The Brattle Group

Estimating the Cost of Debt

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EXECUTIVE SUMMARY

This report discusses the models available for estimating the cost of debt for the purpose of the National Gas Rules in Australia. The new Rule 87 requires "[t]he return on debt for a regulatory year is to be estimated such that it contributes to the achievement of the *allowed rate of return objective*" and that the estimated return on debt must have regard to several characteristics such as (a) the desire to minimize the difference between the return on debt and the return on debt of an efficient benchmark entity referred to in the *allowed rate of return objective*, (b) the relationship between the return on equity and the return on debt, (c) the incentives that the return on debt may provide regarding capital expenditures, and (d) any impact that a change in methodology from one access arrangement period to the next could have on a benchmark efficient entity referred to in the *allowed rate of return objective*.

It is therefore important to consider whether any method, model, market data or other information leads to an overall rate of return that is commensurate with the efficient financing cost of an entity with similar risks to that of the target entity in the provision of reference services. For the purposes of debt estimation both systematic and idiosyncratic risks have to be considered.

All models have relative strengths and weaknesses, and data weaknesses may be more pronounced in a jurisdiction with fewer regulated entities and / or a less active capital market. The focus of the report is on the key characteristics of the various cost of debt estimation methods, models and data available for a decision maker and circumstances under which each methodology may be more or less suitable. It is imperative that the choice of models and their implementation take into account the prevailing economic conditions, industry specifics as well as characteristics of the firm for which the cost of debt is being determined, because, according to the circumstances, each model can show bias. Because the cost of debt interacts with the cost of equity and could impact capital expenditures, a decision maker must take into account specifics about the company, industry and economy. For example, we expect a company with a higher leverage to have a higher cost of debt (and equity) than a company with lower leverage, but the weights assigned to the cost of debt and equity differ, so that the overall cost of capital (absent taxes) is the same. Further, because capital attraction is crucial for entities undertaking capital expenditures, the decision maker must

consider whether the cost of debt estimate allows the entity to raise sufficient funds, so that it can undertake necessary projects.

We review three broad categories of methodologies that can be used to determine the cost of debt. First, the cost of debt can be estimated from market cost of debt using comparable companies. This can be done directly using the cost of debt on an index of companies or through a combination of the risk-free rate and a debt premium. Second, the cost of debt can be based on the embedded cost of debt for one or more companies (also referred to as a portfolio approach or trailing average). Third, the debt cost of recent issuers or investment banks' professional views on the cost of debt for specific companies could be used to determine the cost of debt.

By using embedded cost of debt, the rate regulated entity relies on the historical cost of debt and therefore does not face current financing conditions for the majority of its debt capital. Opponents of embedded cost of debt find that it does not provide the entity the same incentive as market cost to refinance when market conditions indicate that it would be efficient. By using market cost of debt, the regulated firm faces conditions that more closely match conditions in which non-regulated firms operate. Proponents of market cost argue that it gives the entity an incentive to refinance when market conditions dictate that it is efficient.

Regardless of whether market or embedded cost of debt is used, the lack of data can be a serious problem in environments such as Australia, where there are limited numbers of rate regulated entities and few, if any, entities with the same risk characteristics as the target. Therefore, looking to other sources overseas, recent debt issuances or investment banks' forecasts of financing costs becomes important.

Finally, because of the complexity of estimating the cost of debt, the estimate derived from applying each method is likely to result in a range of cost of debt estimates from which the decision maker will determine the cost of debt for the access period. In doing so, all relevant information should be considered and because the risks of the target entity may be unique, the decision maker will need to consider both systematic and idiosyncratic risks.

I. INTRODUCTION AND CONTEXT

A. INTRODUCTION

The Australian Energy Market Commission (AEMC) recently modified the rules that guide the regulation of pipelines in Australia. DBP has therefore asked *The Brattle Group* (*Brattle*) to review the methods that are currently used or could be used to estimate the cost of debt for the purposes of the National Gas Rules (NGR) in Australia. As part of this exercise, DBP has asked us to review various models that are used or could be used to determine the cost of debt. We therefore discuss examples of regulatory approaches in the U.S., Canada, the U.K., and the Netherlands, where regulators have considered a number of methods for determining the cost of debt. In assessing the various methods, we note that Rule 87 requires that "[t]he return on debt for a regulatory year is to be estimated such that it contributes to the achievement of the *allowed rate of return objective*" and that the estimated return on debt must have regard to (a) the desire to minimize the difference between the return on debt and the return on debt of an benchmark efficient entity referred to in the *allowed rate of return objective*, (b) the relationship between the return on equity and the return on debt, (c) the incentives that the return on debt may provide regarding capital expenditures, and (d) any impact that a change in methodology from one access arrangement period to the next could have on a benchmark efficient entity referred to in the *allowed rate of return objective*.[1]

We note that the *allowed rate of return objective* in order to be achieved, requires that "regard must be had to relevant estimation methods, financial models, market data and other evidence"[2] in determining the overall rate of return. We therefore focus on introducing a broad set of methods for cost of debt estimation, the characteristics of these methods and how they interact with economy-wide, industry, and company specific factors. Given the complexity of estimating the cost of debt, the estimate derived from applying each method is likely to result in a range of cost of debt estimates. The decision maker will determine the cost of debt for the access period from the range. In doing so, all relevant information should be considered and because the risks of the target entity may be unique, the decision maker will need to consider both systematic and idiosyncratic risks.

[1] Rule 87, (8) – (11).

[2] Rule 87, (5), part a.

The remainder of this report is organized as follows. *Section I.B* introduces the Australian regulatory system and the reasons for considering the estimation of cost of debt in Australia at this point in time. *Section II* then discusses estimation methods used to determine the return on debt, including methods that rely on current or historical market data, methods that use embedded cost of debt, and other methods. *Section III* provides a discussion of the characteristics of each method. *Section IV* surveys the methods relied upon by regulators in Canada, the U.S., the Netherlands and the U.K. Finally *Section V* provides a discussion of lessons learned, focusing on experiences that have worked well and those that have failed.

B. THE COST OF DEBT

The cost of debt capital is a key parameter in regulatory settings, because it contributes to determining the return to the company's investors. The (required) cost of debt is the rate at which the entity can obtain debt financing. If the allowed cost of debt differs from the return on debt that debt investors require then the difference will be reflected in the return to equity investors. There are two fundamentally different ways to approach the determination of the cost of debt for a rate-regulated entity. First, if the rate-regulated entity itself can be considered to be the benchmark efficient entity referred to in the *allowed rate of return objective*, then the entity's embedded cost of debt could be used as the cost of debt. Second, the cost of debt could be estimated for a benchmark efficient entity of similar risk. The second approach requires the use of estimation methods, models, market data, and other evidence that can then be combined to obtain a reasonable estimate. Under the second approach all relevant information should be used to insure the *Allowed Rate of Return Objective* is achieved.

Up front it is important to recognize that while the cost of equity only varies with systematic risks, the cost of debt varies with both systematic and idiosyncratic risks. It is common to observe non-zero bond betas, which indicate the presence of systematic risks.[3] At the same time, the cost of debt also depends on company-specific characteristics such as the company's capital structure, cash flow variability, the level of capital expenditures, regulatory, environmental and possibly other factors that may not impact systematic risks.

[3] For example, E.J. Elton, M.J. Gruber, D. Agrawal and C. Mann's "Explaining the Rate Spread on Corporate Bonds," in *The Journal of Finance* 56 (2001) reports bond betas ranging from 0.12 to 0.76 depending on the bond type.

Thus, a broader set of factors affect the cost of debt than affect the cost of equity. We discuss these factors further in *Sections III* and *V* below.

1. Australian Gas Law and Gas Rules

Australia's National Gas Law (NGL) specifies that the *National Gas Objective* is

> to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas.[4]

Thus, an overarching goal of determining the rate of return should be to ensure the goal is met. Further, Section 24 (2) of the NGL states that

> A service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs in –
> (a) providing reference services; and
> (b) complying with a regulatory obligation or requirement or making a regulatory payment.[5]

The NGL is supplemented by the National Gas Rules (NGR), which are made under the NGL and govern access to natural gas pipelines. The NGR set the framework for how the Australian Energy Regulator (AER) and the Economic Regulation Authority of Western Australia (ERA) determine access arrangements for covered gas pipelines, including the rate of return on capital which is a component of the charges paid by pipeline customers. We understand that the regulators are currently developing guidelines as to how the rate of return provisions of the NGR may be applied in future determinations.

Of relevance to the determination of the cost of debt, the NGR state that

> … the rate of return for a service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services[6]

and

> [I]n determining the allowed rate of return, regard must be had to: (a) relevant estimation methods, financial models, market data and other evidence…[7]

[4] National Gas (South Australia) Act 2008 (version 1.2.2013), Section 23.

[5] NGL, Section 24 (2).

[6] Rule 87, (2).

[7] Rule 87, (5), part a.

Rule 87 further requires that "[t]he return on debt for a regulatory year is to be estimated such that it contributes to the achievement of the *allowed rate of return objective*" and that "the return on debt may be estimated using a methodology which results in either: (a) the return on debt for each regulatory year in the *access arrangement period* being the same; or (b) the return on debt (and consequently the *allowed rate of return*) being, or potentially being, different for different regulatory years in the *access arrangement period*." Rule 87 at (10) further states that

> the methodology adopted to estimate the return on debt may, without limitation, be designed to result in the return on debt reflecting:
>
> (a) the return that would be required by debt investors in a benchmark efficient entity if it raised debt at the time or shortly before the time when the AER's *decision* on the access arrangement for that *access arrangement period* is made;
>
> (b) the average return that would have been required by debt investors in a benchmark efficient entity if it raised debt over an historical period prior to the commencement of a regulatory year in the *access arrangement period*; or
>
> (c) some combination of the returns referred to in subrules (a) and (b).

Finally, Rule 87 at (11) requires that the estimation of the return on debt have regards to

> (a) the desirability of minimizing any difference between the return on debt and the return on debt of a benchmark efficient entity referred in the allowed rate of return objective;
>
> (b) the interrelationship between the return on equity and the return on debt;
>
> (c) the incentives that the return on debt may provide in relation to capital expenditure over the access arrangement period, including as to the timing of any capital expenditure; and
>
> (d) any impacts (including in relation to the costs of servicing debt across access arrangement periods) on a benchmark efficient entity referred to in the allowed rate of return objective that could arise as a result of changing the methodology that is used to estimate the return on debt from one access arrangement period to the next.

The NGR also state (but does not require) that the cost of debt can be estimated using a methodology that sets the cost of debt at the cost of debt that would have been incurred by a "benchmark efficient entity" referred to in the *allowed rate of return objective* (a) had it raised debt just prior to the regulator's decision *or* (b) had it raised debt over a historical period of time.[8] In the latter case, the NGR require that the cost of debt be formula-based

[8] Rule 87, (10).

and updated each year through the upcoming access period.[9] A combination of (a) and (b) is also possible.

