A cost of debt estimation methodology for businesses regulated by the Queensland Competition Authority

Queensland Competition Authority

June 2013

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Executive summary

Scope of work

The Queensland Competition Authority (the Authority) engaged PricewaterhouseCoopers Australia (PwC) to develop a cost of debt estimation methodology for businesses regulated by the Authority. The key objectives of the project were to make recommendations to the Authority on what data should be gathered, and how that data should be used to estimate a cost of debt for regulated businesses and associated transaction costs, spanning a range of credit ratings and terms to maturity. The Authority provided us with a number of questions relating to three key tasks:

- Identification of appropriate data sources;
- Debt risk premium estimation methodology; and
- Estimation of debt re-financing costs.

In this executive summary, we provide an overview of our analysis and findings, while in Chapter 7 we provide answers to the specific questions raised by the Authority in the Terms of Reference provided to us.

Analytical framework

The standard practice is to use benchmarks for financing assumptions when estimating the regulatory Weighted Average Cost of Capital (WACC). We inform the benchmarks by looking at relevant firms. In order to estimate the benchmark debt risk premium, we need to make a number of assumptions or know a number of things about the regulated firm of interest, including:

1. *The benchmark term of the debt*

The term of debt that is optimal for a particular firm will depend on the capacity of that firm to issue long term debt (dependent upon the certainty of long term cash flows) and the cost of long term debt compared to short term debt relative to the extent of refinancing risk – with this latter factor affected by the certainty of cash flows and the level of gearing. We estimate a benchmark term of debt by focussing on firms that are very similar in the relevant respects to regulated utilities.

Based on our analysis of 5 benchmark regulated energy transmission / distribution businesses, we recommend that the benchmark term of debt (T) be set at 10 years, as the evidence indicates an average term that is close to 10 years at the present time. However, this empirical question requires periodic reassessment.

If the efficient term of debt issuance is 10 years and the regulatory cycle is 5 years, under the Lally method that has been adopted by the Authority, and if Credit Default Swap (CDS) contracts are not available (i.e. the typical case), then the Authority provides the firm with a 10-year debt premium and an allowance for interest rate swaps so that the firm can swap the risk-free rate component of the 10-year debt to a 5-year term. However, the risk-free rate to which the debt premium is added is the 5-year risk free rate.

2. *The benchmark credit rating of the issuing entity*

The credit rating is itself a benchmark that needs to be derived, but this is beyond our terms of reference. The Authority requested that we develop a debt risk premium estimation methodology that can be applied to all credit rating bands between BBB and AAA. When

estimating the cost of debt for a specific benchmark credit rating, we emulate these characteristics either by:

- Targeting a sample that includes only firms with the relevant characteristics (for example, we exclude financials, subordinates, foreign firms and government controlled firms); or by

- Using econometric techniques to adjust the debt risk premium to match the characteristics of a larger group of bond issue observations (for example, we estimate the relationship between the premium and term in order to estimate the premium for the target term).

3. *The type of debt that is issued (bank v. bond) and the location of issuance (domestic v. international)*

The type of debt and its location of issuance is an important empirical question in terms of whether this is likely to make a material difference to the cost of debt estimate, or whether all markets move together. If different forms of debt, and debt issued in different places, have a materially different cost (after taking account of different transaction costs) to Australian corporate bonds of a similar term, then the cost of debt may need to be estimated as the weighted average across those different forms of debt finance (we call this the 'complex portfolio').

We conclude that both domestic and international bonds (translated to Australian dollar equivalents) may be used, as it is not inconsistent to use the latter in conjunction with a domestic asset pricing model. However, if all markets move together (which is what, as economists, we would expect) then it is valid to use a simpler approach – namely, to use the yield on Australian corporate bonds with a term equal to the average term of debt observed across the regulated utilities (which we term the 'simple portfolio') as a proxy for what would be paid under the complex portfolio.

We note that in order to examine the relative cost of bond issues in Australia and Australian company bond issues in international capital markets we first adjusted the yield of the bond issued in the foreign country to a domestic (Australian dollar, i.e. AUD) equivalent yield, and took into account the differential transaction costs. Only then was the equivalent AUD foreign bond yield converted into a debt risk premium by subtracting the appropriate Australian Commonwealth Government bond yield. Hence, the debt risk premiums of bonds issued in Australia, and of foreign bonds issued by Australian businesses could be compared on an equivalent basis.

Strictly speaking, by using a cost of debt with a term equal to the portfolio average as a proxy for the average cost of debt on that portfolio, we are assuming a linear function between the debt risk premium and term – if the function is concave, then using the simple benchmark would lead to an overstatement of the average cost across the complex portfolio, although this is unlikely to be material.

4. *Other characteristics of the issuer*

Other characteristics of the issuer may also matter. It is an empirical question whether they matter or, alternatively, whether the credit rating explains all of the difference in debt risk premia.

- Based on our discussions with market participants, we consider that bonds issued by financial firms and subordinated debt are valued by the market differently to senior, corporate debt, and should be excluded from the analysis;[1]

- We have also identified other factors (like the nationality of the firm) that are important.

Whether the industry sector matters (outside of financials) is an empirical question – but it is difficult to assess from the thin data available whether this is an issue for bond issues by Australian firms.[2]

The complex portfolio vs the simple portfolio approach
If the debt risk premium is estimated on the assumption that a portfolio of debt is issued in different markets and with different forms of debt (the "complex portfolio"), then benchmark assumptions are also required for the proportions of debt that are issued in the different markets, as well as the term of the debt. Consistency between the simple portfolio and complex portfolio approaches requires that the weighted average term of debt (at issuance) be the same under each approach.

We derived the expected term of debt for bond issues in each market by observing the term across all issues by Australian firms in those markets (i.e., we assume that the term in each market is a market wide norm). We derived the following weightings for the different forms of debt by observing the practice of utilities:

- a 50 per cent weighting to domestic corporate bonds, which had an average term to maturity at issuance of 12.1 years;

- a 25 per cent weighting to international bonds, which had an average term to maturity at issuance of 10.7 years; and

- a 25 per cent weighting to bank debt, which had an average term of issuance of 4.9 years.

We checked to see if the weighted average term that is implied by the complex portfolio is not materially different to what was derived by looking at all sources of debt by utilities. A difference would occur if the average term of debt issued in overseas markets by utilities differed materially to the average term of debt overall. The average term for the complex portfolio was 9.9 years, compared with an average of 10 years for the simple portfolio.

Data, estimation techniques and results

The simple portfolio approach

The 'simple portfolio' approach requires only an estimate of the debt risk premium of the target term for the target credit rating for an issue in the Australian corporate bond market. As noted above, the target term that we have advised is 10 years, although we also provide estimates of the debt risk premium for different terms.

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[1] Academic studies also separate the bonds of financial institutions from the bonds of general industrial businesses. For example see Edwin Elton, Martin J. Gruber, Deepak Agrawal, and Christopher Mann (February, 2001), 'Explaining the rate spread on corporate bonds', *Journal of Finance*, Vol. LVI, No. 1.

[2] At the time of writing the difference in the average yield of 10 year BBB rated US utilities and similarly rated general industrial bonds is immaterial.

- We used yields reported by Bloomberg and UBS for actual bonds on issue as the principal data sources to estimate this cost, and defined a specific recent test averaging period (the 20 business days to 28 November, 2012) as a focus for the empirical analysis, and a broader 'Analysis Period' (from May 2010 to November, 2012) to analyse the cost of debt over a longer time period for changing relativities (e.g. between debt risk premiums estimated with the extrapolated Bloomberg FVC and econometric approaches) .

- We have also used the Bloomberg FVC as corroborating evidence and, in the case of BBB+ 10 year debt, recommend its use as the principal source of evidence. We reach the conclusion that Bloomberg should be used for this case because it performs well when tested against the reported yields for the actual bonds (as indicated above) when interpreted using our preferred statistical techniques (as discussed further below), and it also has the benefit of being a simple method.

Taking the reported yields for the actual bonds on issue and deriving an estimate of the debt risk premium corresponding to a target credit rating and term requires the application of a statistical/econometric technique. The limited number of bonds on issue means that we must attempt to glean as much information as possible for the target bond (i.e. with the assessed benchmark credit rating and term to maturity) from the observed yields for bonds with different terms and credit ratings.

- A number of techniques have been applied by different regulators, the most common being a simple averaging of bonds that are close to the target (e.g. the ERA, IPART and previous AER approach).

- We prefer to apply more advanced econometric techniques as the debt risk premium can be matched to the target term with more precision to derive more information from the limited data set (our criticism of the ERA's approach is that it provides a debt risk premium for a materially incorrect term, and our criticism of the previous AER approach is that it did not draw the most out of the limited information).

We have recommended a specific method for estimating different debt risk premia for different terms and credit ratings (data sources, functional form, and estimation technique). However, we caution that this is an imprecise task – in particular, the limited number of bonds on issue makes it very difficult to distinguish the debt risk premium within a credit band.

Complex portfolio

For international bonds, we followed the same method as above, but with the data set defined as bonds issued by Australian firms in overseas markets, swapped back into Australian dollar obligations.

- We found that, at the moment, the estimated debt risk premium is very similar to that derived from Australian corporate bonds. In the BBB+ credit rating band, for a term of 10 years we found that international bonds provided a debt risk premium estimate of 320 basis points, which was not materially different from the 318 basis points derived from using domestic bonds. For the A credit rating band at a 10 year term these estimates were 231 and 220 basis points respectively.

For bank debt, it is only possible to observe the initial issue (whereas for bonds the value can be observed subsequently, including through trades), which restricts the currency of the sample.

- We found that for 5 year bank debt (which is what utilities tend to issue) the issuing yield was very close to our predicted debt risk premium for 5 year bonds using econometric analysis.

We conclude from the above two findings that there is little merit in estimating the debt risk premium by costing a more complex portfolio.[3]

Summary of recommendations

Our recommendations in response to the Authority's three key main questions (and associated sub-questions) are as follows:

1. Identify appropriate data sources for estimating the debt risk premium

- It is important to use cost of debt data from outside the infrastructure / essential services sector in order to increase the sample size.
- The most important benchmark characteristics of the data are credit rating, absence of state or sovereign government ownership, non-financial service, fixed rate or floating rate bonds (translated to fixed rate equivalents), and a lack of special features such as callability.
- Sufficient coverage reflecting the market for funds can be obtained by reference to the Bloomberg and UBS services (averaging bond yields where possible).
- For greater precision, the debt risk premium for T-year debt should be targeted by reference to as large a sample of bonds as possible (rather than targeting a specific set or range of bond terms) and this requires econometric analysis.

2. Recommend a debt risk premium estimation methodology

- *Econometric analysis* - To satisfy the Authority's requirement for a methodology to derive debt risk premium estimates for a range of credit ratings and terms to maturity, we recommend that an econometric analysis based on a simple portfolio approach utilising domestic bond data be applied.
- *Complex portfolio approach* - We recommend against applying a complex portfolio approach that includes bank deals and international bond data, as this approach is likely to derive a similar overall estimate for the cost of debt, is somewhat impractical given the paucity of public information on bank debt, and could be influenced by distortions through using smaller sample sizes.
- *Testing data quality* - The quality of the bond data should be tested to confirm that it reflects the market's opinion (e.g. Bloomberg 'bank feeds') and is not 'stale' (e.g. using the Quandt-Andrews breakpoint test).
- *Functional form* - For credit rating bands where sufficient bond yield observations are available, alternative functional forms (e.g. linear, exponential, cubic, power, logarithmic, quadratic) should be tested using the Schwartz Information Criterion test for the test averaging period and a longer period (say 2 years). We recommend that the linear functional form be adopted, as it performs well in the SIC test and is simple to understand and apply.
- We conclude that it is valid to extrapolate the Bloomberg FVC using a paired bonds methodology, where the increment in the debt risk premium between 7 and 10 years is

[3] We found that in the BBB+ credit rating band, the complex portfolio provided a total yield estimate of 6.35 per cent for a weighted term of 9.9 years, which was three basis points higher than the estimate for 10 years using the simple portfolio approach (i.e. 6.32 per cent for domestic bonds). For the A credit rating band at a 10 year term the difference in total yields was also very close, with estimates of 5.39 per cent and 5.34 per cent respectively for the complex and simple portfolios.

estimated based on the average observed increments between two bonds of similar (7 and 10 year) terms that are issued by the same firms, and we recommend that for the Authority's purposes the Bloomberg curve continue to be referenced as an independent source of information on bond yields.

Debt raising transaction costs

- Based on publicly available information for Australian bond issues in the US market, we estimated debt-raising transaction costs for domestic bond issues at 9.9-10.8 basis points per annum (for a standard issuance size of $250 million), which is approximately 1 basis point higher than in our previous (2010) study.

- For international bond issues by Australian firms we found the cost of debt issuance was approximately 2-3 basis points higher than for Australian domestic bond issues owing to greater 'other' debt raising transaction costs.

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1 Terms of reference and our approach

1.1 Terms of reference

The Queensland Competition Authority (the Authority) engaged PricewaterhouseCoopers Australia (PwC) on 1 February 2013 to develop a cost of debt estimation methodology for businesses regulated by the Authority. The key objectives of the project were to make recommendations to the Authority about what data should be gathered, and how that data should be used to estimate a cost of debt for regulated businesses, with our recommended method to permit the estimation of a cost of debt and associated transaction costs for a range of credit ratings and terms to maturity.

1.2 Identification of appropriate data sources

The first task in the Terms of Reference was to identify appropriate and sufficient data sources that the Authority could rely upon when estimating the cost of debt. In identifying a set of appropriate and relevant data sources, the Authority requested that we address the following questions and provide the associated reasoning:

1 What comparators should be considered? Should the Authority use cost of debt data from outside the infrastructure/essential services sector?

2 The Authority requires debt with a term of T years. To what extent should the Authority continue its current approach of benchmarking only T-year debt versus sampling debt from a range of terms, for example, T ± 3 years (like other regulators)? For example, if the efficient term of debt is assessed to be five years, should the Authority only benchmark 5-year debt, or debt in the term range of two to eight years (i.e. T ± 3 years)? If sampling debt of different terms is considered appropriate then:

   a How should the Authority weight debt with different terms in comparison to the required term?

   b What adjustments are required to make them comparable to the required term?

3 What sources of data should the Authority rely on? Proprietary service data, bond market data, bank debt data, etc? What data sources are relevant and are any adjustments to it required to make it suitable for regulatory purposes?

4 To what extent should the Authority continue to rely on the Bloomberg proprietary fair value yield curves for estimates of the cost of debt?

5 Assess the validity of extrapolating Bloomberg yields (e.g. 7-year) to obtain longer term (e.g. 10-year) yields.

6 Should the Authority rely on bonds with non-standard features (e.g. callable or puttable bonds) in order to obtain a greater sample size? If so, what adjustments are required to make them comparable to straight debt?

7 Should the Authority rely on Australian bonds placed in overseas markets (e.g. United States (US) bond markets) in order to obtain additional data? If yes, then:

   a Is there any inconsistency using such data in a WACC model that uses 'domestic' data otherwise?

b What assumptions are required to make these bonds comparable to Australian placed bonds?

c What transaction costs (e.g. foreign exchange swaps) are required to make them comparable to bonds issued in Australia?

8 Based on 1-7 above, and on any other considerations deemed relevant, develop an approach for obtaining relevant data and any adjustment required to that data to ensure comparability.

9 The approach identified in 8 should be applicable to a range of possible credit ratings; that is, from the standard benchmark rating of BBB/BBB+ to higher ratings of A to AAA.

1.3 Estimation methodology

The second task was to develop an estimation methodology that uses the data sources to estimate an appropriate cost of debt for regulatory purposes. The specific questions the Authority asked us to address were:

1 How should the sample data be used to estimate the cost of debt?

2 What empirical methods/statistical techniques should the Authority apply to obtain an estimate of the cost of debt?

3 Develop a cost of debt estimation methodology given the data and these empirical methods and document the details of how to implement it to estimate the cost of debt for a regulated business.

1.4 Debt financing transaction costs

The Authority noted in its terms of reference that regulated firms incur legitimate transaction costs to finance (and re-finance) their debt portfolios. There has been a long history of Australian regulators providing an explicit allowance for such costs. The Authority's standard practice has been to make an allowance 12.5 basis points per annum, which was a commonly applied benchmark by Australian regulators. However, more recently, the Australian Competition and Consumer Commission (ACCC) and the Australian Energy Regulator (AER) have derived estimates of the benchmark debt raising transaction cost of generally less than 12.5 basis points.

In view of the longevity of the Authority's current assumption, and the more recent work of the ACCC and AER, the Authority requested that we provide a current estimate of annualised debt issue costs in the context of estimating a cost of debt for regulatory purposes.

We observe that the different forms of debt finance that we investigate in this report – domestic and international bonds and bank debt – would be expected to have different associated transaction costs. The appropriate regulatory objective (discussed further in the next chapter) is to compensate regulated businesses for the efficient total cost of debt, inclusive of transaction costs, which in turn requires consistency between the type of debt assumed and the quantum of transaction costs for which provision is made. Thus, the analysis of different forms of debt financing requires a parallel analysis of the different associated transaction costs.

1.5 Assessment of alternative methodologies

In this report we examine a number of alternative methodologies for the estimation of a suite of debt risk premiums that cover a range of benchmark terms of debt at issuance (denoted by

T, the relevant term of debt in years) and a range of credit ratings from BBB to AAA. The assessment of these alternative methodologies is undertaken against a set of evaluation criteria, including:

- ***Accuracy*** – i.e. attempting to estimate with a high degree of precision the actual cost of debt faced by the benchmark firm in all the markets in which it raises debt capital.

- ***Simplicity*** – Relative simplicity is a virtue of the current Australian debt risk premium estimation framework, which estimates a benchmark debt cost based on abstraction from the complex reality of debt raising, by assuming that all debt is raised via domestically issued bonds with T year term to maturity (i.e. the simple portfolio). *A priori* it might be expected that economic forces would equilibrate rates across different markets and that there would be a convergence in the long run. This is the effective assumption, but it has not been comprehensively tested in Australia prior to this report.

- ***Cost of implementation*** – The cost of implementation of a methodology may be expected to be related to the simplicity of the approach. A more complex methodology would be expected to cost more to implement, but this cost will be small relative to the issue at stake (i.e. the regulated revenue impact of the cost of debt estimate). What is likely to become more costly, is the potential for extended argumentation about a more complex methodology, especially in instances where there is an appeals mechanism.

- ***Objectivity*** – Objectivity is a characteristic that is important in obtaining the agreement of parties within the regulatory process. Put another way, the less subjective is the methodology, the more likely it is that the stakeholders will accept its results.

- ***Replicability*** – It is important that the estimation methodology is capable of being accurately replicated by the parties to a regulatory process.

- ***Transparency*** – Transparency is also an important characteristic, and has been raised in connection with the Bloomberg service and the CBA Spectrum methodology previously. However, whilst Bloomberg does not divulge its complete methodology, there is a general description of it. It is also noteworthy that the Bloomberg service is being provided for purposes other than regulation, and Bloomberg has a reputation to uphold. For these reasons we would not expect Bloomberg to be consciously biased in any direction.[4]

The major trade-off that confronts a regulator when estimating the debt risk premium for the benchmark firm is that between accuracy and simplicity. One element of the analysis in this report was to test whether reliance on a simple bond market approach (which has been applied by Australian regulators) is, over the long run, a reasonable proxy for the cost of debt that is established using the more complex debt portfolio approach. This required us to estimate the debt risk premium over a reasonable time period using consistent methodologies and compare the results.

1.6 Report outline

We have structured the report in the following way:

- Chapter 2 presents an analytical framework for the development of a methodology to estimate debt raising costs, and debt raising transaction costs.

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[4] However, this does not mean that Bloomberg will not at times be *statistically* biased, which is why we recommend cross-checking Bloomberg's yields with those of the UBS service, and cross-checking Bloomberg's extrapolated FVC with econometric evidence.

- Chapter 3 outlines a number of alternative cost of debt estimation techniques that are currently applied by Australian regulators, and reviews their advantages and disadvantages in the light of the analytical framework.

- In Chapter 4 we describe the data bases that we have accessed and the process by which we have filtered and prepared the data for the task of estimating the cost of debt and applicable debt raising transaction costs.

- In Chapter 5 we use the data to develop an estimation methodology that provides estimates of the debt risk premium for a range of credit ratings and terms to maturity.

- In Chapter 6 we analyse debt raising transaction costs and develop a methodology for the estimation of these costs for domestic and international bonds, and bank debt.

- Finally, in Chapter 7 we outline the conclusions of our analysis with specific reference to the questions and issues raised in the Authority's Terms of Reference.

2 Analytical framework

2.1 Introduction

This chapter begins with a discussion of the nature of the regulatory framework, which establishes target benchmarks, including those with respect to the cost of debt. Subsequently we:

- Consider the major trade-offs between accuracy and simplicity when developing a debt risk premium estimation methodology that satisfies the Authority's requirements;
- Discuss the characteristics of the benchmark entity that should be applied in estimating a debt risk premium, debt raising transaction costs, and the benchmark term of debt;
- Consider the benchmark characteristics for government owned businesses without reference to competitive neutrality (as requested by the Authority);
- Establish how benchmark regulated businesses finance with debt, i.e. what are the sources of that debt and what is the term at issuance;
- Consider whether international debt issues should be included in the benchmark, and how these might be converted to an Australian dollar equivalent; and
- Outline the analytical framework that we will apply to analyse debt raising transaction costs.

2.2 Regulatory framework and the benchmark firm

2.2.1 A benchmark cost of debt

A standard feature of economic regulation in Australia (which has been applied in all of the Authority's decisions) is that the estimate of the WACC, and the associated parameters, and other finance related matters, are based upon benchmark assumptions. By a benchmark, we mean that the relevant parameter or assumption is assumed (or notional), rather than directly reflecting the actual decisions and position of the regulated business.

The standard that is embodied in the benchmark is normally described as one that reflects efficient behaviour, with efficiency normally being informed by observing the practice of "peer" firms. In addition, it has also been standard practice (albeit with several departures) for the cost of debt to be determined on the assumption that the firm is stand alone and privately financed. This latter assumption is clearly essential for privately owned firms, and for government owned firms it ensures that prices are based on private ownership (i.e., the value of an implicit guarantee from the government owner is ignored). However, we have also been asked to vary this assumption, which we discuss in section 2.3.1

Focussing on benchmark financing arrangements and committing to ignore actual arrangements, brings with it multiple benefits, in principle. It provides businesses with incentives to finance efficiently, while simultaneously protecting consumers from the results of inefficient financing decisions (at least provided that the commitment to ignore decisions of the regulated firm is able to be sustained). It simplifies the regulatory determination process by abstracting from the complexities of actual financing practices (and other difficult issues, like how debt raised for a larger firm should be assumed to be divided between business units). In addition, it also makes for a simple regulatory regime: if actual financing decisions are underwritten by consumers, then some oversight of those financing arrangements is also warranted to provide a check against consumers being burdened by the

cost of decisions that are imprudent from the perspective of the regulated activities in isolation.

2.2.2 Deriving (informing) the benchmark

The objective when deriving the benchmark cost of debt (and related assumptions) is reasonably straightforward, requiring a response to the question: what decisions and resulting cost of debt would be incurred by an efficient firm in the circumstances of the regulated business? In practice, however, answering this question is not entirely straightforward. A constant theme throughout this report is that there are numerous inadequacies in the data available for this task, and a trading off is required in cases between limiting the data set (and so promoting an estimate that is less subject to statistical bias) and considering a wider data set (and so promoting estimates with greater precision).

The two factors that are generally considered to be the most relevant for explaining the cost of debt incurred by a firm are its credit rating and the term of debt that is issued, for which benchmark assumptions are also applied. The benchmark credit rating is outside of the scope of this report, and instead we have been asked to develop a method for deriving the cost of debt for a range of credit ratings. However, we have been asked to recommend an appropriate benchmark for the term to maturity of the debt of regulated businesses based upon the observation of peer firms to the firms the Authority regulates. We discuss the factors that we expect to cause decisions about the term of debt to differ between firms in section 2.5. We use the discussion of these factors to establish the group of firms whose observed behaviour we consider to provide a reliable guide to the term of debt that would be efficient for the firms that the Authority regulates.

In addition, we also consider further whether there are factors other than the term of debt and credit rating that should be factored into the calculation of the benchmark cost of debt. Our recommendation is for the Authority to derive the benchmark cost of debt by analysing the current yields of corporate bonds on issue and (where relevant) the cost of bank debt at the time of issue (what to analyse and the analysis to perform forms much of this report). The purpose of asking whether there are factors other than the term and credit rating that explain the cost of debt is to decide whether we can use our largest sample of bonds and debt issues to estimate the benchmark cost of debt, or whether a better estimate would be obtained by discarding certain observations from the sample (or otherwise allowing for the factor in our estimation).[5] It is noted, however, that only a limited number of the data points (i.e., bonds on issue) exist, and so it is only practicable to discard observations that are influenced by factors that are expected to cause a material and persistent bias in the cost of debt estimation compared to what would be paid by an efficient entity in the circumstances of the entities the Authority regulates.

2.2.3 Current issues: simple vs. complex portfolio

The standard practice in Australia when estimating a benchmark cost of debt (albeit with some exceptions) is for regulated businesses to be assumed to raise all of their debt through Australian corporate bonds, with all debt being the same term (and equal to the weighted average term of debt at issue across the sample of peer firms). We refer to this as estimating the cost of debt according to a "simple portfolio" (and label this the "simple portfolio approach") in this report.

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5 If a certain factor is known to affect the debt risk premium, then when we estimate the debt risk premium, we can obtain a valid estimate by either (i) using a sample of bond observations comprising only those issued by firms that have the relevant factor (for example, have green offices rather than red offices), or (ii) using statistical techniques to estimate the impact of the relevant factor (for example, that having a red office is predicted to add 20 basis points to the debt risk premium) so that we can produce an estimated premium for the target factor (firms that have green offices). We incorporate the relevant factors into our analysis where the data set is sufficiently rich to do so; however, where the effect of a particular factor is based upon secondary sources (such as the professional opinion of market participants) then we adjust the sample of bonds as relevant.

One of the important issues considered in this report is whether there is merit in the Authority pursuing a more complex – but accurate – representation of how firms actually finance in practice. We know that firms typically issue debt of a range of maturities, and use different sources of debt: that is, issue bonds in international markets as well as domestically, and issue bank debt as well as bonds. We refer to estimating the cost of debt on the basis of this more complex portfolio as the "complex portfolio" approach.

The current approach (simple portfolio) has a number of desirable features – most notably that it is one that is practicable to apply – and so the relevant question is whether the simple portfolio approach provides a sufficiently accurate reflection of reality. It is noted that a sufficient condition for continuing to use the simple portfolio approach would be that:

- there is an approximately linear relationship between the debt risk premium and term – which means that the debt risk premium for debt of the average term will be the same as the average debt risk premium across debt with a range of terms, and
- the debt risk premium that is obtained from considering other types of debt (bank debt and international bonds) is approximately the same as the premium on corporate bonds of the same term issued domestically.

We test these factors in Chapter 5.

2.2.4 Does theory cut short some of the issues?

In the discussion above, it was noted that benchmark assumptions typically are (and suggested, by implication, that they should be) determined on the basis of the observed behaviour of peer firms. There are two matters where there has been debate about whether *a priori* reasoning can short circuit the need to undertake observations or, alternatively, circumscribe the permissible evidence, with these matters being:

- Whether it is valid (and consistent with the estimation of the overall WACC) to have regard to evidence from overseas markets; and
- Whether an efficient term of debt can be inferred, thus obviating the need for empirical observation.

Our terms of reference asked us to address the first of these matters explicitly, and this discussion is set out in Section 2.4.

Regarding the term of the debt, it had been argued that the term of debt to which an efficient regulated business should be exposed is equal to the length of the regulatory period. While it was acknowledged by the relevant expert advisers that firms may need to issue debt with an original term of a greater period in order to manage refinancing risk, it was argued that longer term debt could be converted into debt equivalent to that having a term equal to the length of the regulatory period by:

- using interest rate swaps to convert the underlying base interest rate to one that matches the length of the regulatory period (for example, swapping a 10 year fixed rate obligation into a variable [floating] obligation, and then swapping the variable obligations for two sequential fixed rate obligations), and
- using credit default swaps (CDS) to convert the long term debt risk premium component into sequential premia that reflect a shorter term (for example, buying a 10 year CDS and selling two sequential 5 year CDSs).

It has also been acknowledged that an allowance would also be required for the cost of the additional transactions required.

The first of these propositions – that the underlying base interest rate component can be swapped into an obligation matching the length of the regulatory period – is now reasonably

well accepted where the prices of regulated businesses are reset mechanically with reference to spot interest rates at each price review.[6] It also reflects the behaviour of the privately owned regulated businesses in Australia.[7] We observe, however, that if the cost of debt were instead to be set based upon a trailing average of a benchmark total cost of debt – which is a new option that has recently become available for the regulated energy networks – then this conclusion would change. For example, it has been argued that if a regulator were to apply a trailing average approach over 10 years, and the regulated business was large enough, it would stagger its debt portfolio to provide a natural hedge that follows the regulatory debt cost allowance. Hence, it would not be necessary for these firms to swap their long term debt to align with the regulatory period. However, it would not be efficient for smaller regulated firms to stagger their debt in this way, and these businesses would still need to employ swaps.[8]

However, with respect to the second proposition, where the issue has been analysed in sufficient depth, it has been acknowledged that the required trades in credit default swaps are not feasible. In particular, in addition to a number of conceptual issues that have been raised, there is little liquidity in credit default swaps with terms beyond five years, which would therefore preclude such a strategy.

The discussion above is consistent with the Authority's current position on this matter, namely that the base interest rate component of the cost of debt can be hedged to match the length of the regulatory period, but the debt risk premium that is borne will match the original term of the debt.[9] Accordingly, a benchmark for this term based upon observed behaviour is required, which is part of our terms of reference. In addition, the Authority's framework as described here also means that it is appropriate to focus on the debt risk premium in our work rather than the total cost of debt. This because the total cost of debt at T will not be used by the Authority to set the cost of debt allowance. Rather, the debt risk premium at T will be used as a proxy for CDS costs, and added to the base rate yield matching the regulatory period.

We note for completeness, however, that this matter is not settled between the different regulators, and that there have been decisions where the term of all components of the cost of debt has been calibrated to the length of the regulatory period. While this is not a matter that we are addressing, it is relevant to understanding the differences in estimation method and data sources that different regulators have applied to estimate the debt risk premium for a regulated business. These different methods are discussed in Chapter 3.

2.3 The factors that affect the efficient term and cost of debt

Following from the previous discussion, this section discusses the factors that we expect to influence the term of debt that would be issued by an entity with an efficient approach to issuing debt. It also considers whether there are factors other than the benchmark term and

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6 We observe that the hedging behaviour that is posited would only be efficient if a firm had sufficient certainty that prices would be reset mechanically to reflect changes in underlying interest rates at predictable intervals. Accordingly, this logic arguably is only applicable where firms are subject to price control (rather than less formal forms of regulation) comprising specified periodic price reviews.

7 ETSA Utilities, Citipower, Powercor Australia (13 April, 2012), *Joint Response to AEMC Directions Paper* (ERC0134/ERC0135), p.17.

8 Henryk Smyczynski and Igor Popovic (April, 2013), *Estimating the Cost of Debt – A Possible Way Forward*, Regulatory Development Branch, Australian Competition and Consumer Commission, pp. 24-25.

