Methodological review of the cost of capital estimation

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

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Overview

- **WACC framework**
- **Risk-free rate (RfR)**
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  - forward premium
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- **country risk premium**
- **beta**
- **TMR**
- **cost of debt**
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Cost of capital overview

Weighted average cost of capital (WACC)
Overview

ARERA estimates the real pre-tax WACC as:

$$WACC^{real}_{pre-tax,p,s} = CoE^{real}_{p,s} * \frac{(1-g_{p,s})}{(1-T_p)} + CoD^{real}_{p} * \frac{g_{p,s}(1-tc_p)}{(1-T_p)} + F_{p,s}$$

Where:

- the CoE is defined as the cost of equity and is estimated using the CAPM framework:

$$CoE = RfR + \beta * (ERP) + \mathrm{CRP}$$

- the CoD is defined as the cost of debt estimated with reference to market data
- g is the gearing level estimated with reference to the operators' financial data
- T_p is the corporate tax rate
- tc_p is the tax shield respectively
- $F_{p,s}$ is the tax adjustment factor

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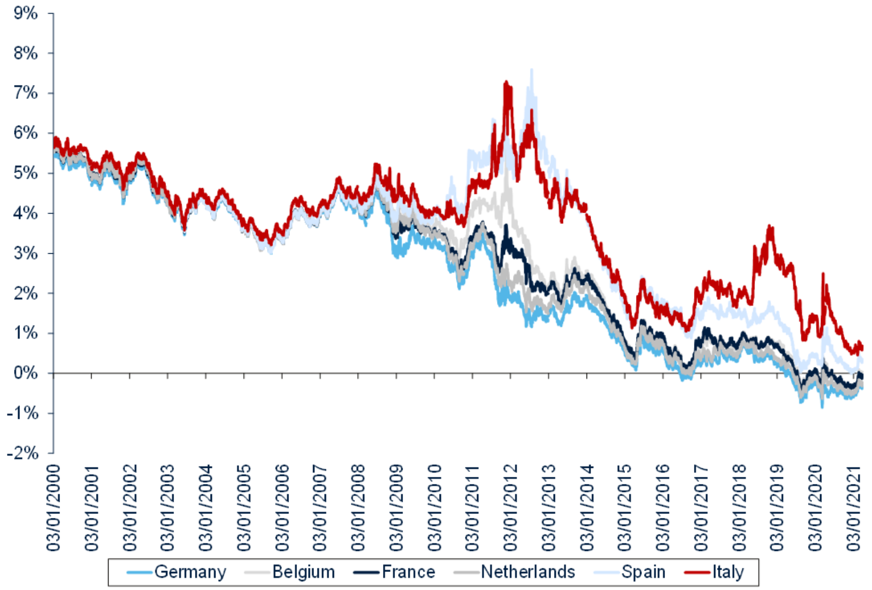
Cost of equity

Risk-free rate (RfR)

Market evidence and the CAPM framework

In the CAPM, the RfR is defined as **a zero-beta asset available to borrowers and lenders**.

Yield on EU government bonds



Fonte: Oxera analysis based on Thomson Reuters data.

Observations

- the rates on highly rated EU bonds have been **falling since the conclusion of the financial crisis in 2010**. This trend persists during the COVID-19 crisis
- the empirical evidence suggests that the **current level of the RfR is negative** for highly rated European economies

Convenience premium
Accounting for the special properties of government bonds

Government bonds have **special properties** that create **additional demand** and suppress their yield below that of a zero beta asset.

- financial institutions must purchase government bonds to fulfil regulatory requirements
- government bonds are an important instrument for hedging interest rate risk
- the amount of capital required to be held by a bank is significantly smaller to support an investment in government bonds relative to other securities with negligible default risk

Since **the CAPM requires investors to borrow and lend at the RfR**, the government yield benchmark must be adjusted. Specifically, the government bond yield should be adjusted for the convenience yield.

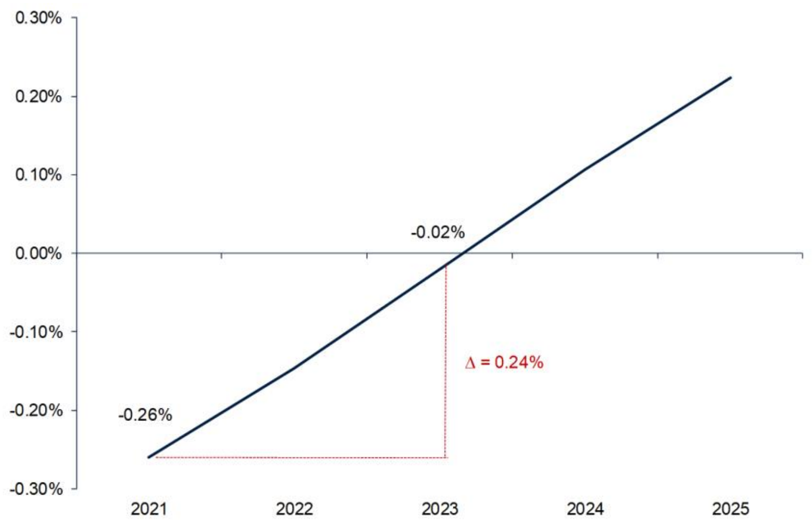
Academic papers suggest that the **convenience yield is approximately 50–100bp** over the medium- to long-term

Forward premium

Estimating expected future interest rates

Expected future interest rates can be estimated with reference to the spot rates of bonds with different maturities.