In the past, both the AER and the ERA have relied on market information to determine the cost of debt for regulated entities. For example, the AER determined the cost of debt based on an average of the recently observed yields on corporate bonds of a comparable rating,[10] and the ERA recently took a similar approach.[11]

Note that under the new Rule 87, two options are specified (though the AER and ERA are free to accept a different approach, neither option is required). We note that the first of these methods resembles a market-based cost of debt for a benchmark efficient entity with similar risks, while the second resembles the embedded cost of debt for a benchmark efficient entity with similar risks.

Rule 87(10)(b) states that cost of debt should be "the average return that would have been required by debt investors in a benchmark efficient entity if it raised debt over an historical period **prior to the commencement of a regulatory year** in the access arrangement period," where the bolded portion indicates that the cost of debt is expected to change during the price control period.

2. What Should We Expect from Models or Methods

It is useful to explicitly recognize at the outset that models or methods are imperfect. All are simplifications of reality, and this is especially true of financial models. Simplification, however, is also what makes them useful. By filtering out various complexities, a model can illuminate the underlying relationships and structures that are otherwise obscured. After all, while a perfect scale model representation of the city might be highly accurate, it would make a poor road map. It is therefore imperative that regulators and other users of the models use sound judgment when implementing and using the models — there is no one

[9] Rule 87, (12).

[10] Australian Energy Regulator, "Final Decision, Jemena Gas Networks: Access Arrangement Proposal for the NSW Gas Networks," June 2010 (AER Jemena Decision) and "Final Decision, Envestra Ltd., Access Arrangement Proposal for the Qld Gas Network," June 2011 (AER Envestra Decision).

[11] Economic Regulation Authority, Western Australia, "Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline," October 2011 as Amended December 2011 (ERA DBNGP Decision).

model or set of models that are perfect. The gap between financial models and reality can sometimes be quite significant (as was painfully demonstrated by the recent financial crisis). Therefore, if an estimation approach is used to determine the forecasted cost of debt for a rate-regulated entity, there is no single, best pricing model available for the estimation of the expected cost of debt. Instead, analysts have a variety of potential models at their disposal, and it must be acknowledged that cost of debt estimation requires the exercise of judgment.

While no model is perfect, there are certain features that make models more useful from a regulatory perspective. For example, it is desirable to have models and methods that i) are consistent with the goal being pursued, ii) are transparent, iii) produce consistent results, iv) are robust to small deviations or sampling error, v) are as simple as possible (while maintaining reliability), and vi) can be replicated by others (*e.g.*, data is widely available). However, in the scheme of regulation under the NGL and NGR the most important feature of any method, model, market data or other evidence is that it contributes to the achievement of the allowed rate of return objective.[12]

For example, the average yield on a well-specified group of comparable companies is a transparent measure, is simple, and can be replicated by others, but it may not be consistent with the regulatory goal being pursued, e.g., the National Gas Objective or the notion that a "service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs" in providing services.[13]

All cost of debt estimation models have strengths and weaknesses that may be more or less pronounced for specific economic circumstances, industries, or companies. For example, the spread between the yield on corporate and government bonds is currently unusually high, so that methods that rely on adding historical spread to the current risk-free rate may be biased. Similarly, certain industries are more prone to cash flow volatility or large capital expenditures than others, thus making a direct comparison across industries biased. Many of the industry specific characteristics also pertain to companies within an industry because the demand or supply situation, the need for infrastructure investments, or other factors may differ.

[12] Rule 87, (8).

[13] NGL Sections 23 and 24.

Regardless of which estimation methods or models are used to determine an expected cost of debt, the estimate is subject to some uncertainty. Therefore, it is more accurate to say that the methods or models give rise to a range of possible cost of debt estimates from which the decision maker can select. In doing so, the decision maker needs to keep the overarching goal in mind, i.e., the National Gas Objective to "promote efficient investment in, and efficient operation and use of, natural gas services …"[14] and the *allowed rate of return objective*.[15]

3. Stability and Robustness

For an estimation model used to determine the cost of debt, stability and robustness over time are desirable unless economic conditions have truly changed. Stability means that cost of debt estimates produced in similar economic environments should be similar, not only period-to-period but also company-to-company within a comparable sample. Robustness is meant here as the ability of a model to estimate the cost of debt across different economic conditions.

In general, all of the models discussed here have characteristics that make them more or less suited to one economic environment versus another. As such, all individual models can be, and often are, subject to some instability over time.

II. COST OF DEBT ESTIMATION METHODS, MODELS, MARKET DATA AND OTHER EVIDENCE

Before discussing the cost of debt estimation methods used in various settings, we note that most methods are based on empirical data, that these methods are **not** mutually exclusive, and that estimation and data error (in a statistical sense) may give rise to a range of plausible cost of debt estimates rather than a single number. It is therefore important to look to the specific risks of the entities for which data is used as well as for the benchmark efficient entity referred in the allowed rate of return objective entity before placing the cost of debt in the range.

[14] NGL Section 23.

[15] Rule 87, (2).

A. METHODS AND MODELS THAT USE MARKET DATA

The market cost of debt is determined using market data, but the exact implementation of this notion differs. Some regulators rely on a forecasted cost of debt while others rely on observed market data. To further complicate matters, some regulators take a simple average of historically observed cost of debt (or yield) figures, some add a debt premium to the risk-free rate, and some combine a forecasted risk-free rate with a historically observed premium on bonds issued by regulated entities. This section describes the various methods that have been used to estimate the market cost of debt in regulatory settings. *Section III* below discusses the characteristics of each approach as well as biases that might be introduced by considering an inaccurate benchmark efficient entity.

Average of Observed Yields

In theory the simplest way to determine the current cost of debt for a company is to use the current market cost of debt for similarly situated companies. This is **not** a straightforward exercise because the NGR calls for the use of a rate of return that is "commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk..."[16] Determining what constitutes a benchmark efficient entity of similar risks or finding a sample of entities with a similar risk profile is not trivial. In particular, the use of the yield on a generic index selected by credit rating is not sufficient, because entities within a given rating differ with respect to their coverage ratios, capital structures, cash flow variability, level of capital expenditures, and fundamental demand / supply conditions. All of these factors affect the cost of debt that the entity will face.

The only truly comparable companies are those that have similar business and financial risks as the benchmark efficient entity for which the cost of debt is being determined. Only rarely will there be a sufficiently large group of such comparable companies from which one can feasibly determine the market cost of debt, so in practice the methodology is often implemented by using the yield on an industry index (e.g., a utility, corporate, or generic index), the yield on bonds issued by a sample of companies, or the yield obtained on recently issued bonds. It may then be necessary to adjust this estimate for industry and / or entity specific facts. This is because the NGR requires the cost of debt is estimated for a benchmark efficient entity of similar risk and that the cost of debt contributes to the

[16] Rule 87, (3).

achievement of the allowed rate of return objective.[17] Specifically, the methodology requires an analyst to (1) determine exactly what the benchmark efficient entity of similar risk should be, (2) determine the time horizon over which the cost of debt should be estimated, and (3) assess what adjustment, if any, to make to the raw estimate.

First, because the NGR reference an efficient benchmark entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services, it is important to consider its exact definition. For example, while it might be tempting to consider only A-rated entities as efficient, this would be incorrect. In particular, one entity may operate with a relatively low gearing and be A-rated, while another entity may operate with a higher gearing and be BBB-rated, but both entities may be efficient benchmarks. Because the cost of debt, in part, depends on the company's gearing, the BBB-rated entity will have a higher cost of debt, but because the cost of equity has a lower weight for the BBB-rated entity, the weighted average cost of capital (WACC) could be exactly the same as that of the A-rated entity. Not only is it important to distinguish credit ratings and notches of credit ratings, but the evaluation cannot stop there as risk characteristics differ across industries and among entities within an industry. For example, two otherwise benchmark efficient entities within an industry may have different capital expenditure needs and therefore face differences in idiosyncratic risk.

Second, because debt is thinly traded and only few bonds of any specific maturity have yield information on any given day, a very short estimation window could result in biased estimates. If a very long period (e.g., several years) is used, the cost of debt truly measures the historical cost of debt rather than the current cost of debt. For example, in the UK Ofgem has recently used a 10-year trailing average from an index of industrial bonds issued in BGP,[18] an approach explicitly designed to allow for changes in interest rates during the price control period (because the cost of debt is reset annually). This approach is consistent with the average maturity of the debt in the industry being analyzed. Updating the cost of debt annually is more important in the UK context because the price control is longer (8 years) than in other jurisdictions.

[17] Rule 87.

[18] Ofgem, "RIIO-T1: Final Proposals for National Grid Electricity Transmission and National Grid Gas," 17 December 2012, p. 25.

Third, it is possible that there are instances where an adjustment to the raw estimate is needed. For example, if there is insufficient data in Australia on the cost of debt for types of industries, it may be possible to use foreign data on the cost of debt and adjust the estimate for generally higher interest rates in Australia than in, for example, the U.S. Similarly, if the only estimates that are available are for entities with either substantially more or less leverage than the target entity, then it may be necessary to increase or decrease the cost of debt for the target entity.

Using the Risk-Free Rate Plus a Debt Premium to Estimate the Cost of Debt

Assuming that the cost of debt for an efficient entity adjusts in response to changes in the risk-free rate, an approach to determining the cost of debt is to add a debt premium to the risk-free rate. This method implicitly assumes that the relationship between the risk-free rate and the cost of debt is constant over time and differs only by a limited number of basis points. Technically, the cost of debt is then calculated as:

$$\text{Cost of Debt} = \text{Risk-free Rate} + \text{Debt Premium} \qquad (1)$$

If the decision maker simply looks at the current risk-free rate, e.g., the current yield on the 10-year government bonds and adds a debt premium, the decision maker implicitly assumes not only that the relationship between the cost of debt for a benchmark efficient entity with similar risks and the risk-free rate is constant but also that this is an appropriate measure of the required return by debt investors on funds (i) raised shortly before the ERA's decision for an access period or (ii) raised over a historical period prior to the commencement of the access period. The method described in Equation (1) can determine the debt premium as the average spread of utility bond yields over government bond yields using a historic period. However, such a simple implementation would not necessarily contribute to the achievement of the allowed rate of return objective as assumes that the utility bond yields relied upon are consistent with the cost of debt of a benchmark efficient entity of similar risk. Because there are many ways in which risk can differ, the risk characteristics of the entity as well as those included in the debt premium need to be considered. To be consistent with the notion that the cost of debt is for a benchmark efficient entity of similar risk, the raw estimate from

Equation (1) will, for most entities, need to be adjusted for risk differences or alternative methods need to be considered in conjunction with this method.