9 More precisely, the total cost of debt will equate to the debt risk premium corresponding to the original term of the debt measured against the applicable swap rate, plus the swap rate corresponding to the length of the regulatory period (and associated transaction costs). This is almost the same as the debt risk premium corresponding to the original term of the debt measured over the applicable government bond rate plus the bond rate with a term matching the regulatory period – the correct figure will be slightly lower by the extent that the swap rate increases with term more quickly than the government bond rate.

benchmark credit rating that are likely to affect the cost of debt that would be incurred by an efficient approach in the circumstances of the Authority's regulated businesses. We discuss these factors so that we can identify the appropriate sources of evidence for deriving these two matters.

Estimation of the debt risk premium

As shown in Table 2.1 below, apart from the characteristics of private ownership and credit rating, the factors that are not important for the estimation of a debt risk premium are often the factors that are important for estimating the benchmark term of debt at issuance, and vice-versa. This is generally due to the fact that bonds by definition have a credit rating, which subsumes many of the risks that are important in the pricing of bonds.

The level of parental support is an important benchmark characteristic for the analysis of the debt risk premium of bonds, since this will influence the credit rating of the bond if the market perceives that the underlying firm will receive parental support in the event of impending corporate failure. This applies to corporate owners, but more specifically, Government Business Enterprises (GBEs) in Australia, and businesses that may enjoy the support of foreign states (e.g. SP AusNet, which is owned by the Singapore Government). It has been noted by the AER's adviser, Oakvale Capital, that the pricing of SP AusNet bonds is differentiated from other bonds in the same credit rating band due to the strength of the guarantee provided through ownership by a sovereign government.[10]

We conclude that industry membership is generally not important for estimating the debt risk premium, but single out the finance industry as an exception. Market participants consider that the yields of the bonds of banks and finance companies trade materially differently from operating non-financial businesses.[11] Therefore, while a large number of bonds are issued by financial institutions, the benchmark should not include such bonds. However, stock market listing is not an important characteristic for estimating the debt risk premium, as the market pricing data for bonds are available irrespective of the listing of the underlying company's shares on the stock market.

Table 2.1 Importance of benchmark characteristics for estimating the benchmark debt risk premium for bonds compared with a benchmark equity beta

Characteristic	Debt (DRP of bonds)	Debt (Term of issuance)
Private / Public Ownership	Important	Important
Listed / Unlisted	Not important	Technically important (while listed and unlisted firms would not be expected to issue debt for different terms, disclosure about the terms of debt facilities is more detailed for listed firms)
Benchmark financing (gearing)	Not important (subsumed by credit rating)	Important, as this will influence re-financing risk and therefore term.
Credit rating	Important, as this factor captures many of the risk characteristics that would otherwise need to be controlled for.	Important, as the benchmark is required for a specific credit rating.

[10] Oakvale Capital (February, 2011), *Report on the cost of debt during the averaging period: the impact of callable bonds*, Report to the AER, p.24.

[11] In relation to this matter we interviewed Mr. Michael Bush, Head of Fixed Interest Securities at National Australia Bank, who confirmed that the industry practice is to remove the bonds of financial institutions when estimating FVCs for corporate bonds. Formal empirical analysis confirms this. See Edwin Elton, Martin J. Gruber, Deepak Agrawal, and Christopher Mann (February, 2001), 'Explaining the rate spread on corporate bonds', *Journal of Finance*, Vol. LVI, No. 1, p.253.

Characteristic	Debt (DRP of bonds)	Debt (Term of issuance)
Regulated business	Not important (subsumed by credit rating)	Important, as we want a benchmark relevant to regulated businesses
Same industry	Not important (subsumed by credit rating), but some industries may be excluded (e.g. finance sector) if they are priced differently.	Important, as risk characteristics may differ between different regulated industries.
Pure-play business	Not important (subsumed by credit rating)	Important, as other non-regulated activities may affect re-financing risk
Domestic / international data	Not as important, since international bonds are available to domestic firms, a DRP for international bonds is observable, and can be converted to a domestic equivalent. In open capital markets arbitrage opportunities (after transaction costs) should be eliminated by trading.	Important, since international differences in institutional factors (e.g. tax rates and depth of capital markets) may affect gearing and the debt terms that are achievable.
Parental support	Important, since the credit rating of the bond will be influenced by the credit rating of the parent, or the parent's identity. In the case of a state or sovereign country parent the guarantee will be so strong that the bond will price differently in the same credit rating band.	Less important.
Size of business	Not generally important as credit rating indicates a minimum size of business, but may be influenced at the large end due to enhanced liquidity.	Important, since the business may not have a standard capital structure unless it has a credit rating (which requires minimum size).

Source: PwC

In summary, we consider that the sample of corporate bonds should:

- Be domestic bonds or international bonds (depending on whether a simple portfolio approach or complex portfolio approach is undertaken to estimate the debt risk premium);
- Have a credit rating that is the same or similar to the target regulated firm under consideration;
- Not have material state or sovereign government ownership; and
- Not be a financial services company.

Once this sample has been assembled, and credit risk is controlled for, the debt risk premium can be estimated for different terms to maturity. That is, once the credit rating is held constant, the only two variables in the analysis are debt risk premium (dependent variable) and term (independent variable).

Estimating the benchmark term of debt at issuance

With respect to benchmarking the term of debt at issuance, almost every benchmark characteristic is important, since we wish to establish a benchmark for a business with a very strictly defined set of characteristics (e.g. regulated network water businesses rated BBB). However, while private ownership is important, we consider that the level of parental support will not be an important characteristic with respect to benchmarking term of debt issuance. Listed businesses, whether they are dominated by a parent or not, will need to ensure that the capital structure is appropriate to optimise re-financing risk.

The application of a number of benchmark characteristics means that the number of benchmark firms meeting the selection criteria will be small, and that some criteria will need to be relaxed in order to ensure there is a reasonable number of firms in the benchmark

group. Most commonly it is necessary to include regulated network firms that have some operations outside the main regulated activity. However, unless there are no domestic benchmarks, international benchmark firms should be used as cross-checks rather than the primary benchmark, owing to differences in institutional factors (such as access to capital markets).

2.3.1 Benchmark entity for government owned businesses without reference to competitive neutrality

As discussed above, it is the standard (but not universal) regulatory practice for regulated prices to be derived for GBEs in the same manner as privately owned businesses. That is, all regulated businesses should be treated as a privately owned business that is assumed to be subject to full market discipline, including in its capital-raising activities.

However, we have been informed that the Authority at times could be directed by the Queensland Government to analyse the cost of debt for a GBE without reference to competitive neutrality. While in practice GBEs will generally obtain debt finance through a central government borrowing agency, the Authority has advised that in such circumstances, rather than reference the actual FVC for Queensland Government bonds, it may (depending on the treatment of competitive neutrality):

- Apply the actual credit rating of the GBE with an assumption of Queensland Government support; or
- Apply the corporate cost of debt for that rating band; and
- Assume that generally observed corporate debt raising transaction costs apply.

Applying these criteria, the Authority might in future need to estimate the debt risk premium for the AA, and potentially also the AAA credit rating band. Hence, the Authority in its Terms of Reference requested that in addition to the BBB and A credit rating bands, we develop a cost of debt estimation methodology for the AA and AAA credit rating bands.

2.3.2 Regulated infrastructure bonds or general corporate bonds

One issue that the Authority has requested that we review is whether the sample of bonds that is considered in the estimation methodology should be regulated infrastructure bonds, or general corporate bonds. Australian regulatory practice has been to consider the wider definition of bonds on grounds that may include:

- Bloomberg, the major service provider of Australian bond FVCs, only provides general curves (i.e. curves not restricted to infrastructure) for major credit rating bands (BBB, A, AA and AAA), which indicates that Bloomberg does not consider there is enough bond data in the Australian market to produce a reliable estimate of FVCs for the regulated utility segment;[12] and
- The number of observations that would be available by restricting the benchmark set to infrastructure bonds would be too few to derive a meaningful estimate of the debt risk premium.

For the US, Bloomberg publishes estimates of FVCs for a composite index of industrial bonds as well as for utility bonds in the BBB credit rating band. We investigated the size and

[12] We note that in the US Bloomberg does provide separate FVC estimates for regulated utilities and general industrial companies (composite).

direction of differential between these two FVCs since 1991, and found that for the vast majority of this period the yields of utility bonds were lower than those of the composite bonds. Excluding the period of the global financial crisis, this differential was found to be 32 basis points at a term of 5 years and 34 basis points at a term of 10 years.[13] The differential has recently been trending downward, and is currently only 12 basis points. Differences between the Australian and US capital markets and regulatory frameworks make it difficult to assume that the same difference in yields would be observed in Australia.[14]

As there are not enough Australian utility bonds on issue to undertake a similar analysis, we recommend that general corporate bonds be analysed to develop a benchmark cost of debt, which means excluding the bonds of financial institutions (as discussed above).

2.4 The use of foreign market data

As noted above, utility firms obtain debt financing from international markets as well as domestic markets, and the possibility of including international data has been considered by some Australian regulators in the past. In this section we consider whether it is appropriate to use foreign data when estimating the debt risk premium for a benchmark firm, and whether doing so is consistent with the use of a domestic CAPM or other domestic asset pricing model.

2.4.1 Economic Regulation Authority (ERA)

In the Dampier to Bunbury Natural Gas Pipeline (DBNGP) case, DBNGP Transmission Pty Ltd (DBP) obtained advice from its debt markets advisor, AMP Capital Investors (AMPCI), which applied a 'direct market evidence' approach to estimate the cost of debt for DBP.

The 'direct market evidence' approach consisted of looking at recent market evidence of debt deals that were most relevant to DBP taking account of its specific risk profile and credit rating. AMPCI maintained that in the wake of the global financial crisis it is necessary for firms to diversify the term at issuance and sources of funds in order to reduce re-financing risk. This diversification process would include Australian bank debt, Australian bonds, bonds issued in the US public market (144A) and US private placement market. Using this approach, AMPCI estimated that DBP's cost of debt in March 2010 was 9.73 per cent, while in April 2011 it had fallen to 9.52 per cent.[15]

The ERA's draft decision rejected the 'direct market evidence' approach for the following reasons:[16]

- They had not provided 'convincing evidence for different allocations of debt into different markets,' and these allocations made a material difference to the debt risk premium estimate;

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[13] For this purpose we defined the worst period of the global financial crisis as the period from 1 September 2008 to 30 October, 2009.

[14] We estimated the difference between the DRP of domestic utility bonds in the BBB, A- credit rating and the domestic BBB, A- econometric regression curve, and found that the bonds are 1 and 15 basis points higher. This demonstrates that the relationship found in the US may not be applicable to Australia.

We note that this was estimated using a sample 4 BBB bonds and 5 A- bonds, and therefore may not represent a robust sample for a definitive conclusion. BBB+ was not calculated because there are no relevant utility bonds with estimates.

[15] DBNGP (WA) Transmission Pty Limited (14 April, 2010), *Submission 8: Rate of Return – Public Version*, p.22; and AMPCI (April, 2011) *Cost of Debt Summary Paper – Dampier Bunbury Pipeline (DBP)*, p.7. We note that key elements of the approach used to estimate the cost of debt in these documents were redacted, and therefore our knowledge of the exact approach applied is limited.

[16] Economic Regulation Authority Western Australia (14 March, 2012), *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline - Submitted by DBNGP (WA) Transmission Pty Ltd*, p.143.

- A debt risk premium for a specific firm was estimated, and not the debt risk premium for a benchmark firm;
- Under the NGL and NGR the market for funds 'is meant as the Australian financial market'; and
- By including international bonds, there was an inconsistency with the assumptions of the domestic CAPM approach, which is applied by the ERA. Specifically, the ERA noted that:

> In addition, were the debt risk premium to be estimated using data from the US capital market, for consistency, all other WACC parameters such as nominal risk free rate, MRP and inflation would also need to be derived using US data.

When this matter came before the Tribunal, it noted that senior counsel for the ERA had said there is nothing in the National Gas Law (NGL) or National Gas Rules (NGR) that would require the ERA to only look at Australian markets for debt funds, even though this had been the ERA's practice. However, the Tribunal did identify a number of issues with AMPCI's methodology and the use of data from international financial markets:[17]

- If a regulator had to 'consider a swathe of Australian and overseas markets in order to estimate the cost of debt and the DRP, the regulator's task would be of considerably greater dimensions and the scope for disagreement over allocations would likewise be considerably greater';
- Much can change in international capital markets in a short time, and different capital market advisers may have different views of the current market and future trends;
- No substantive details were provided in the April 2011 update about how the final cost of debt estimate was calculated;[18] and
- There were no details or justification of how the proposed hypothetical debt was allocated across the different markets.

In summary, the Tribunal discounted AMPCI's 'direct market evidence' methodology for not being transparent, being highly firm specific, and not easy for the regulator to replicate. On the other hand, while it felt that incorporation of foreign data could unnecessarily complicate the regulator's task, the Tribunal did not rule out the use of foreign evidence on the ERA's theoretical proposition that it would conflict with the 'domestic' parameters that are applied in the CAPM by Australian regulators.

2.4.2 *Independent Pricing and Regulatory Tribunal (IPART)*

IPART has taken a different approach to the ERA, having obtained advice from Professor Kevin Davis that the inclusion of international bonds when estimating the cost of debt would not be inconsistent with the domestic version of the CAPM. IPART's approach is to include a number of bonds in its 'basket' of representative bonds, including bonds issued by Australian businesses in the US.

In February 2011, IPART published its draft decision on developing an approach to estimating the debt margin.[19] During its consultation process, IPART received submissions

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[17] Australian Competition Commission, *Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] A CompT14*, para. 270, and paras. 274-276.

[18] See AMP Capital Investors (April, 2011).

[19] IPART, (February, 2011), *Developing the approach to estimating the debt margin: Other Industries – Draft Decision.*

that argued against the use of US market data to estimate the debt risk premium for a benchmark Australian firm. For example:

- Synergies considered:[20]
  - That the yields on US bonds would be driven by conditions in the US market and it would therefore be inconsistent with the application of a domestic CAPM;
  - That the calculations required to translate yields from the US market are not simple or easily replicable; and
- Sydney Water considered that the use of US data would distance the debt risk premium calculation from the conditions faced by the benchmark firm.[21]

In an appendix to that report, IPART incorporated the advice provided to it by Professor Kevin Davis on the question of whether 'debt costs derived from bond issuance in foreign currencies and swapped back into domestic currency [is] compatible with the use of the a domestic CAPM?'[22] Professor Davis' opinion was that due to varying demand and supply conditions in international capital markets, individual corporate borrowers may at times choose to borrow internationally as it may be a cheaper source of finance, while at other times they will borrow domestically. He also noted, however, that sometimes businesses might choose to borrow internationally even if it was dearer due to the benefits of the market diversification effect that this provides. Another reason for doing so, which was not mentioned by Davis, would be to obtain terms longer than those available in the domestic market. For relatively highly geared businesses it is important to reduce re-financing risk by increasing the average term of debt at issuance, which requires some long term issues.

Professor Davis reasoned that to the extent that debt risk premia are influenced by systematic risk factors, and these vary between different markets, then differences in debt risk premia will develop between different markets, and Australian businesses may wish to take advantage of such opportunities. However, he concluded that this fact does not preclude the use of international data on debt risk premiums when estimating a cost of debt for Australian companies:

> Even though a 'domestic' CAPM is used for the estimation of required returns on risky assets (equities), and required returns on debt could be derived from a (domestic or international) CAPM framework, the commonly adopted approach to estimating debt costs is an empirical, observational, one, not based in asset pricing theory. In that approach, actual current borrowing costs of comparable companies are observed, and used as a benchmark… Because required returns on debt can, unlike those for equity, be directly observed, there is no need to refer to a specific asset pricing model. Thus, debt costs observed in international markets can be combined with costs of equity derived from a domestic CAPM.

2.4.3 Conclusion on the use of foreign debt markets data

Neither the Tribunal nor Professor Kevin Davis concluded that on theoretical grounds it is inappropriate to apply foreign market debt data to estimate a debt risk premium for Australian firms. We concur with this view, as the estimation of the cost of debt is an empirical exercise, given the fundamental observable nature of debt risk premia, notwithstanding the current difficulty in obtaining an estimate with a low degree of estimation error. However, a number of issues remain, including questions about the ease of

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[20] Synergies (December, 2010), *Synergies submission*.

[21] Sydney Water (December, 2010) *Sydney Water submission*.

[22] Kevin Davis (13 December, 2010), *Determining Debt Costs in Access Pricing*, Appendix A in IPART (February, 2011), pp.37-47.

estimation, replicability of results, the benchmark behaviour of firms, and the movement of cost of debt relativities between different markets. [23]

In our view, the application of foreign debt market data to estimate the debt risk premium for the benchmark Australian firm requires:

- Establishing the benchmark financing behaviour of the benchmark firm, i.e. discovering how much debt on average is sourced from which overseas markets;
- Establishing a clear and replicable methodology for the conversion of foreign market data to Australian dollar equivalent terms;
- The estimation of all additional transaction costs that would be incurred in sourcing debt from international markets; and
- Undertaking a comparative analysis over a reasonable period of time to assess whether the cost of debt differentials implied by a consideration of international debt market data is justified by the additional complexity and data gathering costs, and the potential for more disagreement (as foreshadowed by the Tribunal).

In Appendix C below we present the methodology that we have applied in this report to convert foreign market data to Australian dollar equivalents, and in Appendix D we provide a worked example. Benchmark financing behaviour with respect to both domestic and international sources of finance is examined below, while the comparative analysis required to assess the relative merits of incorporating international data is undertaken in later chapters of the report.

2.5 Benchmark business financing practices

2.5.1 Benchmark assumptions

As discussed above, an important part of the benchmark framework is establishing what an efficient firm in the circumstances of the regulated business would do in practice, which we have noted is typically and appropriately determined by observing the practice of actual firms. With respect to the scope of this task:

- For the *debt risk premium*, additional benchmarks are required for the assumed credit rating (which we do not cover) and the term of debt (discussed below). In addition, if the complex portfolio approach is adopted, then further benchmarks are required about the types of debt that a regulated business may issue, the country the debt is raised in, the term of the different types of debt and the weightings of each.
- For the *term of debt*, we also need benchmark assumptions about the credit rating (which we do not cover) and the gearing level (which we do not cover).
- For the *debt raising transaction costs*, benchmarks about the type and origin of debt is required (as above), but in addition a benchmark is required for the size of standard debt issues (given that some of the costs are incurred on a per issue basis).

In addition, we also impose a number or policy or consistency constraints on the exercise, the most important of which is that the entity is a stand-alone, privately owned entity (albeit

[23] We also note that estimation of parameters for the CAPM are not strictly based on a domestic CAPM either, because foreign investors influence the observed market risk premium, the risk free rate, and beta. The equity and debt components of cost of capital are estimated with different approaches, the former generally uses the CAPM while the latter does not, but both require empirically based parameters that have been influenced by international market factors (forces).

noting the discussion above that the Authority may be asked at times to relax this constraint).

For the two benchmarks that we are not addressing expressly – the credit rating and gearing level – we assume that the entity has (and must retain) an investment grade credit rating and is geared consistently with respect to standard regulatory practice. The most common gearing assumption is a benchmark of 60 per cent, although this benchmark gearing level may vary depending on the industry. The Authority has requested that our analysis consider benchmarks for regulated entities in the range of industries that it regulates.

In order to derive the remaining benchmark assumptions, it is necessary to look at how peer entities to benchmark regulated businesses actually finance themselves, which we address here. We first derive the group of entities that we are using as the peer group for the purpose of establishing the benchmark.

2.5.2 Peer group for the firms the Authority regulates

The major businesses that are regulated by the QCA are:

- Water network businesses; and
- Infrastructure businesses such as the Dalrymple Bay Coal Terminal (DBCT) and Aurizon.

In order to find appropriate benchmark comparators for these businesses, we conducted a search the Bloomberg service. Initially, we searched for Australian and UK firms (to provide a cross-reference) with operations in the following activities:

- Water and wastewater transmission/distribution;
- Electricity and/or gas transmission and/or distribution;
- Below rail (coal) services;
- Coal port terminal services; and
- Other transport infrastructure (airports and toll roads)

In Australia we found 5 listed regulated energy transmission and distribution businesses that were considered valid comparators for the water transmission/distribution businesses regulated by the Authority:

- APA Group;
- DUET;
- Envestra Limited;
- Spark Infrastructure; and
- SP AusNet.

We found that there were no listed below-rail (coal) service businesses in the world. There was only one listed coal port terminal business, Westshore Terminals in Vancouver, but this business is not a valid comparator for DBCT since a material proportion of its loading contracts are linked to the price of coal. We found 6 Australian comparator firms with airport and toll-road operations, but considered that their greater revenue volatility and non-regulated status made them invalid comparators for below rail (coal) services and coal port terminal services.

On the other hand, in the UK we found 6 listed businesses of sufficient size that were in energy transmission/distribution and/or water transmission/distribution:

- National Grid;
- Pennon Group;
- Scottish & Southern Energy;
- Severn Trent;
- United Utilities; and
- Western Power Distribution.

2.5.3 *Benchmark portfolio of debt*

We would expect that prudent managers of regulated businesses would diversify their debt across a number of different sources and across different terms in order to maximise their refinancing options. Benchmark behaviour with respect to term at issuance is discussed separately below.

Major sources of debt funding that are available to Australian regulated infrastructure firms include:[24]

- Bank debt:
  - Term debt;
  - Revolvers; and
  - Facilities.

  It is typical for the domestic bank debt market to provide loans for terms of 3 to 5 years, with terms greater than 5 years being relatively rare. Bank debt facilities are often used to provide 'head room' for contingencies, such as capital expenditure programs or initial funding for acquisitions. A large portion of these bank facilities may never be used.

  Debt raising costs for bank debt have not previously been analysed for regulatory purposes.

- Domestic bond market:
  - Medium Term Note (MTN) market; and
  - CPI indexed bond market

  The CPI indexed bonds have been issued for long (10 years plus) terms in the past, but this market is currently inactive due to relatively low inflation. Issuance terms for domestic MTNs are in a range of 3 to 15 years.

[24] Hybrid debt instruments, which have both debt and equity characteristics (through a conversion option), are not commonly employed by regulated businesses.

There has been considerable analysis estimating debt raising transaction costs for domestic bonds.

- Offshore capital markets:
  - USPP (Private Placement) market – this US-based market provides issuance terms between 5 and 30 years, and has historically had an issuance capacity of USD40 billion per year;
  - US144A public market - this US-based market provides issuance terms between 5 and 30 years, and has enabled issuers to raise in excess of USD2.5 billion in a single issue;
  - Sterling (UK) market;
  - European (Eurodollar); and
  - Asian bank and bond markets.

  Debt raising costs for international bond issues have not previously been analysed for regulatory purposes.

  Large volumes of long-term debt are being raised in international capital markets, which helps Australian regulated businesses to complete their funding programs as well as assisting them to control their refinancing risk. If access to international markets were not available, shorter borrowing profiles would be the likely result, and the refinancing risk faced by Australian firms would be correspondingly greater.

Results for benchmark debt portfolio

Table 2.2 shows the current breakdown of the debt portfolios of 5 listed Australian regulated energy transmission and distribution businesses that were identified above. We based the analysis on the latest annual report for these businesses, as well as referencing additional information sources such as Bloomberg and Loan Connector. We calculated the proportions of debt for each category based on two approaches:

- The proportion that that type of debt comprises of the total debt of all types across all businesses; and
- The proportions based on the average of the proportions observed in the five businesses.

These proportions were relatively similar, however we recommend reliance on the numbers based on the average of the businesses, as this will give a better reflection of benchmark behaviour.[25] The two approaches give reasonably similar results, with the preferred approach giving a 50 per cent weighting to domestic corporate bonds, a 23 per cent weighting to international bonds, and a 27 per cent weighting to bank debt.[26]

[25] When considering benchmarks in relation to other WACC parameters it is common to take the average of observed values for comparator businesses rather than weighted averages (e.g. in equity beta estimation).

[26] The proportions based on proportions of total debt were: bank debt 27 per cent; domestic bonds 47 per cent; and, international bonds, 26 per cent.

Table 2.2 Australian listed regulated energy: current debt portfolios (2012)

	APA	DUE	ENV	SKI	SPN	Average
Bank debt	27%	38%	24%	17%	28%	27%
Domestic bonds	15%	52%	76%	83%	26%	50%
International bonds	59%	10%	0%	0%	46%	23%

Source: Bloomberg, Loan Connector, Annual Reports

The precise approach of how we obtained the data to arrive at the figures is explained in Appendix A.Appendix E

2.5.4 *The benchmark term of debt issuance*

The typical benchmark regulated business is generally assumed to have a substantial amount of debt (50 to 60 per cent of the value of the enterprise). From first principles we would expect that on average, a typical benchmark regulated business would issue debt for a period longer than the typical regulatory period of 5 years. A prudent debt manager would seek to issue debt that results in a relatively even and manageable debt refinancing task in each year. Limiting the annual refinancing obligation reduces the exposure of the firm to unforeseen events in financial markets that may make refinancing difficult or excessively costly in the short term.

The annual refinancing task is directly dependent on the term of debt at issuance. For example, ignoring growth, if only ten year term debt were to be issued and structured so the refinancing task is constant, then 10 per cent of the portfolio would need to be refinanced each year. If instead, 5 year debt were to be issued, this would raise the annual refinancing task to 20 per cent of the portfolio.

Australian energy network industries – benchmark term of debt issuance

Following the methodology outlined in Appendix A below, and as shown in Table 2.6, we found that for the 5 listed Australian businesses involved in gas and electricity transmission/distribution, the average (median) term of debt at issuance is 10.2 (9.3) years. This average is calculated using each business' weighted average term at issuance for each source of debt employed, using the amounts of debt issued within each source as weights to calculate the weighted term for that source (i.e. for domestic and foreign bonds, and bank debt).

One issue that arises is what influence the ability to credit wrap bonds [27] in the pre-global financial crisis period had on the term of debt at issuance, given that the credit wrapping institutions collapsed during the crisis.[28] When we re-estimated the term of debt at issuance excluding embedded formerly credit-wrapped debt, the average (median) term reduced to 7.9 (7.7) years. However, it is likely that if businesses were seeking longer terms to reduce re-financing risk, in the absence of credit wrapping they would have obtained more long-term debt in international markets. In other words, in the absence of the credit wrapping institutions, the average term of debt at issuance is likely to have been close to the approximately 10 year term currently observed.

[27] A credit wrapped bond is a bond that has been insured by a third party.

[28] Prior to the global financial crisis AAA-rated credit wrapping institutions such as MBIA and Ambac provided guarantees to pay interest and principal payments for otherwise BBB-rated businesses in return for a fee, which enabled them to issue longer term debt than otherwise. See RBA (August, 2008), *Statement on Monetary Policy*, Box B: The domestic credit wrapped bond market.

Table 2.6 also compares the current debt terms at issuance for Envestra, Spark Infrastructure and SP AusNet with the debt terms that were provided to the AER by several of these businesses in 2008-9. This comparison shows that Envestra's weighted average debt term at issuance has risen from 14.4 years as at 2007, to 16.3 years as at the last balance sheet date. We also find that SP AusNet's debt term at issuance has risen from 7.3 to .8.5 years, and Spark Infrastructure's (ETSA/Citipower/Powercor) debt term at issuance has fallen from a range of 10.4 to 10.8 years, to 9.3 years.

Table 2.6 Australian network infrastructure – weighted average term of debt at issuance (31 December, 2012)

Company	Industry	Total debt issued (AUD millions)	Date	Weighted average term at issuance (actual debt)	
Residual debt term				**2007[b]**	**2012[a]**
APA Group	Gas	4,192	31 Dec. 12		9.8
DUET	Elect./Gas	5,200	31 Dec. 12		7.4
Envestra Limited	Elect./Gas	1,248	31 Dec. 12	14.4	16.3
Spark Infrastructure	Elect.	4,700	31 Dec. 12	10.4-10.8	9.3
SP AusNet	Elect./Gas	4,716	30 Sep 12	7.3	8.3
Average					**10.2**
Median					**9.3**

Source: Bloomberg, Loan Connector, annual reports. Notes: a) Assumes unaccounted for bank debt issued at 3 year term. b) AER (2009)

Table 2.7 below shows the weighted average term for the energy network infrastructure businesses for the three major categories of debt. The average term at issuance of bank debt is 4.9 years, for domestic bonds is 11.6 years, and for international bonds is 10.8 years. Envestra stands out in this group with average issuance term of 19.5 years for domestic bonds.

Table 2.7 Australian listed regulated energy: weighted average term at issuance of current debt (2012)

	APA	DUE	ENV	SKI	SPN	Average
Bank debt	5.7	5.1	6.0	3.4	5.0	5.0
Domestic bonds	13.1	8.1	19.5	10.5	9.4	12.1
International bonds	10.8	12.4	-	-	9.7	11.0
Weighted average. term	9.8	7.4	16.3	9.3	8.3	10.2

Source: Bloomberg, Loan Connector, Annual Reports

United Kingdom water and energy network industries – benchmark term of debt issuance

Results for United Kingdom regulated energy and water businesses are shown in Table 2.8 below and demonstrate that these businesses issue long term debt. For our sample of 6 listed electricity, gas and water businesses with transmission/distribution activities we found a current weighted average term of debt at issuance of 21.3 years. The UK's average debt term was found to be considerably longer than in Australia, no doubt due to the greater access that infrastructure firms have to deeper and more liquid bond markets in Europe and the US. This implies that UK network infrastructure firms are subject to less refinancing risk than Australian firms in the same industry.

Table 2.8 United Kingdom network infrastructure – weighted average term of debt at issuance (at 31 March, 2012)

Company	Industry	Total debt issued (GBP millions)	Weighted average term at issuance (years)
National Grid	Electricity/Gas	22,589	19.9
Pennon Group PLC	Water	730	27.3
Scottish & Southern Energy	Electricity	5,141	15.2
Severn Trent	Water	4,179	21.1
United Utilities PLC	Energy/Water	5,656	21.9
Western Power Distribution	Electricity	4,782	22.1
Average			**21.3**

Source: Bloomberg, Loan Connector, annual reports

Conclusion on benchmark term of debt at issuance

Whilst we found evidence that energy and water transmission/distribution businesses in the UK, with a similar regulatory framework as Australia's, issue debt for an average term of 21 years, this is most likely due to their access to deeper capital markets in Europe and the US. In Australia the evidence for the current debt held by listed energy transmission/distribution businesses suggests a benchmark term of debt issuance of approximately 10 years is an appropriate assumption. This implies that we require an estimate of the debt risk premium up to 10 years. However, if a debt portfolio approach were to be adopted, for domestic and international bonds we would require estimates of the debt risk premium beyond 10 years (since the average benchmark terms for these debt categories exceed 10 years).

The appropriate term of debt at issuance is a matter that should be revisited periodically. We recommend that the Authority reviews the benchmark term of debt assumption each time it sets a regulatory cost of debt (unless there has been a review within the past 12 months where the benchmark term had already been assessed).

2.5.5 The benchmark size of debt issuance

The standard issuance size is the average amount of debt issued per debt tranche. Debt is usually issued as a portfolio of tranches, of which a single tranche may comprise a package of multiple tranches separated by characteristics such as maturity and risk. For example, a business may issue a $1 billion debt portfolio, separated by five $200 million issues of corporate bonds.

Estimating the standard issuance size is important because some debt raising transaction costs are applied to an individual issue, while others are applied to the whole portfolio. Debt raising transaction costs comprise:

- An arrangement fee - applicable to each individual issue; and
- 'Other' fees associated with the debt raising - applicable to the whole portfolio.

Owing to our expanded brief, we need to estimate the standard issuance size of domestic corporate bonds but also international corporate bonds and bank debt. In previous studies, we have made a simplifying assumption that debt is financed through Australian domestic corporate bonds, which were found to be issued in $175 million increments, and more recently in $250 million increments. While this needed to be updated in the current report, our Terms of Reference also required us to estimate the issuance size of the other types of debt under the debt 'portfolio' approach.

