INTERNATIONAL COMPARISON OF REGULATORY PRECEDENT ON THE WEIGHTED AVERAGE COST OF CAPITAL

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CONTENTS

Disclaimer

1. INTRODUCTION

Scope

We have been commissioned by the New Zealand Commerce Commission (NZCC) as part of their Inputs Methodology programme to review the approach taken by international regulators on the weighted average cost of capital (WACC), in particular looking at UK and Australian regulators.

This report covers the following issues:

- the trailing average approach to setting the cost of debt allowance;
- approaches to overcome shortages in corporate bond data;
- approaches to overcome shortages in government bond data; and
- the impact the form of control has on the beta term.

In addition to covering these key issues, we have provided a brief summary of relevant WACC parameters to give further context to these decisions. There are several important considerations in setting the cost of capital that sit outside of this report, however this aims to provide a snapshot to help illustrate relevant regulatory precedent.

Nature of the report

This report represents a summary of international precedent on the cost of capital. To achieve a cross-country comparison, interpretation as well as simplification has been necessary. Reference should be made to the source documents, especially where the decision is made in a non-mechanistic way e.g. where a regulator has attached different weight to different pieces of evidence in arriving at a decision.

This report is simply a summary of international precedent, and we do not make an assessment of whether it represents what we would consider to be best practice.

Regulators considered

We focus primarily on six Australian regulators and six UK regulators, drawing upon other international regulatory precedent where applicable. The UK examples are from price control determinations, whilst the Australian examples are from both regulatory determinations and cost of capital guidelines (which do not exist in the UK).

Table 1.1: Primary regulator precedent[1]

Regulator	Reference	Year of decision	Sector
Australian regulatory precedent			
AER	Rate of return guidelines	2013	Energy
ERA	Rate of return guidelines	2013	Utilities
QCA	Cost of Capital Review	2014	Utilities
IPART	Review of WACC methodology	2013	Utilities
ESC	Greater Metropolitan Water	2013	Water
ESCOSA	SA Water	2015	Water
UK regulatory precedent			
Ofgem	RIIO ED1	2014	Energy
Ofwat	PR14	2014	Water
ORR	PR13	2013	Rail
CAA	Q6	2014	Airports
Ofcom	MCT Review	2015	Mobile (telecoms)
CMA	NIE determination	2014	Energy

Approach

We have split the report into two chapters:

- The first chapter looks at the setting of the allowed cost of equity, including the risk-free rate component.
- The second chapter considers the cost of debt allowance.

Within the chapters, we look first at two key issues in some detail, before moving on to providing context around the decisions and concluding each chapter with a summary table.

In our annexes, we provide a worked example of the outcome from using different approaches in addition to the references used in completing the report.

Authors

This report was authored by Ian Alexander, CEPA Director, and Nick Hodges, CEPA Senior Consultant. Their CVs can be found in Annex C.

[1] AER = Australian Energy Regulator, ERA = Economic Regulatory Authority of Western Australia, QCA = Queensland Competition Authority, IPART = Independent Pricing and Regulatory Tribunal NSW, ESC = Essential Services Commission Victoria, ESCOSA = Essential Services Commission of South Australia, ORR = Office of Rail and Road, CAA = Civil Aviation Authority, CMA = Competition and Markets Authority

2. COST OF EQUITY

2.1. Introduction

The cost of equity is typically comprised of three elements; i) the risk-free rate, ii) a market risk premium, iii) equity beta.

We first look at issues relating to the risk-free rate, including the proxy index used, the use of trailing averages and whether this is mechanistic or discretionary. On the equity beta, we focus on the impact of the form of regulatory regime (or form of control) on the beta term.

2.2. Issue in focus #1: Government bond data as proxies for the risk-free rate

The risk-free rate is the foundation of most calculations of the allowed cost of capital. This can be proxied by government bonds, either in nominal form or using index-linked gilts (ILGs). Even when calculating a nominal risk-free rate within the cost of capital, there will be an implicit inflation estimate contained within the nominal yield. This is because the nominal bond yield contains a real return element and an element to compensate for the erosion of purchasing power through inflation.

The return can be earned either through capital appreciation or income. Many economic regulators have built regulatory regimes to support private sector investment by providing investors their nominal cost of capital through two alternative approaches:

- a nominal cost of capital with an non-indexed regulatory asset value; or
- a real cost of capital with an indexed regulatory asset value[2].

2.2.1. Market estimates of the risk-free rate

UK regulators have tended to consider both nominal bonds and index-linked bonds in estimating a real risk-free rate. A nominal risk-free rate may be published alongside this to demonstrate the inflation estimate inherent in their real risk-free rate (via the Fisher equation)[3]. The Bank of England publish yield curves for both nominal and real yields, which involves curve fitting using a parametric approach[4].

A potential absence of data in a UK context is less pronounced than it would be in a country where a mechanistic approach is used. UK regulators may use cross-checks and historic evidence to arrive at a particular value; the use of a trailing average also reduces the impact of outlier values on the determination. However, this is more difficult when a mechanistic

[2] These approaches are not exactly equivalent, as the inflation used in indexed the asset base is outturn, while the inflation estimate implicit within the nominal cost of capital is a forecast (which is linked to what the company faces in financial markets).

[3] (1 + nominal interest) = (1 + real interest).(1 + inflation rate)

[4] Details on this approach can be found in 'New estimates of the UK real and nominal yield curves' Bank of England paper by Nicola Anderson and John Sleath (1999).

and prevailing rate approach is taken[5]. We address some of the issues with each approach in turn below[6].

2.2.2. ILGs

Inflation-linked debt pays a "real" coupon, with compounded inflation typically paid on maturity. This gives a market-driven estimate of the real risk free-rate.

ILGs, if available, can be a good route to calculating the real risk free rate. However, this is not the default mode by which governments issue debt. More often than not, gilts will be nominal, rather than real and in many cases the government may not issue any inflation-linked debt at all.

Even if a government does issue ILGs, the level of precision might be undermined by not having issued any with a remaining maturity similar to that targeted for the cost of capital calculation. In these cases it might be possible to interpolate values from ILGs with a shorter and a longer maturity but this will clearly reduce the level of precision of the estimates.

There is also an important question about what ILG yield actually represents. It is widely recognised that even where they exist and are well-established, such as in the UK, there are factors that mean that ILG yields must be treated with care, particularly those with longer-yields.

In the UK there have been concerns that the yield on ILGs are depressed given a mismatch between limited supply and plentiful demand, particularly from pension funds (see the CMA NIE determination). This might result in a real risk free rate that is too artificially low. More fundamentally, however, is the view that the ILG yield contains a risk premium that the investor receives for effectively insuring against outturn inflation risk[7]. This is a benefit that investors receive from investing in assets whose value is updated each year for outturn inflation. These distortions are relevant for the real risk-free rate as they both serve to artificially depress this estimate of its value.

Clearly, there are some issues to be dealt with when using ILG data where this exists[8]. However, when available, they do provide a powerful piece of evidence that can inform regulatory determinations of the market inflation expectations and consequently the real risk-free rate. Our understanding is that there are Inflation-Indexed Bonds (IIBs) issued by the New Zealand Government Debt Management Office with four bonds currently trading (2016, 2025, 2030 and the recently issued 2035). While obviously the limitations of only

[5] In a UK and Australian context, we are unaware of severe issues regarding a shortage of risk-free rate data.

[6] We focus on estimating a real risk-free rate through ILGs and deflated nominal gilts, however the flip side of this would follow the same approach for estimating a nominal risk-free rate, namely an inflated ILG and nominal gilts.