One interpretation of the method is that the current risk-free rate proxies for the expected risk-free rate over the access period and that the debt premium remains constant, so that the sum of these two figures proxies for the forecasted cost of debt. In a sense, the use of the risk-free rate normalizes the cost of debt estimate.

This approach is currently problematic as the long-term historical average spread is lower than the current spread in countries such as Canada. For example, the historical average spread over the period for which data is available is approximately 100 basis points while the year-end 2012 spread was approximately 150 basis points. At the same time, the current yield on government bonds is historically low, so that an estimation technique as the one in Equation (1) would result in very low cost of debt estimates. For example, the year-end 2012 10-year government bond yield in Canada was about 1.8%, so adding 100 basis points would result in a cost of debt of 2.8%. At the same time the yield on highly creditworthy (A-rated) utility bonds in Canada was approximately 3.2%.[19] Thus, the estimated cost of debt does not reflect the cost at which regulated entities can obtain debt financing.[20] We use U.S. and Canadian data in the discussion due to the limits on available data on rate-regulated debt in Australia. Because the yield on Australian government and corporate debt is substantially higher than the yield on similar debt in Europe or North America, the absolute figures have no bearing on the cost of debt for a benchmark efficient entity of similar risk in Australia.[21]

To illustrate this point Figure 1 below shows the yield on 10-year government bonds plus 100 basis points and the yield on A-rated utility bonds using Canadian data. As shown in the chart, the government bond yield and the yield on highly rated utility bonds follow the trend, but at any given point in time, the discrepancy can be quite large and given the drop in yields, any historic debt was financed at rates much higher than what is common right now. In

[19] Data as of December 2012; 10-year government bond and Moody's Utility A bond yield from Bloomberg.

[20] At a time of very high inflation as was experienced in the eighties, the opposite would be true.

[21] For example, while the yield on 10-year government bonds in Australia was 3.3% at the end of December 2012, the yield on 10-year government bonds in the U.S., Canada, and Bloomberg's Euro Generic bond were 1.8%, 1.8%, and 1.3%, respectively. Thus, the Australian government bond carries a substantial spread to North America and Europe.

Figure 1 the period of the financial crisis of 2008-09 lead to a substantial divergence of the government and utility bond yields.

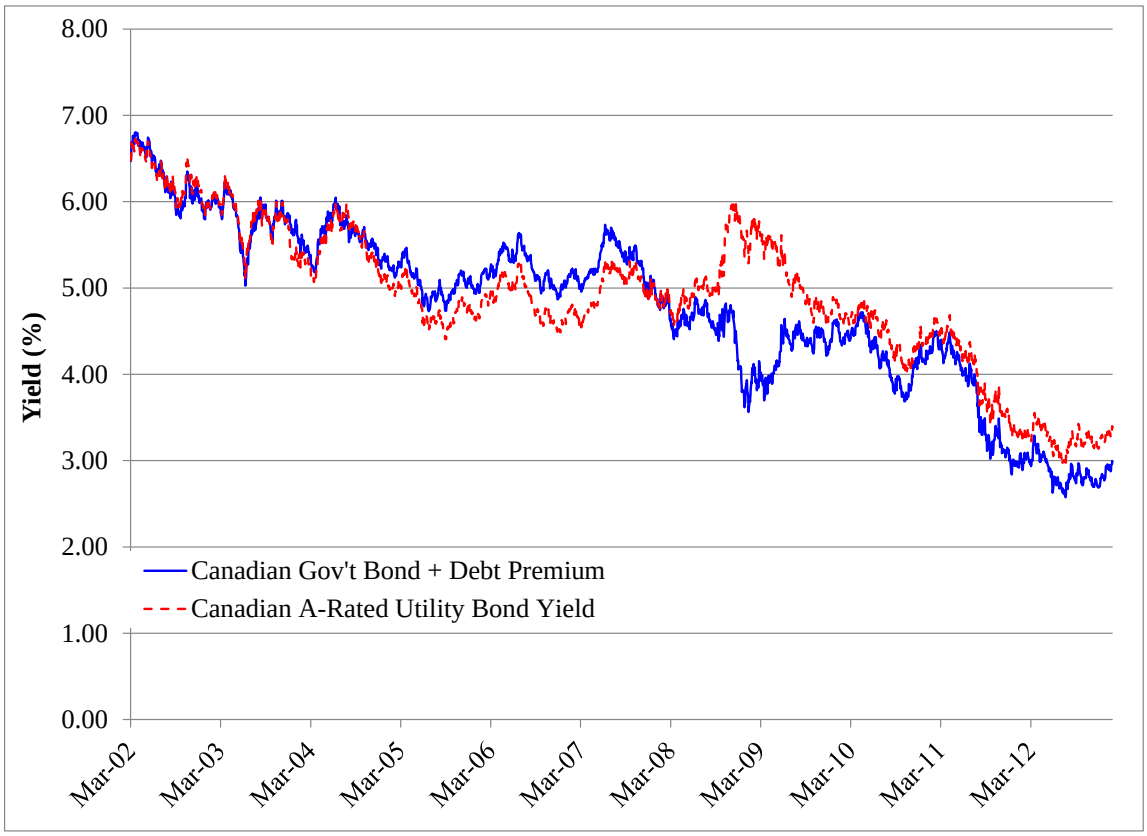

Figure 1: Utility Bond Yield v. Government Bond Yield Plus Historic Debt Premium

Using the Forecasted Risk-Free Rates to Estimate the Cost of Debt

An alternative to using the current risk-free rate plus a risk premium is to use a forecasted risk-free rate and, if the estimate is based on government bonds, add a risk premium to that estimate. The reason that some regulators use a forecast of the risk-free rate and not a forecast of the cost of debt is that few if any forecasts of the cost of debt for rate-regulated entities or corporations are available. In contrast, many governments as well as commercial vendors provide forecasts for countries' risk-free rates. For example, the National Australia Bank provides forecasts for the yield on the Australian 10-year so-called benchmark bond, but not on corporate or rate-regulated entities' bonds.[22] This approach has been taken by, for example, the Ontario Energy Board in Canada. Specifically, they rely on the forecasted yield

[22] The forecast from the National Australia Bank is available at:
http://financial.markets.nab.com.au/News%20and%20Research/Public/Pages/Interest-Rate-Forecast.aspx

on 10-year government bonds plus debt and maturity premia as Canadian utilities commonly issues bonds of longer maturity than 10 years.[23]

This approach has the same flaw as the reliance on the current yield in that the debt premium is not constant and typically changes with the cost of debt. Another problem with this approach is that with the possible exception of the U.S., there are few forecasts available for the cost of debt out for more than one year.

B. METHODS OR MODELS THAT USE EMBEDDED COST OF DEBT

The embedded cost of debt is simply the actual interest expenses of the regulated entity. It is common in North America to include the amortization of any issuance premia or discount, so that the total interest expense is recovered. Regulators in North America commonly use the embedded cost of debt as the cost of debt for regulated entities subject to prudence.[24] In instances where the regulated entity is 100% equity financed, the FERC has in some past decisions used a hypothetical capital structure for the entity and relied on a market based cost of debt for the entity in question. A similar approach is generally followed by other regulators in the U.S. and Canada.[25]

Because the NGR require that the cost of debt be such that the rate of return is commensurate with the financing cost of a benchmark efficient entity with a similar degree of risk to the service provider in the provision of reference services, the relevant embedded cost of debt is that of a benchmark efficient entity with such risks. Thus, it may be feasible to determine the embedded cost of debt for a number of comparable entities of similar risk as that of the target entity and evaluate whether any adjustments need to be made due to the efficiency requirement.

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[23] Ontario Energy Board, *EB-2009-084: Report of the Board on the Cost of Capital for Ontario's Regulated Utilities*, issued December 11, 2009 (EB-2009-0084)

[24] This is the methodology used by, for example, the Federal Energy Regulatory Commission (FERC), which regulates U.S. pipelines.

[25] The one exception is a relatively recent decision by the National Energy Board of Canada, which in its RH-1-2008 decision allowed the recovery of the then market cost of debt rather than the embedded cost of debt.

The embedded cost of debt has the advantage of potentially allowing the regulated entity to recover its actual debt costs. If the benchmark entity obtains debt financing efficiently, reliance on the embedded cost of debt satisfies the NGL Section 24's requirement that a "service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs …"[26] Using the embedded cost of debt, which is a historically trailing average of debt costs decreases the interest rate uncertainty that regulated entities face and in a stable regulatory environment the regulated entity can finance its operations with debt of maturities that best match the entity's needs without considering the potential for gains or losses due to interest rate movements. As regulatory economists, this is how we envision the NGR embedded cost of debt framework will apply.

It is noteworthy that a recent publication by Fitch Ratings indicates that the par-weighted average coupon of U.S. industrial bonds as of year-end 2012 was 4.72% for A-rated bonds and 5.45% for BBB-rated bonds of all maturities. This was down by about 50 basis points for both A-rated and BBB-rated bonds from 2011.[27] As A-rated utility bonds currently have a yield a little above 4%, the gap between the two measures of the cost of debt is approximately 70 basis points.[28] There is generally little difference in the investment grade yield on rate-regulated and other companies in the U.S. although there may be a difference in the maturity profile. Thus, the figures indicate that the difference between a historical trailing average and the current cost of debt is substantial.

To illustrate the difference between the embedded cost of debt and the yield on bonds of a comparable rating, we looked at pipeline and natural gas companies in Australia, Europe, and North America to calculate the embedded cost on bonds whose coupon, principal and term to maturity were disclosed in their annual reports or through Thompson Financial. We then compared the entity's embedded cost of debt to the current yield on comparably rated utility bonds in the entity's home country. Unfortunately, not all companies disclose this information, so Table 1 does not have complete information for companies outside North America. We note that the calculation in Table 1 is approximate because we assumed all

[26] NGL Section 24 (2).

[27] Fitch Ratings, "U.S. Corporate Bond Market: 2012 Rating and Issuance Activity," February 12, 2013.

[28] Source: Bloomberg.

debt issuances sold at par, while in practice some sell at a discount or a premium. The exact calculation of the embedded cost of debt for such entities is illustrated in the appendix.