Table 2.9 shows the average issuance sizes of the three classes of debt financing over the period 2008 to 2013, which were $250 million for domestic corporate bonds, $150 million for international corporate bonds, and $165 million for bank debt.

Table 2.9 Network utility businesses - standard issuance sizes for alternative types of debt (2008-2013)

Debt category	$ millions
Domestic corporate bonds	250
International corporate bonds	150
Bank debt	165

Source: Bloomberg, Loan Connector, PwC analysis

Building an issuance size data set

In order to estimate standard debt issuance sizes, we built up a data set of debt issues by comparable businesses. There are two categories of businesses that the Authority regulates, or may potentially regulate:

- Infrastructure businesses- These are businesses with a high degree of market power but that may face a greater degree of demand risk than a network business. This includes commercial ports, (non-coal) below-rail services and certain local government operations; and

- Regulated network utility businesses - These are network utility businesses that have material market power, but experience relatively low demand risk. This includes below-rail services (coal) and water networks.

We accessed the Bloomberg data terminal to compile a list of Australian businesses that met the definition of an infrastructure or network business. Bloomberg compiles a list of Australian companies according to general industry categories such as retail, government and others, based on Bloomberg's industry classification framework. Using Bloomberg's classification framework, we downloaded a list Australian energy, water, transport and telecommunications businesses. The initial sample of companies was then filtered by removing:

- Non-infrastructure businesses based on Bloomberg's descriptions of a business' operations and purpose;

- Businesses that did not report data; and

- Businesses that did not derive the majority of their revenue from an infrastructure arm.

This produced a list of 12 businesses[29] that we defined as infrastructure businesses. We then further filtered for network utility businesses, reducing the list further from 12 to 6 businesses[30]. The Bloomberg and Loan Connector databases were then used to download bond and bank debt data for our sample of comparators. For the comparator group we first

[29] The firms were: APA Group, DUET, Envestra, Jemena, Spark Infrastructure and SP Ausnet, Adelaide Airport, Australian Infrastructure Fund, Hastings Diversified Utilities Fund, Macquarie Atlas Roads, Sydney Airport, Transurban.

[30] APA Group, DUET, Envestra, Jemena, Spark Infrastructure and SP Ausnet. As a separate exercise, we calculated the average issuance size of bonds for the group of businesses that was excluded, and found that it did not differ materially from the size calculated for the network infrastructure group.

downloaded a list of bond and bank debt securities from Bloomberg that were on issue between 2008 and 2013. We then augmented and cross-checked all bank debt securities using Loan Connector, and added to our data set a number of securities that were not identified by Bloomberg. This formed our database for the analysis of standard issuance size.

Estimated domestic bond issuance size

Based on bonds on issue between 2008 and 2013, we found that Australian regulated network businesses issued bonds in $250 million increments, the same as we found in our earlier study.[31] This was estimated by taking the median issuance size of 21 network business bonds, as shown in Table 2.10 below.

Table 2.10 – Domestic bonds issued by Australian network utility businesses

Bond issuance date range	2004 – 2010	2008 – 2013
Number of bonds	17	21
Total debt	$4,655m	$5,275m
Average issue size	$274m	$251m
Median issue size	$275m	$250m
Fixed coupon bonds (% of value)	47.1%	71.4%

Source: PwC's analysis, Bloomberg, Loan Connector

Estimated international bond issuance size

Using the same 2008 to 2013 period, we found that the median issuance size of international bonds issued by network utility businesses was approximately $150 million. This was estimated by reference to a sample of 28 Network utility bonds. The major reason for the drop in median issuance size for network businesses compared with infrastructure businesses was that network utility businesses have issued more Asian bonds. From our data, the standard issuance size of Asian bonds was on average smaller than for American or European bonds, and this decreased the median estimate.

Table 2.11 – International bonds issued by Australian network utility businesses

Bond issuance date range	($ millions)
Number of bonds	28
Total debt	$6,691
Average issue size	$239
Median issue size	$151
Fixed coupon bonds (% of value)	89.3%

Source: PwC's analysis, Bloomberg, Loan Connector. Note: Values converted to AUD at time of issuance.

[31] PwC, (April, 2012), *Powerlink debt and equity raising costs.*

3 Alternative debt risk premium estimation methodologies

3.1 Introduction

In this chapter we describe alternative approaches that have been used to estimate a 10 year (or T year) cost of debt. The advantages and disadvantages of the alternative methodologies are considered against the background of the analytical framework that was developed in Chapter 2 above. The methodologies considered are:

- the ERA's bond yield methodology;
- IPART's methodology;
- The AER's previous simple average methodology; and
- The AER's current extrapolated Bloomberg FVC methodology.

3.2 Cost of debt estimation methodologies

3.2.1 ERA's bond yield methodology

Outline of the ERA 'bond yield' methodology

The ERA developed its approach to debt risk premium estimation in a discussion paper that it issued on 1 December 2010.[32] The ERA expressed a concern that most bonds in the Australian capital market at the time had a maturity term well below 10 years. The ERA identified a trade-off between:[33]

- *Consistency* – That is, consistency between the debt risk premium and other WACC parameters, such as the nominal risk free rate and market risk premium being based on a 10-year term; and
- *Market Relevance* – That is, how well the estimated debt risk premium reflects prevailing conditions in the market for funds and the risks faced by the service provider.

The ERA placed greater weight on market relevance relative to consistency with other WACC parameters. It considered having a large sample of bonds over a range of maturities is more important than analysing a small number of bonds with a maturity close to 10 years.

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[32] Economic Regulation Authority (Western Australia) (1 December, 2010), *Measuring the Debt Risk Premium: A Bond-Yield Approach*.

[33] Economic Regulation Authority (Western Australia) (1 December, 2010), p. 8.

The ERA's methodology, as currently applied, can be described as follows:

- For the assessed benchmark credit rating (e.g. BBB/BBB+ or A-) select a sample of bonds that:[34]
  - Have a remaining time to maturity of 2 years or longer;
  - Are issued in Australia by Australian entities and denominated in Australian dollars;
  - Are fixed bonds and floating bonds; and
  - Include both bullet and callable/puttable redemptions.
- Rely exclusively on the Bloomberg service for bond yields; and
- Calculate a 'combined weighted average debt risk premium' based on a combination of weights depending on:
  - The remaining term to maturity, and
  - The issuance size of the bond.

The first application of the methodology was to ATCO, which appealed to the Tribunal. On 8 June, 2012, the Tribunal concluded that there had been 'no error in the ERA's decision to depart from the Bloomberg FVC as a basis for estimating the DRP', but disagreed with the form of weighting adopted.[35] The ERA then re-estimated a debt risk premium based on a 'combined weighting' methodology that increased the weighting given to a bond's yield if it had a longer term to maturity and larger size of issuance. The ERA's 'combined weighting system' multiplies the issue size weight (i.e. the percentage that the bond's issue size comprises of total issuance size of the sample) by the maturity weight (i.e. the percentage that the bond's years to maturity comprises of total years to maturity of the sample). The multiplied value for each bond then becomes the basis for a 'combined weighting', which is then multiplied by the bond's observed debt risk premium to calculate its 'contributed debt risk premium'. The sum of the 'contributed debt risk premiums' for all bonds in the sample derives the ERA's overall debt risk premium estimate.

On 28 February, 2011, in its Final Decision on WA Gas Networks Pty Ltd (ATCO), the ERA applied the approach to estimate a debt risk premium.[36]. The approach was adopted in the ERA's 2011 Dampier to Bunbury Natural Gas Pipeline decision, and its recent Water Corporation decision.[37]

Observations on the ERA's methodology

A shortcoming of the ERA's methodology is that does not estimate a debt risk premium for a corporate bond with a selected term to maturity (T). Since it relies on bonds with terms exceeding 2 years to maturity, the term for which the methodology estimates a debt risk premium is determined by the composition of bonds that happen to be in that sample. For

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34 As noted previously, the establishment of the benchmark credit rating is beyond the scope of this report.

35 Application by WA Gas Networks Pty Ltd (No 3) [2012] A CompT12, Para 176.

36 Economic Regulation Authority (Western Australia) (28 February, 2011), *Final decision on WA Gas Networks Pty Ltd proposed revised access arrangement for the Mid-West and South-West Gas Distribution Systems*, pp. 75-92.

37 ERA (25 September, 2012), *Draft Report – Inquiry into the Efficient Costs and Tariffs of the Water Corporation, Aqwest and the Brusselton Water Board*, p. 119.

example, during the 20 business days to 20 December, 2010, a debt risk premium of 289 basis points was estimated using the ERA's methodology, which was close to the simple average of 286 basis, and the average term to maturity of bonds in this sample was 5.2 years.

In its Discussion Paper, and in the ATCO decision, the ERA stated that 'any measure that relies on a small sample of data points will be less reliable than one based on a larger sample.'[38] We do not agree with this justification of the ERA's methodology as it derives a precise estimate of something that we know to be wrong. As discussed in Chapter 2 above, the weight of academic and practitioner opinion is that bonds with a longer term to maturity will require a higher debt risk premium. Hence, the ERA's estimation methodology will not provide an accurate estimate of the 5 year debt risk premium, and will necessarily underestimate the 10 year debt risk premium.[39]

The ERA considered its weighted average debt risk premium (as at 20 December 2010) to be a close estimate of the likely value of the then current 10 year BBB+ debt risk premium. This was based on an inappropriate test, in which the ERA looked at a period prior to the global financial crisis (2005 to 2007) and considered that the resulting 'error of estimate' of 13 to 34 basis points (i.e. the 'bond yield' approach estimate relative to the 10 year yield then estimated by Bloomberg BBB) was low. However, this test was not appropriate because in 2005-2007 the relationship between the debt risk premium and term was very different to the current period. During the 2005-2007 period the debt risk premium increased by only 15 basis points between terms of 5 and 10 years, which was materially lower than the 30 basis points rise that is typical currently (based on the extrapolated Bloomberg FVC).

The ERA's approach is based exclusively on Bloomberg's bond data, and therefore does not access a large number of floating rate bond data that is reported by UBS. The Tribunal endorsed the use of floating rate bond data and using information from UBS.[40] In addition, the ERA's approach does not benefit from the additional perspectives that can be obtained by applying more sophisticated econometric analysis, i.e. the ability to employ a richer data set to produce better estimates of the debt risk premium.

Conclusion on ERA methodology

The ERA recently adopted a 5 year term for the risk free rate, and has argued that it has not seen evidence that regulated network infrastructure firms issue debt for terms exceeding 5 years.[41] However, the ERA did not provide a comprehensive analysis of the market practice of comparable regulated network infrastructure businesses. The ERA's analysis was based on annual report and Standard & Poor's data relating to the remaining term to maturity rather than the term at issuance, which is relevant to the debt risk premium.[42] As we found in Chapter 2 above, while there was some reduction in issuance term during the global financial crisis, for outstanding debt, the average term of debt at issuance is currently approximately 10 years.

The ERA's approach is based on the Bloomberg data set and does not benefit from the important contribution of UBS data, particularly the component relating to floating rate bonds. The ERA's combined weighting system effectively calculates a debt risk premium that

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38 Economic Regulation Authority (Western Australia) (1 December, 2010), p.9.

39 PricewaterhouseCoopers (March, 2012), *SP AusNet, MultiNet Gas, Envestra, and APA Group: Estimating the benchmark debt risk premium*.pp.23-24.

40 For example: 'The Tribunal considers that, as a matter of principle, floating rate bonds ought to be taken into account and treated equivalently to fixed rate bonds.' See Australian Competition Tribunal, Application by ActewAGL Distribution [2010] ACompT 4, par. 58.

41 ERA (29 March, 2012), *Draft Decision on Proposed Revisions to the Access Arrangement for the Western Power Network*, p.177.

42 The debt risk premium incurred by a firm depends on the issuance term, and is invariant to the remaining term to maturity. If a debt structure is evenly spaced over time, with an average term at issuance of 10 years, at any point in time the term to maturity of that debt structure will be approximately 5 years.

is often very close to the simple average, materially under-estimates the debt risk premium for a 10 year bond, and is likely to over-estimate the benchmark debt risk premium for a benchmark 5 year bond. The weighting system was originally designed provide greater weight to longer term bonds in an attempt to estimate the 10 year debt risk premium. With a target 5 year term the weighting system provides greater weight to bonds with terms beyond 5 years, and since these will generally have higher debt risk premiums, other things being equal (e.g. the data sources used), this component of the methodology will be likely to result in an over-estimate of the 5 year debt risk premium.

3.2.2 IPART's methodology

IPART's methodology

IPART selects the Bloomberg 5 year FVC as one observation and averages this together with a selection of Australian and international bond issues by Australian firms to estimate a 5 year debt risk premium. More specifically, IPART's Final decision on estimation of the debt risk premium was as follows:[43]

> 1. We will use data from the Australian and US bond markets and the Bloomberg BBB fair 5-year value curve. We will sample bonds from the Australian and US market that meet the following criteria:
>
> – bonds are issued either in AUD or USD by Australian firms
>
> – bonds have a remaining term to maturity of at least 2 years
>
> – bonds have a credit rating of BBB to BBB+ according to Standard & Poor's
>
> – bonds are fixed, unwrapped and have no embedded options
>
> – the issuing company is not affected by factors such as M&A activity
>
> – prices are available from Bloomberg.
>
> 2. We will adopt the median of the sample of observations to select a point estimate for the debt margin.
>
> 3. We will target a 5-year term to maturity for the debt margin, inflation adjustment and risk free rate.
>
> 4. We will include an allowance of 20bp per annum on the debt margin for debt raising costs.

IPART determined to reduce the term of the debt risk premium to 5 years based on the arguments of Professors Kevin Davis and Martin Lally that the term of the risk free rate should match the regulatory period in order to satisfy the NPV=0 principle. IPART noted that other regulators have accepted this advice:[44]

> Other Australasian regulators, including the Queensland Competition Authority (QCA) and the New Zealand Commerce Commission (NZCC) have accepted the advice of Lally on this issue and moved to a 5-year term assumption. Since we released our draft decisions, the Economic Regulation Authority (ERA) in Western Australia has adopted a 5-year term for the market-based parameters.

IPART also looked at some evidence relating to funding practices, and considered that:[45]

> The findings of the AER in its 2009 review of the WACC were not conclusive as to whether the typical utility portfolio had an average maturity of 5 to 10 years. The review did not resolve whether utilities seek to align debt issues with either the physical asset or the regulated cashflows.

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43 IPART (April, 2011), *Developing the approach to estimating the debt margin, Other Industries – Final Decision*, Box 1.1, p.2.

44 IPART (April, 2011), p.20.

45 IPART (April, 2011), p.21.

IPART concluded that new evidence provided by stakeholders to its review 'did not support the view that the benchmark regulated network utility obtains, or prefers to obtain, longer-term debt.'[46] It also referred to the AER's conclusion during the WACC review, that its retention of the 10 year term assumption was a 'conservative position which is expected to result in over-compensation on average' of 18 basis points per annum.[47]

Application of IPART's methodology

IPART applied its debt risk premium methodology when determining the weighted average cost (WACC) of the Sydney Desalination Plant (SDP) in December 2011.[48] The evidence comprised:

- The Bloomberg 5 year BBB FVC, with a debt risk premium of 342 basis points;
- Eleven Australian bonds issued in the Australian bond market with an average debt risk premium of 324 basis points; and
- Four Australian bonds issued in the American bond markets with an average debt risk premium of 334 basis points.

The simple average of the 16 debt risk premium data points (15 bonds and the Bloomberg BBB FVC estimate) was 328 basis points. IPART added 20 basis points for debt raising transaction costs, and rounded the resulting total cost of debt value to 350 basis points.

Observations on the IPART methodology

In its Table 4.2 IPART's Final decision gives the impression that both the QCA and NZCC estimate a debt risk premium for a 5 year term, when in fact the QCA takes account of the fact that due to refinancing risk the benchmark term of debt issuance (T) is likely to be longer than the regulatory cycle. The Authority needs to estimate the debt risk premium at T (currently 10 years) as part of the process of proxying the value of a Credit Default Swap (CDS) contract that could be used by the benchmark firm to align its financing with the term of the regulatory cycle.

IPART's methodology does not clearly specify its underlying assumption about the benchmark entity and its financing. In the SDP case mentioned above, a 1/16th of the outcome was provided to the Bloomberg 5 year FVC (which itself is meant to be an estimate of the fair value yield of 5 year bonds), while an 11/16th weight was assigned to domestic bonds and a 4/16th weighting was assigned to US bond issues by Australian firms. As mentioned previously, the dominant regulatory approach has been to assume the simple portfolio (comprised only of Australian bonds), but IPART's methodology does not appear to explicitly articulate a complex portfolio framework.[49]

3.2.3 The AER's old methodology

The AER's old methodology to estimate the debt risk premium was to identify a sample of Australian corporate bonds with a credit rating of BBB+ and one notch either side (i.e., BBB, BBB+ and A-) with a term to maturity between 7 and 13 years and to calculate a simple

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46 IPART (April, 2011), p.21.

47 IPART (April, 2011), p.24.

48 IPART (December, 2001), *Review of water prices for Sydney Desalination Plant Pty Limited*, pp.86-87.

49 We note that coincidentally, the weighting given by IPART to US bonds was 25 percent, which is close to the benchmark proportion of international bonds that we have found. However, the average term of IPART's debt was targeted at a term of 5 years rather than the benchmark term of international debt raised by benchmark firms, which is closer to 10 years.

average of those yields (i.e. T±3 years). All bonds on issue (i.e. both fixed and floating rate) were included if:

- there were no strong qualitative grounds to indicate the bond was unrepresentative of a benchmark 10 year, BBB+ rated Australian corporate bond, and
- the bonds were either standard, or able to be adjusted to remove the effect of non-standard features.

For each bond the debt risk premium was calculated as the average of the Bloomberg and UBS debt risk premiums where both sources were available, and using one of the sources otherwise. At this time the AER was concerned with the appropriateness of the Bloomberg method, and identified a series of concerns with that method, including its lack of transparency. The approach was applied in the draft decisions of Powerlink and Aurora Energy.

Observations on the AER's old methodology

The AER's objective was to incorporate a wide set of market evidence to interpret that information in an unbiased manner. Whilst this was a desirable objective, there were a number of weaknesses in the approach:

- It made no reference to the Bloomberg FVC, which we believe should be taken into account alongside a direct interpretation of the market evidence.
- The old AER methodology was vulnerable to sample composition bias. By including bonds within say 3 years of the target term (i.e. T±3 years), if T=10, this required observations of bonds with terms of between 7 years and 13 years. If there happened to be fewer bonds in the 10-13 years range, the sample average term would fall below 10 years. However, even if the average term of the sample were to be exactly 10 years, an outlier (either positive or negative) could have had a material effect (either positive or negative) on the debt risk premium estimate.
- The AER's previous approach did not take account of the debt risk premium information contained in bonds with terms less than 7 years and exceeding 13 years.

3.2.4 Current AER methodology (extrapolated Bloomberg FVC)

As discussed above, in 2009 the AER undertook a detailed review of cost of debt estimation and concluded that a 10 year term was appropriate given the observed practice of regulated businesses, although it considered there was 20 basis points over-compensation for the regulated business (equivalent to the term premium on the CGS yield between 5 and 10 years). [50]

The current AER approach relies on the Bloomberg BBB FVC up to 7 years, and extrapolation of the 7 year Bloomberg curve to 10 years using the 'paired bonds' extrapolation methodology. The logic behind using the paired bonds of a single issuer to estimate the change in the debt risk premium from 7 to 10 years is that this holds constant the quality of the issuer, so that the difference in the debt risk premium between the two bonds may be fully attributed to term.

[50] AER (9 May, 2009), p. xiii.

A paired bonds analysis similar to the one currently applied by the AER was first applied in PwC's report for Powerlink. However, the AER objected to our original sample of 9 (mostly 'A' credit rated) pairs of bonds, since the terms to maturity of many of the longer bonds in these pairs were considerably shorter than 10 years. In subsequent reports for ElectraNet and the Victorian gas distribution businesses we responded to the AER's criticism by limiting the sample of paired bonds to those where:

- the paired bonds were part of the wider sample that we used in our econometric analysis (i.e. BBB, BBB+ or A- rated domestic fixed or floating rate bonds with term to maturity exceeding 1 year, no callability / option features, and available in the Bloomberg or UBS services);
- the longer dated bond has a term to maturity that is close to 10 years;
- the shorter dated bond has a term that is closest to the shorter term that is of concern (i.e. closest to 7 years); and
- the match is between a pair of fixed coupon bonds, or a pair of floating rate bonds.

The AER applied its new debt risk premium estimation methodology in its recent decisions relating to Powerlink, Aurora Energy, ElectraNet and the Victorian gas distribution businesses.

Observations on the AER's current methodology

We consider that the AER's current methodology provides a reasonable estimate of the 10 year debt risk premium for BBB+ rated corporate bonds. For more than a year we have found that the AER's extrapolated Bloomberg FVC methodology has provided estimates that have been relatively close to the estimates obtained by applying an econometric approach that incorporates yield information for a larger sample of bonds in the BBB, BBB+ and A- credit rating categories. This may not always be the case, which is why it is useful to have more than one methodology applied at any point in time.

The observations that we would make in relation to the AER's current methodology, and its potential use by the Authority, are as follows:

- The number of paired bonds that currently meet the specified criteria for selection is small (3 pairs, i.e. 6 bonds). However, the Authority has requested a methodology that is capable of estimating the debt risk premium for a number of credit rating bands. If the extrapolation methodology were to be applied to the wider bands additional paired bonds would ideally need to be found in the lower credit rating bands.
- The current AER methodology, on its own, is unlikely to be flexible enough for the Authority's requirements, which are to have the ability to estimate the debt risk premium for any term up to say, 10 years, and for a range of credit rating bands from BBB to AAA.

The AER is currently undertaking a wide stakeholder consultation in relation to its rate of return guidelines, and the cost of debt is a component of this review. The AER's current consultation paper notes that it had adopted the extrapolated Bloomberg methodology in light of the Tribunal's support for Bloomberg.[51] However, it noted that the Tribunal had more recently upheld the use of the ERA's 'bond yield' approach, and that the current consultation process provides an opportunity to discuss alternative methods for estimating the cost of

[51] AER (May, 2013), *Better Regulation – Rate of return guidelines – Consultation Paper*, pp.71-73 and Appendix G.

debt. In Appendix G of its consultation paper the AER briefly discusses the advantages and disadvantages of Bloomberg, econometric and bond averaging methodologies, and calls for submissions in relation to these matters.

3.3 Conclusion on regulatory approaches

With reference to the Authority's requirement for a methodology that estimates the debt risk premium for a range of credit ratings and debt issuance terms based on alternative approaches that have been applied, our conclusions are as follows:

- *ERA:* The weighted averaging approach that the ERA has developed was initially designed to estimate a 10 year debt risk premium, and due to the weighting it gives to term is likely to materially under-estimate the 10 year debt risk premium, and (holding constant the data source), over-estimate the 5 year debt risk premium. In addition, the ERA has not undertaken a comprehensive assessment of the benchmark term of debt at issuance, which it assumes to be 5 years. Our analysis in the previous chapter showed that the benchmark issuance term is close to 10 years.

- *IPART*: IPART also estimates the 5 year debt risk premium by reference to the 5 year Bloomberg debt risk premium (which is given little weight), and much heavier weighting to a group of domestic bonds with remaining terms to maturity of at least 2 years, targeting a term of 5 years, and a lower weighting to international bonds (translated to domestic equivalents) targeting a term of 5 years. The weightings applied to these three sources of information about bond yields appear unfounded, and unrelated to the financing behaviour of benchmark firms. Again, IPART assumes a benchmark term of debt issuance of 5 years, while in our previous chapter our analysis showed that it is quite close to 10 years.

- *Previous AER methodology*: The AER's previous methodology estimated the 10 year debt risk premium using a simple averaging approach, which calculated the debt risk premium for Australian corporate bonds with 7 to 13 years to maturity (i.e. T±3 years). However, the utility of this approach is also highly dependent on sample composition, and particularly on how the available bonds in the 7 to 13 year term to maturity range are distributed.

- *Current AER methodology*: The AER's current approach applies an extrapolated Bloomberg methodology, using the paired bonds approach to extrapolate the 7 year Bloomberg FVC debt risk premium to 10 years. We note that during the past year and a half this methodology has provided estimates of the BBB+ debt risk premium that are reasonably close to those obtained using an econometric approach. Whether this will continue into the future is not certain, and hence we recommend that an econometric cross-check be applied. We also conclude that the extrapolated Bloomberg approach will not fully satisfy the Authority's requirements, since it has requested a methodology that estimates the debt risk premium that would apply to a range of credit rating bands from BBB to AAA, and a range of T values. Finally, we note that the AER is currently undertaking a review of its rate of return guidelines and has called for submissions in relation to the estimation of the debt risk premium.

4 Analysis of data sources

4.1 Introduction

The Authority has requested us to develop a methodology to estimate the debt risk premium for a range of maturities and credit ratings. We have also been requested to examine the potential to widen the data sources from the current almost universal reliance of Australian regulators on a portfolio of domestic bonds (which we term the 'simple portfolio'), to consider the additional insight that may be obtained by reference to a 'complex portfolio' approach, which would estimate the cost of debt for all major sources of debt in a benchmark capital structure (i.e. including domestic bank debt, domestic bonds, and international bonds). In developing and implementing such a debt risk premium estimation methodology it is important to establish an appropriate set of debt risk premium data.

Hence, in this chapter we:

- Describe the sources of information on bond yields and the nature of this information;
- Discuss how we recommend that the Authority assemble a representative sample of bond yields (including a number of filters we recommend applying), and the results of our application of this method for our Averaging Period and Analysis Period; and
- Report the results of our tests examining the quality of the data that we have applied (and recommend the Authority applies).

4.2 Assembly of a representative sample

Our initial task was to decide the source of the bond yield information. We obtained bond yield data from two providers: Bloomberg, and UBS. Whilst we also considered AFMA as an additional data source, in a previous study we found that Bloomberg and UBS complement each other well. Although there is a large overlap in coverage of bonds, the UBS data source provides data on many floating rate notes that are not available in the Bloomberg data. AFMA's data base was smaller, and less up-to-date in the inclusion of newly issued bonds. Hence, the marginal contribution of the AFMA data to the overall bond coverage was much lower if the previous data sources were being used:[52]

> For the population of fixed coupon bonds approximately 44 per cent of the total daily bond yield observations came from UBS, compared with 34 per cent coming from Bloomberg, and 22 per cent coming from AFMA. For the population of floating coupon rate bonds (and associated trading margins), approximately 74 per cent of daily bond yield observations came from UBS, compared with only 26 per cent coming from AFMA. Bloomberg provides no trading margin data for floating rate bonds...
>
> Since there is an unequal distribution of daily bond yield observations from the three data sources, our approach of taking the average of the three sources (if available), means that many of the yields often represented an average of the yields of two service providers, and sometimes only one service provider (often UBS). For floating coupon bonds, in the vast majority of cases the yields was the UBS yield.

The other data source that we investigated was Yield Broker, which is distributed by Thomson Reuters. This data set provided a reasonably comprehensive source, but was based on an overlapping set of bank feeds with those relied upon by Bloomberg and AFMA.

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[52] PwC (May 2012), *ElectraNet: Estimating the benchmark debt risk premium*, pp. 14-15.

Bloomberg

Bloomberg obtains daily 'feeds' of bond yields from several Australian banks and other financial institutions.[53] The 'Bloomberg Generic Price' (also known as the BGN) is Bloomberg's 'market consensus view' of the yields supplied to it, but Bloomberg does not reveal the methodology it applies to derive the consensus number. In our discussions with Bloomberg executives we have been told that the number is not a mechanical formula, and involves analyst judgement. Bloomberg also provides its own estimate of the yield from its Bloomberg Valuation Service (that is, a function that is equivalent to what financial institutions undertake when preparing their 'rate sheets'), which is known as the BVAL yield. In this report we have focussed on the BGNs, which are represented as being reflective of the market's opinion of the bonds. In addition to collecting each BGN yield we obtained the individual bank 'feeds' that Bloomberg used in determining the BGN yields.

Bloomberg provides financial market information to more than 300,000 subscribers around the world. Bloomberg publishes several 'FVCs' for major credit rating bands. A FVC is one that describes the estimated market yield to maturity for bonds with a given credit rating, over a range of terms to maturity. For a given term to maturity, a bond with the average characteristics of the credit rating band is expected to trade such that its yield to maturity is on the FVC at that term. While Bloomberg's FVCs were, during a period prior to the global financial crisis, provided for terms of 10 years, the current situation is more restricted. At the time of this report Bloomberg FVCs are available as follows:

- BBB credit rating band – 7 years;
- A credit rating band – 7 years;
- AA credit rating band – 8 years; and
- AAA credit rating band – 4 years.

UBS

The bond yields provided in daily 'rate sheets' by UBS are its own opinions about the end of day yield that would be observed if the bond traded at that time. These yields are provided by UBS on a daily basis and disseminated electronically to its clients. Unlike the Bloomberg and AFMA data sources, which represent the combination of the opinions of several institutions, the UBS yields are the opinion of one institution. However, we expect that UBS, like Bloomberg, takes account of other comparable bond data sources when making its own decisions about yields.

Bond selection criteria - domestic

As discussed above, we used the Bloomberg and UBS services since yields based on more than one source are more comprehensive (i.e. provides a larger sample of bonds) and will therefore be more reflective of the market for funds. The bond yields shown in our analysis were based on, whenever available, the average of the yields reported by Bloomberg and UBS. If both data sources were not available for a particular bond, we took the yield provided by the single source.

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[53] Bloomberg receives 'feeds' from between 2 and generally less than 5 or 6 bond yield suppliers on a daily basis.

The initial sample was based on the population of fixed and floating corporate bonds available between 8 April 2010 and 28 November 2012. This 32 month period, which we call the 'Analysis Period', was determined by the longest period for which we had daily yield observations from both services.[54] From this initial sample of bonds, we filtered the data to only include corporate bonds with the following characteristics:

- Australian issuance by an Australian entity,
- investment grade credit rating by Standard and Poors[55],
- the issuing entity is not a financial entity,
- the corporate bond is senior (i.e. not subordinated),
- standard corporate bonds without special features such as call options attached,
- a term to maturity greater than one year, and
- yields reported by either Bloomberg or UBS.

We excluded the bonds of financial institutions on the basis of advice from debt market professionals who told us that the market interprets these bonds as trading differently to what their credit rating would suggest for corporate bonds.[56] Call options were excluded since the observed yield needs to be adjusted to remove the effect of the option, which adds complexity and the potential for analyst-induced error. Floating rate notes were included, as they can be readily converted to fixed rate equivalents, [57] and provide a larger sample of valid observations. Moreover, the Tribunal has stated that 'as a matter of principle, floating rate notes ought to be taken into account and treated equivalently to fixed rate bonds'.[58]

Bonds that had less than one year to maturity were eliminated. The yields on bonds with less than a year to maturity remaining are influenced by monetary policy, and their inclusion would be likely to distort the shape of the debt risk premium curve. In open capital markets long term interest rates are influenced by international market movements (thereby eliminating arbitrage opportunities), however, shorter term interest rates are influenced by the policies of central banks setting the cash rate.[59] We understand from discussion with market participants that bonds with less than a year to maturity are ignored when the yield relativities of bonds with longer terms to maturity are being considered.[60]

Finally, we eliminated the bonds that were issued by SP AusNet. During the 'Analysis Period' these bonds were distinguished from the others due to a majority holding by

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[54] The study period was constrained by the first date from which we had UBS daily term sheets (8 April, 2010).

[55] Investment grade refers to a credit rating of BBB- and above.

[56] This advice was provided by Mr. Michael Bush, head of fixed interest research at NAB, and Mr. Matthew Santoro, joint head of debt and capital markets at PwC (and formerly an executive of the capital markets group at Deutsche Bank).