[7] For example a 30 bp inflation risk premium was assumed in analysis prepared for Ofwat's PR14 determination. See PWC (Dec 2014) *"Updated evidence on the WACC for PR14: A report prepared for Ofwat"* p19

[8] It is our understanding that in the Australian case, there is reduced Commonwealth ILG issuance post-GFC and this has reduced the data available for a regulator to consider.

having four maturities, with one of these soon to be redeemed, are significant, the existence of the bonds does allow for some market measurement of a real risk-free rate as a cross-check. The inflation estimate can be clearly derived for these bonds as there is a corresponding nominal bond with the same maturity. This may be useful information if interpolation or curve fitting approaches are adopted by the regulator.

2.2.3. Use of nominal gilts

As mentioned above, it is possible to use an expected inflation rate to derive a real risk-free rate from a nominal risk-free rate (or derive expected inflation from a real and nominal risk-free rate). Data on nominal gilt yields is widely available and free from many of the issues that plague ILGs. However, the greater robustness of observations of government yields is often offset by the need to use less precise information on inflation expectations.

Inflation expectations can be derived from a range of sources beyond that implicitly used in the ILG approach describe above[9]. These include:

- *Government and/or economist forecasts* – for example when seeking to perform a similar transformation to the cost of debt at PR14, Ofwat considered inflation forecasts produced by the Office for Budget Responsibility[10].
- *Surveys* – for example in the US, the Federal Reserve Bank of Philadelphia produces a survey of long-term inflation expectations. This was previously used to deflate US values as part of the methodology used by CREG, the energy regulator in Colombia[11].
- *Central bank target inflation rates* – assuming the central bank is credible, an inflation target might be a reasonable estimate, particularly if a long-term approach is adopted.

Each approach has its pros and cons. For example, Government and/or economist forecasts might be backed by a rich body of analysis but often do not extend many years into the future. Surveys can incorporate a wide range of views but might not be frequent or respond well to market conditions[12]. Central bank rates provide a good long-term anchor but are likely to be wrong in the short run.

2.2.4. Inflation indices

In the UK, most regulators have indexed regulatory asset values and regulatory allowances using the Retail Prices Index (RPI). This is despite the fact that there are known

[9] The difference in yield between nominal gilts and ILGs of the same maturity gives what is referred to as a "break-even" inflation rate estimate over the time period considered.

[10] Ofwat (Dec 2014) *"Final price control determination notice: policy chapter A7 – risk and reward"* p36 available on the Ofwat website here

[11] CREG (Mar 2002) *"Costo promedio de capital: metodología de cálculo para la distribución de energía eléctrica y gas combustible por redes"* p65 available on the CREG website here

[12] For example, during the Global Financial Crisis US break-even inflation fell sharply while the Livingstone survey (referenced above) was largely unmoved.

methodological issues with its calculation[13] and the Bank of England has targeted Consumer Price Inflation (CPI) since 2003[14]. This has led some regulators to consider a move towards use of CPI.

In reality the exact measure of inflation should not matter. What does matter, however, is that the index used to provide capital appreciation is the same as that used to deflate the risk-free rate. Therefore, for example in the UK, if the Bank of England's CPI target were to be used to deflate the risk-free rate used to provide a return on assets linked to RPI, an adjustment would need to be made to account for the difference between CPI and RPI inflation. Consistency should be ensured between inflation and how costs have been forecast or a risk is created. In addition, the inflation index should be representative of the inflation cost a company faces otherwise this will create a mismatch. A few of the UK regulators have started to migrate to using CPI (Ofcom, WICS and the CAA) from RPI while others are starting to consider the implications of a possible shift to CPI.

[13] See for example ONS (2013) "National Statistician announces outcome of consultation on RPI" available on the ONS website here

[14] It previously targeted the RPIX (RPI excluding mortgage interest payments) measure of inflation.

2.3. Issue in focus #2: Form of control and the beta term

The beta term used in the CAPM equation is a measure of systematic or non-diversifiable risk of returns relative to the market. The form of regulation used is relevant in that this may be a source of such risk. This also extends more broadly than the form of control itself, and includes mechanisms that affect the risk profile of the regulated entity. As the form of control is one element of the overall risk profile of a company, there is a lack of quantification of the impact of using different regulatory regimes. Theoretical research does suggest that the specific form of regulation can affect profit variability and hence the risk faced by regulated companies.

2.3.1. Theoretical background

The return of a company can be split into revenues and costs. The form of control can affect the variability of both revenues and costs, therefore it is logical that the form of control can affect the beta term. However, a distinction must be made in terms of what represents systematic risk (captured in the beta term) and non-systematic risk (not captured in the beta term).

There is a spectrum that can be derived for the riskiness for companies of being regulated in different forms. The below table illustrates the type of regulation and the riskiness of elements within the regulatory setting.

The spectrum goes from cost of service regulation (or rate of return regulation) to a revenue cap to a price cap, each time increasing the elements which are not regulated.

Table 2.1: Profit elements controlled by the form of regulation

Regulation type	Regulated elements	Unregulated elements
Cost of service	P, Q, C, U	
Revenue cap	P, Q	C, U
Price cap w/ cost pass through	P, U	Q, C
Price cap	P	Q, C, U

Source: Alexander, Mayer and Weeds (1996)

Note: P is the regulated price, Q is the regulated quantity, C is controllable cost and U are uncontrollable costs.

With a hypothetical cost of service regulation form where the regulated price instantaneously adjusts to equalise allowable revenues and realised costs, the regulated firm would arguably bear no diversifiable or non-diversifiable risk, and thus if they bore no risk, a zero asset beta may be assumed. In practice, we are unaware of any regulatory package where the firm does not bear some risk, as this would not contain strong incentive properties. At the other end of the spectrum in the table i.e. price cap regulation, the range of returns will depend on the extent to which the price cap bites. If this ceiling is significantly

above the price a firm would wish to charge, there would be little difference between the firm being regulated and not-regulated, purely based on the form of regulation.

Where systematic risk has been transferred from the regulated company to consumers, this should be reflected in the use of a lower asset beta, and subsequently lower charges paid for by those same consumers. Parallels may be drawn to proposals related to the split cost of capital, where the investment to date carries a different risk profile to new investment to be carried out.

2.3.2. Ancillary mechanisms

Comparing a price cap and revenue cap, the key difference is the presence of volume or demand risk within the price cap regime. The degree of this will vary by both sector and company. The mechanisms contained within the regulatory regime also make a key difference here, as without mitigation mechanisms volume risk can be substantial.

There may be mechanisms which insulate a company from this demand risk, albeit under a notional price cap basis. This could include demand triggers or automatic adjustment mechanisms. As the exposure to volume risk decreases, the difference between a price cap and revenue cap narrows, and where the regimes approximate to one another, no difference in the asset beta would be observed (the price cap beta would approximate to the revenue cap beta).

There are other risk mitigation measures which should be considered in setting the asset beta. These may be related to either costs or revenues. Demand-based mechanisms are concentrated on revenues, while a key feature of many regulatory regimes is the ability of the regulated entity to pass-through certain costs to consumers or share these costs with consumers. These reduce the risk faced by companies, as would a review to re-open costs in light of certain cost-incurring events.

2.3.3. Empirical studies

There are a number of papers which focus on the impact of regulation itself on a sector, however for the purpose of this study we are interested in differential risks between alternative forms of regulation.

A study by Alexander, Mayer and Weeds (1996) looked at 135 different countries over the 1990-1994 period to assess the beta for regulated utilities, in particular those in the UK and the US. The study spanned a number of sectors including traditional utilities. This found that UK utilities subject to price cap regulation had significantly higher asset betas than US utilities subject to rate of return regulation. In a follow-up paper, Alexander and Irwin (1996) find that investors in firms operating under price cap regulation require a return of around 100 basis points higher if they were regulated under rate of return regulation. A further paper by Alexander, Estache and Oliveri (1999) considered the impact of regulatory regime

in transport specifically, finding that the choice of regulatory regime greatly affects the degree of market risk a company faces.