	Embedded Cost of Debt [1]	Utility Bond Yield [2]	Bond Rating [3]
Australian Regulated Utilities			
APA Group	n/a	n/a	BBB
Envestra Ltd	6.81%	n/a	BBB-
SP AusNet‡	n/a	n/a	A-
European Regulated Utilities			
Enagas SA	2.12%	n/a	BBB
National Grid PLC	5.09%	2.79%	A-
Snam SpA	2.68%	2.79%	A-
European Regulated Utilities Average	3.30%	2.79%	
North American Pipelines			
Boardwalk Pipeline Partners LP	5.42%	3.58%	BBB
ONEOK Partners LP	6.18%	3.58%	BBB
Spectra Energy Corp	6.28%	3.00%	BBB+
Spectra Energy Partners LP	4.22%	3.58%	BBB
TC Pipelines LP	4.61%	3.58%	BBB
Williams Partners LP	5.64%	3.58%	BBB
Enbridge Inc.‡	4.85%	3.65%	A-
TransCanada Corp‡	6.21%	3.65%	A-
North American Pipelines Average	5.43%	3.52%	

Sources and Notes:
‡ Bond yield calculated as (1/3) * BBB yield plus (2/3) * A yield to account for notching.
[1]: Obtained from Thomson Financial as of 1/24/2013 for the Australian and European Regulated Utilities and from companies' latest annual reports for National Grid and the North American Pipelines.
[2]: Bloomberg LP as of 2/7/2013.
[3]: Bloomberg LP as of 2/7/2013. Bond rating for APA Group obtained from Standard & Poor's as of 2/19/2013.

Table 1: Embedded Cost of Debt and Corresponding Utility Bond Index Yield

It is evident from Table 1 above that the embedded cost of debt can be quite different from the current market cost of debt. Based on the sample's most recent annual reports, the embedded cost of debt is higher for most companies due to the decline in interest rates over the last several years. If market-based interest rates increase, it is likely that the embedded cost of debt will be lower than the market-based costs.

Table 1 also makes it abundantly clear that the reliance on the embedded cost of debt for comparable companies requires a careful consideration of whether the entities considered are efficiently financed and of comparable risk to the target entity. The variability in the embedded cost of debt across entities even within an industry and country or region is substantial.

C. OTHER EVIDENCE

Among the other evidence that can be used to determine the cost of debt is a review of recent debt issuances or the polling of one or more investment bankers about the likely cost of debt. As an example of the latter, we consider how the New Brunswick Energy and Utilities Board (NBEUB) determined the cost of debt for Enbridge Gas, New Brunswick, which is a gas distribution subsidiary of Enbridge Inc. In setting the allowed cost of debt for Enbridge Gas, New Brunswick, the NBEUB determined, based on evidence submitted by the company, that the company could not plausibly issue debt at the same rate as its parent, Enbridge Inc. Therefore, NBEUB asked investment banks to give a professional opinion on the likely debt financing costs for Enbridge Gas, New Brunswick relative to the company's embedded cost of debt. Based on the information obtained from the two investment banks, the NBEUB added 100 basis points (1%) to the embedded cost of debt of the parent company, Enbridge Inc.[29]

It may also be possible to obtain information on bonds recently issued by comparable companies. Specifically, if the debt issuance market for rate regulated entities is sufficiently active, it is possible to collect information about the cost of debt from these issuances. In doing so, we caution that outside North America, the debt issuance market is often thin, and it may be difficult to find debt issuances from entities that are sufficiently comparable to a benchmark efficient entity with similar risks to that of the target entity in the provision of reference services. Thus, to use the approach in Australia, it will most likely require looking at not just Australian debt issuances but also at debt issuances in other countries where Australian rate regulated entities raise capital. Further, it is important to consider the maturity

[29] New Brunswick Board of Commissioners of Public Utilities (now NBEUB), "Decision in the Matter of an Application by Enbridge Gas New Brunswick Inc. for Approval of its Rates and Tariffs," June 23, 2000, pp. 23-25.

of the bonds, whether the bonds are secured or unsecured, senior or junior, and generally what the total risk profile of the issuing entity is. Finally, the market for debt issuances can change quickly with especially more leveraged entities being vulnerable to market conditions. This was particularly true in the fall of 2008 and spring of 2009, where very few debt offerings materialized.

III. CHARACTERISTICS OF COST OF DEBT ESTIMATION METHODS, MODELS, MARKET DATA AND OTHER EVIDENCE

A. FACTORS TO CONSIDER

Before we discuss the characteristics of each method, model, market data or other evidence, we emphasize that the cost of debt cannot be determined in isolation. There are, as acknowledged in Rule 87 (11) (b), important interactions between the cost of debt and the cost of equity through leverage. The overall cost of capital (WACC) of a company is the weighted average of the cost of debt and the cost of equity. As the leverage increases, larger weight is placed on the cost of debt. Therefore, risk of default increases and the cost of debt (and equity) increases. This change in relative weight generally does not change the overall cost of capital (absent taxes) and says nothing about the efficiency of an entity.[30] Therefore, the cost of debt for a benchmark efficient with similar risks to that of the target entity in the provision of reference services entity increases with leverage.

The cost of debt, unlike the cost of equity, depends on the totality of the risk (systematic and idiosyncratic) for the entity. Therefore, it is imperative to evaluate the risk characteristics of the entity and if needed adjust for differences in risks.[31] As an example, the New Brunswick decision above illustrates a case in which the regulator recognized that a specific utility faced risks that made its cost of debt different from that of its parent company (and different from other entities in its industry). In addition to leverage, company-specific facts such as the variability of its cash flow, the magnitude of its capital expenditures, and fundamental supply / demand dynamics affect debt costs. Furthermore, the access to and cost of debt may

[30] The WACC may change if the new capital structure is not within the broad middle range of capital structures over which the WACC is a minimum for a particular company.

[31] For a discussion of risk positioning of an individual rate regulated entity, see, *The Brattle Group*, "Estimating the Cost of Equity for Regulated Companies," prepared for the APIA, 17 February 2013, pp. 67-73.

depend on industry factors such as fundamental oil and gas prices and the level of inflation in the country or region where funds are raised. Thus, there is no one simple formula available to determine the expected cost of debt.

Under Rule 87 (11) (c), the approach to determining the cost of debt must consider the "incentives that the return on debt may provide in relation to capital expenditure over the *access arrangement period*, including as to the timing of any capital expenditure." It is clear that if the rate of return differs from the cost at which the rate regulated entity can obtain financing, capital expenditures may be affected. For example, if the allowed cost of debt is set at a lower rate than that at which the entity can obtain debt financing, the entity will have an incentive to postpone capital expenditures until it can either file a new tariff request or until the allowed and the market costs of debt converge. Similarly, if the allowed cost of debt is set higher than the market cost of debt for a period of time, there is an incentive to pull capital expenditures forward in time to "catch up" on needed investments. Regardless of the direction of the bias, incentives to undertake capital expenditure are affected by the allowed cost of debt decision. The refinancing of debt is affected in the same manner as is capital expenditures - if the cost of debt is lower than the cost at which debt financing can be obtained, then refinancing may be postponed, done at maturities that are different from those the entity normally would use to balance its debt portfolio or the rate-regulated entity may delay capital expenditures to minimize the need for funds.

One consequence of the discussion above is that the notion of a benchmark efficient entity with similar risks to that of the target entity in the provision of reference services cannot readily be associated with a specific credit rating as entities necessarily will have different levels of gearing, cash flow variability, capital expenditures, and demand / supply fundamentals. Within any given rating and even within notched ratings, the range of companies can be quite broad, so simply relying on the yield on an index cannot be expected to measure the cost of debt for a benchmark efficient entity with similar risks.

Lastly, a key issue in choosing which method, model, data or other evidence to rely on is availability of needed information. For example, yield data on utility bonds of a variety of ratings is readily available in the U.S., but data for anything but A-rated entities is scarce in Canada and Europe. In Australia, we know of no source for yields specific to rate-regulated

entities, so the reliance on the yield of a group of companies becomes less transparent and likely requires adjustments for not only entity-specific risk but also for industry and country risks.

B. SUMMARY CHARACTERISTICS OF EACH METHOD

Regardless of the approach used to determine the cost of debt, there are advantages and disadvantages. The following summarizes some of the key characteristics of the available estimation methods, models, data and other evidence.

1. Market-Based Cost of Debt

Average of Observed Yields

- The market cost of debt reflects the debt financing cost in capital markets and thus is more aligned with the cost of debt that could be achieved by a company more exposed to competition.
- For a well-specified market index or group of comparable companies, it is easy to determine and audit the market cost of debt if such a group is available.
- Proponents argue that the reliance on market cost of debt gives the regulated entity an incentive to obtain the cheapest possible financing.
- The maturity of the available market cost of debt may not match the rate-regulated entity's maturity horizon.
- Currently observed yields may not be reflective of the cost of debt over the access period.
- It may not be feasible to find a group of comparable risk benchmark efficient entities from which to estimate the market cost of debt, i.e., the average yield does not take into account company-specific risks.
- If the market cost of debt differs from the cost at which the entity can obtain debt financing, the rate regulated entity faces incentives to move capital expenditures forward or backward in time or to have frequent tariff filings.

- Regulated entities could have an incentive to match the debt financing to the regulatory period rather than to what is optimal for an entity with very long-lived assets.[32]

Risk-Free Rate Plus a Debt Premium

- Assumes the cost of rate-regulated debt and government debt moves in sync.
- If a forecasted risk-free rate is used, the cost of debt estimate is forward looking.
- At any point in time the debt premium may be upward or downward biased relative to the market cost of debt.
- Estimating and auditing the cost of debt estimate is simple.
- In many countries a forecasted risk-free rate is only available few years out making the estimate less forward –looking.

In addition to the above characteristics, we urge caution in relying strictly on bond ratings to assess the efficient cost of debt because (i) the costs of debt and equity interact through leverage, (ii) the cost of debt depends on total risk, which varies by industry (including across different types of utilities) and across companies, and (iii) a specific rating covers a broad range of companies. We also note that using the government bond rate plus a debt premium is likely to cause additional difficulties if, for example, the country whose government debt is being used faces unique circumstances. As an example, Greek government debt has a higher yield than the debt of many Greek companies. At the same time, if a historical risk premium is added to the government debt yield, a higher cost of debt would be estimated.

2. Embedded Cost of Debt

- The cost of debt can readily be calculated from rate-regulated entities' records although obtaining a sufficient group of benchmark efficient companies of similar risk may prove challenging.
- The cost of debt estimate is more stable over time.

[32] We observe debt maturities that are relatively long in North America, where the use of embedded cost of debt is common. Shorter debt maturities are common in Australia and Europe, where market cost of debt is more frequently used.

- The rate-regulated entity's capital expenditure decisions are unaffected by the cost of debt allowance.
- The cost of debt does not necessarily reflect market cost (which is what non-regulated entities face).
- The rate-regulated entity has less incentive to refinance than when the cost of debt equals market cost of debt.
- The cost of debt estimate is less readily available as it relies on non-public records in Australia.[33]
- Because of the limited number of similar risk benchmark efficient entities available, the cost of debt estimate will likely need to be adjusted to take into account the risk-characteristics of the entity. One way to do this is to use data obtained from investment banks.

