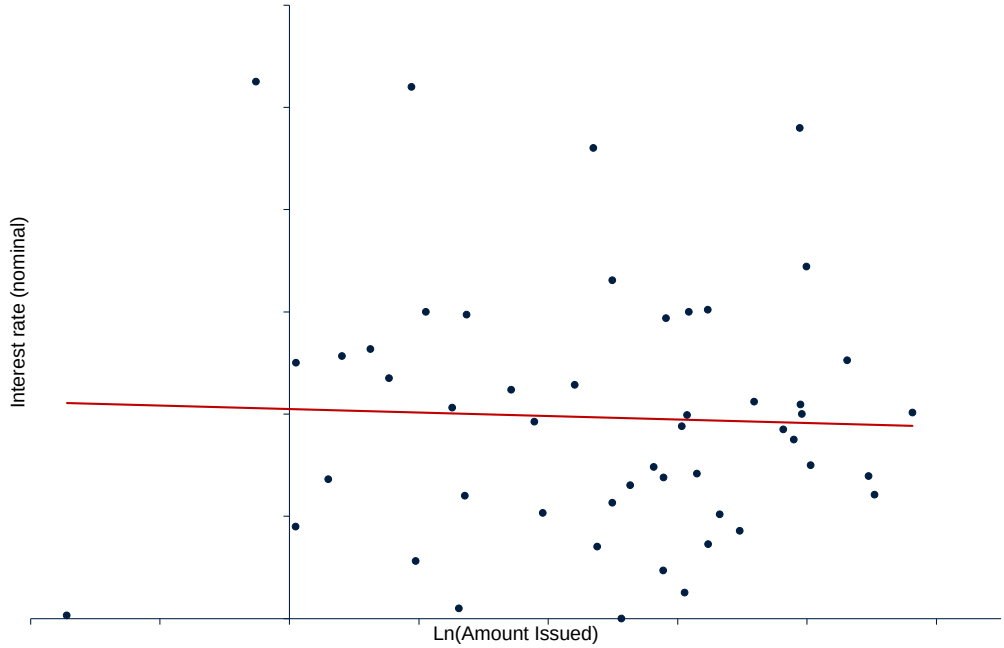


Note: The values in the x-axis and y-axis were anonymised for confidentiality reasons.

Source: Oxera analysis, based on data provided by ARERA.

[22] The p-value is the probability value associated with the statistical test (t-test). In this case, the p-value informs the probability of the beta coefficient to be equal to zero. If the p-value is lower than 0.05, then the beta is said to be statistically significant at the 5% level – i.e. the probability of the beta to be equal to zero is less than 5%. If the p-value is greater than 0.05 than the beta coefficient is said not to be statistically different from zero – i.e. the probability of the beta to be equal to zero is greater than 5% and therefore it cannot be considered statistically significant

Figure 3.2 Relationship between the amount issued and the interest paid



Note: The values in the x-axis and y-axis were anonymised for confidentiality reasons.

Source: Oxera analysis, based on data provided by ARERA.

We observe a few clusters in the graph and some potential outliers. However, no clear pattern emerges in relation to asset size and CoD nor between amount issued and CoD.

4 Managing uncertainty

4.1 General principles

As noted in the Oxera 2021 report, uncertainty mechanisms could be used to account for unexpected changes in specific cost of capital parameters.

In evaluating the options and determining the frequency of the adjustment, the regulator should consider the efficient allocation of risk—that is, whether the company or customer is best placed to manage the risk.

In choosing between options for managing uncertainty it is crucial to adopt a method that is perceived as transparent and objective. In practice, any updating to the cost of capital within a price control period may therefore need to be limited to parameters that can be estimated relatively 'mechanistically' from market data. It is also important that the selected approach does not impose an excessive regulatory burden.

A number of possible options were considered.

- **Trigger mechanism.** A trigger mechanism could adjust some parameters only if some clearly defined benchmark moves beyond (i.e. above or below) a pre-determined threshold**.** A trigger mechanism involves a number of practical issues in defining the benchmark and the trigger level, as well as the adjustments that are required once the threshold is breached.
- **Re-opener.** A re-opener mechanism is similar to a trigger, but its occurrence would be subject to the discretion of the regulator and company. The main difference between a trigger and a re-opener is that a re-opener mechanism would not necessarily follow a mechanistic formula. However, the introduction of a re-opener could increase the uncertainty of the regulatory framework and the burden on the regulator.
- **Indexation.** Another potential approach is the use of an indexation mechanism, whereby the allowed cost of capital (or a component of it) varies mechanically with some clearly defined benchmark.
- **Pass-through.** An ex post pass-through of the actual cost of capital (or a component of it) would be similar to the indexation mechanism, except that the allowed revenue would be updated to cover the actual cost already incurred by the company. Although this method presents limited scope for outperformance, it protects companies against adverse shocks of any size. In addition, provided that the regulator has information on companies' actual costs, this approach is relatively simple to implement. Similarly to the indexation mechanism, this method would increase the volatility with respect to the current framework.