A further cross-country study was conducted by Gaggero (2012), which did not find significantly different betas for regulated firms in a study using 170 regulated firms across a number of countries for the period 1995-2004. This model seeks to control for cross-country differences and posits that more incentivised forms of regulation i.e. price caps, tend to have a number of risk mitigation mechanisms supporting them e.g. cost-pass throughs.

A report by Grout and Zalewska (2006) focusses on the UK and on the effect of moving from a price cap to a profit-sharing mechanism. This finds a statistically significant change in the firms' betas after controlling for other factors (though the authors do not seek to quantify the impact on beta).

There is other evidence which seeks to explain the observed differences in asset betas for different types of regime. A previous Commerce Commission report has considered some of this evidence[15]. While the explanations provided are clearly important and explain some of the observed difference in asset betas, it is also clear from a theoretical basis that some difference would be expected. What is unclear is how significant the differences in asset betas are between regimes with different levels of market risk.

2.3.4. Regulatory precedent

The theoretical and empirical research is largely captured in a November 2012 discussion paper by the QCA on the form of regulation and risk[16]. The regulator supports the proposition that the form of regulation does matter, though does not identify any explicit adjustment that should be made.

In considering the approach of other Australian regulators, the QCA find the AER to take a broad approach to assessing the risks as a whole, whilst the ESC recognises the difference in risk from the form of control, but does not appear to make an adjustment for this.

In the UK, the regulation of airports involves the use of a price cap regime. The beta adopted is higher than for other regulated sectors using revenue caps. The regulator, CAA, made the following comment in the run-up to the most recent price control[17]:

'The price cap is calculated as the forecast revenue requirement divided by the forecast passenger traffic. Certain commercial revenues are also largely driven by traffic. Traffic forecasts are uncertain, with large differences in Q5 between actual and forecast traffic. This uncertainty ultimately results in a higher cost of capital and therefore higher airport charges.'

[15] See H8.98-H8.110 of *Input Methodologies (Electricity Distribution and Gas Pipeline Services) Reasons Paper*, December 2010.
[16] QCA (2012) Risk and the form of regulation, November 2012.
[17] CAA (2012) Review of Price Regulation at Heathrow, Gatwick and Stansted Airport ('Q6'): Policy Update, May 2012.

The impact of this depends on the extent of the risk, with experts on behalf of Heathrow finding that volume risk for airports is more volatile than for other sectors. In analysing comparator betas, risk sharing mechanisms were considered in that they may reduce observed betas.

The impact of volume risk also depends on whether there are any biases in the forecasting approach. An example of this is the AER noting a persistent bias in forecasts and over-recovery of revenues. An example is given for the 2006-10 Victorian electricity distributors over-recovering revenue relative to the forecast by $568m[18].

The beta term represents the co-efficient of the relationship between the company and the market. It is not concerned with the intercept term and the overall level of return, therefore in theory the removal of the bias in forecasting is unlikely to affect the asset beta, despite firms being potentially worse-off in expected financial terms.

Placing an exact value in beta terms on the form of control is difficult and requires decomposing observed betas. With the exception of the Colombian energy regulator, CREG, we are unaware of other regulators outside of New Zealand who apply an explicit adjustment[19].

[18] As quoted in the QCA (2012) paper.
[19] See the end of Section 2.4 for further description of this approach.

2.4. Context for the cost of equity

Trailing average period for the risk-free rate

A potential option for a regulator is to use the most recent data available using a prevailing rate as near to the price control as possible. This has the advantage of being representative of current market conditions, but the drawback is that as the trailing average period shortens, the outcome can be increasingly volatile and the data considered may be anomalous. Some regulators have adopted an 'on the day' approach, which is close to the end of the spectrum, with a short trailing average period taken to try to reduce some of these risks. Other regulators have looked at longer trailing average periods, over a decade in some cases. This choice may depend on whether the regulator has a duty to ensure the financial viability of an incumbent or whether the regulator prices relative to the price of a new entrant.

Australian regulators have typically adopted a short trailing average period (20-40 days) on the risk-free rate (though some use a trailing average for the debt premium under a 'hybrid' model). IPART have recently moved to considering a longer term trailing average, where they consider a ten year trailing average as well as a shorter trailing average. ESCOSA are the only Australian regulator noted to not identify the same risk-free rate for estimating both the cost of debt and cost of equity, instead choosing to consider an all-in cost of debt based on a ten year trailing average.

Four of the six UK regulators used a starting point for the risk-free rate based on longer-term trailing averages (typically looking at a ten year average). The two other UK regulators who did not do this, Ofwat and CAA, were advised by the same expert, and did cross-check their 'current' approach (spot rate plus forward rate approach) against a longer term trailing average approach. Ofcom state that they seek to balance a more current approach with a historic trailing average approach, with the figure assumed approximating to the ten year average of ten year ILG yields.

Alternative approach: Belgian Telecoms regulator and weighting of short and long-term estimates
The Belgian Telecommunications regulator, IBPT, introduced a measure in early 2015 that assigned certain weightings on estimates for both the risk-free rate and the market risk premium (MRP) depending on the assumed long-term weighting of each. The proportional weighting for the MRP is matched with the risk-free rate through use of trailing averages[20].

Use of forward curves

There is a significant difference between an 'on the day'/ prevailing rate approach and a spot approach with the use of forward curves. Therefore, it is important to understand whether forward rates have been used in setting an allowance.

[20] Institut Belge Des Services Postaux Et Des Telecommunications (IBPT) (2015) Decision du conseil de l'IBPT du 26 Fevrier 2015 concernant le cout du capital pour les operateurs puissants en belgique.

The six Australian regulators noted do not consider forward curves, due to a greater adherence to the CAPM model, with financing implicitly assumed to take place at the start of the regulatory period and with a role for interest rate swaps.

The six UK regulators do consider forward curves. The reason for this is the nature of setting the cost of capital in the UK involves an assumption of more continuous financing over the price control period. This approach has similarities to an annual updating approach, however represents an ex-ante forecast of the risk-free rate over the regulatory period. The drawbacks of this would be the accuracy of forward curves as estimates and any potential impact on the use of swaps.

Ofgem, with the use of cost of debt indexation on an all-in basis with annual updating does not estimate a risk-free rate to apply for the cost of debt. In risk-free rate estimation, index-linked gilts (ILG) are preferred by UK regulators (often cross-checked against deflated nominal yields) as this removes inflation risk and is appropriate given the setting of a real cost of capital. In considering cost of debt indexation, the CAA noted that the 'incorrect' inflation assumption of breakeven inflation was a factor in their choice to not adopt indexation[21]. This relates to the choice of inflation deflator i.e. breakeven inflation corresponding to expected inflation over the term of the debt, whilst revenues are indexed using outturn RPI for the price control. The CAA instead used a fixed ex-ante allowance for the cost of debt, considering forward rates for the risk-free rate and the cost of debt. On the cost of new debt, CAA and their expert advisor included an assumption that the all-in cost of debt would rise by less than implied by the nominal government bond forwards (a co-efficient of +0.8 was assumed).

Alternative approach: Competition and Markets Authority use of base rate forward estimates
The Competition and Markets Authority (CMA), the UK appeals body, considered the spot rate plus forward curve approach for estimating the risk-free rate for the Bristol Water 2015 determination. Rather than adopt the same approach as the CAA in the Q6 determination looking at ten year government bond forwards, the CMA chose to focus on expected changes in the Bank of England base rate.