In addition to the pros and cons above, we note that many of the advantages or disadvantages of using market-based cost of debt depends on the exact measurement of the market cost of debt. For example, the reliance on the risk-free rate plus a debt premium is associated with more problems than is the reliance on the yield of a well-defined index that is based on a reasonably large amount of bonds and companies in the relevant industry. Similarly, the embedded cost of debt is easier to track and audit if all debt is issued by one specific entity (the regulated entity or the parent) than if it is issued by a number of different parties. Finally, we note that some debt is subject to private placement and therefore the market cost of debt is not readily available.

3. Market Data and Other Evidence

The characteristics of other evidence inherently depend on the nature of such evidence. The two most promising candidates in this category are the cost of recently issued debt by comparable companies and estimates on the likely cost of debt financing obtained from investment banks.

[33] In North America, annual filings provide sufficient public data to easily determine that the embedded cost of debt.

- If data is available on recently issued debt of comparable companies, it provides a true estimate of the current cost of debt financing. Such data may be difficult to obtain - especially in a smaller market.
- Data obtained from recent debt issuances is readily auditable.
- Data obtained from recently issued debt is likely to vary substantially over time, so that the cost of debt varies substantially from one access period to the next.
- Estimates from investment banks can be obtained even when there are no current debt issuances, so data should readily be available.
- The data from investment banks is likely not readily auditable.
- Like the data from recent bond issuances, the data will depend substantially on current market conditions and is likely to vary substantially over time.

There is no unanimously correct cost of debt methodology. All methods, models, market data and other evidence have unique characteristics that make the methodology more or less useful in specific circumstances. However, to avoid any bias, it is important to maintain consistency across access periods. Most notably, if moving from an embedded cost of debt methodology to a market-based methodology, current debt should be grandfathered. If moving from a market-cost of debt methodology to embedded cost of debt or other methods, the impact is likely to be less severe, because the cost of debt estimate is already based on data that changes substantially over time.

IV. REGULATORY SURVEY

A. AUSTRALIA

Jemena decision

In the 2010 Jemena Gas Networks (JGN) decision,[34] the AER determined the cost of debt as the 20-day average yield on what the AER viewed as comparable 10-year corporate debt. The main points of substance in the case were that disputes that arose between JGN and the regulator were associated with the choice and derivation of the corporate bonds used. The key difficulty is that there are relatively few publicly-traded corporate bonds in the Australian capital market. The AER used fixed-rate BBB+ rated corporate bonds with remaining terms of more than two years that were issued in Australia by an Australian

[34] AER Jemena Decision.

company and conjointly priced by Bloomberg, CBASpectrum, and UBS. There were six such bonds. The AER eliminated one bond from the sample because it showed large swings in price. The AER then tested which of the "fair value curves" for BBB rated debt published by Bloomberg and CBASpectrum more closely matched the observed yields on the remaining five bonds. Since the CBASpectrum curve was a slightly better match, the AER selected that curve, and read the 10-year yield from that curve. Figure 2 below (taken from the AER decision)[35] illustrates this process.

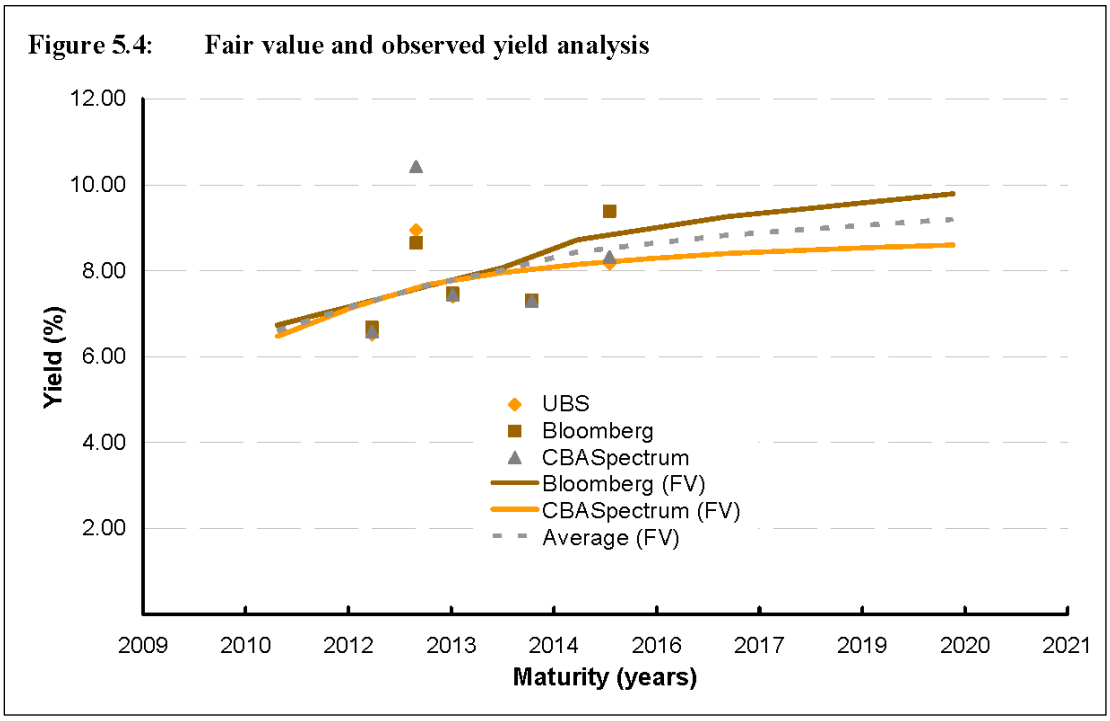


Figure 2: Replication of Fair Value and Observed Yield Analysis from AER Decision

The AER determined a cost of debt of 8.78% by this process. It is apparent from Figure 2 above that the fair-value curves from which the AER determined the cost of debt did not match the yields on the bonds relied upon by AER particularly well, that the curves extrapolate well beyond the point at which there is any relevant market data, and that the resulting cost of debt is very sensitive to the methodology used to derive the fair value curve (the Bloomberg curve, which is ostensibly reporting the same thing as the CBASpectrum curve on which the AER relied, would have yielded a cost of debt closer to 10%).

[35] AER Jemena Decision, p. 198.

In addition to dispute over which fair-value curve should be used, the choice of credit rating was also at issue in the case. JGN argued that gas networks are riskier than electricity networks, and that therefore it would be appropriate to use a benchmark entity with a lower credit rating than BBB+. The AER rejected this argument because there was little evidence on credit ratings of actual gas and electricity utilities in Australia, and because statistically there was no evidence to support the thesis that gas utilities have riskier revenues. The AER also pointed out that, in its WACC review (which was the origin of the decision to use a BBB+ rated bonds), the bond AER used was chosen conservatively, being towards the bottom of the range identified (BBB+ to A-).

The EUAA[36] submitted evidence which suggested that one Australian utility had been able to raise debt "offshore" at a cost significantly (280 bps) below the cost determined by the AER in setting rates for that utility. The AER dismissed this concern on the grounds that the Rules required the AER to set the cost of debt by reference to a benchmark utility, not the actual cost of debt of any one utility.[37]

The AER also included an allowance for debt-raising costs. On the basis of modeling the fees that would be incurred to raise debt equivalent to the debt-funded proportion of the asset base, the AER determined an allowance of approximately 9 bps.[38]

Envestra

In the Envestra decision, the AER similarly considered evidence from what was considered comparable bonds and fair value curves. The AER ultimately determined that the cost of debt should reflect evidence from both the Bloomberg BBB fair value curve (extrapolated) and a recently-issued bond from APA Group (a gas utility), equally weighted. This evidence is shown in the Figure 3 below (note that in this figure yields are expressed relative to the risk-free rate, so the Y-axis is the debt risk premium).[39]

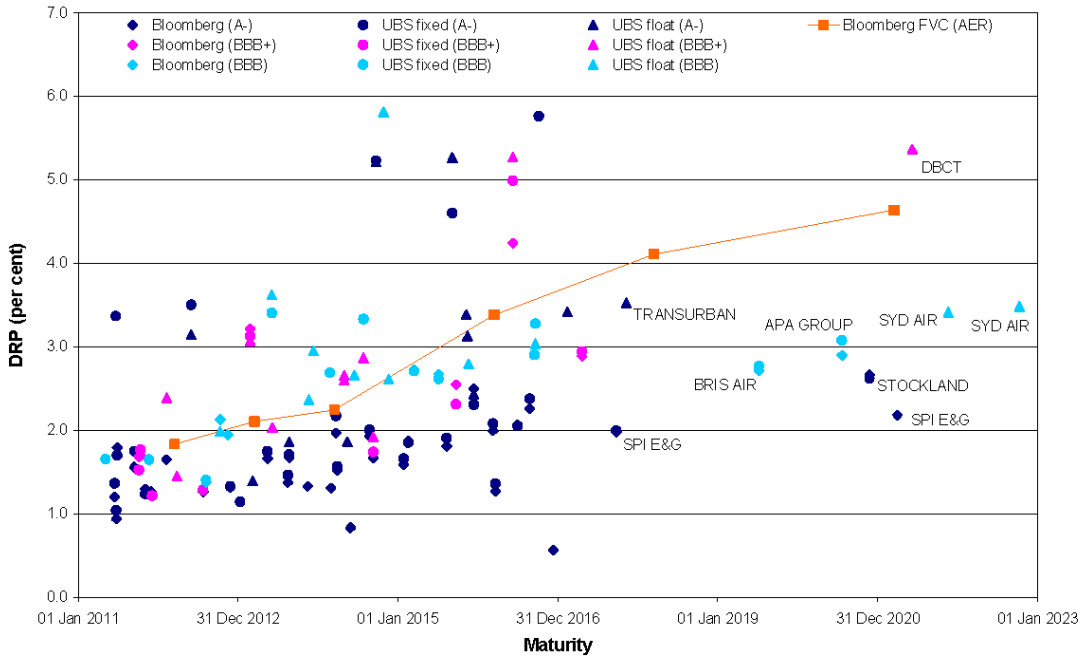
[36] The Energy Users Association of Australia, a national association of large electricity and gas users.

[37] AER Jemena Decision, p. 184.

[38] AER Jemena Decision, p. 278.

[39] Reproduced from the AER Envestra Decision, p. 49.

Figure 5.1 Australian corporate bonds with credit ratings ranging from BBB to A–



Source: Bloomberg, UBS, AER analysis.
Note: Yields are annualised, and floating bonds have been converted to fixed rate equivalents. No other adjustments have been made.
Observed yields for the Brisbane Airport and SP AusNet bonds only became available from 28 and 30 March 2011 respectively. As such, references throughout this chapter to the observed yields of the Brisbane Airport and SP AusNet bonds reflect average yields over the period from 1 April 2011 to 31 May 2011. Although these dates are not in Envestra's averaging period, the AER considers these bonds provide relevant information in setting the benchmark DRP.