[57] This is achieved by adding the floating rate margin of a bond on to the BBSW of the same term to maturity.

[58] Australian Competition Tribunal, Application by Actew AGL Distribution [2010] ACompT4, paras. 53-58.

[59] Penelope Neal (June, 1993), 'The determination of interest rates and the effectiveness of monetary policy in deregulated financial markets,' *Economic and Labour Relations Review*, Vol. 4, No. 1.

[60] Again, we obtained advice from Mr. Michael Bush, head of fixed interest research at NAB, and Mr. Matthew Santoro, joint head of debt and capital markets at PwC (and formerly an executive of the capital markets group at Deutsche Bank).

Temasek, which is the investment arm of the Singapore Government.[61] When assessing this bond the AER's adviser, Oakvale Capital, noted that a key issue impacting the yield of these bonds is that 'the risk is in fact the risk of the Government of Singapore.'[62]

> The key feature supporting the bond was the parental support of the issuer's owners and the link to the Government of Singapore.

The initial sample comprised 1,601 bonds which was the population of bonds available from the two sources over our study period.[63] Filtering this raw sample based on the criteria outlined above resulted in a sample of 185 bonds with credit ratings ranging from BBB- to AAA, which included 114 fixed coupon bonds, and 71 floating coupon bonds[64]. This reduced sample was subjected to further analysis, with the key findings presented below.

Bond selection criteria – International

The bond selection criteria for international bonds were the same as for domestic bonds except for two distinguishing features. First, we only used Bloomberg data since the UBS (Australia) rate sheet that was our data source does not provide international bonds. Secondly, our bond filtration approach was different: instead of filtering the initial sample for Australian bonds issued by Australian entities we filtered for international bonds issued by Australian entities. We began with the same initial sample of 1,601 bonds, which we filtered on our selection criteria, resulting in a sample of 81 bonds (all fixed coupon).

4.3 How published bond yields are determined

It is important to recognise that the vast majority of the yields provided by Bloomberg, UBS and similar services are not yields determined by trades of bonds. Instead, they are the opinions of financial institutions that are engaged in bond market issuance and trading. Based on our discussions with bond traders and debt market analysts (e.g. in NAB and RBS) we know that these opinions are not adjusted through daily analysis of individual bonds. Rather they are determined by setting a bond's yield at a margin (in basis points) to a benchmark reference rate; most commonly the Bank Bill Swap Rate.

From time to time the price making institution will consider whether specific information relating to a particular bond requires a yield revision. New information about a bond may include:

- new information relevant to assessments of the relative risk of the bond;
- information relevant to movements in the market wide pricing of corporate bonds;
- actual trades in the bond or a comparable bond;
- issuance of new, comparable bonds (and hence an observation of a new price); and

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[61] Subsequently, on 17 May, 2013, SP AusNet announced the sale of a close to 20 per cent stake in the firm from Temasek to China's State Grid Corp. This resulted in an immediate downgrade in the credit rating of SP AusNet from A- to BBB+. See ASX (17 May, 2013), 'Standard & Poor's and Moody's Credit Ratings Update.'

[62] Oakvale Capital, (February, 2011), *Report on the cost of debt during the averaging period: The impact of callable bonds,* , p. 24

[63] This was the total number of bonds that were included in the data base of one or more of the yield providers (i.e. Bloomberg and UBS).

[64] The trading margins reported by floating coupon bonds were converted to yield to maturity estimates for equivalent fixed coupon bonds using an appropriate interest rate swap yield.

- opinions on the price of the bond or comparable bonds published by other institutions (e.g. benchmarking syndicates, AFMA, Bloomberg, circulated daily 'rate sheets').

Most corporate bonds will have been issued years previously, with most having been either infrequently or never traded. It is therefore possible that for some bonds the margin that has been set relative to the benchmark would not have been updated for a long time. In these cases the observed margins may be 'stale', i.e. not reflective of what the bond would trade for at the market time. One of the key objectives of the data quality analysis presented in this chapter is to test whether we can be confident that the yield data (opinions) are not unduly stale.

4.4 Testing the quality of the data

With respect to the quality of the bond sample, our concerns were with:

- The quality of Bloomberg data, as it was used in estimating the Bloomberg FVC;
- The currency of the data, since this affects the quality of the Bloomberg data, which was a major input into all the alternative methodologies we examined; and
- The quality and currency of the UBS data, which was also an important input into most alternative methodologies.

4.4.1 Tests of Bloomberg data inputs

Bloomberg receives daily bond yield opinions from financial institutions ('bank feeds'), and transforms these into yields that it presents as the market's consensus. Whilst UBS yields are the opinions of one bank, we expect that its opinions would be formed after taking account of its own views of the market, and those of other banks. Hence, both Bloomberg and UBS yields will be influenced by the bond yield opinions of the group of institutions that provide feeds to Bloomberg. We therefore sought to test whether the Bloomberg and UBS yields are actually reflective of the broader market's opinions, where the 'market' is defined as the median of the Bloomberg 'bank feeds.'

This was done by calculating for the entire Analysis Period the average difference (expressed in basis points) between the median yields of the Bloomberg bank feeds, and the yields reported by Bloomberg (i.e. Bloomberg BGNs).[65] It was found that on average, over the entire Analysis Period (defined as October 2010 to 28 November, 2012):

- The Bloomberg BGNs were 2 basis points higher than the median of the Bloomberg bank feeds for domestic bonds, and 4 basis points higher for international bonds.
- We also found that on average over the entire Analysis Period the UBS yields were only 8 basis points higher than the median of the Bloomberg bank feeds for domestic bonds.

These differentials are not too dissimilar to those obtained in our previous reports for ElectraNet and the Victorian gas distribution networks, and indicate that the yields in both the Bloomberg and UBS data sources are on average relatively close to the average of

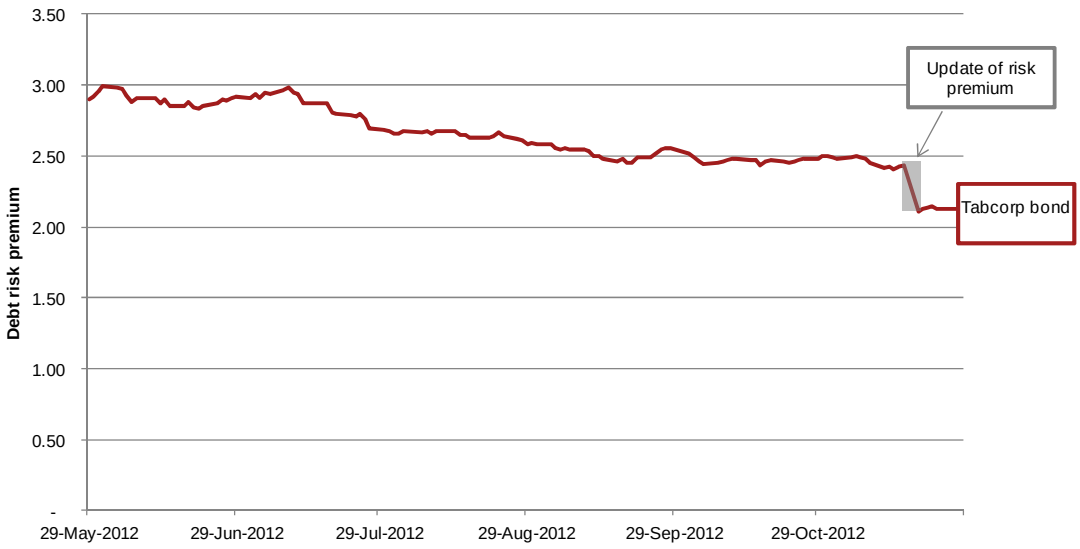
[65] This approach is similar to the analysis of Bloomberg BGN bond yields that we undertook in November, 2009. See PwC (November, 2009), *Victorian Distribution Businesses – Methodology to Estimate the Debt Risk Premium*. One of the tests that were applied in that study examined the extent to which Bloomberg's BGN's reflected the bank feeds that were being provided to it. In this study we expressed this difference relative to the median of bank feeds (which is likely to be a good reflection of the market's opinion as it minimises the influence of outliers). We have also expressed the differential in terms of basis points rather than percentage points, as this can be related more easily to the scale of the BGN, which can also be expressed in terms of basis points.

market opinion. The median absolute differentials between Bloomberg BGN and UBS yields measured against the median of the Bloomberg bank feed yields were found to be 4 basis points and 12 basis points respectively. Hence, we concluded that during the Analysis Period, the data sources that we relied on could be considered to be reflective of market opinion, where 'market opinion' is defined as the median of Bloomberg bank feeds.

4.4.2 Are the bond yield estimates 'stale'?

As noted above, the reported bank feed yields (i.e. inputs to Bloomberg) and UBS yields are set to follow a benchmark curve, and it is possible that some of these yields are 'stale' (i.e. out-of-date since they have not been updated for some time).[66] When a financial institution's opinion about a bond yield has been updated for some new item of information, we would expect to see a material shift in the debt risk premium for that bond. Figure 4.1 below displays the debt risk premiums for a Tabcorp bond during the period from May 2012 to November 2012. In early November 2012, the debt risk premium for the Tabcorp bond that was reported by UBS shifted downward materially, and never came back to the original level. This type of shift is defined as a 'structural break', and our hypothesis is that if such structural breaks are found in the data, the yields have most likely been updated. Observing whether there has been a recent structural break provides a test of whether the current yield for that bond may be considered to be reflective of current market conditions. However, we acknowledge that even if there has not been a recent structural break, it is possible that the bond observation is not stale. That is, it may reflect a finding of no change in the outlook for the bond.

Figure 4.1 Example of a 'structural shift' - an update in the reported debt risk premium (UBS data)



Source: PwC.

As in a number of previous reports that we have undertaken for ElectraNet, the Victorian gas distribution networks, and SP AusNet, we applied the Quandt-Andrews breakpoint test to the UBS data to uncover the distribution of structural breaks in the individual yields over time.[67] Although the Quandt-Andrews breakpoint test could have been applied to all the

66 This was confirmed in our discussions with bond market participants, in particular Mr. Michael Bush, head of fixed interest research at NAB.

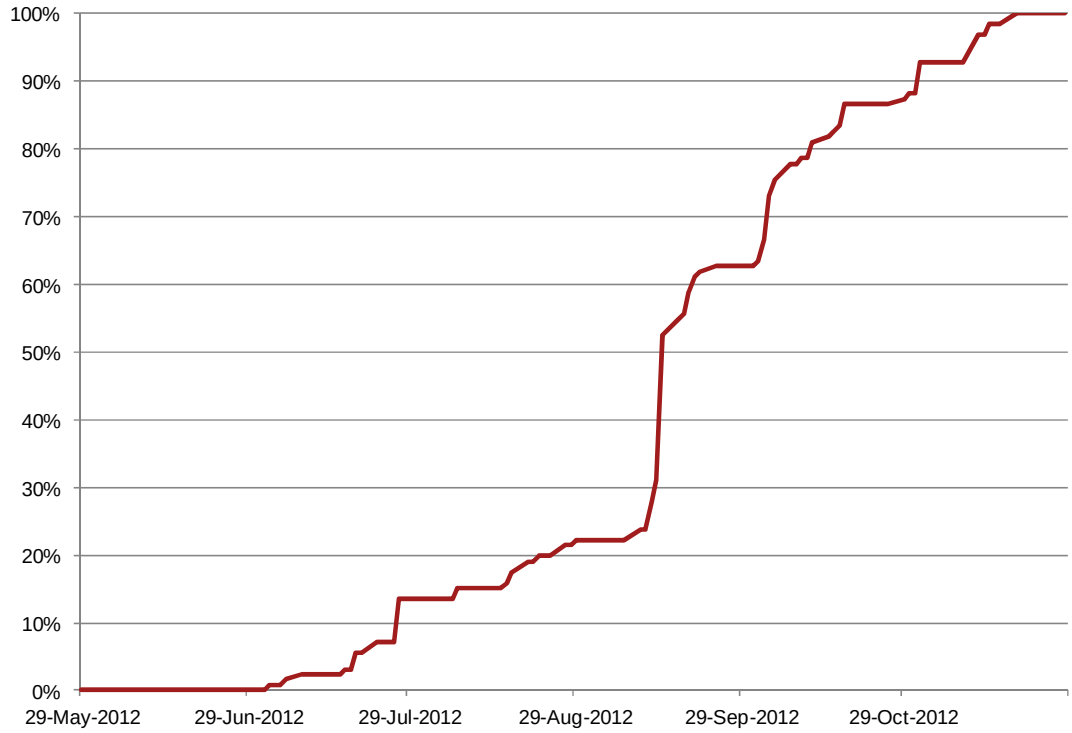
67 The Quandt-Andrews Breakpoint Test tests for one or more unknown structural breakpoints in a sample for a specified equation. The Quandt-Andrews test performs a single Chow Breakpoint Test at every observation between two dates, or observations. The test statistics derived from these Chow tests (Likelihood ratio and Wald F statistic) are then summarised into

Bloomberg bank feed data, these bank feeds were not individually as comprehensive as the UBS data. The term 'recent' was defined as the six month period up to the latest averaging period bond yield date (28 November 2012). It was felt that a shorter period would set an unrealistic target for reassessment of all the bonds in the UBS data base, and that a longer period would be too long for those opinions to continue to be considered reflective of the current market.

Application of the staleness test to UBS yield data

We conclude there is no reason to believe that the UBS data would not provide a reasonable indication of current bond market conditions. For the 185 domestic UBS bonds in the test sample, 126 (70 per cent) had the requisite minimum number of consecutive observations to apply the Quandt-Andrews breakpoint test.[68] The 55 bonds that we could not test were cases where the bond had either matured prior to the end of the six month test period (54 cases), or had been issued too recently (1 case). We considered that the yields for newly issued bonds (i.e. issued in the 6 months prior to 28 November, 2012), could not be considered to be stale.

Figure4.2– Relative staleness of bond yields - UBS data passing the Quandt Andrews breakpoint test (6 months to 28 November, 2012)



Source: UBS data and PwC analysis.

Figure 4.2 demonstrates that for every bond that could be tested, a structural break was found to occur at some time during the six month test period. A high proportion of breaks was found to have occurred over the period of September to October 2012, which indicated

a single test statistic for a test against the null hypothesis of no breakpoints between two dates. For further details see: Donald W. K. Andrews , '(July, 1993), Tests for Parameter Instability and Structural Change With Unknown Change Point', *Econometrica*, Vol. 61, No. 4 pp. 821-856.

[68] The minimum number of observations was 7. Although five observations are required to produce the required F-statistic, the premise of the test is to identify the maximum F-statistic, and therefore needs a point of comparison.

that an overwhelming majority of the bonds (approximately 78 per cent) had been re-assessed by UBS in the 3 months prior to 28 November, 2012.

5 Using the data to estimate the benchmark

5.1 Introduction

In this chapter we develop an empirical/statistical methodology to estimate the debt risk premium for credit rating bands ranging from BBB to AAA across a range of maturities. As discussed above, we have been requested to compare two broad approaches:

- *The simple portfolio approach*

  The existing Australian regulatory paradigm, which we label the 'simple portfolio approach, assumes that domestic bond yields provide a reasonable proxy for the cost of all sources of debt obtained by the regulated business. The second section in this chapter shows the results from applying alternative debt risk premium estimation methodologies within this paradigm.

- *The complex portfolio approach*

  The third section in this chapter applies the 'complex portfolio approach', which estimates the cost of debt taking individual account of the various major sources of debt (bank debt, domestic bonds and international bonds), and estimates a weighted average cost of debt based on the benchmark portfolio.

The final section compares the debt risk premium estimates obtained under the existing Australian regulatory paradigm (i.e. the simple portfolio) and the complex portfolio approach over a period of time for alternative terms to maturity.

We also observe that the vast majority of the analysis of debt risk premia for regulatory purposes in recent years has focussed on the BBB+ credit rating (being the most common assumption that regulators have adopted), and that much of the debate about the magnitude of the premium has focussed on a 10 year term (being the assumption that is adopted in the energy network sector), with much of the empirical work focussed on the reasonableness of the estimate of this single point value. In order to provide for comparability with decisions and analysis presented elsewhere, we therefore highlight the methods and results that are appropriate for the BBB+ rating (as well as a 10 year term).

However, our task is broader than this – in particular, the Authority has asked our view on how to derive a debt risk premium for a range of credit ratings and terms to maturity. It follows that the standard approaches that are adopted in those other contexts need not be appropriate for the task the Authority has sought.

5.2 The simple portfolio approach

In this section we estimate the debt risk premium applying three alternative estimation methodologies for deriving a benchmark debt risk premium from Australian corporate bond data, namely:

- the use of Bloomberg FVCs, including appropriate method for extrapolating the FVC to the desired term;

- a simple averaging of subsets of bond yields (with the two sub-methods being the AER's previous method and the ERA's 'bond yield' approach; and

- the use of econometric methods, for which we discuss and present results for three sub-methods, namely:
  - *Pooled regression* - estimating the function for the target credit rating by pooling observations for the target credit rating with the neighbouring two ratings categories;
  - *Combined regression* - estimating the function for a credit rating in combination (or as a system) with neighbouring credit ratings, so that the information is combined but econometric techniques are used to estimate the gap between credit ratings; and
  - *Combined domestic/international data regression* - repeating the above analyses, but also includes the overseas information.

5.2.1 Bloomberg FVCs

Between 2005 and 2007 Bloomberg provided FVCs out to 10 years for the range of credit ratings. Bloomberg discontinued the publication of FVCs out to 10 years from 9 October, 2007, with the current situation for each credit rating band being:

- BBB FVC – 7 years;
- A FVC – 7 years;
- AA FVC – 8 years; and
- AAA FVC – 4 years.

For the test averaging period (i.e. the 20 business days to 28 November, 2012), the debt risk premiums based on these FVCs are presented in Figure 5.1.

While the Bloomberg service has the potential to provide the Authority with information on debt risk premiums over a range of credit rating bands, and as discussed in Chapter 3, it has been supported by the Tribunal, it does have some practical drawbacks in relation to the Authority's specific requirements.

On the positive side, Bloomberg's FVC analysis is:

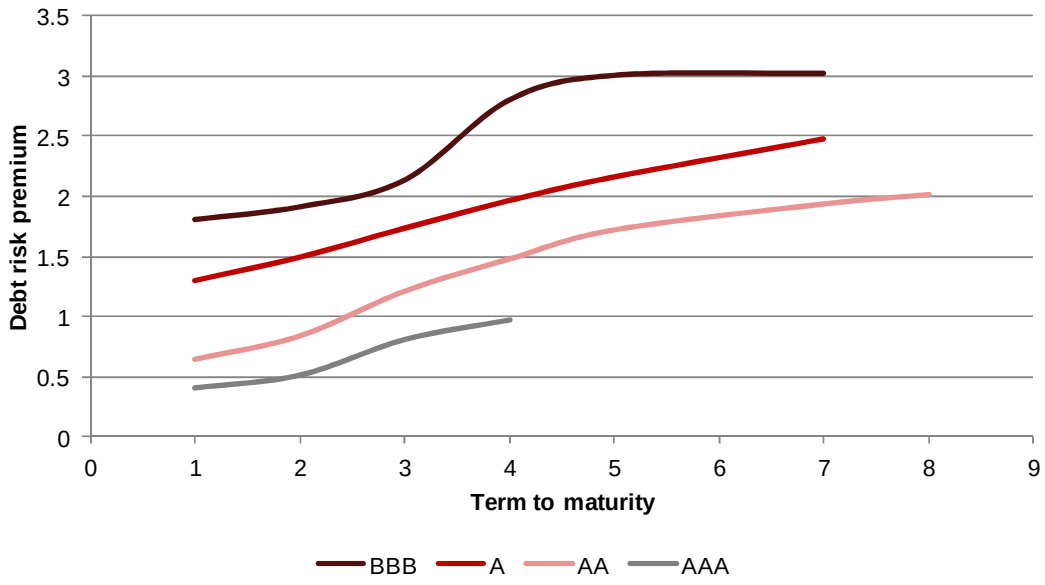
- Reasonably straightforward to apply and objective;
- Produced by a professional service;
- Supported by the Tribunal; and
- For the 10 year, BBB+ point, has been subject to extensive testing against bond data.

A downside is that the Bloomberg BBB FVC does not go out to 10 years and so extrapolation is required – but then there is an accepted method for extrapolating out to 10 years. A key downside is that estimates are presented only for broad ratings categories and not for the notches within each category. Debt risk premia can vary materially across notches – and it cannot be known without further analysis which of the notches the Bloomberg BBB FVC curve seems closest to. The Bloomberg BBB FVC has been extensively tested at the long end, and there is reasonable acceptance that the 10 year Bloomberg BBB FVC extrapolated using the accepted method represents most closely a BBB+ rating. But there has been no testing of the Bloomberg BBB FVC for shorter terms, or the A curve.

Bloomberg's BBB FVC has generally been considered, by both regulators and firms, as a BBB+ FVC, and the latter has been the most common credit rating for which the debt risk

premium has been estimated by regulators. However, there are no similar conventions with respect to the other credit rating bands provided by Bloomberg. The fact that Bloomberg does not provide a 6 year FVC can be remedied by a linear interpolation from the 5 and 7 year FVC values (if available). To overcome the problem that Bloomberg does not provide a BBB credit rating FVC to 10 years, the AER has recently adopted an extrapolation methodology. This approach is considered in more detail below, and is one that could potentially be extended to the other credit rating bands.

Figure 5.1 – Bloomberg: debt risk premium for Australian corporate bonds by credit rating, (20 days to 28 November, 2012)



Source: Bloomberg and PwC's analysis

5.2.2 *Current AER methodology - Bloomberg extrapolation*

The objective of the AER's current methodology is to estimate a 10 year debt risk premium for a BBB+ rated bond. It is therefore a limited objective compared with the Authority's requirement for an approach that can estimate debt risk premiums for a range of terms to maturity over a range of credit rating bands from BBB to AAA.

Table 5.1 below shows how the current AER methodology would be applied to obtain an estimate of the debt risk premium for a 10 year BBB+ bond. Three pairs of bonds were found in the range of credit ratings from BBB to A-, which fit the selection criteria. These bonds had an average rise of 7.93 basis points per annum, which when applied to the 7 year Bloomberg BBB estimate of 301 basis points, derived an estimated 10 year debt risk premium of 325 basis points. As noted previously, the extrapolated 10 year Bloomberg BBB FVC estimate (which by convention has been accepted as the BBB+ estimate) is 325 basis points.

Applying the extrapolation methodology to other credit rating bands requires an estimate of the annual rise in these curves based on the same paired bonds methodology that has been used for the BBB curve. We found that there were several paired bonds in the A credit rating band (6 paired bonds), which provided an estimated average increment of 7.36 basis points per annum. This yielded an estimated 10 year debt risk premium of 269 basis points for the A credit rating band. However, there were no paired bonds in the AA and AAA credit rating bands to undertake this analysis. In fact, there were only 6 AA rated corporate bonds and 2 AAA rated corporate bonds (both issued by Airservices Australia) in the sample, all which are not long enough maturity to be appropriate paired bonds.

Applying the annual rise in the A rating band to the AA and AAA bands, the extrapolated Bloomberg curves would provide 10 year debt risk premiums of 217 basis points and 141 basis points to the AA and AAA bands respectively.

Table 5.1 – Debt risk premiums (basis points) applying the AER's current extrapolated Bloomberg methodology (20 days to 28 November, 2012)

Credit rating	4 years	5 years	6 years	7 years	8 years	9 years	10 years
BBB+	279	300	**301**	301	**309**	**317**	**325**
A	196	216	**232**	247	**254**	**262**	**269**
AA	148	172	**183**	194	202	**209**	**217**
AAA	97	**104**	**112**	**119**	**126**	**134**	**141**

Source: Bloomberg, and PwC analysis Note: Figures in bold are extrapolations or interpolations.

5.2.3 The old AER methodology

Table 5.2 illustrates the debt risk premium estimates obtained by applying the AER's previous approach (using a T±3 year window) for the BBB+ credit rating band for both 5 year and 10 year benchmark terms. The results show that the 5 year debt risk premium estimate of 245 basis points is materially below the Bloomberg 5 year debt risk premium estimate of 300 basis points. The average term of the bonds lying in the range of terms from 2 years to 8 years was 4.1 years. For a term of 10 years the old AER methodology averaged the yields of bonds with terms to maturity ranging from 7 years to 13 years, which would have provided a debt risk premium estimate of 314 basis points. However, since the average term of the sample was only 8.4 years, a debt risk premium of 314 basis points was likely to be an under-estimate of the 10 year debt risk premium.

These results highlight a major problem with the AER's old methodology, which was that the average years to maturity of the sample is likely not to equal the target benchmark term. For example, in the case of the 10 year benchmark, there were only 6 bonds in the sample at T±3, leaving little opportunity to narrow the range. On the other hand, increasing the range to T±5 would have reduced the average term to 6.8 years, and provided a debt risk premium estimate of 272 basis points.

Table 5.2 – BBB+ Debt risk premiums applying the old AER approach: T±3 years (20 days to 28 November, 2012)

Term to maturity	5 years	10 years
Bond observations	54	6
Average term (years)	4.1	8.4
Debt risk premium (basis points)	245	314

Source: Bloomberg, and PwC

5.2.4 The ERA's 'bond yield' methodology

As discussed in Chapter 3, the ERA's methodology applies a weighted averaging approach, which is based on a sample of Bloomberg bonds with terms to maturity exceeding 2 years. Table 5.3 shows that the simple average term of the sample is 4.46 years, and the weighted average debt risk premium the methodology produces is 268 basis points. Since the longest term in the sample of Bloomberg bonds happens to be 7.69 years, and the shortest term is 2.33 years, this is similar to the old AER's methodology (T±3), except the ERA's methodology uses only Bloomberg bonds (hence not using the UBS data) and excludes A-

bonds.[69] Unlike the old AER methodology, the ERA's methodology is not constrained with respect to term at the upper end (i.e. it allows all Bloomberg bonds with any term above 2 years). Therefore, if longer dated bonds were to be issued and included in the Bloomberg sample, it is possible that the ERA's average term would rise above 5 years, and its debt risk premium would rise commensurately. As noted in Chapter 3, the ERA's methodology was originally designed to estimate the 10 year debt risk premium, but is unlikely to provide an accurate estimate of the 5 year debt risk premium, or the 10 year debt risk premium.

Table 5.3 – BBB+ Debt risk premium applying the ERA approach (20 days to 28 November, 2012)

Name	S&P rating	DRP (bp)	Term (years)	Value ($m)	Term x Amount	Weight	DRP contrib.
APT PIPELINES	BBB	302	7.69	300.00	2,305.61	16%	49
BRISBANE AIRPORT	BBB	271	6.65	200.00	1,329.54	9%	26
CALTEX AUST LTD	BBB+	245	6.02	150.00	903.52	6%	16
DEXUS FINANCE	BBB+	253	5.82	120.00	698.50	5%	12
SYDNEY AIRPORT	BBB	287	5.64	100.00	564.01	4%	11
HOLCIM FINANCE	BBB	231	4.67	250.00	1,168.41	8%	19
CROWN GROUP LTD	BBB	246	4.67	300.00	1,402.09	10%	24
DEXUS FINANCE	BBB+	223	4.43	210.00	930.87	7%	15
UNITED ENERGY	BBB	286	4.41	265.00	1,167.41	8%	24
NEW TERMINAL	BBB	300	3.85	100.00	384.95	3%	8
MIRVAC GROUP	BBB	320	3.84	225.00	863.68	6%	20
GAIF BOND ISSUER	BBB	331	3.51	175.00	614.25	4%	14
SANTOS FINANCE	BBB+	250	2.86	100.00	285.57	2%	5
SYDNEY AIRPORT	BBB	238	2.64	175.00	461.89	3%	8
HOLCIM FINANCE	BBB	193	2.36	250.00	590.71	4%	8
MIRVAC GROUP	BBB	260	2.33	200.00	465.99	3%	9
Average			**4.46**				**268**

Source: Bloomberg, PwC's analysis

5.3 Econometric approach

5.3.1 Econometrics vs the average of observed yields

As discussed in detail in Chapter 3 above, in recent years some regulators have experimented with debt risk premium estimation approaches that calculate the average of the observed debt risk premiums over a span of years to maturity. One approach that was used in the past by the Australian Energy Regulator (AER), and is currently applied in a slightly different form by IPART, is to take a simple average of the observed yields (or debt risk premiums) around the term of interest (T). For example, this could be an average of bond yields that are within 2 or 3 years of the term of interest, i.e. T ± 2, or T ± 3. As noted, another approach, which is currently applied by the ERA, uses all observations for bonds with more than 2 years to maturity.

From first principles, we consider these approaches to be inferior to econometric-based approaches because:

[69] In addition to Bloomberg bonds, the AER's old methodology included UBS floating rate notes converted to a fixed rate equivalent yield, and bonds from the three rating categories of BBB, BBB+ and A-.

- Econometric approaches have the potential to fully exploit the maximum amount of information that can be drawn from the available data. Econometric approaches are not constrained to calculate an average for that data set, but provide the ability to estimate the debt risk premium for a specific term that may not be heavily populated with observations.

- A simple averaging approach (i.e. T ± 2, or T ± 3) will only provide an appropriate estimate of the T year debt risk premium if the distribution of observations within the chosen band is distributed in a manner that provides that coincidental result. Otherwise, we would expect the approach to provide an over- or under-estimate of the debt risk premium, and to more often provide an under-estimate if the distribution of bond yield observations is weighted to the lower side of T.

An averaging approach that is open-ended (i.e. using bonds with a term exceeding say, 2 years), will provide a precise debt risk premium number for a random term (N) that is determined by the composition of the sample. The term N will only equal the term that is being estimated (T) by accident, and even then will be subject to the same reservations that were outlined above. For example, in the Australian domestic bond market yield observations at terms beyond 5 to 7 years are less frequent, so this averaging approach will under-estimate the debt risk premium for every term T that is greater than N.

5.3.2 *The sample of bonds*

The sample of domestic bond data that we have assembled using our inclusion criteria has the characteristics shown in Table 5.4 below. The most numerous credit rating bands were the BBB and A- credit rating bands, with respectively 32 and 27 bond observations. The overall average term to maturity of the 111 bonds in the sample was 4.03 years. On the assumption of a reasonably constant re-financing of these bonds, it suggests that the average term of Australian corporate bonds at issuance is approximately 8.0 years (i.e. twice the current term to maturity). This is a significantly shorter term to maturity than we have observed for network infrastructure businesses.

Table 5.4 –Sample sizes and average remaining terms to maturity of domestic bonds available for econometric analysis (20 days to 28 November, 2012)

Credit rating band	Number of bond observations	Average term to maturity (years)
BBB-	7	5.16
BBB	27	3.95
BBB+	11	4.54
A-	32	3.75
A	16	3.59
A+	10	5.07
AA	6	3.35
AAA	2	2.75
Total	111	4.03

Source: Bloomberg, and PwC

As foreshadowed in section 5.2 above, there are two potential responses to the problem of small sample sizes, namely:

- *Pooled regression approach* – i.e. pool neighbouring bands (i.e., if the target is BBB+, pool BBB, BBB+ and A-), assume that the predicted value is approximately a debt risk premium of the average (i.e., the target rating, and test whether this is likely

to be the case). Thus, for the BBB+ credit rating band (11 observations), the inclusion of BBB and A- bonds increases the sample size to 70 pooled bonds, and for the A credit rating band the sample is increased from 16 to 58 pooled bonds, which allows for a more robust estimate of the debt risk premium;[70] or

- *Combined credit rating bands approach* – i.e. estimate a system of equations, so that information from a wider sample is used and an econometric prediction is provided about the gaps between the curves – although this requires further constraints to be imposed on the estimation method (in the examples below we have assumed that curves are parallel).[71]

As discussed in Chapters 2 and 3, the econometric approach seeks to employ the maximum available information relating to the debt risk premiums observed for bonds with different terms. However, a methodology is required to determine the most appropriate functional form.