Term of bonds for the risk-free rate

The concept of term matching on the risk-free rate is to compensate investors for risks faced within the regulatory period and neither to reward nor penalise investors for risks outside of the regulatory period. Term matching is done by matching the length of the government bond term to the length of the regulatory review period. If the yield curve is upward sloping, this implies that the risk-free rate increases with the length of the regulatory period.

Two of the six Australian regulators sampled adopt term matching. There may be significant impacts based on the approach taken; for example, the ERA stated that annual updating of

[21] This would appear unlikely in itself to be a reason to reject such an approach.

the risk-free rate would require the use of a one-year bond as a proxy, as such a model would be akin to a one year regulatory period. Under such an approach, the regulated company would be assumed to refinance everything annually. The ERA did however say in a March 2015 discussion paper that there could be benefits from moving away from an 'on the day' approach to the risk-free rate. The QCA use term matching, quoting the advice of Dr Martin Lally in that term matching is the only option for the term of the asset which is consistent with the NPV = 0 principle, stating that they had placed more weight on this than IPART who had viewed this as a secondary consideration and moved away from term matching.

The UK approach meanwhile is more independent of the timing of the regulatory decision with rolling financing assumed, and so term matching is not applied. In selecting the appropriate term for government bonds, the Competition Commission (CC, now CMA) previously noted distortions in longer dated ILGs due to pension fund dynamics, although noting these in principle to be the best source of data on the risk-free rate. More recently, the CMA has observed distortions on short-dated ILGs due to the impact of the credit crunch and stated that these distortions are increasingly well understood. A further option discussed on the risk-free rate in the UK was the use of interest rate swaps. In their Stansted review, the CC rejected the use of such an approach due to a number of factors including volatility, potential distortions, absence of long-run data and difficulty in applying credit and inflation adjustments. Ofwat also rejected the use of interest rate swaps for proxying the risk-free rate.

Alternative approach: Norway focus on asset term rather than regulatory term
In its CAPM approach, Norway's energy regulator adopted long time horizons for the risk-free rate estimates and market risk premium. Norway's regulator considers that a longer term for government bonds is preferable for regulated businesses who make long-term capital investments to better reflect the assumed life of assets[22].

Mechanistic or discretionary setting

Government bonds are considered to be a suitable proxy for estimating the risk-free rate. Regulators may choose to adopt a mechanistic approach to setting the risk-free rate to remove uncertainty, while a different approach would be to make a judgement based on a range of evidence.

The Australian regulators considered all use a mechanistic approach to setting the risk-free rate. This is based on a trailing average of a set period from a benchmark data index. However, there are potential caveats to this mechanical application which are relevant to consider in light of their proposed approach. For example QCA adopt a 20 day trailing average period immediately prior to the regulatory period in 'normal circumstances'.

[22] NordREG 'Economic regulation of electricity grids in Nordic countries', 2011

None of the UK regulators considered use a mechanistic approach. This may be for times when the data is considered to be distorted, for example depressed yields due to the effect of quantitative easing. Based on the use of a Total Market Return approach for the cost of equity, the specific risk-free rate estimate may be less material. The impact of Quantitative Easing in the UK has been estimated as depressing ILG yields by up to 100bps. This had led to increasing 'aiming up' on the ten-year ILG ten-year trailing average, though there are large differences in the risk-free rate assumed by different UK regulators. In the Stansted review, the CC rejected a mechanistic approach, though in their RIIO ED1 decision Ofgem raised the possibility of indexation of the cost of equity.

Alternative approach: Use of a crisis risk premium in Ireland
CER, the Irish energy regulator added a crisis risk premium to the risk-free rate to take into account the risks associated with the Eurozone crisis. The crisis premium added to the cost of equity is of the same magnitude as that added to the cost of debt[23].

Approach on beta estimation

There are a large number of variations in estimating beta. This includes both qualitative measures such as relative risk analysis and regulatory precedent, as well as quantitative analysis based on quoted comparators, both domestic and international.

Australian regulators tend to base their equity beta range on a sample of comparators, with regulatory precedent considered in arriving at a point estimate. The time period considered does vary with the ERA looking at weekly beta estimates back to 2001, while IPART looks back on a monthly basis as far as 1973. The use of international comparators varies also; the AER focus on Australian firms only due to perceived complexities in comparing international companies with the circumstances at hand, whilst IPART looks at comparators from Australia, New Zealand, Canada, the US and the UK.

UK regulators have placed significant weight on regulatory precedent in setting an estimate for the beta. This has tended to be stable over time. For the PR14 price control, Ofwat did decrease the asset beta from 0.40 to 0.30. This more closely reflected market evidence on UK comparators, which sat significantly below regulatory precedent, though evidence on these comparators have increased since the time of the determination. In the absence of a range of domestic comparators, Ofcom and the CAA are two regulators who have considered international comparators in their beta analysis. There is a lack of consensus on the appropriate methodological approach however, with some regulators looking at daily betas, while others prefer weekly or monthly estimates, the time frame for estimating beta and the counterfactual index to be used.

Alternative approach: Colombian beta uplift for the form of control
The Colombian energy regulator, CREG, applies an uplift for the form of control if the regulated company operates under a price cap as opposed to rate of return regulation, as is typically the case

[23] CER, 'Mid-Term WACC for EirGrid and ESB Networks', 2013

Alternative approach: Colombian beta uplift for the form of control
observed in the US[24]. For more discussion, please see section 2.3.

[24] CREG, 'Resolucion 095 de 2015', 2015

2.5. Summary table for the risk-free rate

Table 2.2: Regulatory precedent on the risk-free rate

Regulator	Benchmark country for bonds	Mechanistic application?	Benchmark bond term for 5yr control	Term matching?	Trailing average period	Fwd curve considered?
Australian regulatory precedent						
AER	Australia	Yes	10yr	No	On the day (20 day)	No
ERA	Australia	Yes	5yr	Yes	On the day (40 day)	No
QCA	Australia	Yes	5yr	Yes	On the day (20 day)	No
IPART	Australia	Yes	10yr	No	On the day (40 day) & trailing (10yr)	No
ESC	Australia	Yes	10yr	No	On the day (40 day)	No
ESCOSA	Australia	Yes	10yr	No	On the day (20 day)	No
UK regulatory precedent						
Ofgem	UK	No	10-20yr	No	5-20yrs	Yes
Ofwat	UK	No	10-20yr	No	Spot	Yes
ORR	UK	No	5-20yr	No	10yr	Yes
CAA	UK	No	5-15yr	No	Spot	Yes
Ofcom	UK	No	5-10yr	No	5-20yrs	Yes
CMA	UK	No	10-20yr	No	5-20yrs	Yes

3. COST OF DEBT

3.1. Introduction

The cost of debt may be set using an all-in cost of debt or using the sum of a risk-free rate and debt premium. Where the latter approach is adopted in the precedent considered, the risk-free rate is estimated on the same basis as set out in the cost of equity chapter unless otherwise specified.

3.2. Issue in focus #3: Data availability on the cost of debt

While it is not possible to observe the forward-looking cost of equity in practice, it is possible to do so for the cost of debt. This can make calculating that value far simpler and precise and does not require use of theoretical frameworks such as the capital asset pricing model (CAPM). In ideal conditions, the cost of debt can be highly-tailored to the context in which it is applied, capturing a number of key features:

- the timing of debt finance being raised;
- its maturity of the debt;
- its riskiness (credit rating)[25];
- the expected level of inflation over the relevant period; and
- the currency in which debt is raised.

If data permits, essentially the approach is to identify an external benchmark for debt finance costs based on conditions that are as similar as possible to the case in which the value will be applied[26]. This approach however is data intensive and cannot always get comparator bonds of the same type, therefore adjustments are required. As more adjustments are required, this would widen the confidence intervals around the estimates.