Figure 3: Replication of Australian Corporate Bonds with Credit Ratings Ranging from BBB to A- from AER Envestra Decision

The AER placed weight on the yield of the APA Group bond because it had a similar (BBB vs. BBB+) credit rating to what was viewed as the benchmark utility, and because it was a 10-year bond. The AER also included an allowance for debt-raising costs, equivalent to approximately 11 bps.[40]

DBNGP

The ERA determined the cost of debt by a debt risk premium approach. The premium over government bonds was estimated from a sample of 15 corporate bonds with ratings in the BBB- to BBB+ range, and terms of 2.4 to 8.8 years. Four subsets of this group were considered, and four methods were used for calculating an average debt risk premium (in all cases, the debt risk premium was equal to the observed yield less the calculated yield on

[40] AER Envestra Decision, p. 77.

a government bond of equivalent term). The results of this process are shown in Figure 4 below.[41]

Table 37 Debt Risk Premiums under Various Scenarios and Weighted Average Approach, (per cent) as at 30 September 2011

Weighted Average Method	Scenario 1 (15 bonds)	Scenario 2 (12 bonds)	Scenario 3 (5 bonds)	Scenario 4 (3 bonds)	Simple Average of all 4 scenarios
Simple Average	3.107	3.062	3.084	2.996	3.062
Term to Maturity Weighted Average	**3.146**	**3.106**	**3.083**	**2.992**	**3.082**
Amount Issued Weighted Average	3.162	3.148	3.064	2.965	3.085
Median	3.119	2.999	3.119	2.940	3.044

Source: Authority's calculations

Figure 4: Debt Risk Premiums under Various Scenarios from ERA Decision

In Figure 4 above, Scenario 1 contained all 15 bonds, Scenario 2 excluded BBB- bonds, Scenario 3 excluded bonds shorter than 5 years, and Scenario 4 excluded both BBB- and shorter bonds. The ERA determined that the appropriate debt risk premium should be 3.082%, the simple average of the four scenarios with the term-to-maturity-weighted-average (the bold row in the table above). Subsequently, following an appeal, the ERA revised its decision to 3.143%, which was based on a joint-weighted version of Scenario 2 (where the weights on each of the 12 bonds were proportional to the product of the amount issued and the term to maturity).[42]

The ERA also allowed debt-raising costs of 12.5 bps.

The ERA rejected evidence put forward by the DBP which suggested that Australian utilities would be likely to raise at least some debt outside Australia, *e.g.* in the U.S. DBP

[41] Reproduced from the ERA DBNGP Decision, p. 149.

[42] Pages 8–10 of *Revised access arrangement decision pursuant to rule 64(4) of the National Gas Rules giving effect to the Economic Regulation Authority's proposed revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline Revised by reason of and pursuant to orders of the Australian Competition Tribunal made on 26 July 2012* (ERA, October 2012).

presented evidence on the cost of doing so, swapped back into an Australian-dollar-equivalent basis. The ERA rejected this evidence, in part because the methodology seemed to generate different weightings (on the different sources of debt finance) over time.[43]

Because of the smaller market for longer term debt in Australia, it is reasonable to expect that Australian companies benefit from raising some debt internationally. Further, because rate-regulated entities necessarily obtain funds for payment of interest and repayment of debt in AUD, the cost of swapping these funds back into AUD needs to be considered as long as it is efficient to raise funds internationally. In considering whether international debt funding is efficient, it is necessary to consider not only the yield on such debt, but also the maturities available, because companies benefit from financing their debt with a portfolio of debt instruments that span a range in terms of the maturities, exposure to country risk, etc.

B. NORTH AMERICA: CANADA AND THE U.S.

Standard Cost of Debt Determination

Regulators in Canada and the U.S. usually allow the embedded cost of debt to include the amortization of any issuance premia or discount to be recovered in rates provided the debt was prudently incurred. The only substantial difference across U.S. regulators is whether they allow the embedded cost of debt to be determined solely from debt and debt costs that existed prior to the rate case or if they allow the debt and debt costs to be updated with information about upcoming debt offerings. In the latter case, the regulator commonly requires specific information about the amount of debt and its terms from the underwriter of the debt. Canadian regulators usually allow the amount and cost of debt to be updated for planned debt issuances.

North American pipelines generally issue significant amounts of debt with long maturities. As shown in Table 2 below, more than 80% of the debt held by a group of North American pipelines has more than 5 years to maturity, and many of these debt issuances have maturities in excess of 10 years.[44]

[43] See ERA DPNGP Decision, p. 146

[44] The North American companies listed in Table 2 are pipelines characterized by having substantial pipeline assets (oil, natural gas, or liquids), an investment grade bond rating, and no recent mergers

Company	Currency	Current Portion of Long Term Debt [1]	Notes Payable [2]	Less Than 1 Year [3]	1 to 5 Years [4]	More Than 5 Years [5]	Total [6]
Australian Regulated Utilities							
Envestra Ltd	AUD	-	91	91	-	633	725
Australian Regulated Utilities Total		-	91	91	-	633	725
Australian Regulated Utilities Total (%)		0%	13%	13%	0%	87%	100%
European Regulated Utilities							
Enagas SA	USD	-	2,082	2,082	666	-	2,748
Fluxys Belgium	USD	153	40	193	133	466	639
National Grid PLC	USD	-	-	-	4,169	4,958	9,127
REN - Redes Energeticas Nacionais	USD	-	69	69	-	-	69
Snam SpA	USD	2,089	3,612	5,701	2,330	5,659	11,602
European Regulated Utilities Total		2,242	5,804	8,046	7,298	11,083	24,185
European Regulated Utilities Total (%)		9%	24%	33%	30%	46%	100%
North American Pipelines							
Boardwalk Pipeline Partners LP	USD	-	-	-	1,350	1,075	2,425
ONEOK Partners LP	USD	361	-	361	1,100	2,436	3,536
Spectra Energy Corp	USD	525	1,052	1,577	-	10,607	11,659
Spectra Energy Partners LP	USD	150	58	208	250	250	558
TC Pipelines LP	USD	3	-	3	27	349	376
Williams Partners LP	USD	324	-	324	2,010	5,018	7,028
Enbridge Inc.	CAD	252	548	800	2,568	8,948	12,064
TransCanada Corp	CAD	935	1,880	2,815	397	17,661	19,938
North American Pipelines Total		2,550	3,538	6,088	7,702	46,344	57,584
North American Pipelines Total (%)		4%	6%	11%	13%	80%	100%
MLP Total		838	58	896	4,737	9,128	13,923
MLP Total (%)		6%	0%	6%	34%	66%	34,663

Sources and Notes:
[1] - [2]: Bloomberg LP as of 1/25/2013.
[3] = [1] + [2].
[4] - [5]: Obtained from Thomson financial for Australian and European companies and companies' latest annual reports for National Grid and the North American Pipelines.
[6] = [2] + [4] + [5].
Spectra Energy Corp and TransCanada Corp list a range of maturity dates for various bonds in their annual reports.
When this occurred, the longest maturity was used.
Total percentages may not add up to 100%.

Table 2: Summary of Australian, European and North American Debt Maturities

or acquisitions. We note that the majority of the companies are so-called Master Limited Partnerships (MLP), which are pass-through entities for U.S. tax purposes. Therefore, the corporate entities have no tax benefits of debt although their owners do. The Australian entities are the Australian pipelines for which we have recent decisions and the European rate-regulated entities are those recently reviewed by the Dutch regulator for the purpose of determining the generic WACC.

Instances Where Cost of Debt Differed from the Embedded Cost of Debt

National Energy Board

The National Energy Board (NEB) is an independent federal agency in Canada that regulates international and interprovincial aspects of the oil, gas and electric utility industries. The NEB determines rates, including the cost of capital and capital structure, for interprovincial and international pipelines. The NEB has traditionally allowed regulated pipelines to recover their embedded cost of debt, but in its RH-1-2008 decision,[45] the NEB allowed Trans Québec & Maritimes Pipelines Inc. to earn a WACC based on a market cost of debt. The cost of debt was set at the market cost of debt relying on the yield of an index of utility bonds. Specifically, the NEB noted

> the market cost of debt was assumed to be equal to the current yield on an index of utility bonds corresponding to each sample company's debt rating.[46]

Using this principle, the NEB used a 15-day average yield on an index of bonds that have the same rating as the companies used to determine the cost of equity.

Ontario Energy Board

The Ontario Energy Board (OEB) regulates Ontario's electric and gas markets and utilities including some provincial pipelines.[47] While the OEB generally uses the utility's embedded cost of debt for rate making purposes, a formulaic approach is used to determine the deemed cost of long-term and short-term debt for entities that have no debt outstanding. This estimate is also used as a cap on inter-company borrowing costs that can be recovered in rates.[48] The deemed long-term cost of debt is determined as the Long Canada Bond Forecast from *Consensus Forecast*[49] plus a maturity premium plus the average spread of a long-term A-rated utility bond yield over the long Canada bond yield. Specifically,[50]

$$LTDR_t = LCBF_t + Average_{3\ months}\ (UtilBonds_t - CB_t) \qquad (2)$$

[45] National Energy Board, *Reason for Decision, RH-1-2008,* issued March 2009 (RH-1-2008).

[46] RH-1-2008, p. 27.

[47] The OEB bases rates on a forecast test year and the forecasted cost of service.

[48] Ontario Energy Board, *EB-2009-084: Report of the Board on the Cost of Capital for Ontario's Regulated Utilities*, issued December 11, 2009 (EB-2009-0084), p. 59.

[49] Consensus Forecast is a subscription service from Consensus Economics. The service provides consensus estimates on the 10-year Canadian government bond yield.

[50] EB-2009-0084, Appendix C.

Where LTDR is the Long-Term Deemed Debt Rate, LCBF is the Long Canada Bond Forecast for the year, UtilBonds is the realized yield on 30-year A-rated utility bonds, CB is the realized yield on 30-year Canada Bonds and the average is taken over three months prior to the date the rates are implemented.[51]

Similarly, the OEB determined a deemed short-term debt rate (STDR), which is the average 3-month bankers' acceptance rate plus a forecasted average spread of short-term debt issuances over the 3-month bankers' acceptance rate using R1-low Canadian utilities.[52] Specifically,[53]

$$STDR_t = \text{Average}\ (BA_t) + AnnualSpread_t \qquad (3)$$

Where STDR is the Short-Term Deemed Debt Rate, BA is the 3-month Bankers' Acceptance rate, which is averaged over a month, and AnnualSpread is the average annual spread between debt issuances of an R1-low utility and 3-month Bankers' Acceptance rate. The AnnualSpread is obtained by OEB staff by contacting major banks whereas the 3-month Bankers' Acceptance rate is available from Cansim (Series V39071).