4.2 Implementation issues

ARERA's general approach for updating specific cross-sector parameters and managing uncertainty is outlined in Table 4.1 below.

Table 4.1 General approach to updating cross-sector parameters and managing uncertainty

Approach	Variables
Parameters set over the WACC period (six years)	TMR ADD Weights for embedded and new debt CP and UP
Parameters set every three years	Taxes (T and t_c) Graduality factor for cost of debt (values for the second sub-period are known ex ante)
Trigger mechanism	Possible annual updates for 2023 and 2024 are subject to an overall WACC trigger mechanism of 50bps (for $RF^{nominal}$, isr, SPREAD, iBoxx).[1] If the trigger is activated, the following parameters are reset: • nominal risk free rate ($RF_{nominal}$); • inflation (ia and isr); • CRP (SPREAD + FPCRP); • iBoxx indices; • FP. Mid-period review with new values in place from 2025

Note: [1] The approach for 2026 and 2027 will be defined at the end of the first three-year period.

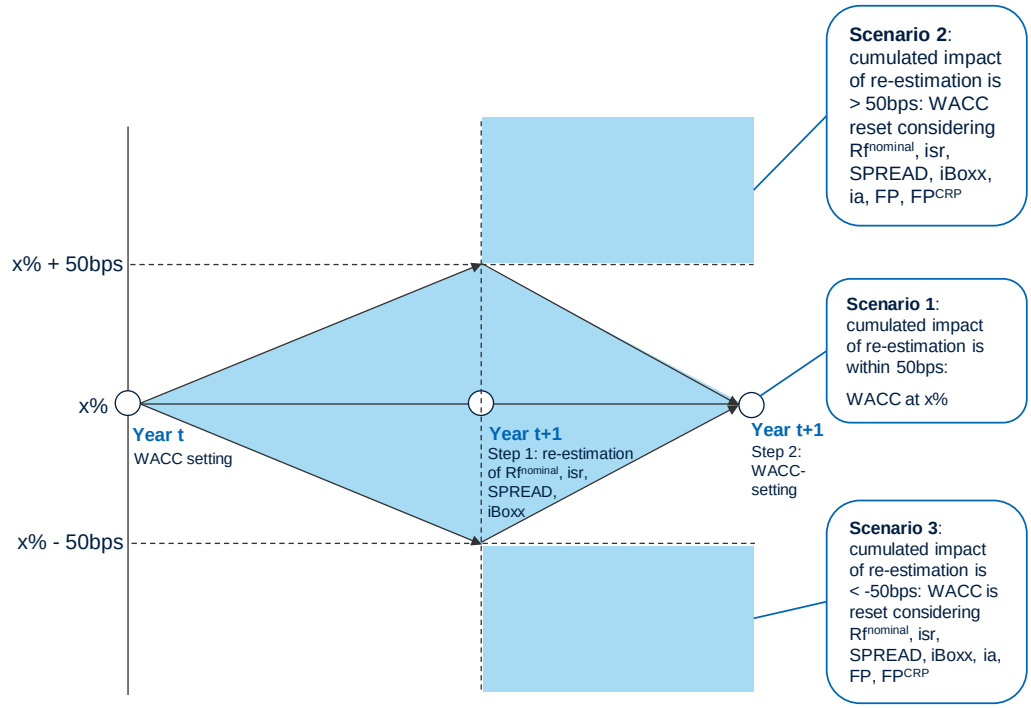
Source: Oxera analysis.

According to ARERA's approach, a number of cross-sector parameters are set over the entire WACC period (i.e. six years).

The taxation parameters (that is, the overall tax rate, T and tax shield parameter, t_c) are examined every three years, based on a review of actual levels of tax incidence. The graduality factor developed by ARERA is expected to change in the second three-year WACC period, based on values determined ex ante.

Over the course of the first three-year period (i.e. 2023 and 2024), ARERA decided to implement a trigger mechanism. Over this period, the WACC level is updated only if the cumulated impact of updating individual parameters is above a pre-determined threshold (50bps). This approach is illustrated in Figure 4.1 below.

Figure 4.1 ARERA's illustration of the trigger mechanism



Source: Oxera analysis.

In the illustration, it is assumed that the real, pre-tax WACC set for year t is x%. According to the trigger mechanism, in year t+1 ARERA will re-estimate the $RF^{nominal}$, isr, SPREAD and the iBoxx indices based on new market evidence.

If the re-estimation of these parameters leads to a revised WACC within 50bps of the allowed level in year t, ARERA will not make changes to the original determination in year t+1.

If instead the re-estimation of these parameters leads to a change in WACC beyond 50bps (in absolute terms), ARERA will update the allowed WACC, also considering new evidence for parameters ia, FP and FP^{CRP}.

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