3.2.1. Australian regulatory precedent

The data available for estimating the cost of debt in Australia narrowed due to the increased illiquidity of longer term bonds following the GFC. An example of this is the ceased publication of fair value curves from Bloomberg (2014) and CBASpectrum (2010). This has led a number of regulators to consider which is the appropriate cost of debt benchmark index to use.

[25] UK regulators have tended to assume a 'comfortable' investment grade credit rating, such as BBB+ to A-. This is due to requirements in several licences to maintain an investment grade status and these credit ratings give a buffer against that. It also is in-keeping with any regulatory duties that require ensuring financeability.
[26] There is no requirement to use the same comparators for debt as there is for equity, although they may overlap.

A 2014 review of their cost of debt estimation approach by the QCA notes some of the issues with an absence of data and their proposed solution.

To start off with, the QCA note that the use of a benchmark is preferred to an entity's actual debt costs because:

a) customers are protected if the firm is inefficient in its financing decisions;

b) the firm retains the benefit (if any) of adopting more efficient financing arrangements;

c) it simplifies the regulatory task as the regulator does not have to examine and understand the firm's financing arrangements in depth; and

d) for government-owned entities, it reflects the principle of competitive neutrality.

The QCA has recently proposed moving to an econometric approach recommended by their expert advisor, which assumes a linear relationship between the debt margin and term to maturity (subject to periodic review). Data from the RBA and Bloomberg are then used as cross-checks. This follows on from the QCA's previous approach of using a Bloomberg seven year fair value yield extrapolated out to ten years.

The data for the bespoke econometric approach came from UBS and Bloomberg, with UBS seen to give greater coverage, especially of floating rate notes. Other sources e.g. the Australian Financial Markets Association (AFMA) and Thomson Reuters were seen to overlap with the above two sources. Although only 50% of debt issuance was found to be using domestic bonds (27% being bank debt, 23% being foreign denominated debt), this was retained as the sole source due to transparency and complexity considerations. A broad sample of companies were considered if they met the criteria, not solely regulated entities. This increased the sample size and statistical precision of estimates.

There are benefits identified by the QCA to using third party data in terms of its reputation, access and cost, but the new Bloomberg (BVAL) indices may not have a sufficient level of transparency and the change of data availability means that new indices have not been tested in a regulatory context. The grouping by credit rating is at the broad level (i.e. BBB, A, AA) rather than the individual notch level (e.g. BBB-, BBB, BBB+). This does not extend to ten years either, so is seen as a cross-check.

The RBA data series considered only produces month-end figures, so this does not have the depth of data with a daily series. IPART chose to use two monthly data points whilst the AER have considered methods to derive daily estimates using gilts. However, the series has benefits in that it goes out to ten years maturity, which the Bloomberg BVAL indices did not. Following their cost of capital review, IPART moved to a ten year term to maturity (from five years). The RBA series is available from January 2005 and has been selected by IPART for use in estimating the cost of debt (replacing the Bloomberg indices). Sensitivity testing by IPART for the water industry indicated an increase of 70bps using the new approach.

A further issue is whether international bonds should be included in the cost of debt benchmark. IPART had moved to including USD-denominated debt, guided by the advice of Professor Davis who stated that a domestic cost of debt can be estimated using currency swaps, whilst the CAPM is not used for estimating the cost of debt thus there are no inconsistencies to be concerned about. The RBA index chosen includes foreign-denominated bonds issued by Australian non-financial corporates.

3.2.2. Breadth of comparator range

In looking for comparators, as the name would suggest, they should be as comparable as possible. However, there is a trade-off between the degree of comparability and the breadth of the sample. A larger sample has the benefit of reducing the impact of any single observation and may lead to a more accurate estimate. Ofgem, for example, currently use third-party (Markit iBoxx) indices to calculate cost of debt allowances and look at non-financial corporates of broad BBB and A rated corporates of ten year plus maturity. This gives a large number of bonds and has the positive of a more stable index yield, but may be less representative of the regulated companies' debt costs. An example of this is the 'halo effect', whereby regulated utilities have been shown to outperform the index.

In certain cases, it might be possible to find one comparator but that is likely to be affected by company-specific effects. Mechanistic approaches can only really be followed when the cost of debt is derived from a large sample of companies, and to do so it might be necessary to look abroad. Domestic comparators can be used as a cross-check but individual observations must be treated with care.

When regulators cannot calculate a robust domestic cost of debt, it is common practice in countries with thinner financial markets to look abroad. This is an approach that has been adopted in Brazil, where in 2011 ANEEL, the energy regulator added a US-derived corporate debt risk premium for the desired credit rating and a country risk premium[27] to the domestic risk free rate. This approach adds an additional uncertain variable into the calculation of the cost of debt but it can allow for a wider sample of comparators to be brought into the estimate. This is complicated however by the need for a currency adjustment. In the Eurozone, national regulators have looked at other countries, which should give a more robust answer as a currency adjustment is not required.

The discussion above has focussed primarily on approaches that rely on the availability of publicly listed bonds. With long term debt tenors, implied yields for shorter periods can be estimated. However, in certain cases the lack of such data is not just an issue of market size but of the level of financial market development such that, for example, bank finance is the primary source of debt even for large capital intensive projects. This is not ideal for calculation of the cost of debt as bank finance data is not always available in a public and

[27] ANEEL used the JP Morgan EMBI country risk premium values but this could also be calculated using other methods such as by comparing the yields on government bonds at equivalent maturities in the two countries. See ANEEL (2011) "Technical Note no.º 297/2011-SRE/ANEEL" Retrieved from the ANEEL website here.

transparent fashion, does not have an associated risk premium and is generally of a shorter maturity. Nonetheless, if that is the primary mode of finance, it might be appropriate to reflect that in the cost of debt.

In Colombia, the energy regulator, CREG, sets an allowed cost of debt for regulated networks using aggregated data on bank finance costs published by the central bank[28]. Only a small number of the companies in the country have the scale or ability to access domestic or international bond markets. There is very limited data available domestically, making a bond-led approach both inappropriate for many companies not able to access such finance and inaccurate. Therefore, there are clearly some merits in pursuing information on bank finance, particularly if that is what is used in practice[29]. If a central authority does not provide aggregated statistics, it might be possible to inspect debt costs in accounts for a sample of comparators but we are not aware of that approach being used in practice.

3.2.3. Conclusion

While it would be possible for a regulator to use actual debt costs from within the industry this may not be ideal. Without looking further afield it is difficult to identify if the cost of debt is efficient and if restricted to historical costs might be of limited value for setting the cost for future years. There could also be potential to manipulate the benchmark.

Availability of data is key for setting the allowed cost of debt. Lack of it is far from fatal. However, such a case should ideally be reflected in the use of such data, ideally using a mix of approaches and acknowledging the risk of imperfect comparators or potentially flawed information.

[28] For example see p6 CREG (2015) "Resolución No 095 de 2015" available on the CREG website here.
[29] However, the assumed marginal source of finance for a bank to lend to a company is the bond market – so whether the borrowing is direct or indirect, it is likely to be priced consistently with bond market rates.

3.3. Issue in focus #4: Prevailing rate or trailing average on the cost of debt

3.3.1. Introduction

The use of a trailing average for the cost of debt has been an issue that has received much attention from Australian regulators. The traditional approach had been to use an 'on the day' approach for the risk-free rate and debt premium, which differed to the UK regulatory model that has tended to use longer-term trailing averages.

In the Australian regulatory setting, there have been three different approaches considered.

- 'On the day' approach – both the risk-free rate and debt premium are estimated using a prevailing rate.
- 'Trailing average' approach – both the risk-free rate and debt premium (or all-in cost of debt) are estimated using an historic average.
- 'Hybrid' approach – the risk-free rate is estimated using an 'on the day' approach, whilst the debt premium is estimated using the 'trailing average' approach.