Table 3 below shows the OEB's estimate for the long-term cost of debt and the realized (market) cost of debt during the year the estimate was made.

	A-Rated Utility Bond Yield	Deemed LT Debt Rate
2012	4.77%	5.01%
2011	5.21%	5.32%
2010	5.92%	5.87%

Table 3:[54] OEB Cost of Debt and Comparable Bond Yield

[51] OEB obtains the UtilBond yield from Bloomberg (Series C29530Y) and the yield on long Canada Bonds (CB) from Cansim (Series V39056).

[52] R1-low is a rating designation used by Dominion Bond Rating Services.

[53] EB-2009-0084, Appendix D.

[54] EB-2009-0084 "Cost of Capital Parameters Updates for 2010 Cost of Service Applications," 2/24/2010; "Cost of Capital Parameters for 2011 Cost of Service Applications for Rates Effective May 1, 2011," 3/3/2011; "Cost of Capital Parameters Updates for 2012 Cost of Service Applications," 11/10/2011; and

Table 3 above shows that the OEB's cost of debt estimates vary around the realized utility bond yield in the year of the estimate. We note that the OEB estimates the cost of debt (and equity) for the entities it regulates in the late fall of the year prior.

New Brunswick Energy and Utilities Board

The interesting deviation from using the embedded cost of debt in New Brunswick relates to the cost of debt allowed for Enbridge Gas, New Brunswick. Enbridge Gas, New Brunswick is a subsidiary of Enbridge Inc. In setting the allowed cost of debt for Enbridge Gas, New Brunswick, the New Brunswick Energy and Utilities Board added 100 basis points (1%) to the embedded cost of debt of the parent company, Enbridge Inc. In making this determination, the regulator asked two investment banks to give a professional opinion on the likely debt financing cost of Enbridge Gas, New Brunswick relative to the embedded cost of debt of the parent company.

C. EUROPE

Most European regulators use market information to determine the cost of debt that regulated entities are allowed to recover in rates. While we found no systematic disclosure of debt maturities, coupon rates, discounts or premia among European utilities, we notice that the information available on the maturity of debt outstanding by, for example, Flyxys in Belgium, NationalGrid in the U.K., Snam in Italy or Redes Energeticas Nacionais SGPS in Portugal indicates that debt maturities are much shorter that the maturities we see among North American pipelines. This is important because the maturity of a regulated entity's debt affects not only the cost of debt but also refinancing risks and the variability of interest expenses. Under a regime where embedded cost of debt is recovered, the maturity of the outstanding debt also affects the stability of rates.

The U.K.: Ofgem

In the U.K., the Office of Gas and Electricity Markets (Ofgem) is the entity that determines the allowed return for regulated electric and gas companies. In considering Ofgem's

"Cost of Capital Parameters Updates for 2012 Cost of Service Applications for Rates Effective May 1, 2012," 3/2/2012.

approach, it is important to know that Ofgem relies on a real (rather than nominal) WACC and currently uses an 8-year regulatory cycle with some annual formula-based updates.

In determining the cost of debt that is included in rates, Ofgem uses a trailing average of historically observed yields on a broad index of bonds. In its most recent decision,[55] Ofgem specified the cost of debt as the simple 10-year trailing average of two so-called iBoxx indices of Sterling denominated corporate bonds.[56] Ofgem uses a real rather than a nominal cost of debt, so an inflation adjustment is made to the nominal value for a final real cost of debt of 2.92% for 2013-2014 (estimated in October 2012). The cost of debt is updated annually (*i.e.*, rates will be adjusted each year to take account of changes in the 10-year trailing average adjusted yield).[57]

Ofgem does not make any allowance for issuance costs. The iBoxx indices are composed of a broad set of bonds and in Ofgem's view the characteristics of network companies and the regulatory regime within which they operate allow them to raise debt more cheaply than other companies of similar credit rating. Therefore Ofgem finds that the margin provided by the index will allow network companies to recover any costs that are not directly in the index.[58]

The Netherlands: NMa and OPTA

In the Netherlands, NMa regulates energy companies (including pipelines), while OPTA regulates communications markets in the Netherlands. The two agencies merged at the start of 2013.

To estimate a cost of debt for the regulated firms, the Dutch regulator considers the yield on debt issued by other A-rated European companies. The methodology specifies that the allowed cost of debt is the risk-free rate plus the average spread of the regulated firms' debt over the risk-free rate over the last three years. The risk-free rate is also calculated over a 3-

[55] Ofgem, "RIIO-T1: Final Proposals for National Grid Electricity Transmission and National Grid Gas," December 17, 2012 (Ofgem Decision), pp. 25-26.

[56] The iBoxx indices are fixed income indices published by MarkIt, a data and financial services provider with offices in many countries. The bond-based indices are available in several currencies including U.K. sterling.

[57] Ofgem Decision Table 3.1.

[58] Ofgem Decision p. 26.

year period. As the Dutch regulator relies on the German risk-free rate, the spread is over the German 10-year bond.

A-rated debt has remained reasonably stable over the three year reference period, moving in a band between 1.0-1.5%, while BBB+ debt has been more volatile. The spread is indicated in Figure 5 below, which shows that the most recent 3-year period misses the volatility seen at the end of 2008 and beginning of 2009.

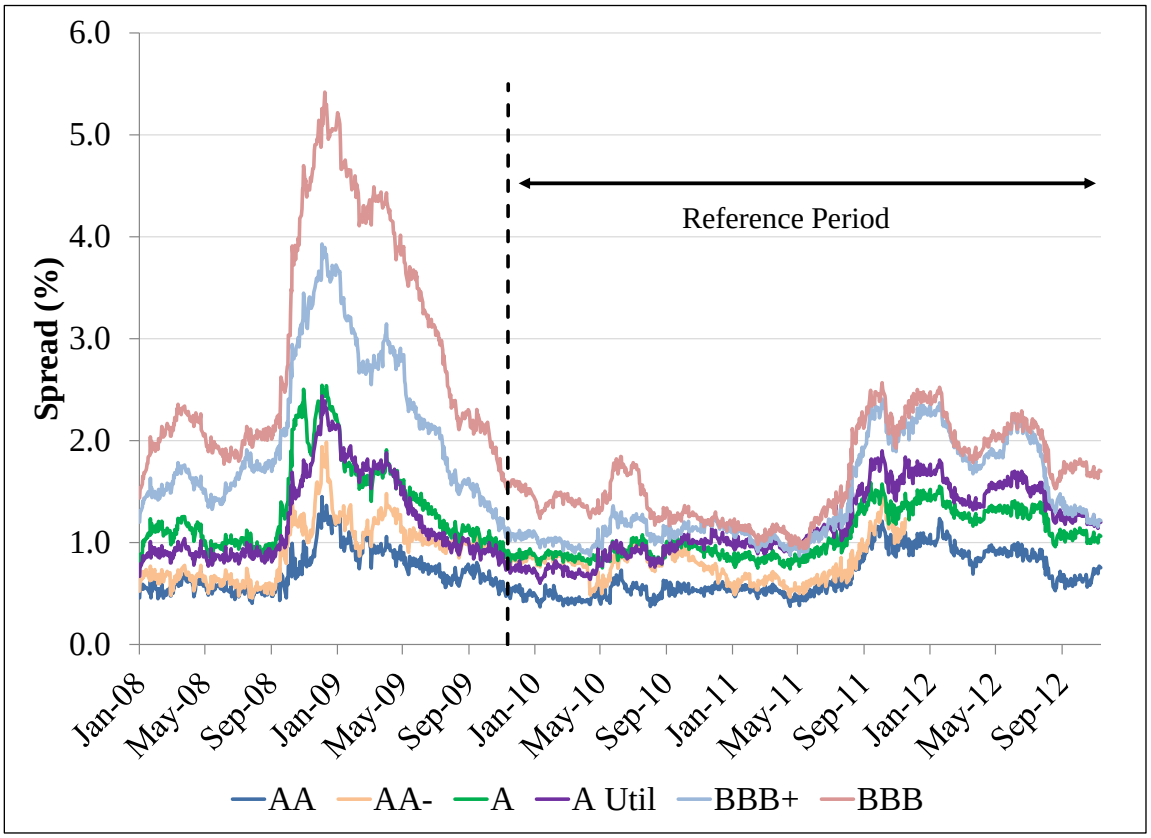


Figure 5: Credit Spread on European Rated Debt

Calculating the spread for each type of bond over a 3-year period and averaging the results, the NMa / OPTA obtain the spread added to the risk-free rate. The regulator takes the risk-free rate to be the average of the German risk-free rate over the most recent three years. The average spread is calculated as above and the regulator then adds another premium to cover issuance and other non-interest costs. Thus, the cost of debt is determined as the risk-free rate plus the average spread plus an allowance for issuance costs.

Looking to the methods used by various regulators, we can summarize the methods relied upon as shown in Table 4 below.

Regulator	Primary Method	Specifics
AER	Current Market Cost of Debt	Average of corporate bond yields over a relatively short time period
ERAWA	Risk-Free Rate plus Premium	Current risk-free rate plus the average premium estimated from 15 corporate bonds and an allowance for issuance costs
U.S.	Embedded Cost of Debt	Actual costs including any premia or discount
Canada	Embedded Cost of Debt	Actual cost including any premia or discount
OEB	Secondary method: forecasted cost of debt	Forecasted 10-year government bond yield plus historic utility debt premium
Ofgem	Historical Market Cost of Debt	10-year historic average of all Sterling denominated bonds
Netherlands	Risk-Free Rate plus Premium	3-year period and benchmark is other European A-rated utilities

Table 4: Summary of Regulatory Approaches to Setting the Cost of Debt

From Table 4, it is evident that there currently are a number of different approaches to determining the cost of debt.

V. USING THE METHODS AND LESSONS LEARNED

A. CHARACTERISTICS AND PRACTICES

In addition to the standard methodologies reviewed in Table 4 above, at least one Canadian regulator (New Brunswick Energy and Utilities Board) relies on information from investment bankers to determine a reasonable cost of debt allowance. Specifically, the regulator recognized that at its standard cost of debt allowance, the regulated entity would not be able to raise debt capital needed for infrastructure development. Additionally, in light of the financial crisis, the Portuguese regulator[59] recently changed its approach to estimating the cost of debt. Specifically, instead of using the Portuguese 10-year bond, where the yield spiked, the regulator started using either German or a combination of all AAA-rated Eurozone government bonds to determine the risk-free rate. Since the Portuguese regulator relies on the risk-free rate plus a debt premium to set the cost of debt, the method used to determine the cost of debt has changed. These examples illustrate that regulators have

[59] Portugal Entidade Reguladora dos Serviços Energéticos (ERSE).

recognized the need to be flexible and take country or company-specific circumstances into account.