Forward curve



Fonte: Oxera analysis based on ECB data.

Observations

- the forward premium reflects the market expectation of future interest rates
- the forward premium is estimated as:

$$\boldsymbol{FWD\ rate} = \frac{(\boldsymbol{1} + \boldsymbol{i_a})^{\boldsymbol{t_a}}}{(\boldsymbol{1} + \boldsymbol{i_b})^{\boldsymbol{t_b}}} - \boldsymbol{1}$$

where:

- ia = the yield on bond a of ta periods
- ib = the yield on bond b of tb periods

Uncertainty premium

Recognising uncertainty in forecasting market parameters

Future interest rates might be lower or higher than expected future interest rates. Adding a premium for the uncertainty of how interest rates will evolve is a way to mitigate the risk of under-compensation.

The implicit premium allowed by regulators varies, and tends to be low once estimates of the forward premium and convenience premium are netted off.

Risk-free rate (RfR)

Bringing all the parameters together

The RfR of the next control period is determined by adding the three premiums to the yield on AA+ government bonds:

$$\boldsymbol{RfR_{CP22} = Yield_{AA+} + FWD_{premium} + CP_{premium} + UP_{premium}}$$

Where the level of the $\boldsymbol{FWD_{premium}}$ will vary according to the length of the regulatory period.

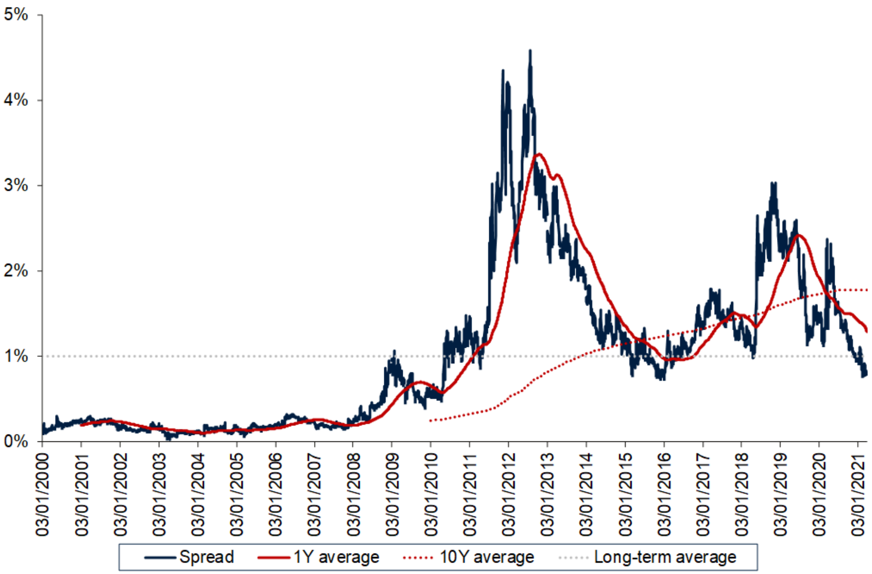
In this framework, **the uncertainty around future interest rates is captured by the different premiums**. Therefore, the yield on **government bonds** used to benchmark the RfR level **should reflect the current market conditions**—i.e. spot or short-term average.

Country risk premium (CRP)

Estimating the additional premium required by investors to invest in Italy

An investor holding EUR might require a **premium to invest in Italian assets**. We estimate this premium with reference to the **spread between Italian bonds and AA+ government bonds**.

Spread: Italian vs AA+ bonds



Observations

- the spread between Italian bonds and AA+ government bonds is **volatile**
- the **current level** of the spread is aligned with the long-term average **of 1%**
- under the current framework a trigger mechanism is used to account for the volatility in the spreads and allow for a pass-on of historical ‘costs’

Fonte: Oxera analysis based on Bloomberg data.