In the UK, regulators typically have adopted greater discretion in setting the cost of debt allowance. The only regulator sampled to use a mechanistic approach is Ofgem, who use a cost of debt indexation mechanism, involving annual updating. This covers the all-in debt costs, both for new and embedded debt costs. Other regulators, such as Ofwat and the CAA have adopted a disaggregated approach, whereby a specified weight is attached to new debt and embedded debt, with a value attached to each of these components to arrive at an overall cost of debt.

Where a trailing average period is not used, for example when estimating the cost of new debt, forward rates are considered to try to estimate the debt cost over the regulatory period. Therefore the UK model does not utilise the on the day approach, nor is the hybrid approach used.

There are a number of variations within these approaches in both the UK and Australia, for example the use of annual updating or whether to weight the trailing average. Implementation and transition issues are discussed later within this article, whilst we look first at the choice of the overall framework.

3.3.2. On the day approach

The QCA in April 2015 published their Final Decision on the trailing average approach to the cost of debt[30]. The conclusion arrived at by the regulator was that disadvantages from moving to a trailing average or hybrid approach outweighed the advantages (with the hybrid preferred to the trailing average approach). The rationale for this decision included the following points:

[30] QCA (2015) Trailing Average Cost of Debt, Final Decision, April 2015.

- The on the day approach provides more accurate investment signals.
- The focus on prevailing rates is consistent with their broader WACC approach and this provides more regulatory certainty.
- The complexity of a trailing average approach, for example a weighted average and need for transition, imposes costs of adopting such an approach.
- Annual updates would be required under a trailing average approach – this leads to additional costs.
- The current approach provides a partial hedge for equity holders.
- The NPV=0 violation is minimal and may be symmetric.
- The trailing average approach may overstate the allowed cost of debt.

The regulator saw some merit in a trailing average approach through smoother prices, but largely rejected the arguments put forward by proponents of the trailing average approach.

The ESC have used an on the day approach, however for the 2016 water price review, a service provider (Melbourne Water) has proposed the use of a trailing average approach, therefore the regulator will be providing their view of this topic in the coming months.

3.3.3. Trailing average approach

The AER approach involves a transition to a trailing average approach. The regulator considered that holding a portfolio of debt with staggered maturity dates was likely an efficient debt financing practice of the benchmark efficient entity and thus a trailing average portfolio was reflective of the efficient debt financing costs of such an entity, minimising any expected difference. This approach would allow a service provider to manage interest rate risk without exposing itself to significant refinancing risk, promoting efficient of investment. Further benefits include that the trailing average approach:

- smooths movement in the cost of debt allowance over a number of years, reducing price volatility (subsequently giving a greater efficiency of outcome) and giving investors more stable returns;
- minimises the consequences of a single measurement error; and
- may be more reflective of actual debt management practices of non-regulated businesses, and be more likely to represent efficient financing practice.

ESCOSA have moved to a trailing average period, recognising past efficient financing practices, encourages efficient re-financing of this debt and reduces volatility, as well as incentive the issuance of new debt at or below efficient market rates.

The IPART methodology uses multiple approaches; on the day and trailing average. This approach was seen to minimise distortions relative to efficient financing practice and to more closely reflect actual debt management practices of NSW utilities.

3.3.4. Hybrid approach

The ERA have previously used an on the day approach, but have recently recommended a move to a hybrid approach in a March 2015 discussion paper. The continued use of an on the day approach to the risk-free rate is seen to be a perfect predictor for the risk-free rate as firms are able to hedge this. Error performance of the 'on the day' estimator was also found to be lower than the five or ten year trailing average. The debt premium term under the current approach does involve annual updating.

In moving to the hybrid approach, the ERA note that using a (longer term) trailing average for the debt premium:

- is fully replicable (unlike the on the day approach); and
- can meet the NPV=0 principle (whilst the on the day approach involves a small violation).

3.3.5. Implementation and transition issues

In considering the trailing average approach, there are number of aspects relating to implementation and transition. If a trailing average approach is deemed to be appropriate, a decision must be made on whether the trailing average used should be simple or weighted and whether any transition is required[31].

The AER rejected a weighted trailing average approach for the following reasons:

- the use of implied weights create a number of benchmarks, which increases complexity;
- weights can only be calculated ex-post and so involve true-ups and ongoing changes;
- weights may not provide incentives on optimal timing of decisions; and
- such an approach increases complexity.

However, the ERA in their proposed future approach find that weighting is appropriate and can remove distortions for new investment.

In moving to a trailing average approach, the AER has applied transitional measures together with annual updating. This involves an extending trailing average period as time progresses, with the move from the on the day approach to a ten year trailing average taking place over a ten year period. Some respondents to the AER did however note that a transitional period may not be required for the debt premium, however the AER rejected this position. ESCOSA are currently investigating how to implement their trailing average approach to the cost of debt.

[31] There a number of other implementation questions. Some of them are addressed in Section 3.4.

3.4. Context for the cost of debt

Trailing average period

As with the risk-free rate, a trailing average period can be used for the all-in cost of debt or debt premium, depending on which approach is taken by the regulator.

With the exception of ESCOSA, the Australian regulators considered use an approach which considers the risk-free rate plus debt premium rather than an all-in cost of debt. This permits a different trailing average period for the debt premium compared to the risk-free rate (a 'hybrid' approach). Half of our Australian sample use short-term trailing averages for both, whilst IPART considers both short and long term trailing averages. The AER are transitioning to a longer term trailing average (10yrs). ESCOSA currently use a ten year trailing average. The QCA meanwhile have stated that the difficulty in designing an appropriate transitional approach adds to the cost and complexity of adopting a trailing average approach.

UK regulators have tended to look at different periods of debt premium spreads, ranging from the long term (up to 20 years) to current evidence. Where a benchmark cost of debt index has been used at the all-in cost of debt level, a trailing average has typically been applied, most frequently being ten years. Following their use of a ten year trailing average for cost of debt indexation in RIIO GD1 and T1 controls, Ofgem adopted a 'trombone' mechanism for the RIIO ED1 determination, with the trailing average period extending from ten years out to twenty years over the space of a decade (the price control itself is eight years in length). This was intended to reduce interest risk exposure for the networks and in reviewing an appeal on this topic, the CMA stated that ensuring the financeability of networks through this change was in the long-term best interests of consumers.

Alternative approach: Swedish transitional cost of capital
The Swedish energy regulator enforced a rule for the 2012-2015 regulatory period whereby the cost of capital was weighted using the current model (1/3 weight) and the historic income model (2006-2009, 2/3 weight). This reduced the cost of capital from 5.2% to 3.2%. Following an appeal from the energy industry, the High Court ruled that a transition approach was illegal and concluded that a higher pre-tax WACC of 6.5% was appropriate.[32]

Term of bonds for debt

If a company issues seven year debt as an example, through interest rate swaps it is possible to reduce (or increase) the effective tenor of the risk-free rate component of that debt. The debt premium term cannot be swapped out and so would remain at seven years. Therefore it is possible to differ in the term of corporate bonds and government bonds considered. In setting the term for the cost of debt or debt premium, this generally reflects the state of capital markets and issuance from regulated utilities.

[32] ElecPor 'Electricity distribution investments: what regulatory framework do we need', 2014

With the exception of the ERA, the debt premium (or all-in cost of debt for ESCOSA) is based on ten year term to maturity bonds in the considered Australian regulatory precedent. ERA was one of the two regulators who term matched for the risk-free rate. The other was the QCA, who use a ten year term for the debt premium. In looking at whether this violated the NPV=0 principle, it was found to do this only in a very small fashion for both an 'on the day' approach and for a staggered debt issuance approach. The debt term is typically based on the length of debt issued by a hypothetical efficiently financed network.