5.3.3 Testing for the best functional form

Given the controversy that has surrounded estimation of the debt risk premium since the onset of the global financial crisis, we have in the past applied econometric analysis to direct market evidence of bond yields. In order to apply econometric analysis to estimate the debt risk premium, it is necessary to make an assumption about the form of the relationship between debt risk premium and term to maturity, i.e. the functional form, or shape of the debt risk premium curve.

Theory and empirical evidence on functional form

Early empirical observation in the US credit markets found the debt risk premium to be 'humped', i.e. to rise with term for a period, but then decline. Merton's (1974) seminal work on the valuation of corporate bonds offered a theoretical explanation for this phenomenon. It was his proposition that because highly rated bonds have a very low default risk, their exposure to term offers the possibility of a future material rise in default risk.[72] As a result the debt risk premium will rise with term. On the other hand, bonds that are already rated low have high default risk, and given time are more likely to reduce this risk. As a result of these processes, Merton concluded that the term relationship for long dated low rated bonds would be humped. That is, the yield curve rises with term at first, but then becomes negative at longer terms.

In contrast to Merton's hypothesis, practitioners in fixed income securities markets have expressed the view that the 'term structure of credit spreads is one that increases with maturity and is steeper the lower the credit rating.'[73] For example, in their 1991 paper, Litterman and Iben, of the Fixed Income Research Department of Goldman Sachs, noted that:[74]

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[70] We note that the pooling approach has been endorsed by the Tribunal, e.g. see Application by Jemena Gas Networks (NSW) Ltd (No. 5) [2011] ACompT10, para. 55.

[71] For example, the CBA Spectrum service, which was discontinued during the global financial crisis, applied a system of equations to simultaneously derive a range of curves for every credit rating band based on all available observations in all credit rating bands.

[72] Robert C. Merton (1974), 'On the pricing of corporate debt: The risk structure of interest rates', *Journal of Finance*, Vol. 29, pp.449-470.

[73] Arthur D. Warga (1995), 'Review of Valuation of Fixed Income securities, by Frank Fabrozzi', *The Journal of Finance*, Vol. 50, No. 2, June, p762.

[74] Robert Litterman and Thomas Iben (Spring, 1991), 'Corporate bond valuation and the term structure of credit spreads,' *Corporate Journal of Portfolio Management*, p.54.

> ...we find that the term structure of corporate spreads is generally upward-sloping, indicating a market perception of higher probabilities of default in the more distant future.

More recent empirical work has cast doubt on the logic applied by Merton and others, particularly in relation to the implications that can be drawn from the observed hump in the term structure of BBB bonds in the US. For example, Helwege and Turner (1999) found that previous empirical studies had not provided an appropriate control for credit quality *within* the BBB credit rating band. Their evidence supported the hypothesis that:[75]

> When the more credit worthy firms in a given credit rating category are most likely to issue long-term bonds, the estimated credit yield curve for that rating category will be biased downwards.

In other words, Helwege and Turner's hypothesis was that only the most highly regarded businesses in the low rating category would be able to issue bonds at the long end of the maturity range. The 'hump' that had been observed by previous researchers was therefore found to be an artefact of incomplete empirical testing (i.e. not allowing for this risk differential within a credit rating band). A year after Helwege and Turner's research was published, Jia He, Wenwei Hu, and Larry H.P. Lang found that for BBB rated bonds in the US over the period 1993 to 1997, the credit spread was upward sloping for terms up to 10 years, and was humped only for very long terms to maturity (i.e. after a term of 25.7 years).[76] The Merton theory has continued to be challenged in the literature owing to its inability to explain empirical findings. For example, in 2007 Covitz and Downing concluded that:[77]

> ...direct tests of Merton-style models find that the models seriously under predict the level of long-term bond spreads.

While it is generally accepted by academics and practitioners alike that debt risk premium rises with term to maturity, there is debate about whether the relationship is linear, or a more complex curvilinear function. Past empirical research has provided evidence of both linear and non-linear relationships:

As noted above, Jia He, Wenwei Hu, and Larry H.P. Lang (2000) found a humped relationship only after 25.7 years, so that the empirical function would have been upward sloping well beyond the 10-20 year term that is of concern to us. In the US, Sorge and Gadanecz (2008), found that the term structure of the debt risk premium was 'essentially linear' with term for bonds and bank debt, i.e. the:

> 'term structure of bond spreads as estimated in regression (4a) can be fitted by an upwardly-sloping regression line with an R^2 exceeding 0.95 (i.e. it is essentially linear)'.[78]

Potential functional forms

In order to take account of the possibility of both linear and non-linear functional forms, we recommend econometric estimation (i.e. regression analysis) using the following functional forms:

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75 Jean Helwege and Christopher M. Turner (1999), 'The Slope of the Credit Yield Curve for speculative-Grade Issuers,' *The Journal of Finance*, Vol. 54, No. 5, October, p.1872.

76 Jia He, Wenwei Hu, and Larry H.P. Lang, (11 August, 2000), 'Credit Spread Curves and Credit Ratings', Working Paper, Chinese University of Hong Kong.

77 Dan Covitz and Chris Downing (October, 2007), 'Liquidity or Credit Risk? The Determinants of Very Short-Term Corporate Yield Spreads,' *Journal of Finance*, Vol. 62, No. 5, pp. 2303-2328.

78 Marco Sorge and Blaise Gadanecz (2008), 'The term structure of credit spreads in project finance,' *International Journal of Finance and Economics*, Vol. 123, p.80.

- linear,
- quadratic,
- exponential,
- cubic,
- logarithmic, and
- power.

Testing for the best functional form

We undertook two sets of tests of the functional form:

1. *During the test averaging period* - We ranked each functional form based on the observed Schwarz Information Criterion (SIC) test score for the test averaging period. The Schwarz Information Criterion (SIC), or 'Bayesian Information Criterion', is used to rank alternative functional forms based on the efficiency of the goodness of fit to the data. The equation providing the lowest SIC is ranked as superior.[79] Further explanation of the SIC test is provided in Appendix E below.

2. *During the entire Analysis Period* -We calculated SIC statistics for each regression equation for each of the 658 twenty business day averages in the Analysis Period (implying 3,948 equations in total, i.e., 658 days x 6 functional forms), where the input data for each comprised the average for each of the relevant bonds over the previous 20 day period.

Using the results of these tests enabled us to assess the relative merits of each functional form during the test averaging period, and also to assess the ranking of each functional form over time. The functional form that was most highly ranked over the entire Analysis Period would provide additional confidence that that functional form reasonably reflects the long term relationship between the debt risk premium and term (relative to idiosyncratic factors that might influence the debt risk premium during a particular 20 day averaging period). The choice of a functional form that provides relatively consistent results over time is important in a regulatory context, since the test averaging period will not be the averaging period that is actually used to determine the debt risk premium for the regulated business.

Testing for balanced representation from different credit rating bands

To estimate the FVC for the BBB+ credit rating band we have previously recommended the pooling of observations from the BBB, BBB+ and A- credit rating bands, as this provides a materially larger sample (70 bonds during the test averaging period for domestic bonds), that is likely to generate a more reliable debt risk premium estimate. A question that then arises is whether the pooled sample is more biased toward one or other of the neighbouring credit rating bands around the central BBB+ band. We calculated the average credit rating score by assigning values (1, 2 and 3) to the three credit ratings around a BBB+ credit rating

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79 See, G. Schwartz, (1978), 'Estimating the Dimension of a Model', *Annals of Statistics*, Vol. 6, No. 2, pp. 461–464. We used the SIC methodology rather than the Ramsay Reset test, as the latter is applied to test whether a linear functional form can be improved by applying a more complex functional form, while the SIC test is a broader test of model selection. See J. B. Ramsay, (1969), 'Tests for Specification Errors in Classical Linear Least Squares Regression Analysis,' *Journal of the Royal Statistical Association*, 72, pp.635-641.

(i.e. 1 for BBB, 2 for BBB+ and 3 for A-). Similarly, for the A credit rating band we assigned values of 1, 2 and 3 to credit ratings of A-, A, and A+ respectively.

5.3.4 *Overview of econometric estimates – pooling of neighbouring notches*

In Table 5.5 the debt risk premium for each credit rating band has been estimated including observations from one notch above, and one notch below the credit rating band of interest (i.e. BBB-, BBB, and BBB+ bonds pooled to estimate the BBB credit rating band; BBB, BBB+ and A- bonds pooled to estimate the BBB+ credit rating band, and A-, A, and A+ bonds pooled to estimate the A credit rating band).

Table 5.5 shows how the 10 year debt risk premium estimates for the BBB, BBB+ and A credit rating bands were distributed relative to the extrapolated Bloomberg BBB curve for alternative functional forms over the 20 day averaging period ending 28 November, 2012.[80]

Table 5.5 – 10 year debt risk premium estimates (pooled data) for 20 business days to 28 November 2012 (basis points) by functional form

Function	BBB rated	Function	BBB+ rated	Function	A rated
Quadratic	398	Cubic	447	**Bloomberg extrapolated**	**269**
Exponential	390	Quadratic	350	Exponential	221
Cubic	384	Exponential	328	Linear	220
Linear	383	**Bloomberg extrapolated**	**325**	Cubic	217
Power	364	Linear	318	Power	212
Logarithmic	359	Power	296	Logarithmic	211
		Logarithmic	291	Quadratic	188

Source: PwC's analysis, Bloomberg, UBS.

With respect to these estimates we note the following:

- *BBB credit rating band*

  In the BBB credit rating band the logarithmic and power functions provided materially lower estimates of the debt risk premium (364 basis points and 359 basis points respectively) than the linear and cubic functions (383 and 384 basis points), with the exponential and quadratic functions providing higher estimates still (390 and 398 basis points).

- *BBB+ credit rating band*

  In the BBB+ credit rating band the extrapolated Bloomberg curve (325 basis points) was positioned between estimates using the exponential function (328 basis points) and the linear function (318 basis points). There were also materially higher estimates based on the cubic and quadratic functions (447 and 350 basis points respectively), and materially lower estimates were obtained using the power and logarithmic functional forms (296 and 291 basis points respectively).

- *A credit rating band*

[80] Each observation is the simple average of the Bloomberg and UBS debt risk premium, where both services published an estimate, or the separate Bloomberg or UBS estimate where they did not. UBS is not a contributor to Bloomberg's bank feeds.

In the A credit rating band the Bloomberg curve was found to provide a materially higher estimate of the debt risk premium than any econometric estimate (269 basis points). On the other hand, except for the quadratic function, all the alternative functional forms in the A credit rating band provided estimates of the 10 year debt risk premium that lay within a relatively narrow band of 211 basis points (logarithmic) to 221 basis points (exponential).

5.3.5 *BBB credit rating band*

In Table 5.6 below we show the 10 year debt risk premiums estimated using alternative functional forms, and the corresponding SIC ranking for the 20 business days to 28 November, 2012, and for the wider Analysis Period since 2010. Based on this analysis we consider that the linear function is to be preferred.

- Over the whole Analysis Period i.e. for the 658 days up to 28 November, 2012,[81] the linear form was on average ranked equal first (with the exponential form), however:
  - We consider that less weight should be placed on either the cubic or exponential functions since they lack broader theoretical foundations and empirical support. On the other hand, as discussed above, the linear functional form does have empirical backing, and is simpler to apply and easier to communicate (in terms of a constant increment per annum).
- While the linear functional form was ranked second to the exponential function during the 20 business days up to 28 November, 2012, again we discount the exponential function owing to its lack of theoretical and empirical support.[82]
- The other functions either performed poorly during the latest averaging period (power, quadratic), or more generally (logarithmic).

Table 5.6 – BBB credit rating band - debt risk premium regression estimates for 20 business days to 28 November, 2012 (basis points)

Functional form	10 year BBB Debt Risk Premium (basis points)	Schwartz Information Criterion test for averaging period		Average rank by SIC for period 6 May 2010 to 28 November. 2012
		Value	Rank	Rank
Quadratic	398	1.858	6	5.14
Exponential	390	1.789	1	2.58
Cubic	384	1.817	3	4.69
Linear	383	1.803	2	2.58
Power	364	1.836	4	2.75
Logarithmic	359	1.845	5	3.26

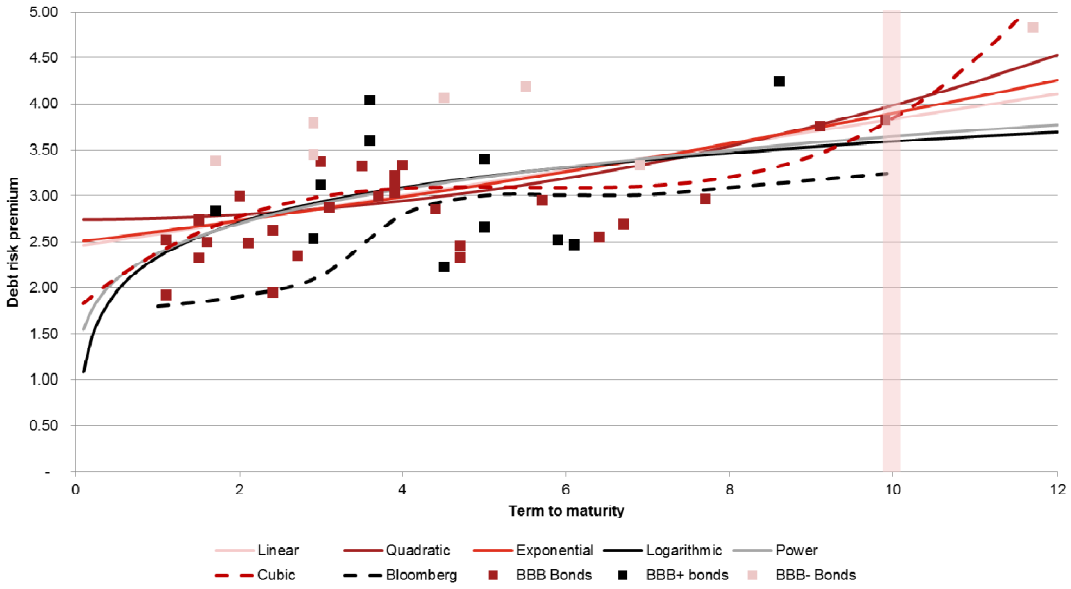
Source: UBS, Bloomberg, PwC.

[81] There were 658 overlapping regressions, with each day's regression being based on 20 days of observations up to and including that day. For these 658 overlapping periods of 20 days the power functional form was ranked first at 2.19 on average, with the next best functional form on this criterion being the linear function (ranked 2.13).

[82] We have not seen any academic papers or market practitioner reports that provide a theoretical justification, or empirical evidence supporting a debt risk premium function that is convex to the origin.

Figure 5.2 shows the debt risk premium estimate for each functional form, with the 10 year term to maturity estimate highlighted. We find that the extrapolated Bloomberg BBB FVC at 10 years (which estimates the BBB+ debt risk premium) was well below the econometric estimate of the BBB curve at 10 years. However, the 'hump' of the Bloomberg FVC at 5 years is close to (14 basis points away from) the value estimated by the BBB econometric regression line at 5 years. This suggests that the Bloomberg FVC provides a reasonable estimate of the BBB debt risk premium at 5 years, but is not a good estimator of the BBB curve at any other term to maturity.

Figure 5.2 – BBB rated debt risk premium estimates for alternative functional forms for 20 days to 28 November, 2012 (percentage points)



Source: PwC's analysis, Bloomberg, UBS.

5.3.6 *BBB+ credit rating band*

Table 5.7 below presents the alternative functional forms by the debt risk premium estimate they generate for BBB+ credit rated bonds at a term of 10 years. Based on this analysis, our view is that the linear function is to be preferred.

- The exponential and linear forms scored best and second best respectively (i.e. lowest and second lowest score) on the SIC test during the averaging period, while the power and linear function were ranked highest and second highest on average throughout the 658 days up to 28 November, 2012.[83]
  - We consider that less weight should be placed on either the cubic or exponential functions due to the fact that they lack broader theoretical foundations and empirical support. On the other hand, as discussed in Chapter 2 above, the linear functional form does have theoretical and empirical backing.

[83] There were 658 overlapping regressions, with each day's regression being based on 20 days of observations up to and including that day. For these 658 overlapping periods of 20 days the power functional form was ranked first at 2.19 on average, with the next best functional form on this criterion being the linear function (ranked 2.13).

  - While the power functional form was ranked marginally higher than the linear function over the entire Analysis Period, the linear form is simpler to apply and easier to communicate (in terms of a constant increment per annum).

- The other functions either performed poorly during the latest averaging period (power), or more generally (quadratic and logarithmic).

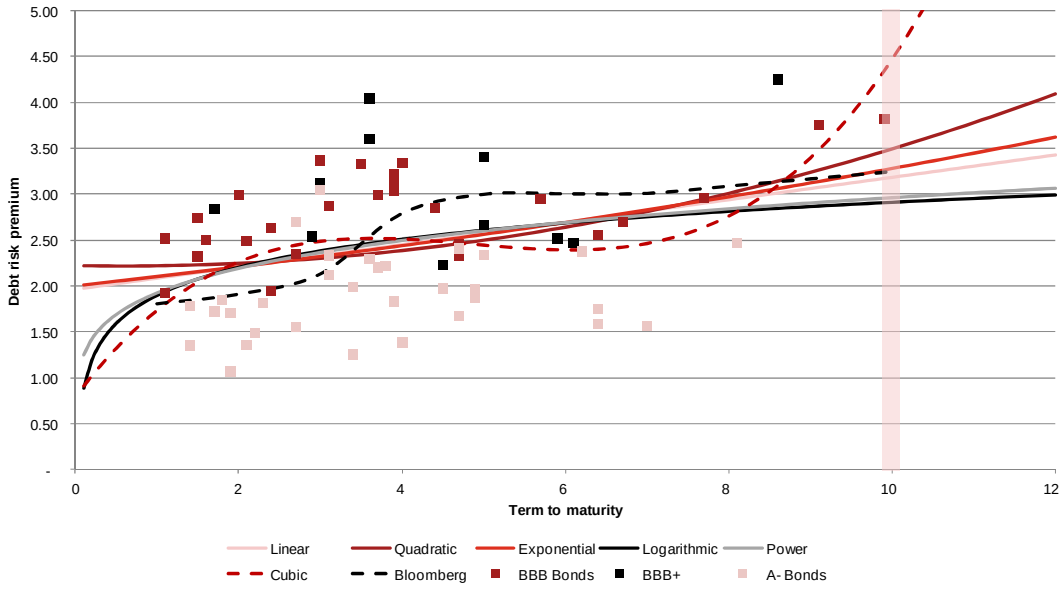
Table 5.7 – BBB+ credit rating band - debt risk premium regression estimates for 20 business days to 28 November 2012 (basis points)

Functional form	10 year BBB+ Debt Risk Premium (basis points)	Schwartz Information Criterion test for averaging period		Average rank by SIC for period 6 May 2010 to 28 November. 2012
		Value	Rank	Rank
Cubic	447	2.103	2	5.75
Quadratic	350	2.151	6	4.96
Exponential	328	2.098	1	2.91
Bloomberg extrapolated	**325**	n/a	n/a	n/a
Linear	318	2.103	2	2.19
Power	296	2.115	4	2.13
Logarithmic	291	2.118	5	3.06

Source: UBS, Bloomberg, PwC.

Figure 5.3 below displays the debt risk premium estimate for each functional form, with the 10 year term to maturity estimate highlighted. From the figure it is evident that the extrapolated Bloomberg BBB FVC produced a debt risk premium estimate that was close to the linear regression function at a term of 10 years, but was higher or lower than the linear function at most other terms to maturity. It is also apparent that between 2 years and 7 years, apart from the exponential function (and the Bloomberg curve), there was a high degree of similarity in the debt risk premium estimates using alternative functional forms.

Figure 5.3 – BBB+ rated debt risk premium estimates for alternative functional forms for 20 days to 28 November, 2012 (percentage points)



Source: PwC's analysis, Bloomberg, UBS.

Throughout the Analysis Period the average credit rating was always close to BBB+ (1.9 based on the assigned values).[84] The number of bonds in the BBB+ rating band was always less than one-third of the total sample, which provides a justification for our pooling of BBB+ observations with the neighbouring bands of BBB and A-.

5.3.7 *The A credit rating band*

Table 5.8 below presents the alternative functional forms by the debt risk premium estimates they generate. Based on these results, if we were only examining the A credit rating band our view would be that the logarithmic or power function should be preferred. The power function was the best function on average throughout the 658 days of the Analysis Period, but was only marginally ahead of the logarithmic function, which was the best functional form for the averaging period ending 28 November, 2012. However, the practical impact of choosing between the power, logarithmic, and linear functional forms was relatively minor (ranging from 211 to 220 basis points).

Table 5.8 – A credit rating band - debt risk premium regression estimates for 20 business days to 28 November 2012 (basis points)

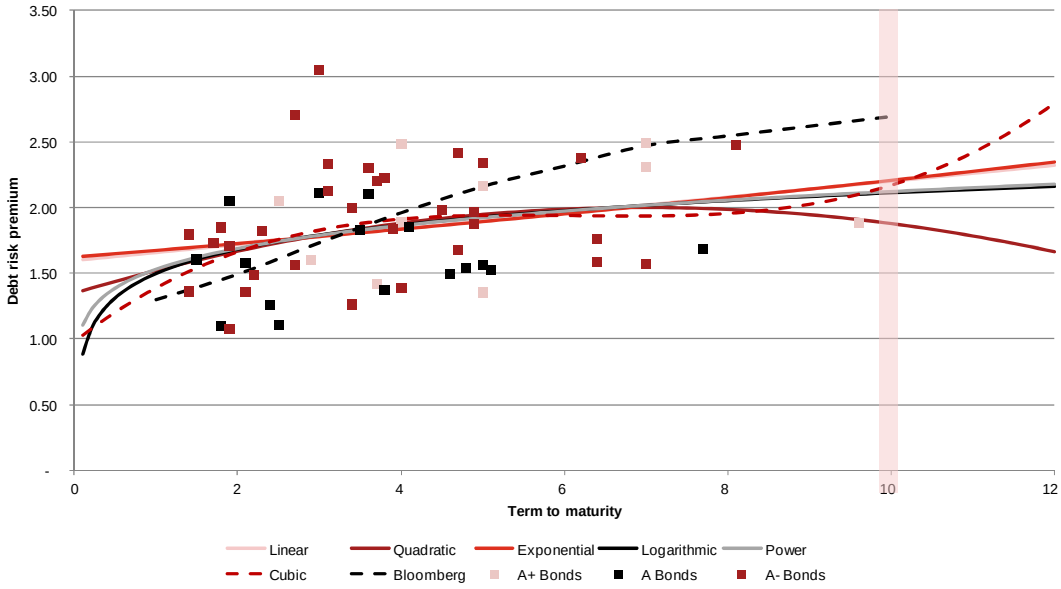
Functional form	10 year A Debt Risk Premium (basis points)	Schwartz Information Criterion test for averaging period		Average rank by SIC for period 6 May 2010 to 28 Nov. 2012
		Value	Rank	Rank
Bloomberg extrapolated	**269**	n/a	n/a	n/a
Exponential	221	1.210	4	4.22
Linear	220	1.207	3	3.05
Cubic	217	1.316	6	5.40
Power	212	1.189	2	1.97
Logarithmic	211	1.186	1	2.01
Quadratic	188	1.257	5	4.34

Source: UBS, Bloomberg, PwC.

Figure 5.4 below shows the debt risk premium estimate for the A credit rating band for each functional form. The extrapolated Bloomberg A FVC is materially higher than the regression estimates at 10 years term to maturity, and for all maturities beyond 4 years. Hence, it may provide a good reflection of the A- curve, which is the dominant credit rating band (in terms of bond observations) within the wider A credit rating band (encompassing A-, A and A+).

[84] The average score obtained for the sample was 1.9, which was close to the theoretical average of 2 required for a BBB+ credit rating given the notional scores applied to each credit rating between BBB and A- (i.e. a score of 1 for a credit rating of BBB, a score of 2 for a credit rating of BBB+, and a score of 3 for a credit rating of A-).

Figure 5.4 – A rated debt risk premium estimates for alternative functional forms for 20 days to 28 November, 2012 (percentage points)



Source: UBS, Bloomberg, PwC.

As noted above, based only on the evidence for the A credit rating band, we would conclude that the logarithmic or power functions should be preferred. However, in the previous section we preferred the linear form for its overall goodness of fit and for its simplicity. Given the finding of very little difference between the debt risk premium estimate for the logarithmic, power and linear functional forms over the range of terms to maturity of 5 to 10 years, we again preferred the linear form for its simplicity and ease of interpretation.

5.3.8 Other credit rating bands

The AA and AAA credit rating bands

A separate econometric approach could not be undertaken for the AA and AAA credit rating bands. Being dominated by the bonds of financial institutions and state government central borrowing agencies, the total number of corporate bond yield observations in the AA credit rating band was at most 6, while for the AAA credit rating band there were only at most 3 observations. For example, while a pooling of A+, AA and AAA bonds would have provided a total pooled sample of 18 bonds, this sample would have been heavily skewed toward the A+ credit rating band, resulting in a poor estimate of the debt risk premium for the AA credit rating band.

Therefore, in order to estimate FVCs for these two credit rating bands we calculated the average difference (in basis points) between the DRP of the A credit rating band regression, and the AA and AAA bonds in our sample. Having determined that the average difference were 20 basis points and 52 basis points respectively for the 20 business days to 28 November, 2012, we made an assumption that the slope (i.e. the change in the debt risk premium per year to maturity) of the AA and AAA curves would equal the slope of the A curve (which we established by reference to a reasonable sized sample of bonds rated A-, A or A+). These relationships are shown in Table 5.7 below, where the differences between the A curve and the AA and AAA curves are respectively 20 and 52 basis points.

Table 5.7 – Estimating the debt risk premium for the AA and AAA credit rating bands (basis points) (20 days to 28 November, 2012)

Credit rating	2 yrs	3 yrs	4 yrs	5 yrs	6 yrs	7 yrs	8 yrs	9 yrs	10 yrs	Source:
A	172	178	184	190	196	202	208	214	220	Pooled regression
AA	151	157	163	169	175	181	188	194	200	21bp less than A curve
AAA	120	126	132	138	144	150	156	162	168	52bp less than A curve

Source: Bloomberg, and PwC analysis.

The A- and A+ credit rating bands

Having determined the other credit rating band FVCs between BBB and AAA, we simply interpolated the A- and A+ FVCs.

5.4 Alternative econometric approaches

5.4.1 A combined credit rating bands approach

As noted above, an alternative to the pooled regression approach is the combined credit rating bands approach. Under this approach all the observations in the relevant credit rating bands are combined, and an estimate is made of a family of FVCs for the full range of major credit rating bands from BBB to AAA. In a linear specification this requires that dummy intercept and slope variables are defined for all but one of the credit rating bands, which then becomes the base case. Applying this approach to the BBB through to A+ credit rating bands (using both a domestic bonds only, and a combined domestic / international bonds sample) resulted in the estimated debt risk premiums shown in Table 5.8 below.

In most bond rating categories the 10 year debt risk premium estimate was slightly higher for the combined domestic/international sample. In all bond rating categories except BBB- the domestic bond estimate and the pooled domestic/international bond estimate were within 12 basis points of each other. However, it is anomalous that in both samples the BBB+ estimate lay above the BBB estimate, and in the domestic bonds case, materially above the BBB estimate. This is contrary to all expectations, and is likely due to the relatively small sample size in the BBB+ credit rating band. This result implies a BBB+ estimate of 353 to 355 basis points, which is significantly higher than the 336 basis points estimated for the BBB credit rating band using domestic bonds only. Due to these results for the BBB+ credit rating band being 'out of context', we prefer to place greater reliance on the greater number of observations in our simple portfolio pooled regression analysis estimate of 318 basis points, and the extrapolated Bloomberg curve estimate of 325 basis points.

Table 5.8 – Linear regression 10 year debt risk premium estimates using a pooled sample analysis for 20 days to 28 November, 2012 (basis points)

Credit rating	BBB-	BBB	BBB+	A-	A	A+
Domestic bonds only	430	336	355	246	218	240
Domestic and international bonds	465	351	353	251	228	218

Source: UBS, Bloomberg, PwC.

5.4.2 An alternative method: joint domestic and international bonds estimate

In the section above, and in sections 5.4 and 5.5 below we find that the DRP on international corporate bonds (for the same term and credit rating) are reasonably similar to domestic corporate bonds when swapped into Australian fixed rate equivalent terms. An implication of this is that if the number of corporate bonds on issue is considered

inadequate to draw meaningful results, the domestic and international bond observations could be pooled to increase the sample size. Against this, however, the consideration of international bonds involves additional complexity, which is why the majority of Australian regulators to date have relied solely on domestic corporate bonds, and why we recommend that the Authority continue with this practice. However, for completeness we present the results from combining international and domestic bonds in Table 5.9.

The only pooled credit rating band that could be estimated for international bonds was the BBB+ band, which in November 2012 included 5 BBB bonds, 6 BBB+ bonds, and 16 A- bonds, with average terms to maturity of 7.68 years, 4.14 years, and 6.16 years respectively. As such, it could be argued that the resulting BBB+ estimate may be statistically biased through having a preponderance of shorter term higher rated A- bonds. The linear regression results show that the 318 basis points simple portfolio (domestic bonds) estimate of the 10 year debt risk premium for the BBB+ credit rating band for the test averaging period was only 2 basis points lower than the international bond estimate. Furthermore, the joint domestic/international bonds pooled estimate of the 10 year debt risk premium of 317 basis points (using a sample of 97 bonds in the BBB, BBB+ and A- credit rating bands) was just one basis point lower than the simple portfolio estimate.

Table 5.9 – BBB+ debt risk premium – joint domestic and international bonds linear regressions (20 days to 28 November, 2012)

	10 year debt risk premium estimate	No. of observations
Simple portfolio (domestic bonds)	318	70
International bonds	320	27
Joint domestic/international bonds	317	97

Source: UBS, Bloomberg, PwC.

5.5 Complex portfolio approach

5.5.1 Implementing the complex portfolio approach

What we have termed the debt portfolio approach requires estimation of the benchmark debt risk premium based on the cost of constructing the debt portfolio that reflects the average practice across the relevant Australian regulated infrastructure firms. In Chapter 2 we estimated the benchmark debt capital structure of firms in the Australian regulated energy industry based on a division between bank debt, domestic bonds and international bonds. While we have already considered the simple portfolio component above, in this section we examine the possibility of separately estimating debt risk premiums for bank debt and international bonds, and using these estimates to derive a debt risk premium estimate for the complex portfolio.

Economic theory would suggest that with open capital markets it should not be possible for firms to consistently arbitrage international capital markets in order to achieve a lower cost of debt. Hence, our task is to test this proposition by investigating:

- Whether the debt risk premium at 5 years for bank debt is the same as for domestic bonds with equivalent term; and
- Whether the debt risk premium at 10 to 12 years for foreign bonds is the same as for domestic bonds.

We tested the equivalence of the complex portfolio and simple portfolio only for the BBB+ and A rating bands, as these are the only credit rating bands that have enough foreign bond observations to attempt such estimation. For example, a debt risk premium could be estimated through a pooled regression for the A credit rating band as there were 16 A-, 14 A, and 15 A+ international bonds. Other credit rating bands could not be estimated due to insufficient bond observations. We therefore use the results for the BBB+ and A credit rating bands to infer that they can be applied more generally.