Beta
Methodology overview

In the CAPM framework, the beta parameter measures the exposure of a regulated business to systematic risk. In estimating the beta the following should be considered:

Comparator selection	Selection of a sample of listed companies that engage in the activity of interest, ideally in a jurisdiction with similar regulatory framework. For an unbiased estimate of the beta, it is necessary to filter the sample based on the liquidity of the stocks.
Time frame and frequency	Trade-off between more datapoints (i.e. longer estimation windows) and a more up-to-date estimation (i.e. fewer datapoints but more reflective of the current market conditions). Longer time frames also allow lower frequency data to be used.
Reference index	Assuming that investors will diversify their portfolios within the relevant currency zone, the use of a Eurozone index to estimate the beta of Eurozone companies is preferred.

Total market return (TMR)

Methodology overview

The Equity Risk Premium (ERP) can be determined as the difference between the TMR and the RfR.

The TMR can be estimated using the following methodologies:

Historical ex post	Forward-looking
• Dimson, Marsh e Staunton (DMS) publish the **historical market returns** from 1900 to today • the historical ex-post TMR is based on the **average of the historical returns of: Germany, Belgium, Netherlands and France** • academic evidence suggests that correct discount rates are closer to the arithmetic than the geometric mean	• forward-looking forecasts of market returns are often published in **surveys and analyst reports**. Due to the differing purposes and methodologies of such studies, the results should be interpreted with caution • another forward-looking method is the dividend discount model (DDM). **DDMs are based on the theory that the price of a stock today equals its future dividends discounted to the presented**. Because of the sensitivity of the DDM to multiple assumptions, its results should be interpreted with caution

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Cost of debt

Cost of debt
Methodology overview

The cost of debt of a regulated utility can be split in two:

- cost of embedded debt (i.e. the interest obligations on instruments raised in the past and not yet expired)
- cost of new debt (i.e. the interest obligations on instruments that will be raised in the next control period)

Therefore, the total cost of debt can be estimated as:

$$\boldsymbol{CoD = CoD_{embedded} * (1 - w) + CoD_{new} * w}$$

Where $\boldsymbol{w}$ is the weight of new debt with respect to the total debt. The cost of embedded and new debt can be estimated as:

$$\boldsymbol{CoD_{embedded} = historical\ iBoxx + ADD}$$

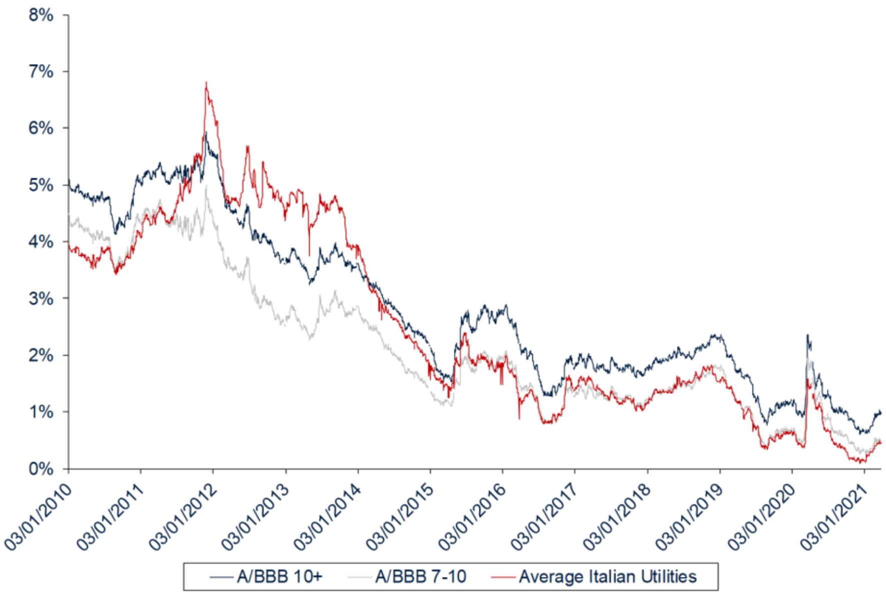
$$\boldsymbol{CoD_{new} = Spot\ iBoxx + FWD_{premium} + UP_{premium} + ADD}$$

Where the ADD is an additional allowance to cover transaction costs.

Cost of debt

Estimating the CoD with reference to market data

Cost of debt



Fonte: Oxera analysis based on Thomson Reuters data.

Comment

- yields on a **blended index of A and BBB+ bonds appear to be aligned with the Italian utilities index**
- further, the Italian sample appears to be aligned with the yield on bonds with **seven to ten years to maturity**

Rating

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.

Source: Oxera analysis based on Thomson Reuters data.

Conclusion
WACC estimation

The methodology proposed reflects the recent regulatory developments in Europe and in the UK, as well as the most recent academic and empirical evidence.

- RfR: forward-looking estimate based on the yield of AA+ government bonds
- CRP: recognition of a historical premium required by investors to invest in the Italian market
- ERP: forward-looking estimate based on the historical market return
- CoD: recognition of the historical costs incurred. Forward-looking estimate of the new cost of debt to be incurred in the next control period

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