The UK cases look at the same or longer time periods (the ten year plus index averages at around 20 years term to maturity at present). This term is aimed to be reflective of an efficient financing strategy in both cases and when cross-checked against regulated utilities appears to be appropriate, as companies weighted average maturities at issue are consistent with the benchmark term. The ten year plus index for non-financial corporates has been used as the benchmark by both Ofwat and Ofgem. Both regulators have looked at the all-in cost of debt. The ORR considered a risk-free rate plus debt premium approach, cross-checked against cost of debt indices. The corporate bonds considered by the ORR's expert was for a ten year period, consistent with the assumed term of the risk-free rate. In this case, the ORR set a cost of capital for a notional efficient company which is assumed to issue ten year debt.

Alternative approach: Danish use of premium over mortgage bonds
The WACC is not used for the regulation of electricity distribution in Denmark. The allowed rate of return is capped at a 30 year mortgage bond rate plus a 1% premium.[33]

Annual updating of the debt premium

Annual updating removes the need to forecast future rates when setting an ex ante allowance, but requires a change in price. This can be updated using a longer term trailing average or a more current rate, though the use of a current rate could lead to larger changes in price after an update. Annual updating typically requires a more mechanistic approach, whereby the regulator repeats their calculation each year and adjusts the allowance this way, otherwise there would be large transaction costs from having a regulator make a decision at a greater frequency.

Half of our regulatory sample in Australia have moved to the use of annual updating on the debt premium (or all-in cost of debt) using the approach set out in Table 3.2. This includes both 'on the day' and longer term trailing average approaches. The AER have moved to a longer term trailing average approach with annual updating, as part of the transition from an on the day approach. This extends to a ten year trailing average over the course of a decade. AER also permit networks to choose a period between ten days and 12 months prior to the start of each regulatory year, over which observed rates are averaged to estimate the return on debt.

[33] NordREG 'Economic regulation of electricity grids in Nordic countries', 2011

In the UK there is only one regulator that uses annual updating (Ofgem). The length of the price control in this sector is longer than in other regulated UK sectors at eight years. The National Audit Office (NAO) recently criticised Ofwat for not using indexation and sharing gains with consumers[34]. Like the AER, Ofgem use a varying length of trailing average period. This extends by ten years over a period of ten years, for Ofgem extending to a twenty year average for RIIO ED1. Ofwat rejected updating under cost of debt indexation due to this placing more risk on consumers and with the companies better placed to manage financing risk. The CAA felt that the arguments to and for indexation were finely balanced, but given the lumpy finance required for lumpy capex at airports, rejected its use.

Alternative approach: Finnish and Belgian annual updating of WACC components
The Finnish energy regulator updates the risk-free rate annually.[35] In addition, the Belgian energy regulator, CREG, update both the risk-free rate and asset beta calculation.[36]

Use of actual embedded debt costs

The use of a cost of debt benchmark can incentivise firms to outperform the index and avoids the ability of regulated entities to game the system. In the absence of an appropriate benchmark or with a greater focus on ensuring company financial viability, actual debt costs may be considered and passed through if found to be efficient. This is more likely to be applied when regulating a single network.

All the Australian regulators surveyed use a notional benchmark. This was to give the correct incentive properties consistent with economic regulation. A hybrid of notional and actual approaches could be through the use of different weighted trailing average periods where these are not based on an 'on the day' type approach. The AER has rejected the use of weighted trailing average periods, with concerns over the incentive properties of this. The QCA states that in principle the WACC does not need to be identical for all regulated firms, but there is material additional complexity from adopting such an approach.

In the UK, the majority of sectors use notional benchmarks, cross-checked against companies' actual debt costs (including fees). The two exceptions are in sectors where a single entity is being regulated. In the case of the CMA, the absence of a suitable benchmark for the regulated network, NIE, was noted as a reason for relying upon actual debt costs. The CAA used actual debt costs for the Q6 control, though only considered the airports' sterling denominated debt. This was felt by the regulator to be a good proxy for the airports' non-sterling denominated debt.

Alternative approach: German allowance of pass-through debt costs
BNetzA, the German energy regulator, as of 2011, allows a pass-through of debt costs rather than setting an allowance. This approach is mirrored in Belgium and also typically used in the United

[34] NAO (2015) The Economic Regulation of the Water Sector, October 2015
[35] NordREG 'Economic regulation of electricity grids in Nordic countries', 2011
[36] Glachant et al, 'Incentives for investments: Comparing EU electricity TSO regulatory regimes', 2013

Alternative approach: German allowance of pass-through debt costs
States, allowing embedded (actual cost of debt) in regulatory decisions.[37]

[37] Glachant et al, 'Incentives for investments: Comparing EU electricity TSO regulatory regimes', 2013

3.5. Summary table for the cost of debt

Table 3.1: Regulatory precedent on the cost of debt

Regulator	RfR + Debt premium approach	Annual updating of debt premium/ cost of debt	Actual debt or benchmark for embedded debt	Corporate bonds characteristics	Trailing average	% new debt
Australian regulatory precedent						
AER	Yes	Yes	Benchmark	BBB+ 10yr	From 40 days to 10 yr	n/a
ERA	Yes	Yes	Benchmark	BBB+ 5yr	40 day	n/a
QCA	Yes	No	Benchmark	BBB+ 10yr	40 day	n/a
IPART	Yes	No	Benchmark	BBB 10yr	40 day & 10yr	n/a
ESC	Yes	No	Benchmark	Broad BBB 10yr	40 day	n/a
ESCOSA	No	Yes	Benchmark	BBB 10yr	10yr	n/a
UK regulatory precedent						
Ofgem	No	Yes	Benchmark	Broad BBB and A 10yr plus	From 10yr to 20yr	10% to 5% p.a.
Ofwat	No	No	Benchmark	Broad BBB and A 10yr plus	10yr	25%
ORR	Yes	No	Benchmark	Broad BBB and A 10yr	From Spot to 10yr	25%
CAA	No	No	Actual	Broad BBB and A 10yr plus	n/a	30%
Ofcom	Yes	No	Benchmark	UK providers	1yr	30%
CMA	No	No	Actual	BBB and BBB+ comparators	n/a	10%

ANNEX A COMPARISON OF UK AND AUSTRALIA: A WORKED EXAMPLE

A.1. Introduction

In this section, we look at an example of what the cost of capital would be for the UK using the approach of an Australian regulators, the ESC, where a less discretionary approach is undertaken. The ESC approach yields a significantly lower real vanilla WACC. However, this approach is a simplification as comparators would differ and this is a short-term estimate; over the long-run, the differences may be expected to be much narrower.