5.5.2 *Bank debt*

Foreshadowing our Chapter 6 findings for debt raising transaction costs, we note that the cost of bank debt is comprised of an upfront charge, and on-going interest charge. A major component of the up-front charge is actually a charge for risk taking, and should therefore be properly included with the annual interest cost charge. The bank interest costs observed in this section include this component of the interest charge, which amounted to 21 bp.

As noted in Chapter 2, unlike a bond, bank debt is not a traded financial instrument, and consequently Bloomberg cannot provide a synthesis of market opinion on the current cost of bank debt, as it does for bonds. However, since bank debt and bonds are to a degree substitutable, we should expect there to be some relationship between bond yields and the cost of bank debt. We tested this proposition by accessing the LoanConnector data base, and assembling the cost of bank debt issues by credit rating for Australian corporates over the period from May 2010 to January 2013.[85]

In Australia the terms agreed for most corporate bank debt issues are not made public. The majority of those bank deals where the outcomes were made public were rated BBB+ or A, and we investigated these credit rating groups separately. The debt risk premiums observed for bank deals in the BBB+ credit rating group are shown in Figure 5.5 below. The debt risk premiums of the bank deals at each announcement date for different maturities (1, 3 and 5 years) are shown against the risk premiums predicted by econometric analysis (linear regression) for the same maturities over a two year period. That is, each line in Figure 5.5 below represents the debt risk premium estimated by linear regression for terms of 1, 3 and 5 years, but shown in cross section over time.

Examination of Figure 5.5 shows that for 3 out of 5 of the bank deals in the BBB+ credit rating category, and at 5 years to maturity the regression line estimate of the BBB+ debt risk premium based on domestic bond yields provided a reasonable estimate of the debt risk premium that was negotiated in the bank deal. In two cases in 2011-12, the bank deals were concluded at a low debt risk premium relative to the estimate of the debt risk premium obtained from a linear regression. We have already seen that while at a term of 10 years the extrapolated Bloomberg curve was reasonably approximated by the linear regression function, at a term of 5 years the Bloomberg curve predicted a materially higher debt risk premium than the value predicted by linear regression. The debt risk premiums observed for the bank deals at a term of 5 years were therefore much closer to the regression line estimate than to the Bloomberg curve. This is further evidence that at a term of 5 years the BBB Bloomberg curve does not provide a reasonable estimate of the debt risk premiums for BBB+ debt that are obtainable in the market.

At terms of 3 years and 4 years to maturity, Figure 5.5 indicates that the debt risk premiums negotiated in the bank deals were almost all materially lower than the levels predicted by the econometric analysis. The terms of only one BBB+ bank deal at a term of 2 years was available, and was concluded at a debt risk premium slightly above the level the level predicted by regression analysis. For the 3 and 4 year bank deals it looks as if the bank deals were being done at debt risk premiums that at that time were indicated by bonds with a year less to maturity (i.e. 2 and 3 years respectively). While this may be an aberrant result due to a small sample size, it might also reflect the fact that terms below 5 years are not the preferred issuance terms for domestic corporate bonds, while for bank debt this is the most common range of issuance terms. In other words, bank debt may be preferred at terms below 5 years because it is likely to be cheaper than bonds at those terms, while very little bank debt is issued for terms beyond 5 years because capital market sources (bonds) are cheaper at those terms to maturity.

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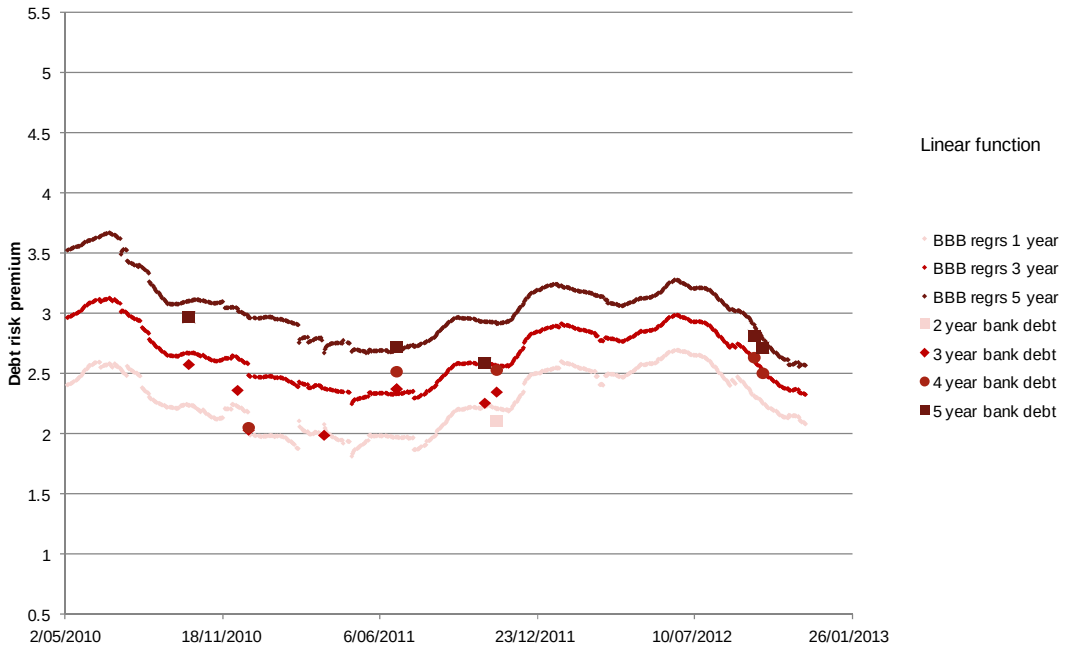
[85] LoanConnector is a debt information service provided by Thomson Reuters. It consolidates publicly available debt information for a range of companies, including Australian and UK companies. Importantly, it consolidates corporate bond issuances, and publicly available bank debt information.

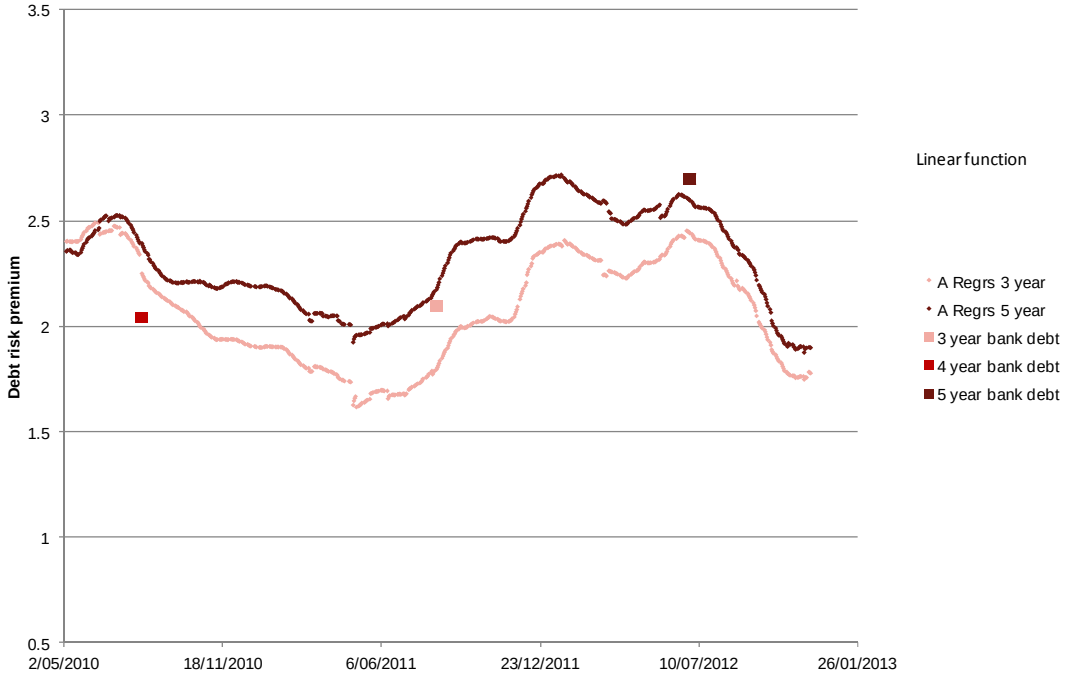
Figure 5.5 – Debt risk premium: BBB+ rated bank debt vs econometric predictions (percentage points)



Source: Loan Connector, UBS, Bloomberg, PwC analysis.

As can be seen from 5.6 below, there was even less information available on bank deals in the A credit rating. Of the three bank deals with information available, the latter two deals were concluded at debt risk premiums above the levels predicted by a linear regression of A rated bonds, while one was below the levels indicated by the bond pricing data.

Figure 5.6 – Debt risk premium: A rated bank debt vs econometric predictions (percentage points)



Source: Loan Connector, UBS, Bloomberg, PwC analysis.

5.5.3 International bonds

As discussed in Chapter 2, international bonds have been included in the debt risk premium estimation methodology adopted by IPART, and the inclusion of Australian international bond issues into the benchmark has been discussed at various times. To incorporate the pricing of international bond issues by Australian firms, we have translated the international market data to Australian dollar yield equivalents using the methodology that is summarised in Chapter 2 above, and is more fully explained in Appendix C below.

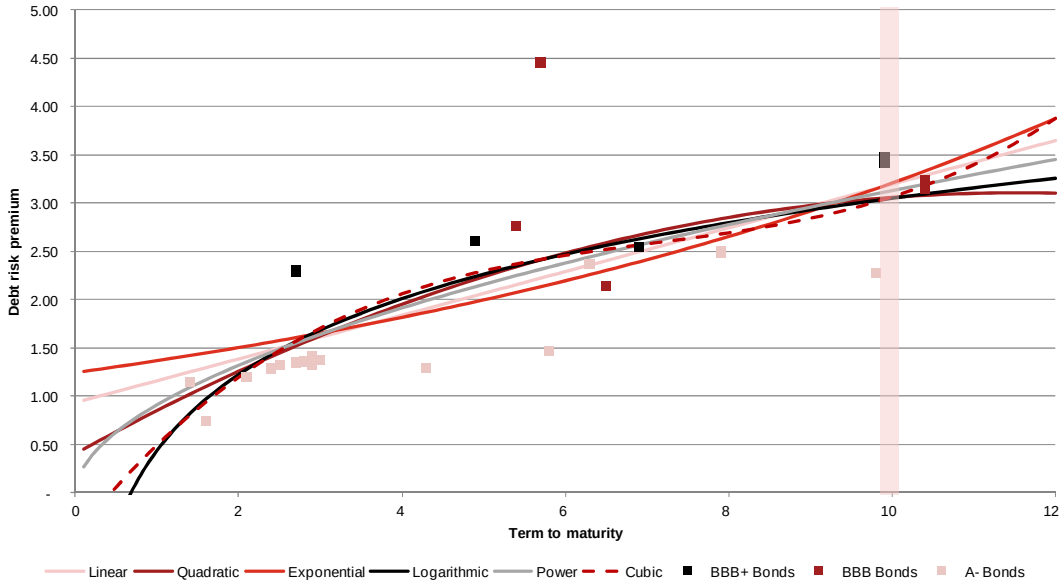
The relative cost of bond issues in Australia and Australian company bond issues in international capital markets was assessed by first adjusting the yield of the bond issued in the foreign country to a domestic (Australian dollar, i.e. AUD) equivalent yield, and taking into account the differential transaction costs. Then the equivalent AUD foreign bond yield was converted into a debt risk premium by subtracting the appropriate Australian Commonwealth Government bond yield. In this way the debt risk premiums of bonds issued in Australia, and of foreign bonds issued by Australian businesses, could be compared on an equivalent basis.

For the test averaging period (20 business days to 28 November 2012), we found 27 bond issues in international markets by Australian BBB, BBB+ and A- rated businesses, and 45 international bonds with an A credit rating.. However, at the beginning of the Analysis Period (i.e. May 2010) we could only find 5 international issues to estimate a BBB+ function (i.e. rated BBB, BBB+ or A-), and 20 international issues for estimating an A function (i.e. rated A+, A, or A).

BBB+ rated international bonds

As shown in Figure 5.7, during the test averaging period the linear function for 10 year term international BBB+ rated bonds predicted a debt risk premium of 320 basis points, which compares with a debt risk premium of 318 basis points for domestic bonds during the same period. However, at a term to maturity of 5 years, the international BBB+ bond function indicated a debt risk premium of 206 basis points, which was materially lower than the 257 basis points indicated for domestic bonds of the same term. However, a visual inspection of Figure 5.6 suggested that it was being disproportionately influenced by a large number of 1 to 3 year term A- bonds. This bias toward the A- credit rating was confirmed by the calculated average credit rating value of 1.59 (where A- was 1, BBB+ was 2, and BBB was 3). As noted above, the average terms to maturity of the A-, BBB+ and BBB bonds in the international pooled sample were 4.14 years, 6.1 years and 7.68 years respectively. In other words, on average the heavily weighted international A- bonds generally had materially lower terms to maturity than the international BBB+ and BBB bonds.

Figure 5.7 – Debt risk premium: International BBB+ rated bonds issued by Australian businesses (percentage points) for 20 business days to 28 November, 2012



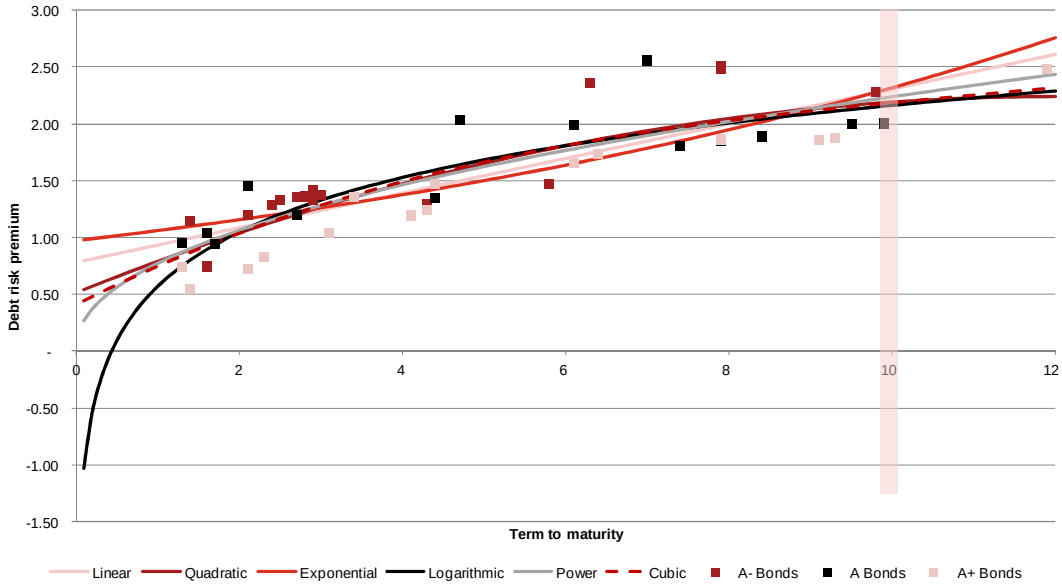
Source: Loan Connector, UBS, Bloomberg, PwC analysis.

A rated international bonds

Figure 5.8 below shows the estimated function for Australian bonds issued internationally with an A credit rating (i.e. A+, A or A-). During the test averaging period the linear function for 10 year term international A rated bonds predicted a debt risk premium of 231 basis points, which was not materially higher than the debt risk premium of 220 basis points predicted for domestic bonds. However, at a term to maturity of 5 years, the international A rated bonds (linear) function predicted a debt risk premium of 155 basis points, which was materially less than the 190 basis points predicted for domestic bonds (linear function) at that term to maturity. In contrast to the BBB+ estimation above, this differential could not be explained by disproportionate representation of the component ratings, as the average rating was calculated at 2.02 (where 2 would indicate an A rating).

We do note in this regard that at a term of 5 years the linear functional form provided materially lower estimates of the debt risk premium than either the logarithmic or power functions, which were found to be superior functional forms using the SIC test. However, while the linear functional form probably understated the 5 year debt risk premium, this is of little relevance if we are targeting a 10-12 year term at issuance, where the choice of functional form makes relatively little difference to the debt risk premium estimate.

Figure 5.8 – Debt risk premium: International A rated bonds issued by Australian businesses (percentage points) for 20 days to 28 November, 2012



Source: Loan Connector, UBS, Bloomberg, PwC analysis.

In conclusion, for both the BBB+ and A credit rating bands, for the 20 business days to 28 November, 2012, the international bond data supported the 10 year debt risk premium estimated with domestic bond data, but we also found that at a term of 5 years the debt risk premiums in the international market were materially lower than in the domestic market when using the linear functional form. In the case of the BBB+ curve this was most likely due to an over-representation of A- bonds reducing the estimated debt risk premium at a 5 year term.

5.6 Comparison of alternative methodologies

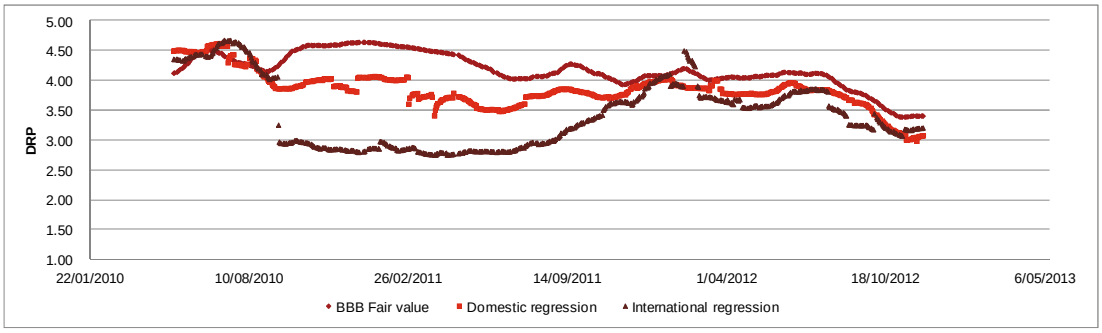
In this section we compare the results obtained by applying alternative methodologies to estimate the debt risk premium for a range of credit rating bands. We begin by considering the predictions of the debt risk premium obtained from a reliance on the extrapolated Bloomberg methodology compared with predictions obtained from econometric analysis and the debt 'portfolio' approach. Lastly, we compare the predictions of all the alternative approaches.

5.6.1 Comparison of debt risk premium estimates over time

Figure 5.9 below displays three estimates of the 10 year BBB+ debt risk premium over the period from May 2010 to November, 2012. In general the extrapolated Bloomberg value tended to provide the highest estimates, although there have been periods when the domestic bonds regression estimate (linear function) equalled (e.g. late in 2011), or exceeded (up to mid-September 2010), the extrapolated Bloomberg value. Currently, as we have already seen, the linear regression and extrapolated Bloomberg values are relatively similar at a term of 10 years. With respect to the international bonds regression estimates we found that during 2010 they generally equalled or exceeded the extrapolated Bloomberg and domestic regression estimates.

In mid-September 2010 there was a sudden 100 basis points fall in the 10 year term international bonds debt risk premium estimate (from just over 400 basis points to just under 300 basis points), and for the next 12 to 14 months there was a marked divergence between all three estimates, with the extrapolated Bloomberg estimate rising above 450 basis points, and the domestic bonds regression estimate ranging between 350 and 400 basis points. In December 2011 all three series converged again, and have been relatively close ever since.

Figure 5.9 – BBB+ 10 year credit rating debt risk premium: comparison of Bloomberg, domestic and international regression results (percentage points) for 20 days to 28 November, 2012



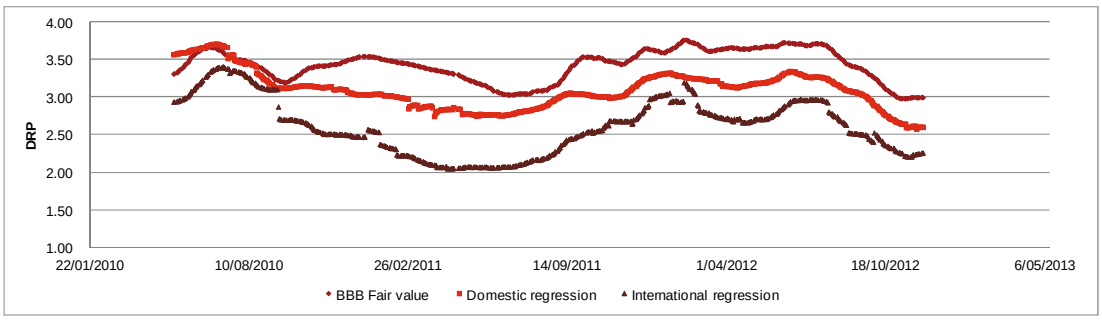
Source: Loan Connector, UBS, Bloomberg, PwC analysis.

Upon investigation we found that the sudden fall in the international bond debt risk premium estimate in mid-September 2010, and was due to a change to the composition of the sample (which had a material effect because of the very small sample at that time). The number of observations of international bonds in mid-September 2010 was only 7, and the introduction of three Woolworths bonds (one of which had a term of 10 years), caused the regression estimate to drop sharply. Over the next 12 months the international bonds regression estimate drew closer to, and for a time converged with, the domestic bonds regression estimate and the extrapolated Bloomberg estimate. By this time (late 2011) the number of bonds in the international sample had increased to 16, and subsequently grew to 27 bonds.

A sample of 27 bonds in 2012 is likely to be much more dependable than the sample of 7 bonds in September 2010, however it still considerably smaller than the 70 bond sample that we used to estimate the domestic bonds regressions. Hence, we would not recommend placing any reliance on the international regression estimates prior to 2012, and conclude that in recent times, when a more respectable number of international bonds could be observed, the 10 year BBB+ debt risk premium predicted from analysis of international bonds has been similar to that observed from domestic bonds.

Figure 5.10 shows that a term of 5 years to maturity a smaller fall in the estimated debt risk premium occurred for international bonds (relative to the large fall in the 10 year debt risk premium). As noted above, at 5 years we found that for international bonds the debt risk premium estimate was materially lower than the domestic bonds estimate and the Bloomberg estimate. In other words, at the 5 year term to maturity, the current differential between the debt risk premium estimate based on econometric analysis of domestic and international bonds has persisted for some time. However, as noted above, we have reason to believe that the international pooled regression estimate is under-estimated due to an over-representation of shorter term to maturity A- rated bonds.

Figure 5.10 – BBB+ credit rating 5 year debt risk premium: comparison of Bloomberg, domestic and international regression results (percentage points) for 20 days to 28 November, 2012

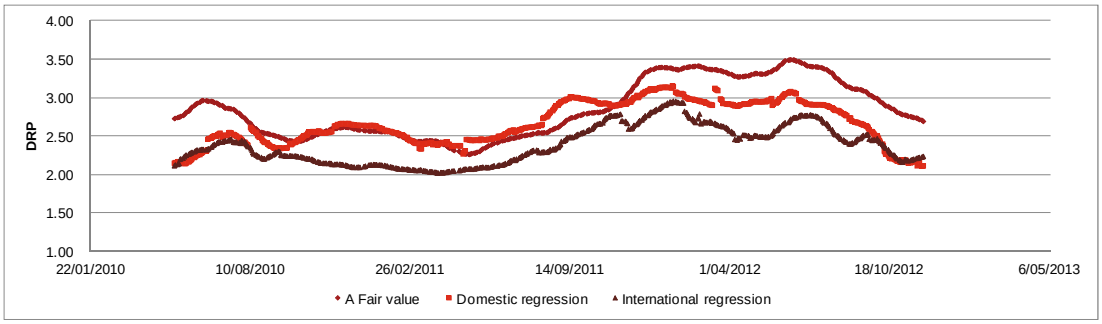


Source: Loan Connector, UBS, Bloomberg, PwC analysis.

The econometric estimates for the A credit rating band are displayed in Figures 5.11 and 5.12 below. For the A credit rating band we found that at the 10 year term the estimate based on international bonds evidence was close to the domestic bonds estimate.

However, in the past (between 2010 and the end of 2011) the domestic regression estimate of the debt risk premium tracked the extrapolated Bloomberg estimate, and both were materially higher than the international bonds estimate. While this might be evidence that there are periods when pricing differentials between domestic and international markets provide arbitrage opportunities for cheaper financing, the number of bonds in the international sample was smaller during 2010-11, and we have noted that under-estimation of the international debt risk premium could be expected due to over-weighting of A- bonds.

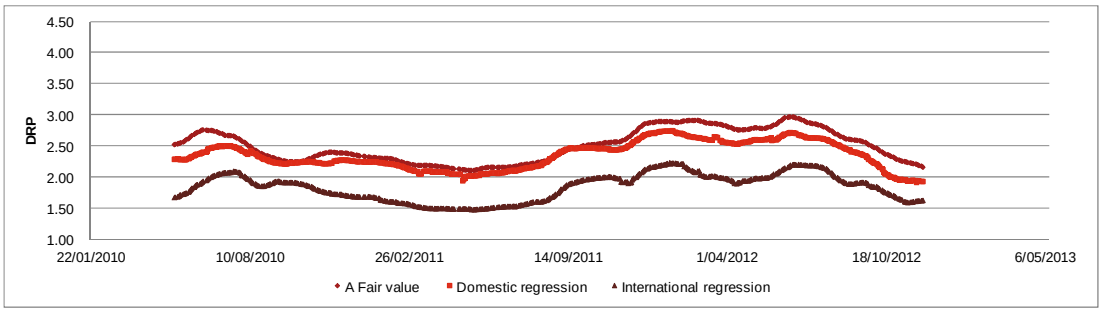
Figure 5.11 – A credit rating 10 year debt risk premium: comparison of Bloomberg, domestic and international regression results (linear function) (percentage points)



Source: Loan Connector, UBS, Bloomberg, PwC analysis.

However, at the 5 year term to maturity in the A credit rating band, while the domestic bonds econometric estimate was often relatively close to the Bloomberg estimate, the international bonds econometric estimate was always 40 to 50 basis points below the domestic bonds estimate, and sometimes as much as 80 basis points lower than the Bloomberg curve. We have noted that the 5 year debt risk premium is likely to be under-estimated owing to the linear functional form being applied (rather than a power or logarithmic function).

Figure 5.12 – A credit rating 5 year debt risk premium: comparison of Bloomberg, domestic and international regression results (linear function) (percentage points)



Source: Loan Connector, UBS, Bloomberg, PwC analysis.

Debt risk premium estimates applying a complex portfolio approach

In Table 5.10 we show the results of applying a complex portfolio approach to estimate the debt risk premium. Under this approach the components of the capital structure are

separated, with individual estimates of the debt risk premium applied to each of these components. The capital structure weights and terms to maturity at issuance were drawn from the discussion in Chapter 2 above, while the estimates of debt risk premiums were based on the linear regression results for domestic and international bonds.

In the analysis presented above, we found that it was impractical to apply a direct benchmark for bank debt owing to a lack of updated market information. Specific pricing details for few bank deals are made public, and they soon become stale in the market. However, we also found that in the BBB+ credit rating category the 5 year debt risk premium estimated by a linear regression was a reasonable estimate of the 5 year debt risk premium for bank debt. We therefore considered it reasonable to apply the debt risk premium estimated by linear regression as a proxy for debt risk premium of 5 year bank debt. Table 5.10 shows that for the 20 business days to 28 November, the estimated 10 year 'portfolio' BBB+ cost of debt yield was 635 basis points, while the corresponding A cost of debt yield was 539 basis points.

Table 5.10 – Cost of debt at 10 years based on the complex portfolio approach (20 business days to 28 November, 2012)

Debt component	Weight in capital structure	Term to maturity at issuance	BBB+ DRP(bp)	BBB+ cost of debt (bp)	A DRP(bp)	A cost of debt (bp
Bank debt	27%	4.9	258	531	190	464
Domestic bonds	50%	12.1	344	678	233	567
International bonds	23%	10.7	342	662	246	566
Weighted average			**313**	**635**	**221**	**539**

Source: Bloomberg, UBS, Loan Connector, and PwC analysis. Note: Excludes debt raising transaction costs. .

Comparison of alternative methodologies

Table 5.11 sets out the debt risk premium estimates obtained using alternative methodologies for terms of 5 and 10 years.

- *Extrapolated Bloomberg FVC*

  The current AER extrapolated Bloomberg methodology was found to provide the highest estimates of the debt risk premium at both 5 and 10 year terms to maturity, in both the BBB+ and A credit rating bands. However, at a 10 year term to maturity the difference between the extrapolated Bloomberg methodology and several of the other methodologies were immaterial for the BBB+ credit rating band.

- *10 year term to maturity*

  At a 10 year term to maturity three alternative methodologies (i.e. the old AER 'simple average', simple portfolio and complex portfolio approaches) all produced debt risk premium estimates that were close to each other (i.e. between 314 and 318 basis points), and close to the extrapolated Bloomberg estimates (i.e. between 7 and 11 basis points lower). For a 10 year benchmark term in the BBB+ credit rating band we conclude that the extrapolated Bloomberg approach provided a reasonable estimate of the debt risk premium.

  In the A credit rating band we found that at a term of 10 years the extrapolated Bloomberg estimate of 269 basis points provided a materially higher estimate of the debt risk premium than the other methodologies. The old AER 'simple average' methodology (238 basis points) would have provided the second highest estimate, but still 31 basis points below the extrapolated Bloomberg methodology. The

domestic bonds analysis and 'portfolio' approach (incorporating international bond issues) provided estimates of 220 basis points and 222 basis points respectively. Applying these estimates as cross-checks of the extrapolated Bloomberg methodology for the A credit rating band, would have caused us to question the extrapolated Bloomberg estimate.

- *5 year term to maturity*

  At a term of 5 years the extrapolated Bloomberg methodology provided a 300 basis point BBB+ debt risk premium estimate that was materially higher than all the other methodologies. Of the alternative approaches the ERA's methodology provided the highest estimate (268 basis points) for a BBB+ credit rating, but we have expressed our reservations about the appropriateness of this methodology. The simple portfolio regression approach obtained a lower estimate of 257 basis, while the old AER 'simple average' methodology was lower still at 245 basis points. Reasons for these differentials relative to the simple portfolio pooled regression included:

  – That the ERA's methodology excluded A- bonds (i.e. only BBB and BBB+ bonds were used) that were included in the simple portfolio pooled regression, and this exclusion of A- bonds would have raised the ERA's BBB+ estimate as a result; and

  – That the average term to maturity for the AER's 'simple average' approach was only 4.1 years, which would be expected to under-estimate the debt risk premium for 5 years.[86]

The fact that the old AER approach provided estimates that were higher or lower than the simple portfolio methodology was due to the average terms of the old AER sample being more or less than the target terms (5 and 10 years), and being more likely to have been influenced by single observations, as these estimates depended on fewer observations than the econometric approach.

Table 5.11 – Cost of debt estimates using alternative methodologies (20 business days to 28 November 2012)

	BBB+ credit rating			A credit rating		
	5 year DRP (bp)	10 year DRP (bp)	10 year cost of debt (bp)	5 year DRP (bp)	10 year DRP (bp)	10 year cost of debt (bp)
Extrapolated Bloomberg	300	325	639	216	269	583
Old AER methodology	245	314	628	187	238	552
ERA methodology	268	n/a		155	n/a	
Simple portfolio – (linear) regression	257	318	632	190	220	534
Complex portfolio approach	n/a	n/a	635	n/a	n/a	539

Source: Bloomberg, UBS, Loan Connector, and PwC analysis. Note: Excludes debt raising transaction costs.

The complex portfolio approach provided estimates of the 10 year cost of debt that were three basis points higher than the domestic bond regression in the BBB+ credit rating band

86 We note that the difference between the old AER approach and the domestic bonds regression approach was 12 basis points. More than half of this difference can be explained by the average 7.36 basis point per annum rise in the debt risk premium in the A credit rating band based on paired bonds analysis.

and very close in the A credit rating band (5.34 per cent vs 5.39 per cent). This is not surprising given that 73 per cent of the value is determined by the simple portfolio regression (which at a term of 5 years is also the proxy for the bank debt component).