Before discussing the methods, models, market data and other evidence in detail, we briefly summarize the characteristics of the methodologies discussed in Table 5 below.

	Evaluation Criteria			
Cost of Debt Estimation Method	Underpinning	Bias	Impact of Market Conditions	Forward or Backward-Looking
Observed Yields	Uses historical data	Aggregates diverse entities' yield, which may be biased for the risk characteristics of the target	Sensitive to economic conditions and inflation	Backward
Risk-Free Rate Plus Premium	Assumes the the risk-free rate and cost of debt maintains a constant spread	Biased if risk-free rate impacted by monetary policy or flight to quality and if the (historical) risk premium does not reflect current market conditions	Very sensitive to monetary policy, flight to quality, and inflation	Backward
Forecasted Risk-Free Rate Plus Premium	Assumes the the risk-free rate and cost of debt maintains a constant spread	Same as above, but risk-free rate is less prone to bias	Same as above but less sensitive	Forward
Embedded Cost	Can be viewed as either: - assuming the access period cost of debt will be similar to the embedded cost of debt - treating debt cost as an operating expense.	Historical financial conditions affect the current cost of debt	N/A	Backward
Investment Banks' Forecasts	Bank specific	Subject to individual investment banks' perception of market conditions and company factors	Sensitive to monetary policy, inflation, and industry policy	Forward

Table 5: Summary Characteristics of Cost of Debt Estimation Methodologies

Looking at Table 1 in *Section II.B*, it is clear that there can be a substantial difference between the embedded cost of debt and the yield on a comparable utility bond index. This difference can easily increase if there is no index of utility bonds available to determine the market cost of debt or the debt premium needed. In this case it becomes imperative that the regulator looks to the reasonableness of the estimates obtained and ideally compares the

results to either (i) the embedded cost of debt or (ii) the cost at which the regulated entity currently can raise debt (for example, using information from investment bankers).

We raise this issue because there is relatively little information available in the public domain about Australian bonds' maturities or yields. While we were able to approximate the embedded cost of debt for a number of pipelines in North America and have readily available utility bond indices by bond rating, we found only two publicly listed bonds for Envestra (using Bloomberg and Thompson Financial) and none for other Australian pipelines. Thus, there is very limited information available to determine the current or historical yield on utility bonds. As a result we recommend that regulatory entities in Australia (i) rely on embedded cost of debt, which is readily available and / or (ii) use a combination of the methods discussed above to assess the cost of debt.

B. Impact of Economic, Industry and Company Factors

Economy-wide Factors

In times of sharply declining or increasing debt cost, the reliance on market cost of debt necessarily leads to the regulated utility either issuing shorter maturities or a divergence between the actual incurred cost of debt and the allowed cost of debt. This may bias capital expenditure decisions. Further, in a market where data on market cost of debt is not readily available and where many entities issue debt overseas, it becomes necessary to derive an estimate relying on the market cost of data from overseas to capture the debt capital market. At the same time, Australian issuers are but a small portion of overseas market and therefore adjustment for country, industry, and company factors are likely needed. There may also be a need for efficiency adjustments although plausibly most entities that remain in operation are efficient.

As the spread between rate-regulated entities and the government bond yields changes or the risk characteristics of the risks of bonds change, the reliability of the various methods discussed in Section II above is affected. The effects are illustrated in Table 6 below. We note that by change in risk, we are referencing the change in the premia debt investors require and that Table 6 considers only the relative reliability, i.e., the methods discussed are not mutually exclusive.

	Spread: Utility and Government Bond Yield			
Change in Risk		High	Average	Low
	High	Other	Forecast Risk-Free + Premium	Other
	Average	Forecast Risk-Free + Premium	Risk-Free + Premium, Embedded Cost	Forecast Risk-Free + Premium
	Low	Embedded, Other	Risk-Free + Premium, Embedded	Other

Table 6: Reliability of the Cost of Debt Estimation Methods as Spreads or Risk Changes

In a smaller debt market such as Australia, it may make sense to solicit input from investment banks or recent debt issuances to determine the cost of debt. This methodology is referenced as "Other" in Table 6.

This will become especially useful if there are few comparable companies or if the target entity faces unique circumstances that may cause the cost of debt to be either higher or lower than that of available comparable companies.

Industry Factors

In addition to the economy-wide factors considered above, industry factors affect the cost of debt and the methodology chosen to best estimate a forward looking cost of debt. Industry-specific factors that affect the cost of debt and the estimation thereof include regulatory initiatives, supply and demand conditions for the industry, and gas prices. If, for example, regulatory initiatives are such that cash flow variability increases, then the cost of debt increases although the cost of debt in other industries would be unaffected. Similarly, the supply / demand conditions may be such that the industry needs to engage in large capital expenditures and thus is adding CapEx leverage, which increases the cost of debt. In those circumstances, the reliance on a generic model such as the risk-free rate plus a debt premium will not reflect the industry specific risks. Similarly, because it is unlikely that a sufficiently large sample of comparable companies can be found (especially in a smaller debt market), the average of the observed yield will also be biased. In these circumstances, the entity's own embedded cost of debt or other methods such as the yield on recently issued debt or investment banks' forecasts may prove useful.

Company-Specific Factors

We stress that there is an interaction of the cost of debt with the cost of equity through gearing as recognized in Rule 87. Similarly, each entity will have unique risk characteristics in the form of, for example, cash flow variability, demand / supply conditions, the need for capital expenditures, exposure to commodity markets, etc. Therefore, a forward-looking cost of debt estimate cannot be estimated without an assessment of the risks inherent in the rate-regulated entity's operations. The higher the risk of an entity, the higher the entity's cost of debt is.

In summary, the cost of debt can be viewed either as an operating expense-like item and the embedded cost of debt of the entity itself becomes an obvious candidate for the cost of debt. This obviously would need to be subject to a prudence review. Alternatively, the cost of debt can be viewed as a component of the cost of capital, which is an opportunity cost. In the latter case, the question becomes how best to estimate the expected cost of debt assuming efficient financing. There is no one way to do so, and we therefore have described the pros and cons of some methods that have been used in the past. Each of these methods, models, market data and other evidence has strengths and weaknesses, so for the *allowed rate of return objective* "to be achieved regard must be had to relevant estimation methods, financial models, market data and other evidence."[60]

[60] Rule 87, (5) part a.

APPENDIX: SPECIFICS ABOUT THE NUMERICAL ANALYSES

A. DETERMINING DEBT MATURITIES

In order to determine the distribution of embedded debt maturities, we examined the long-term debt issued by a sample of publicly traded regulated utilities across Australia, Europe, and North America.

For Australia, we created our company universe from three sources: the members of the Australian Pipeline Industry Association (APIA), utilities currently undergoing regulatory filings with the AER, and utilities used by the AER and the ERA.[61] We then restricted the sample of companies to only publicly-traded electricity and natural gas generation, distribution, and transmission companies.

For North America, we included all regulated pipelines that satisfy a series of criteria. To be included, an entity must be a publicly traded entity owning substantial pipeline assets that are subject to regulation. We included only companies with an investment grade bond rating (BBB- or higher from Standard & Poor's) and 2011 revenues in excess of $300 million. Companies with large merger or acquisition activity or dividend cuts were eliminated.

Europe, like Australia, has a limited number of publicly traded pipelines, so we included regulated entities that were included in a recent filing for the NMa. Schedule 1 below list the companies we considered.

[61] See, for example, Economic Regulation Authority, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, dated October 31, 2011, p. 128 and Deloitte Touche Tohmatsu Limited, *Attachment B – Refinancing, Debt Markets and Liquidity*, prepared for the AER on November 12, 2008, p. 27.

Company Name	Region	Business Segments
APA Group	Australia	Natural Gas Pipeline
Envestra Ltd	Australia	Natural Gas Distribution and Transmission
ERM Power Ltd	Australia	Electric Generation
SP AusNet	Australia	Electric Distribution and Transmission, Natural Gas Distribution
Boardwalk Pipeline Partners LP	North America	Natural Gas Pipeline
ONEOK Partners LP	North America	Natural Gas Pipeline
Spectra Energy Corp	North America	Natural Gas Pipeline
Spectra Energy Partners LP	North America	Natural Gas Pipeline
TC Pipelines LP	North America	Natural Gas Pipeline
Williams Partners LP	North America	Natural Gas Pipeline
Enbridge Inc.	North America	Natural Gas Pipeline
TransCanada Corp	North America	Natural Gas Pipeline
Enagas SA	Europe	Natural Gas Distribution, Storage, and Transmission
Fluxys Belgium	Europe	Natural Gas Pipeline
National Grid PLC	Europe	Electric and Natural Gas Distribution and Transmission
REN - Redes Energeticas Nacionais	Europe	Electric Generation, Electric and Natural Gas Distribution and Transmission
Snam SpA	Europe	Natural Gas Distribution, Storage, and Transmission

Schedule 1: Regulated Utilities in Australia, Europe, and North America

We collected information on long-term debt held by the sample companies from their most recent annual reports and determined the debt maturities using information for all long-term debt mentioned in the annual reports.

B. Determining the Embedded Cost of Debt

The embedded cost of debt of a company is calculated as follows. For each debt issuance, we obtain information about the coupon, the principal, the maturity, and any discount or premium obtained at issuance. The embedded cost of debt is then calculated as the weighted

average interest expense adjusted for the amortization of discounts or premia. The following example illustrates the calculation.

Example: Calculating the Embedded Cost of Debt

Assume a regulated entity has issued three bond series with the characteristics listed in Schedule 2 below.

Series	Date of Issue	Maturity	Coupon	Principal	Price
A	1/1/2005	12/31/2014	6.00%	$1,000,000	102%
B	1/1/2010	12/31/2024	5.00%	$800,000	98%
C	7/1/2012	6/30/2031	4.50%	$1,200,000	100%

Schedule 2: Assumptions Used in Example

To determine the embedded cost of debt, it is necessary to calculate (i) the premium (Series A) or discount (Series B) obtained, (ii) the annual amortization of the premium or discount, and the annual interest expense. Having determined these figures the embedded cost of debt is the total annual debt cost (coupon payment plus amortization) divided by the dollar amount obtained from the issuance. Finally, the embedded cost of debt is the weighted average cost of debt. This is calculated in Schedule 3 below.

Series	Premium (Discount)	Annual Amortization	Annual Coupon Payment	Annual Cost of Debt	Embedded Cost of Debt
A	$20,000	$5.48	$60,005	$60,011	5.88%
B	($16,000)	($2.92)	$39,997	$39,994	5.10%
C	$0	$0.00	$54,000	$54,000	4.50%
Weighted Average Cost of Debt					**5.12%**

Schedule 3: Calculating the Embedded Cost of Debt