The case study we consider if the Ofwat PR14 price control. We take a data cut-off date of 1 October 2014. The WACC decision adopted by the England and Wales water regulator for this determination was as follows:

Table A.1: Ofwat PR14 price control cost of capital

Parameter	Decision	Notes
Real risk-free rate	1.25%	Spot + forward curve primarily
Debt issuance costs	0.10%	Additional allowance for issuance costs
Cost of debt (inc fees)	2.59%	Long term trailing average of A and BBB non-financial corporates 10yr plus index
Equity Risk Premium	5.50%	Historic evidence, DGM and survey
Equity beta	0.80	Based on UK comparators and precedent
Gearing	62.5%	Risk of control, financeability, precedent
Cost of equity (post-tax)	5.65%	-
Real vanilla WACC	3.74%	-

A.2. Worked example – ESC approach

Table A.2: ESC equivalent for PR14 estimation

Parameter	Decision	Notes
Real risk-free rate	-1.00%	40 day trailing average, 5yr UK ILG
Debt issuance costs	0.00%	No explicit allowance for debt issuance
Cost of debt (inc fees)	1.30%	40 day trailing average of UK BBB 10yr index (from Bloomberg)
Equity Risk Premium	5.20%	MRP over bonds 1899-2013 UK arithmetic
Equity beta	0.65	Based on comparator beta estimates (Aus)
Gearing	60.0%	Based on actual gearing of comparators (Aus)
Cost of equity (post-tax)	2.38%	-
Real vanilla WACC	1.13%	-

Source: Bloomberg, Bank of England, Dimson, Marsh and Staunton

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ANNEX C CVs

Ian Alexander, CEPA Director

Ian is a Director at CEPA with almost 25 years' experience of working on regulation and industry reform. He is an expert in regime design and financial aspects of regulation. Since starting work on regulation in 1991 Ian has worked extensively in the UK, Ireland and Australia on the development and implementation of regulation. He has also worked across all the regulated sectors – energy, water, transport and communications. He has supported government departments, regulators, companies and major consumers and consequently has an appreciation of the requirements of the range of stakeholders. This range of experience can be used to bring both multi-sector and international examples to any project.

Ian has led cost of capital and asset valuation projects for companies, regulators and consumers since 1991.

Ian has published widely on regulation and finance. Publications include:

- *The Regulation of Investment in Utilities: concepts and applications,* Alexander and Harris, World Bank Discussion Paper 52, 2005
- *Regulatory structure and risk: An international comparison*, Alexander, Mayer and Weeds, World Bank Discussion Paper, 1996
- *The Cost of Capital: Application of financial techniques to state aid*, Alexander, OXERA Press, 1995

Selected project experience

- **Ireland, WACC for a mature company, GNI, 2015.** As part of the team advising Gas Networks Ireland, advice on recent cost of capital determinations in Ireland and the UK and the implications this would have for a mature gas networks business. This work was strategic advice to the newly formed Ervia business as it considers preparation for forthcoming price reviews in gas and water.
- **UK, WACC, Ofcom, 2015.** Ian is leading a team from CEPA that is supporting Ofcom in assessing the consistency of the WACC decisions taken by the regulator in the different sub-sectors. Where differences exist the team is challenging Ofcom to ensure a robust defence of the approach exists.
- **Ireland, Interim WACC, EirGrid, 2013.** As part of the price determination there was an option to review the allowed cost of capital since it had been set during the period of uncertainty created by the global financial crisis. Ian and a team from CEPA worked with EirGrid to re-determine the allowed cost of capital and to propose a settlement to the regulator for the remainder of the price control period.
- **Australia, WACC position, IPART, 2013.** Ian provided expert advice to IPART on aspects of the cost of capital. This was specifically in relation to where in the range a point estimate should be chosen and how different regulators have addressed this problem.
- **UK, Interconnector WACC – Cap and Collar, Ofgem, 2012 – 2015.** Ofgem changed its approach to interconnectors in line with EU directives for a more regulated approach to this key area of infrastructure. Having decided on a cap and collar approach, Ian led a CEPA team that considered the way that the cap and collar could be calculated and the implications that this would have.
- **UK, Risk and Return, Thames Water, 2012.** As part of its preparation for a possible interim determination and also the forthcoming price review, PR14, CEPA provided advice on the possible return that would have been allowed. This included advice on both ways in which WACC might be updated during a review as well as how the value would be set at the next determination. Ian provided support to the CEPA team advising Thames Water.
- **UK, Q6 support, British Airways, 2011 – 2014.** Ian was project director for work for British Airways on estimating the allowed weighted average cost of capital for the Q6 determination. This included lessons from other regulatory regimes as the position on the allowed return on equity was adjusted downwards following the CC NIE determination. CEPA also provided support to British Airways as they

prepared for a possible CC appeal of the CAA's final determination.

- **UK, RPI-X@20 Financeability, Ofgem, 2010.** Ian was project director for a study which reviewed Ofgem's approach to financial issues as part of RPI-X@20. This covered how the cost of capital was set, the treatment of the RAB, the approach to depreciation and the use of financeability tests. This paper was published as part of a consultation exercise.

Nick Hodges, CEPA Senior Consultant

Nick is a Senior Consultant at CEPA, where he has worked since 2011. He specialises in utility regulation and in particular regime design and financial aspects of regulation. He has worked on a number of cost of capital projects across regulated sectors whilst at CEPA, in the UK, Europe, Australia, New Zealand, Asia and Latin America. This includes a recent secondment role at the Commerce Commission where he provided support on cost of capital aspects for the Unbundled Copper Local Loop (UCLL) and Unbundled Bitstream Access (UBA) determinations.

Selected project experience

- **New Zealand: Cost of Capital for Telecoms pricing decision and Input Methodologies, Commerce Commission, 2015.** The regulator and competition body required support on the cost of capital, in setting their final determination for Unbundled Copper Local Loop and Unbundled Bitstream access in telecoms. Nick undertook a nine week full-time secondment looking at the pricing determination.
- **UK: Cost of Capital for Network Rail for PR13, Office of Rail and Road (ORR), 2013.** The project involved analysis of an appropriate cost of capital for Network Rail, as part of ORR's 2013 Periodic Review. This included investigating the impact of the company being limited by guarantee and the UK government's financial indemnity mechanism acting as a credit guarantee. Nick conducted quantitative and qualitative analysis of market evidence and regulatory precedent in setting a range for the cost of capital.
- **UK: Cost of Capital and financial issues in telecoms, Ofcom, 2015.** CEPA were appointed by Ofcom to provide expert advice on cost of capital issues across a range of decisions in the telecoms sector. Nick analysed what the appropriate discount rate should be in the case of overpayment, disaggregation of asset betas to reflect different risks across BT's telecommunications business and estimating the market value of spectrum based on opportunity cost concepts.
- **UK: Advice across RIIO price controls, Centrica, 2011-2014.** Centrica appointed CEPA to provide advice across the RIIO price control determinations in the energy sector, including the incentive package, regulatory building blocks, financeability and the cost of capital. Nick was Project Manager for the team advising Centrica and was responsible for developing a range of papers, including a review of consultation and decision papers from the regulator, for example Ofgem's cost of equity market returns consultation.
- **UK: Cost of Capital and financial issues in water, Large UK water co, 2012.** A large water company commissioned CEPA to provide input to their plans on the cost of capital and financeability ahead of the price control. Nick looked at market evidence, regulatory precedent and reports from credit rating agencies in the upcoming regulatory settlement.
- **UK: Cost of Capital for UK airports for Q6, British Airways (BA), 2012-14.** CEPA provided technical support to British Airways throughout the setting of the Q6 price control for Heathrow and Gatwick airports (2014-18 and 2014-21 respectively). Nick acted as Project Manager for this work, across the cost of capital. This included analysis of international comparator airport betas, how a cost of debt indexation mechanism might be calculated, and analysis of the existing debt portfolio of these airports.
- **Australia: Approach to assessing financeability, IPART, 2013.** IPART, the New South Wales multi sector regulator, commissioned independent advice from CEPA on their approach to financeability. Nick provided modelling support, analysing financeability ratios under different scenarios and adjusting for adjusting for differences in regulatory and statutory accounting approaches.
- **Australia: Cost of Capital for Victorian Gas Review, Australian Energy Regulator (AER), 2013.** The AER sought advice relating to the Victorian Gas Review, in particular on the relationship between the risk-free rate and market risk premium. Nick reviewed independent expert reports and empirical evidence.

- **Ireland: WACC for Irish Water and Gas Networks Ireland, Ervia, 2015.** Ervia have commissioned CEPA to provide support on two different cost of capital. The first of these relates to the setting of the cost of capital for a mature energy network, while the second workstream is on an appropriate cost of capital for the newly formed Irish Water.