At a benchmark term of 10 years the extrapolated Bloomberg FVC also provided a reasonable approximation of the BBB+ regression debt risk premium estimate (325 basis points vs 318 basis points), but a materially higher estimate of the A curve (269 basis points vs 220-221 basis points). At a term of 5 years both the BBB and A Bloomberg FVCs materially over-estimated the observed BBB+ and A debt risk premiums (i.e. as reflected in the regression results).

5.7 Recommended methodology

5.7.1 Overview

In view of the analysis presented above, our recommended methodology to estimate a family of debt risk premium functions at a point in time is as follows:

- Assemble Australian corporate bond data with remaining terms to maturity in excess of 1 year for all credit rating categories using the average (where possible), of Bloomberg and UBS data for fixed and floating rate debt.
- Test for potential staleness of the bond yield data using the Quandt-Andrews break point test for the 6 months prior to the averaging period.
- Where possible, i.e. if there are sufficient observations, for the major credit ratings estimate the relationship between the debt risk premium and term based on alternative functional forms (linear, exponential, cubic, power, logarithmic) using the credit ratings around the central credit rating in order to maximise observations. For example, a regression estimating the BBB curve would use the available BBB-, BBB and BBB+ observations.
- Test whether the weighting of different credit rating observations (and their term to maturity distribution) is likely to reflect the credit rating function being estimated.
- Using the Schwartz Information Criterion test, assess which functional form is most efficient during the averaging period and over the longer term (e.g. the last 2 years) with daily overlapping regressions (i.e. adding an observation for the next day and dropping off the last day).
- Make a judgement about which functional form has performed well on average and in the current period (we found that the linear functional form performs relatively well, preserves degrees of freedom in econometric analysis and is simple to apply and understand).
- If finer credit rating bands are required between those directly estimated by econometric analysis, they can be interpolated for each year.
- If the AA and AAA credit rating categories have too few observations to enable econometric analysis, their distance from the A curve should be determined by the average difference between the respective individual bond observations from the A curve.

5.7.2 Debt risk premium estimates

Applying this methodology, we assessed that the linear functional form was appropriate since it was best or one of the best performing functional forms during the test averaging period and over the Analysis Period, and estimated the family of debt risk premium curves shown in Table 5.12. For comparative purposes we show the Bloomberg extrapolated BBB FVC estimates which, as discussed above, appear to under-estimate the BBB/BBB+

regression estimates at 2 to 3 years, approximate the BBB regression estimate at 5 years, and approximate the BBB+ regression estimate at 10 years to maturity.

It is reassuring to note that interpolation of the regression estimates for the 10 year BBB and A curves (i.e. 383 and 210 basis points respectively) based on pooling of neighbouring credit rating bands derives a BBB+ estimate of 329 basis points, which is only slightly above the extrapolated Bloomberg estimate (325 basis points) and the BBB+ pooled regression estimate (318 basis points). As noted above, the econometric approach yields a materially lower pooled estimate of the 10 year A-credit rating estimate than the extrapolated Bloomberg estimate (210 basis points vs 269 basis points).

Table 5.12 – Debt risk premiums (basis points) applying the recommended methodology (20 days to 28 November, 2012)

Credit rating	2 yrs	3 yrs	4 yrs	5 yrs	6 yrs	7 yrs	8 yrs	9 yrs	10 yrs	Source:
Regression										
BBB	273	287	300	314	328	342	356	369	383	Pooled regression
BBB+	221	233	245	257	269	281	294	306	318	Pooled regression
A-	196	205	214	223	233	242	251	260	269	Interpolated
A	172	178	184	190	196	202	208	214	220	Pooled regression
A+	162	168	174	180	186	192	198	204	210	Interpolated
AA	151	157	163	169	175	181	188	194	200	Difference from A
AAA	120	126	132	138	144	150	156	162	168	Difference from A
Bloomberg										
BBB	191	213	279	300	301	301	309	317	325	Extrapolated FVC
A	149	173	196	216	232	247	254	262	269	Extrapolated FVC
AA	84	121	148	172	183	194	202	209	217	Extrapolated FVC
AAA	51	80	97	104	112	119	126	134	141	Extrapolated FVC

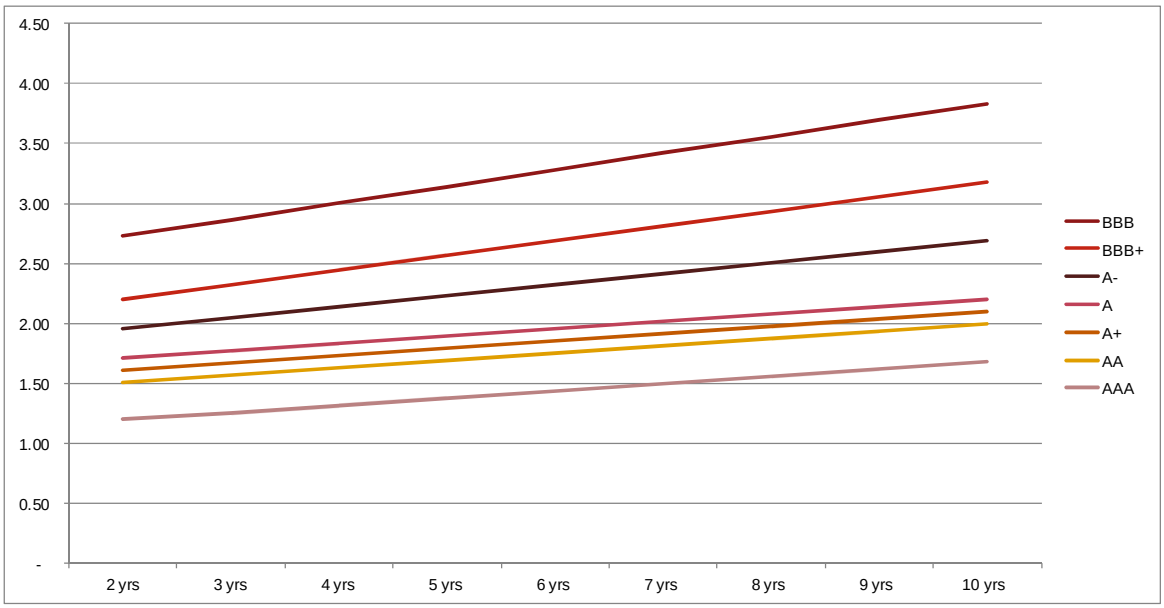
Source: Bloomberg, and PwC analysis.

The AA curve, which was estimated by commencing with the pooled estimate A curve and deducting the observed difference between the A curve and observations of AA bonds, is materially higher than the Bloomberg AA curve up to 5 years. Beyond 5 years to maturity the Bloomberg and extrapolated Bloomberg AA curve estimates were found to exceed the regression estimates by up to 17 basis points. By contrast, the Bloomberg AAA curve was always found to lie materially below (ranging between 30 and 70 basis points) the AAA curve that was derived based on average bond differences from the A curve. It is likely that this material differential was due to Bloomberg estimating its AAA FVC by reference to bonds issued by major Australian banks and financial institutions (including TCV, Treasury Corporation Victoria). As discussed earlier, we consider that the bonds of banks and financial institutions are not appropriate comparators for the bonds of industrial firms.

Figure 5.13 below displays the family of debt risk premium curves from BBB to AAA based on the data in Table 5.12. We note that the steepness of each curve increases from A to BBB, which accords with the expectation that an increasing premium for term should be required by investors in successively less worthy credit rating bands. However, the curves below A have been constrained to adopt the same increment for term as the A curve itself. This is because the yield curves below the A rating yield curve (i.e. yield curves for credit bands higher than an A rating) have been derived by reference to the slope of the A curve. For

example, the AAA curve has been determined by the average distance observed between the two AAA-rated bonds (52 basis points), and the A curve.

Figure 5.13–Debt risk premium: Recommended methodology for major credit rating bands for 20 days to 28 November, 2012 (percentage points)



Source: Loan Connector, UBS, Bloomberg, PwC analysis.

5.7.3 Cost of debt estimates

Whilst we understand that in applying its cost of debt methodology the Authority is primarily concerned with estimating the debt risk premium, in this section we provide the total cost of debt estimates (excluding debt raising transaction costs) that result from the previous debt risk premium analysis. That is, we show the cost of debt relative to term, without reference to any alignment to the term of the regulatory period that might be undertaken by a regulated business.

In Table 5.13 below we add the Commonwealth Government bond yield (CGS yield) to the debt risk premiums estimated above. The first row in Table 5.13 shows that the CGS yield was relatively flat up to a term of 4 years, and then increased relatively uniformly, virtually as a straight line, between 5 years and 10 years, with increments of approximately 7 to 8 basis points per annum.

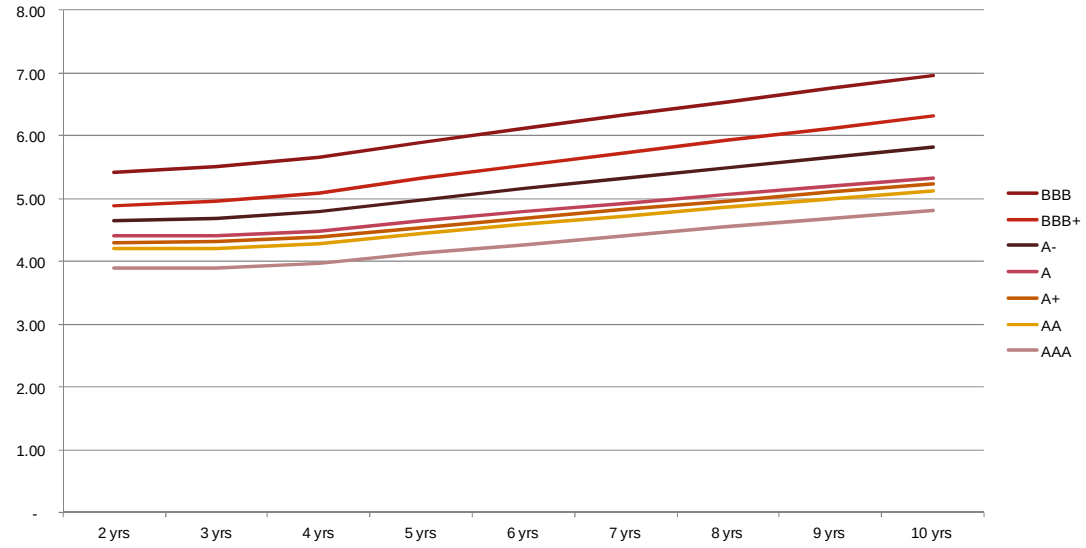
Table 5.13 – Cost of debt (per cent) applying the recommended methodology (20 days to 28 November, 2012)

Credit rating	2 yrs	3 yrs	4 yrs	5 yrs	6 yrs	7 yrs	8 yrs	9 yrs	10 yrs
CGS yields	2.69	2.64	2.65	2.75	2.83	2.91	2.99	3.06	3.14
Regression:									
BBB	5.42	5.51	5.66	5.89	6.11	6.33	6.55	6.76	6.97
BBB+	4.90	4.97	5.10	5.32	5.52	5.73	5.93	6.12	6.32
A-	4.65	4.69	4.79	4.99	5.16	5.33	5.50	5.66	5.83
A	4.41	4.42	4.49	4.65	4.79	4.93	5.07	5.20	5.34
A+	4.31	4.32	4.39	4.55	4.69	4.83	4.97	5.10	5.24
AA	4.20	4.21	4.29	4.45	4.59	4.73	4.87	5.00	5.13
AAA	3.89	3.90	3.97	4.13	4.27	4.41	4.55	4.69	4.82

Source: Bloomberg, and PwC analysis.

Figure 5.14 below shows the cost of debt estimates of Table 5.13 in chart format. Given the straight line regression estimates for the debt risk premium, and the fact that the underlying Commonwealth Government bond yield was found to increase almost linearly after a term of 4 years, it is not surprising that the cost of debt estimates are also found to increase almost linearly with term after 4 years. For example, at a term of 10 years, the methodology predicts a cost of debt (excluding debt raising transaction costs) of 6.32 per cent for a credit rating of BBB+, and a cost of debt of 5.83 per cent for a credit rating of A-.

Table 5.14 – Cost of debt (percentage points) applying the recommended methodology (20 days to 28 November, 2012)



Source: Bloomberg, and PwC analysis.

5.8 Conclusion

5.8.1 Econometric analysis – simple portfolio

We recommend that the debt risk premium benchmark continues to be based on a simple portfolio of domestic corporate bonds, rather than on a complex portfolio that reflects the average or benchmark capital structure (i.e. includes international bonds and bank debt). This is because:

- The benchmark term of debt at issuance is approximately 10 years (i.e. T=10);
- At a term of 10 years the weighted average debt risk premium under the complex portfolio approach has been found to approximate the simple portfolio debt risk premium in the BBB+ and A credit rating categories, and this is likely to have been the case over the last 12-18 months. Again, we note that this analysis was based on translation of the yields of Australian foreign bond issues in equivalent AUD yields, which were then converted into debt risk premiums over the Australian Commonwealth Government bond yields.
- It has been necessary to proxy the cost of bank debt with the estimated debt risk premium of domestic bonds at 5 years (T=5, which was the average term of bank debt at issuance for the benchmark companies), so that 75 per cent of the outcome is determined by domestic bonds;
- In some important credit rating bands (e.g. BBB-, BBB, BBB+) the number of observations of international bond issues in the complex portfolio is likely to be too small to be confident of the resulting estimate;

- The weightings of component credit ratings in the international sample were sometimes biased; [87]

- The numbers of domestic bonds in the wider BBB and A credit rating categories (i.e. 45 and 58 respectively) provide a reasonable basis for econometric analysis to be applied, even though for higher credit rating bands (i.e. 6 AA bonds and 2 AAA bonds) the evidence was relatively thin due to the absence of corporates with such high credit ratings, and consequently our confidence in the debt risk premium estimates for these credit rating bands is much lower.

5.8.2 Assessment against selection criteria

We consider that the simple portfolio approach we have recommended best satisfies the assessment criteria that we listed in Chapter 2:

- ***Accuracy*** – Over the range of credit ratings and terms to maturity the simple portfolio regression approach offers a higher degree of precision in estimating the actual cost of debt faced by the benchmark firm compared with alternative approaches (such as the ERA's 'bond yield' approach, and the old AER 'simple average' of bond yields (T±3 years) approach, and the extrapolated Bloomberg methodology). In addition the ERA's 'bond yield' approach does not estimate the debt risk premium for T=10, and is a poor estimator of the 5 year debt risk premium.

- ***Simplicity*** – We noted that simplicity is a virtue of the current Australian debt risk premium estimation framework, which assumes that all debt is raised via domestically issued bonds with T year term to maturity (i.e. the simple portfolio). We found that when a complex portfolio approach was adopted, the resulting estimates of the debt risk premium at different terms and credit ratings were reasonably similar to the domestic bonds approach.[88] In other words, there was little to be gained from the complex portfolio approach, which has further disadvantages in that:

  – The available data for Australian international bond issues is weaker (has less observations) than the domestic bond data; and

  – It cannot be fully implemented due to lack of transparent and timely data on the terms of domestic bank deals (resulting in a proxy value having to be assigned).

  On the other hand, the proposed simple portfolio regression approach is more complex than the ERA's 'bond yield' approach, and the previous AER's 'simple average' (T±3 years) approach.

- ***Cost of implementation*** – The simple portfolio methodology can be expected to cost more to implement, and is more costly than the ERA's 'bond yield' approach, the 'simple average' (T±3 years) approach, and the extrapolated Bloomberg approach. However, the simple portfolio approach is less costly than the complex portfolio approach.

- ***Objectivity*** – The ERA's approach and IPART's approach both rank low in terms of objectivity, and do not produce debt risk premium estimates for the range of terms

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87 The majority of the bonds used to create the BBB+ curve were rated A-, which biased the curve's DRP, and subsequently cost of debt, to a rating of A-.

88 However, this result assumes that the 5 year debt risk premium estimate obtained through regression analysis is a reasonable proxy for the debt risk premium for 5 year bank debt.

that the Authority requires. On the other hand, Bloomberg is objective to the extent that it is based on an independent source and is widely used by market participants. The objectivity of the recommended simple portfolio approach is enhanced by the application of statistical tests that allow the best functional form to be chosen. However, the results of these tests must sometimes be tempered by judgement informed by theory and previous empirical research.

- ***Replicability*** – All the methodologies we have considered are replicable.

- ***Transparency*** **–** The Bloomberg service has often been criticised for not being transparent, but it ranks highly on its objectivity. The other approaches are all transparent.

The most important trade-off is between accuracy and simplicity. While it is more involved than some of the alternatives, the simple portfolio regression approach is simpler than the complex portfolio approach, and provides estimates of the cost of debt that approximate those of the complex portfolio approach. Furthermore, the complex portfolio approach would also be more difficult to apply to the BBB credit rating band owing to fewer observations. In summary, we consider that the domestic bonds regression approach is best able to satisfy the Authority's requirement for a methodology that provides a debt risk premium estimate for a range of terms and credit ratings.

5.8.3 Role of the Bloomberg FVC curve

We also recommend that where possible, reference should be made to the Bloomberg FVC, and that extrapolations of the Bloomberg FVC be undertaken using the 'paired bonds' analysis approach. This provides a relatively low cost independent alternative view (albeit one that is not transparent). As we have seen, in recent times the extrapolated Bloomberg curve has been a reasonable estimator of the 10 year BBB+ curve, but not necessarily a good estimator of the debt risk premium for other terms (e.g. the 5 year term) for the BBB+ credit rating band, or for all terms in the A credit rating band (where the Bloomberg curve appears to be a better estimator of the A- curve). It is possible that the Bloomberg AAA curve does provide a reasonable estimate of the debt risk premium for all AAA-rated bonds, which overwhelmingly are financial institutions, but for that reason it is unlikely to provide a reasonable estimate of the cost of debt for AAA rated industrial firms.

6 Benchmarking debt raising transaction costs

6.1 Introduction

In this chapter we develop a methodology to estimate the debt raising transaction costs required to re-finance the benchmark firm's debt portfolio.

The Essential Services Commission of Victoria (ESCV) was the first to recognise the legitimacy of regulated businesses incurring costs to raise debt, and to compensate this with a 5 basis point addition to the cost of capital. Subsequently, a regulatory practice of applying compensation of 12.5 basis points emerged and was widely adopted. However, in 2004 the ACCC adopted a methodology for determining compensation that was based on a study undertaken by the Allen Consulting Group (ACG).[89] Under this methodology, the debt raising transaction cost is estimated for each company based on the number of standard bond issues that would be required to finance the benchmark proportion of its regulated asset base (RAB).

The Authority has applied compensation of 12.5 basis points for a considerable period, and has requested a new analysis of the matter based on current market data. Importantly, the Authority has requested us to extend our analysis beyond the previous approach to consider all components of the debt portfolio of the benchmark business. This requires estimates of the debt raising transaction costs for bank debt, domestic and international bonds.

In this chapter we:

- Reference Bloomberg for data relating to transaction costs paid by Australian and US businesses issuing bonds in the US market, and Loan Connector to obtain data on transaction costs paid by Australian businesses obtaining bank loans;
- Research the latest Australian legal, selling, roadshow, company and issue-specific credit rating costs, registry costs and paying fees associated with domestic and international bond issues and bank debt issues; and
- Assess the benchmark total transaction cost for raising debt that is dependent on the size of business (total debt being re-financed) and the benchmark average size of bond / bank issue.

We distinguish the debt raising transaction cost for:

- The Australian bond issuance approach, which is the standard approach that has been adopted in the past; and

[89] Allen Consulting Group, (December, 2004), *Debt and Equity Raising Transaction Costs.*

- The debt 'portfolio' approach, which takes account of all components of the benchmark firm's debt portfolio and builds up from the separate costs incurred to raise bank debt, domestic and international bonds.

6.2 Estimating debt raising transaction costs

Having, as a first step, estimated the debt raising transaction costs incurred, we defined their separate components as:

- Arrangement/placement fees (arrangement fees) earned by investment banks to compensate for their management of the capital raising process; and
- Other costs associated with the debt raising process such as credit rating fees and legal fees.

We analysed each cost component separately and then combined them to derive an estimate of the total debt raising transaction cost. In the following sections, we describe the methodology we applied to estimate each debt raising transaction cost component.

6.2.1 Arrangement fees

This section explains the methodology we applied to estimate arrangement fees for bonds, and bank debt. Our general methodology was to analyse publicly available data on debt raising transaction costs published by Bloomberg and Loan Connector for bonds and bank debt respectively. For comparable businesses we identified a relevant sample of bonds and bank debt issued between 2007 and 2012, and then downloaded from Bloomberg or LoanConnector the debt arrangement fee that was charged by investment banks.[90]

In Australia, details of debt raising transaction costs are seldom publicly reported for bank debt, and are never revealed for corporate bond issues. Hence, we had to rely on US data revealing the arrangement fees paid by Australian businesses issuing bonds in the US.

Bond arrangement fees

Bond arrangement fees were estimated by first selecting a suitable sample of corporate bonds, and then estimating the implied basis points per annum[91] from the up-front bond arrangement fee.

We began by identifying a list of relevant corporate bonds issued by Australian businesses between 2008 and 2013. Using Bloomberg's 'SRCH' function, we identified 1,673 corporate bonds. From the initial list, we eliminated bonds that:

- Were issued by financial institutions because they operate in a specific market separate to the corporate bond market;
- Were not investment grade, because transaction costs are expected to be materially higher for non-investment grade bonds;
- Had not identified a credit rating;
- Were convertible bonds, because they have equity-like characteristics, and therefore have an issuance cost structure that closely resembles equity issuance; and

[90] Arrangement fees were revealed for only a minority of bond and bank debt issues.

[91] Basis points per annum refer to the equivalent annual yield of debt in terms of basis points implied by the bond arrangement fee.

- Had not made issuance cost data publicly available.

Application of the elimination criteria listed above left us with a sample of 33 bonds. Further filtering of the data to only infrastructure or network businesses would have removed almost all of these observations (other than two Telstra Corporation bonds and a Melbourne Airport bond). As we were seeking a reliable and robust estimate of bond arrangement fees, we decided to include all 33 bonds to increase the sample size, and therefore the robustness of the estimate.

The final step was to record each bond's arrangement fee and translate it into a basis points per annum value. Bond arrangement fees are generally expressed as an up-front number of basis points. To convert this to an equivalent annual value, we calculated the annual fee over the term of the bond required to equate the NPV of the annual fee to the value of the up-front fee, using a notional discount rate of 10 per cent.

Bank debt arrangement fees

Bank debt arrangement fees were estimated applying the same two part approach that was applied to bond arrangement fees. First, we selected a suitable list of bank debt issues, and secondly, we estimated the implied basis points per annum implied by the up-front bank debt arrangement fee.

We accessed Loan Connector to download a list of bank debt issued by Australian businesses between 2008 and 2013. Examining the 497 bank debt issues in the list, we eliminated those issues that:

- Were not investment grade;
- Did not identify their credit Standard & Poor's credit rating; and
- Did not make issuance cost data publicly available.

This left 86 bank debt issues. We then removed bank debt issued by non-infrastructure businesses, as this enhanced the relevance of bank arrangement fee estimates while still providing a reasonable sample size of 22 issues.

Again, bank debt arrangement fees, like bond arrangement fees, were reported as an up-front fee. In order to calculate the basis points per annum, we applied the same methodology that was used to convert bond arrangement fees into an annual equivalent. When the up-front fee was reported as a range, we used the middle of the range as the reported up-front fee.

Specific arrangement fee issues analysed

The Authority indicated a preference for flexibility to choose to apply the appropriate debt raising transaction cost for any combination of term to maturity, credit rating and issuance size. Hence, we analysed whether and how these factors affect the size of debt arrangement fees.

For Australian corporate bonds, previous empirical studies have not found a relationship between debt arrangement fees, and either term at issuance or issuance size. In our 2010 study, we plotted the relationship between bond arrangement fees and term at issuance and found that there was "…no discernible relationship between the annualised cost and term at

issuance."[92] In that study we plotted the relationship between bond arrangement fees and issuance size and found that:[93]

> For the group excluding these four bonds, there was no discernible relationship between the annualised issue cost and size of issue.

For this report, we have revisited the relationship between term at issuance and issuance size with debt arrangement fees using updated data. In addition, we have expanded our analysis to also consider the relationship between credit rating and debt arrangement fees; *a priori* we believe that as long as debt is investment grade, moving between different investment grade credit ratings will have a marginal impact on debt arrangement fees.

To enhance the robustness of our analysis, we have cross-checked our analysis of Australian corporate bonds in the US, with a larger sample of US corporate bond issues. The US corporate bond market is much more active than the Australian market and produces many more bank arrangement fee observations.

We selected the sample of US corporate bonds in the same manner as Australian corporate bonds. However, we did not report the bond arrangement fee for every available US bond issue. Instead, we sought to establish a representative sample of US bond arrangement fees by identifying 16 buckets of bonds with different combinations of the following characteristics:

- Industry (infrastructure or non-infrastructure);
- Credit rating (ratings above and including and below BBB+);
- Issuance size (larger and smaller than $US 100m[94]); and
- Term at issuance (longer and shorter than 15 years).

Starting at the top of the list of US bond issues, we went down the list choosing the next bond that satisfied the requisite characteristics for a bucket until we had either reached an imposed maximum number of 30 bonds in the bucket, or had exhausted the list. We chose a maximum of 30 bonds for a bucket as this was considered to be a sufficient sample size for bond issues with a specific set of characteristics. We note, however, that we could not fill some buckets with 30 observations because there were less than 30 bonds with that combination of characteristics. Application of this selection process resulted in a final sample of 317 relevant US bond arrangement fee observations.

6.2.2 *Estimation of the arrangement fee*

In this section we report on the results we obtained by applying our methodology for estimating debt arrangement fees. We found that:

- The average arrangement fee for bonds was 8.6 basis points per annum;
- The average arrangement fee for bank debt was 17.2 basis points per annum; and
- Neither the bond nor the bank debt arrangement fees were related to issuance size, term at issuance and credit rating.

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92 PwC, (April, 2011), *Powerlink debt and equity raising costs*, p.17.

93 PwC, (April, 2011), p.16.

94 We have chosen $100 million because we found that US infrastructure businesses on average issue $100 million bonds in the domestic market.

For each type of debt, in this section we explore whether in the updated data there was a relationship between debt arrangement fees and term at issuance, credit rating and issuance size. We then analyse US bond issuance data for US companies as a cross-check of the analysis of US bond issues by Australian companies.

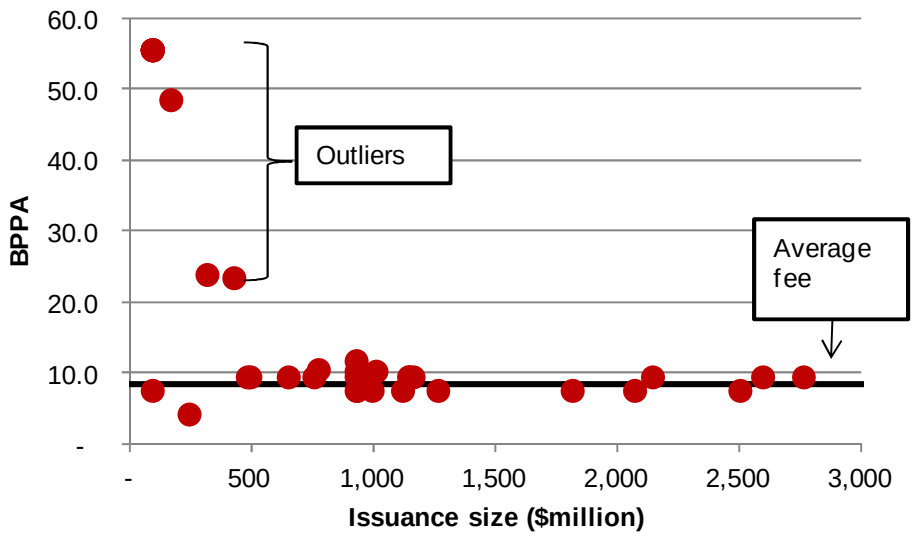
Arrangement fees in basis points per annum

Bonds

We found that the arrangement fee for Australian companies issuing corporate bonds in the US was 8.5 basis points per annum. For the full sample of 33 bonds, we estimated an average arrangement fee of 19.1 basis points per annum. However, this included several outliers ranging between 23.7 and 55.3 basis points per annum. Removing these outliers, we estimated an average arrangement fee of 8.5 basis points per annum, which is 1.3 basis points per annum higher than the finding of our 2010 study.

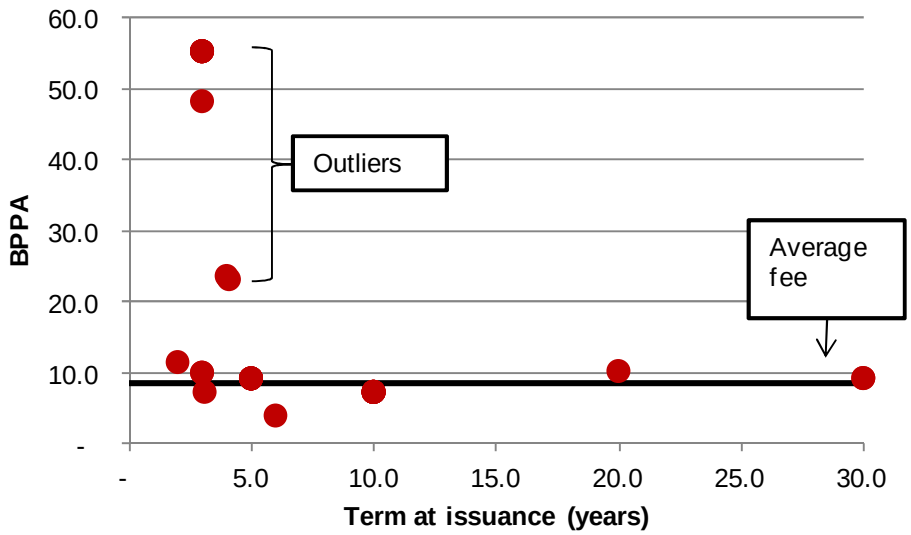
We also found no discernible relationship between arrangement fees and issuance size, term at issuance and credit rating. To investigate the relationship, we plotted arrangement fees against issuance size, term at issuance and credit rating, as shown in Figures 6.1, 6.2, and 6.3 respectively. In all three figures, removal of the outliers identified within the brackets resulted in an average arrangement fee that remained relatively constant with respect to term at issuance, issuance size and credit rating increases.

Figure 6.1 – Arrangement fee of bonds on issue between 2008 and 2013 by issuance size in $million



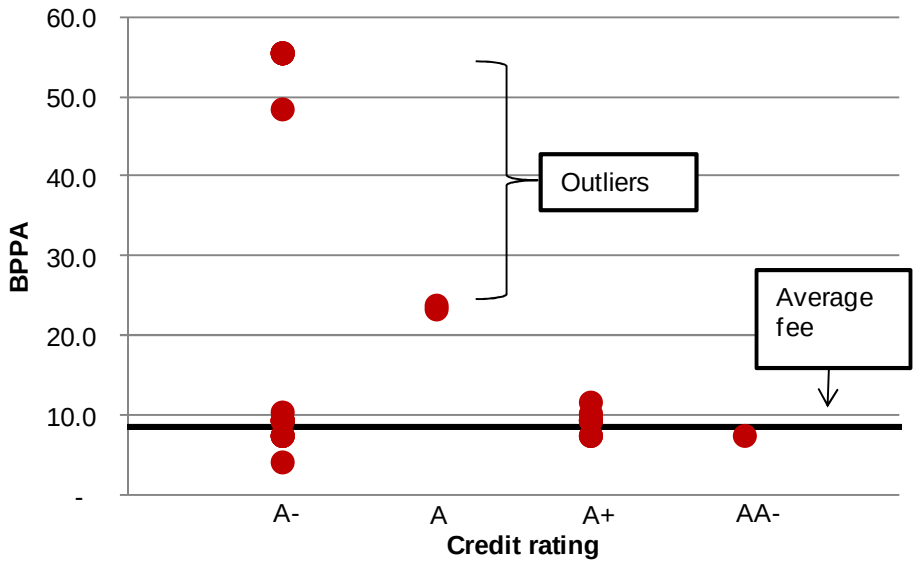
Source: PwC's analysis, Bloomberg

Figure 6.2 – Arrangement fee of bonds on issue between 2008 and 2013 by term at issuance in years



Source: PwC's analysis, Bloomberg

Figure 6.3 – Arrangement fee of bonds on issue between 2008 and 2013 by credit rating



Source: PwC's analysis, Bloomberg

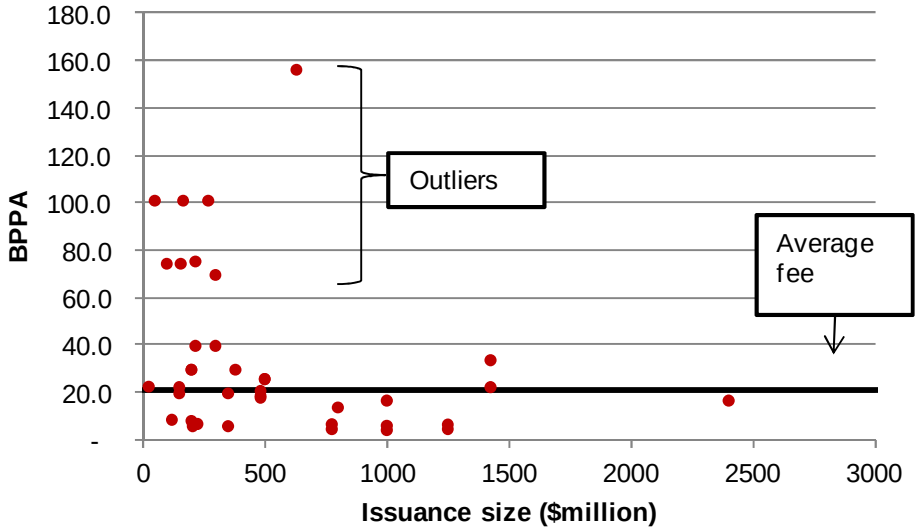
Bank debt

We found that the arrangement fee for Australian bank debt was 21.1 basis points per annum. Taking the average of the total sample of 22 bank debt deals, we estimated an average arrangement fee of 41.4 basis points per annum. However, as for corporate bonds, there were a few large outliers ranging between 69.1 and 155.8 basis points per annum. After removing the outliers, we found the average arrangement fee to be 21.1 basis points per annum; an estimate that we believe is more appropriate.

As for corporate bonds, we can't conclusively find that bank debt displayed a discernible relationship between arrangement fees and issuance size, term at issuance and credit rating. We plotted arrangement fees against issuance size, term at issuance and credit

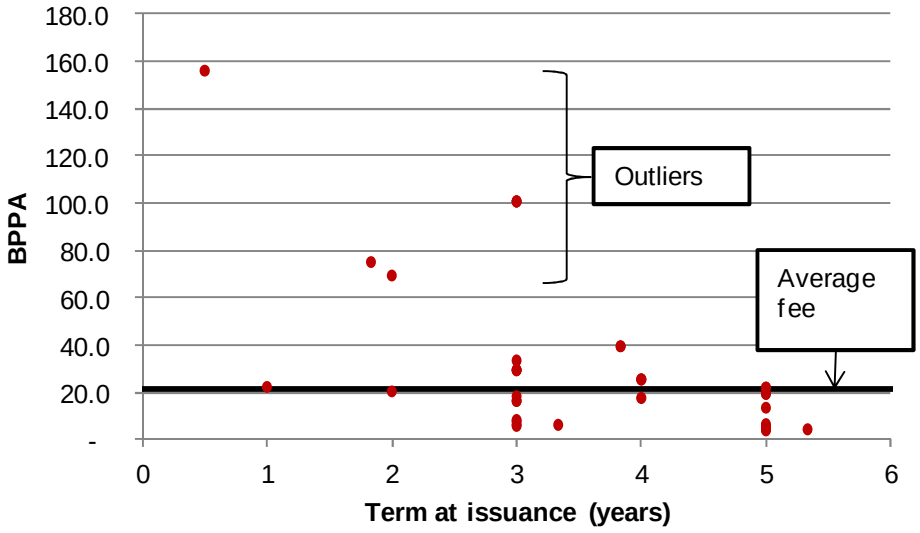
rating similar to corporate bonds, shown in Figures 6.4, 6.5 and 6.6 respectively to analyse the relationships. In the three figures, if we ignored the outliers identified within the brackets, we found that the average debt arrangement fees remain relatively constant as term at issuance, issuance size and credit rating increases. Although there may be an appearance of the arrangement fee decrease with issuance size, term at issuance and credit rating, they are insufficient observations to confidently conclude this.

Figure 6.4 – Arrangement fee of bank debt on issue between 2008 and 2013 by issuance size in $million



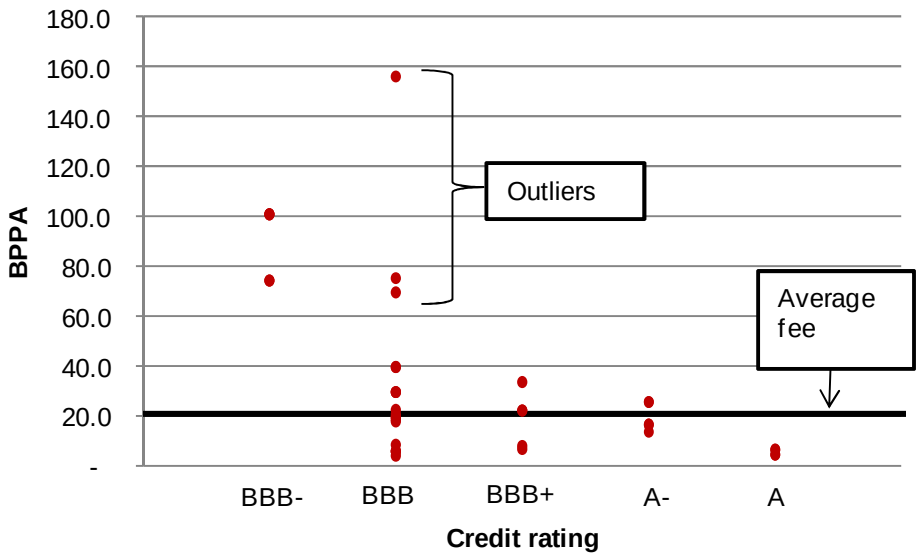
Source: PwC's analysis, Bloomberg

Figure 6.5 – Arrangement fee of bank debt on issue between 2008 and 2013 by term at issuance in years



Source: PwC's analysis, Bloomberg

Figure 6.6 – Arrangement fee of bank debt on issue between 2008 and 2013 by credit rating



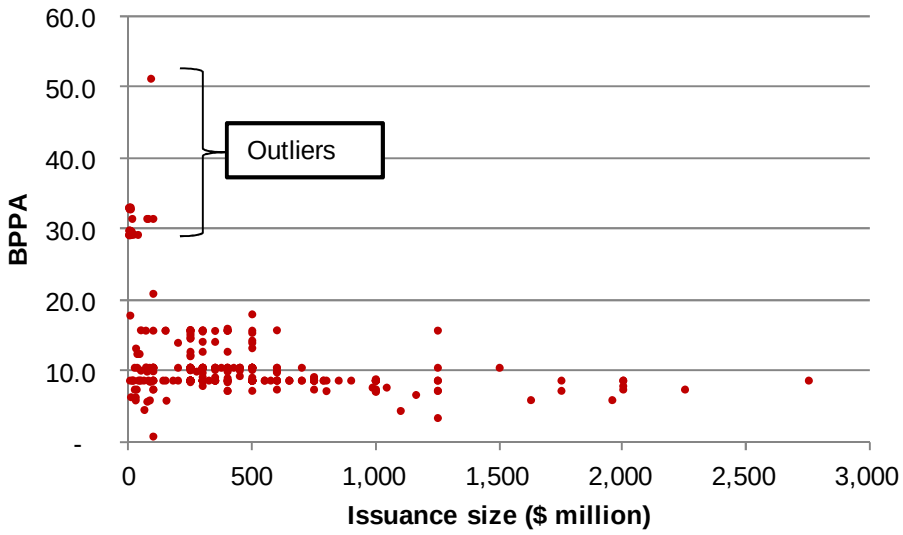
Source: PwC's analysis, Bloomberg

Cross-checking Australian US bond arrangement fees with general US bond arrangement fees

Although data for Australian US bond issues showed that there was no discernible relationship between arrangement fees and issuance size, term and credit rating, this analysis was based on a sample of only 34 bonds. In order to cross-check the result, we also analysed a larger sample of 317 US domestic bond issues. Note that as the purpose of this is to cross-check our Australian results, we have used a recent sample of US data.

The US data also showed no discernible relationship between arrangement fees and issuance size, and credit rating. After removing material outliers, we found that bond arrangement fees for US bonds to be fairly consistent and steady as issuance size, term at issuance and credit rating changes. This result corroborates with the Australian data, and suggests minimal sample size bias in the Australia data.

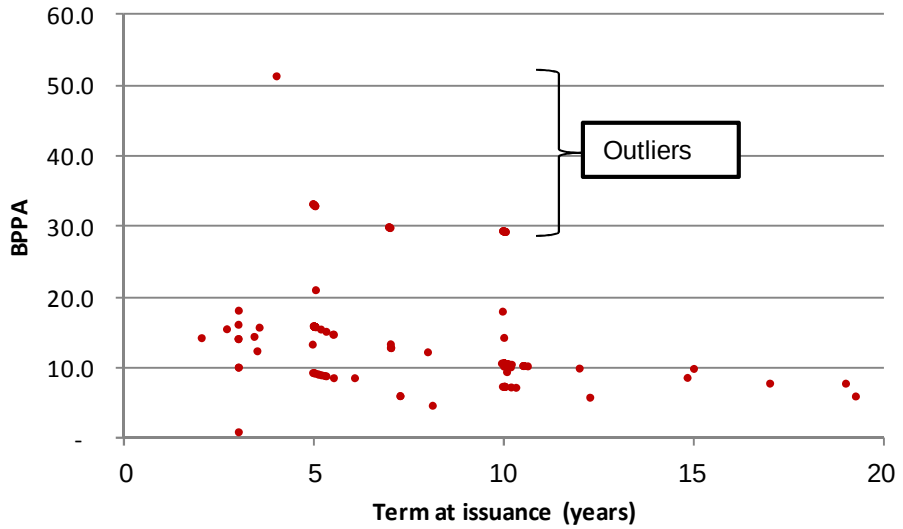
Figure 6.7 – Arrangement fee of US corporate bonds on issue between 2007 and 2012 by issuance size in $million



Source: PwC's analysis, Bloomberg

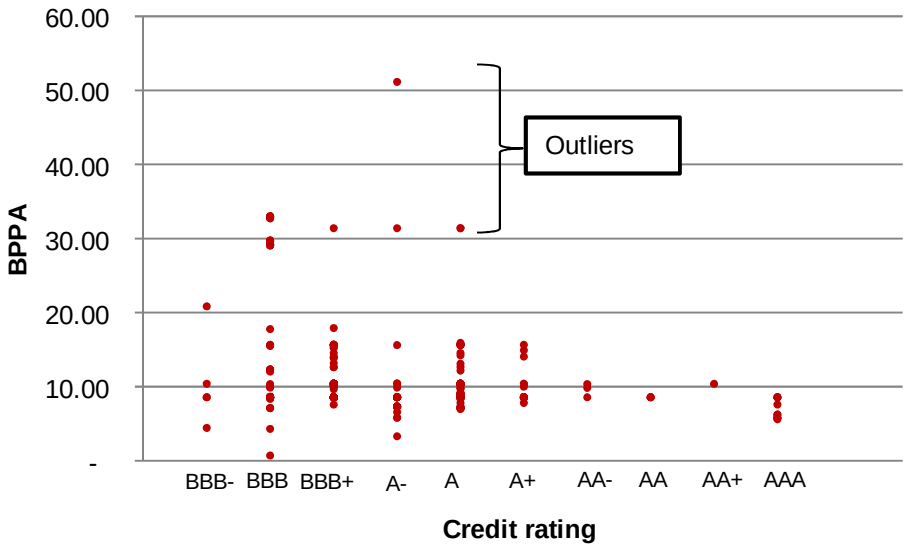
As can be seen in Figure 6.8 below, elimination of outliers indicates a reduction in the per annum arrangement fee as the term of issuance is increased. We corroborated this visual impression with regression analysis, which showed a statistically negative slope coefficient with respect to term. A quadratic functional form indicated a 12.7 basis points per annum arrangement fee at a 5 year term, and a 10.7 basis points per annum arrangement fee at a 10 year term. However, the evidence for Australian bond issues in the US is clearly invariant with size of issuance, and the US results may be due to other factors that are specific to the US market.

Figure 6.8 – Arrangement fee of US corporate bonds on issue between 2007 and 2012 by term at issuance



Source: PwC's analysis, Bloomberg

Figure 6.9 – Arrangement fee of US corporate bonds on issue between 2007 and 2012 by credit rating



Source: PwC's analysis, Bloomberg

6.2.3 *Other debt raising transaction costs*

'Other' debt raising transaction costs refer to fees for the services of credit rating agencies, legal advisors and other agencies, which is an important component of the total cost of issuing debt. In this section we discuss the methodology we have applied to estimate 'other' debt raising transaction costs, followed by an empirical analysis that estimates these costs for Australian corporate bond issues, international bond issues, and bank debt.

We note that there are different fees associated with issuing secured, as opposed to unsecured bonds and bank debt. A bond or bank debt that is secured when the issuer pledges assets as collateral. There is additional legal work associated with secured loans, and therefore higher transaction costs. Since benchmark businesses may be expected to issue a mix of secured and unsecured debt, we have averaged the costs of secured and unsecured debt when calculating other debt raising transaction costs.

Our approach

Our first task was to identify and define 'other' debt raising transaction costs. Issuing international bonds is likely to incur higher costs due to additional road show expenses and legal fees. Hence, we have separately identified and defined the cost structures for each type of debt issue.

We contacted a number of market participants and provided them with a questionnaire that requested information about the standard fee that is currently charged for each identified cost item. Where there were gaps in the responses, we conducted interviews with the relevant representatives of the credit rating agencies, legal firms and investment banks.[95] Having received a number of responses, we averaged them to determine an average fee estimate.

[95] The respondents included two credit rating agencies, three law firms and two investment banks (with the latter inputs being reviewed and confirmed by PwC's debt advisory team).

'Other' bond raising transaction fees

Domestic bond issues

We have identified five categories of 'other' bond raising transaction fees. The first four are consistent with our 2010 study and ACG's 2004 study[96], and the fifth relates to currency hedging costs (which are relevant to international bond issues):

- *Legal fees for the issuer and the agent* – Costs charged by legal firms for preparing documents for the bond issue:
  - Master program fees – Legal costs incurred for preparing a bond Master Program, which is used as the base document under which multiple issuances of bonds are undertaken over a period of time (usually 10 years);
  - Legal fees for the issuer – Fees charged by legal firms for preparing documentation for the issue of bonds under the Master Program.
- *Credit rating fees* – Fees charged by a credit rating agency who are engaged as part of the issue. These are separated into the following four categories:
  - *Initial credit rating* – Fee to establish a credit rating;
  - *Annual surveillance fee* – Fee charged by the rating agency to maintain the credit rating each year;
  - *Up-front bond issue fee* – Fee charged by the credit rating agency when a new bond is issued.
- *Registry costs* – Fees charged by bond registry organisations, which are engaged in registering investors in a bond, separated into:
  - Initial set up costs are to compensate for establishing a registry service for a bond, and
  - An annual fee that is charged by the registry organisation.
- *Agent's out-of-pocket expenses* – These are the out-of-pocket expenses charged by the agents of a bank undertaking the bond issue. These costs include travel and accommodation, venue hire, printing etc.
- *Cross-currency hedging* – Costs incurred with the International Swaps and Derivatives Association (ISDA) so that currency conversion rates may be hedged.

Note that credit rating fees and cross-currency hedging fees are considered 'overarching' fees. These fees relate to work performed for the business whenever new debt is issued, and are applicable to the business as a whole.

In Table 6.1 below, we summarise our survey findings for each category of cost.

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[96] Allen Consulting Group, (December, 2004), *Debt and Equity Raising Transaction Costs*.

Table 6.1 – Other bond issuance transaction costs – Domestic (2013)

Cost item	Unit	Estimated value	Source
Legal counsel – Master program	Per ten years	$56,250	Legal firms
Legal counsel – Issuer's	Per issue	$15,625	Legal firms
Credit rating agency – Initial credit rating	Per issue	$77,500	Rating agencies
Credit rating agency – Annual surveillance	Per annum in total	$35,500	Rating agencies
Credit rating agency – Up front bond issue	Per issue	5.2 bps of issue size	Rating agencies
Registrar – Up front	Per ten years	$20,850	Banks
Registrar – Annual	Per annum per issue	$7,825	Banks
Investment bank's out-of-pocket expenses	Per issue	$3,000	Estimated

Source: Legal firms, banks and credit rating agencies consulted by PwC.

International bond issues

Compared with domestic bond issues there are three additional costs incurred in international bond issues:

- Additional legal costs are required for both the issuer and the agent to prepare documentation consistent with the laws of the international market;
- Legal costs in the Australian market are higher for an international bond issue compared with a domestic bond issue; and
- Out of pocket expenses are substantially larger because there is much more travel required for an international bond issue.

In addition, a Master Program is not necessary, therefore its associated fees are not incurred.

Our estimates for international issues are based on a US private placement international bond issue, and we have assumed that this represents a reasonable proxy for 'other' bond raising transaction in international markets. The combined estimates for 'other' international bond raising costs are shown in Table 6.2 below.

Table 6.2 – Other bond issuance transaction costs – International (2013)

Cost item	Unit	Estimated value	Source
Domestic legal counsel – Issuer's	Per issue	$75,000	Legal firm
Domestic legal counsel – Agent's	Per issue	$7,500	Legal firm
International legal counsel – Issuer's	Per issue	$75,000	Legal firm
International legal counsel – Agent's	Per issue	$85,000	Legal firm
Credit rating agency – Initial credit rating	Per issue	$77,500	Rating agency
Credit rating agency – Annual surveillance	Per annum in total	$35,500	Rating agency
Credit rating agency – Up front bond issue	Per issue	5.2 bps of issue size	Rating agency
Cross-currency hedging – ISDA	Per issue	$26,667	Legal firm
Investment bank's out-of-pocket expenses	Per issue	$87,500	Estimated

Source: Legal firms, banks and credit rating agencies consulted by PwC.

'Other' bank debt raising transaction fees

As shown in Table 6.3 below, the 'other' bank debt raising transaction fees are similar to 'other' bond raising transaction fees except that raising bank debt incurs syndication fees.

Often bank debt is not provided by one lender but by multiple lenders. In order for the multiple parties to work together and lend money to a single entity, the bank debt must be syndicated, with these fees being charged by the lead bank, which organises the syndicated loan. However, in contrast to bonds, no registration fees are incurred in relation to bank debt.

Table 6.3 – Other bank debt issuance transaction costs (2013)

Cost item	Unit	Estimated value	Source
Domestic legal counsel – Issuer's	Per issue	$86,667	Legal firm
Domestic legal counsel – Agent's	Per issue	$90,000	Legal firm
Credit rating agency – Initial credit rating	Per issue	$77,500	Rating agency
Credit rating agency – Annual surveillance	Per annum in total	$35,500	Rating agency
Credit rating agency – Up front bond issue	Per issue	3.5 bps of issue size	Rating agency
Syndication fee	Per issue	$42,500	Estimated
Agent's out of pocket expenses	Per issue	$3,000	Estimated

Source: Legal firms, banks and credit rating agencies consulted by PwC.

6.3 Estimate of total debt raising transaction costs

In this section we bring together our findings to estimate the total debt raising transaction costs for bank debt, domestic and international bond issues. Table 6.4 summarises the results based on the relevant standard issue size, term to maturity, for total debt raising transaction costs for each debt category by combining the base arrangement fee with other debt raising transaction costs (in terms of an equivalent basis points per annum).[97]

To demonstrate the impact of multiple debt issues on the cost (basis points per annum), we assumed 1 and 8 notional debt issues (ranging from $250 million to $2,000 million in total debt on issue). The actual estimated debt raising transaction costs for a benchmark firm will depend on how much notional benchmark debt is being raised, and the type of debt being raised, which will determine the exact number of issues for each category of debt.

Compared with our 2011 report for Powerlink, the domestic bond raising transaction cost is slightly higher, which can be attributed to the slightly higher arrangement fee. For domestic bond issues our 2011 report found that the transaction cost for a single issue was 9.7 basis points per annum, of which 7.2 was comprised of arrangement fees.[98] The current study has estimated a single issue domestic bond issuance cost of 10.8 basis points per annum, of which 8.5 basis points per annum is attributed to arrangement fees. Hence, the overall increase of 1.1 basis points per annum in the estimated transaction cost (9.7 to 10.8 basis points per annum) was due to a 1.3 basis points per annum increase in the arrangement fee, offset by a 0.2 basis points per annum fall in the other transaction costs (2.5 basis points per annum to 2.3 basis points per annum).

97 We have used a notional discount rate of 10 per cent to arrive at a basis points per annum estimate

98 PwC, (April, 2011), *Powerlink debt and equity raising costs*, p.4.

Table 6.4 Summary results for standard benchmark debt raising transaction costs

	1 issue	8 issues
Domestic corporate bonds (10 years term to maturity)		
Amount raised	$250m	$2,000m
Basis points per annum	10.8	9.9
International corporate bonds (10 years term to maturity)		
Amount raised	$150m	$1,200m
Basis points per annum	13.9	12.3
Bank debt (4 years term to maturity)		
Amount raised	$165m	$1,320m
Basis points per annum	27.2	25.5
less, 'other' bank transaction costs	6.1	4.5
Estimated risk element (to be added to the interest cost)	**21.1**	**21.1**

Source: PwC analysis based on Bloomberg, Loan Connector and interviews with banks, credit rating agencies and legal firms.

Overall, we found the debt raising transaction cost for international bond issues to be 2.3 basis points per annum (8 issues) to 3.1 basis points per annum (1 issue) higher than for domestic bond issues (i.e. 12.3 to 13.9 basis points per annum).

Bank debt (with an average 4 years to maturity) was subject to materially higher debt raising costs that were approximately 16 basis points per annum to 17 basis points per annum higher than for bond issues (i.e. in the range of 25.5 to 27.2 basis points per annum). Again, it must be emphasised that this apparent differential is due only to the fact that the vast majority of the up-front fee in bank deals is a reward for risk taking, and is therefore more properly part of the interest cost of bank debt, and not a pure transaction cost. As shown in Table 6.4 above, the pure transaction cost component is between 4.4 and 6.1 basis points per annum (i.e. the 'other' costs associated with bank debt), and the interest rate component is 21.1 basis points per annum. In the analysis in Chapter 5 we separated out the estimated risk element in the bank debt and added this to the stated bank debt interest cost in order to make the total bank debt interest cost comparable with estimated bond yields estimated from linear regression analysis.

In applying these findings, the Authority can choose to adopt:

- An overall estimate of transaction costs for debt raising (e.g. 11 basis points per annum), which is the approach that it has applied in the past (except that 12.5 basis points was provided); or

- A specific debt raising transaction cost allowance (in basis points per annum) that is based on an estimate aligned to the size of the debt component of the RAB of the regulated business, as has been the practice of the ACCC (since 2004) and the AER.

7 Conclusion

7.1 Introduction

In this chapter we provide specific responses to the questions that were posed in the Authority's Terms of Reference.

7.2 Identification of appropriate data sources

The Terms of Reference requested us to first identify appropriate and sufficient data sources that the Authority could rely upon when estimating the cost of debt. That is, the task was to develop a data selection/sampling approach.

7.2.1 What comparators should be considered

Should the Authority use cost of debt data from outside the infrastructure/essential services sector?

We approached this issue separately for the estimation of the debt risk premium and for the assessment of the term of debt at issuance.

Comparators for debt risk premium estimation

Our analysis concluded that it is important to use cost of debt data from outside the infrastructure / essential services sector. It is well known that any statistical analysis that relies on less information (e.g. bond data yields), will be less reliable and result in wider confidence intervals than if more information is reviewed. The Australian Competition Tribunal (ACT or Tribunal) has raised this principle on a number of occasions specifically in relation to estimation of the debt risk premium. For example, when considering the ERA's estimation methodology, the Tribunal noted that:[99]

> A sample of 13 is still a respectable number, given the paucity of bond-issuing firms in Australia... [but] ... the sample size of six is too small to enable the ERA (or the Tribunal) to have much confidence in the reliability of its estimate.

Since a large proportion of the Australian regulated infrastructure sector is still under government ownership, for which firms the debt is generally procured by central government borrowing agencies, there are relatively few bonds issued by regulated utilities. Given the difficulties of assembling representative bond data to estimate the debt risk premium for industrial firms as a whole, the task would be made even more difficult if the sample were to be restricted to regulated, or infrastructure businesses alone.

In summary, we concluded that the benchmark corporate bond should:

- Have a credit rating that is the same or similar to the target regulated firm under consideration;
- Not have material state or sovereign government ownership;
- Not be a financial services company; and

[99] Application by WA Gas Networks Pty Ltd (No 3) [2012] ACompT 12 (8 June 2012), Paras. 169-170.

- Be a domestic bond or an international bond (provided that this reflects the benchmark financing characteristics of firms).

The use of international bond data is complex, and is discussed in greater detail below.

Comparators for the estimation of term of debt at issuance

With respect to assessment of the term of debt at issuance, there are far fewer observations of regulated businesses in the Australian context, and it is necessary to relax the benchmark characteristic requirements. For example, if the aim is to determine a benchmark term of debt at issuance for network regulated businesses that may be expected to be relatively highly geared (e.g. at 60 per cent), then privately owned network businesses in the energy and / or water sector will be appropriate comparators, even if they have some non-regulated activities (which is common practice). Government owned businesses cannot be included in this analysis since they do not face the same re-financing risks as privately owned businesses (as financing is generally undertaken by a state government central borrowing agency that relies on the state's credit rating). While international comparators may also be examined as a cross-check, the observed terms of debt at issuance are likely to be influenced by conditions specific to those markets.

7.2.2 Benchmarking only T-year debt versus sampling debt from a range of terms

The Authority requires debt with a term of T years. To what extent should the Authority continue its current approach of benchmarking only T-year debt versus sampling debt from a range of terms, for example, T ± 3 years (like some other regulators)?

We recommend that the Authority continue benchmarking T-year debt rather than a term of T ± 3 years, as some other regulators have done, or are currently doing. For example, if the benchmark efficient term of debt were assessed to be five years, the Authority should only benchmark 5-year debt, and not debt in the term to maturity range of two to eight years (i.e. T ± 3 years), and if the benchmark is 10 years, the Authority should estimate the debt risk premium for T=10 years. Three Australian regulators have applied, or are currently applying a methodology that calculates a simple average (old AER and IPART methodologies), or weighted average (ERA) of debt risk premiums for bonds.

The old AER methodology

The AER's previous methodology estimated the 10 year debt risk premium using a simple averaging approach, which calculated the debt risk premium for Australian corporate bonds with 7 to 13 years to maturity (i.e. T±3 years). However, the utility of this approach is also highly dependent on sample composition, and particularly on how the available bonds in the 7 to 13 year term to maturity range are distributed. If the sample is weighted toward the 7 to 10 year range, the 10 year debt risk premium is likely to be understated, which would then require a compensating adjustment.

ERA

The ERA targets a debt risk premium term of 5 years. However, the weighted averaging approach that the ERA developed was initially designed to estimate a 10 year debt risk premium, and is unlikely to provide an accurate estimate of the debt risk premium for T=5 years. This approach will materially under-estimate the 10 year debt risk premium, and either over- or underestimate the 5 year debt risk premium depending on specific sample composition. Furthermore, the ERA has not undertaken a comprehensive assessment of the benchmark term of debt at issuance, which it assumes to be 5 years. Our analysis has shown that the benchmark issuance term is close to 10 years.

IPART

IPART also estimates the 5 year debt risk premium by reference to: the 5 year Bloomberg debt risk premium (which is given little weight); heavy weighting to a group of domestic bonds with remaining terms to maturity of at least 2 years, targeting a term of 5 years; and, a lower weighting to international bonds (translated to domestic equivalents) targeting a term of 5 years. The weightings applied to these three sources of information about bond yields are not substantiated by a complex portfolio analysis, and appear unrelated to the actual financing behaviour of benchmark firms. IPART also assumes a benchmark term of debt issuance of 5 years, while our analysis shows that it is actually very close to 10 years.

The Authority's contingent supplementary questions were, if sampling debt of different terms is considered appropriate, then:

2.1 How should the Authority weight debt with different terms in comparison to the required term?

2.2 What adjustments are required to make them comparable to the required term?

As we have concluded that sampling debt from a number of periods is likely to increase the inaccuracy of estimating a T year debt risk premium, we have not responded further to these supplementary questions. [100]

7.2.3 What sources of data should the Authority rely on?

This question relates to whether the Authority should rely on proprietary service data, bond market data, bank debt data, etc? In other words, what data sources are relevant and what adjustments to the data are required to make it suitable for regulatory purposes?

In this report we have examined a broad range of cost of debt data relating to domestic and international bonds, and domestic bank deals. Our conclusions may be summarised as follows:

Domestic bond yields – In this study we have included Bloomberg and UBS bond yields, which overlap to a large degree and are found to be reasonably highly correlated. We recommend that these values be averaged where both are available for a particular bond. In a previous study we also examined the bond yield information provided by the Australian Financial Markets Association (AFMA), but found that the marginal contribution was negligible if the other two sources were already being used.[101] Similarly, there is a large degree of overlap with the Yield broker data base.

International bond yields – For international bonds issued by Australian entities, we recommend the same selection criteria be applied as for domestic bonds, except that only Bloomberg would be used to find international bonds.

Fixed and floating rate bond yields – We recommend that both fixed and floating rate bond yields (converted to fixed rate equivalents) be included in order to increase the sample size.

Bank debt – We also examined bank deal data sourced from LoanConnector. Unfortunately, this data source is relatively incomplete due to the fact that most terms of bank deals are not made public. Furthermore, the deals that are made public become stale

[100] We do note, however, that the best way to adjust a simple average estimate to the required T value would be to undertake an econometric analysis, which provides another reason for undertaking the latter.

[101] PwC (May, 2012), *ElectraNet: Estimating the benchmark debt risk premium*, pp. 14-15.

very quickly, and are not subject to on-going market opinion (as is the case for bond yields). These features make reliance on bank debt data problematic.

7.2.4 What reliance should be placed on the Bloomberg proprietary FVCs?

Bloomberg publishes a set of FVCs that reflect the opinions of the banking community, which provides daily 'rate sheets' to the service. On several occasions the Tribunal has expressed its support for reliance on the Bloomberg FVC to estimate the debt risk premium:[102]

> In addition, there was evidence before the AER to show that the Bloomberg FVC provided an accurate representation of the yields on benchmark corporate bonds and that it was widely accepted by market practitioners.

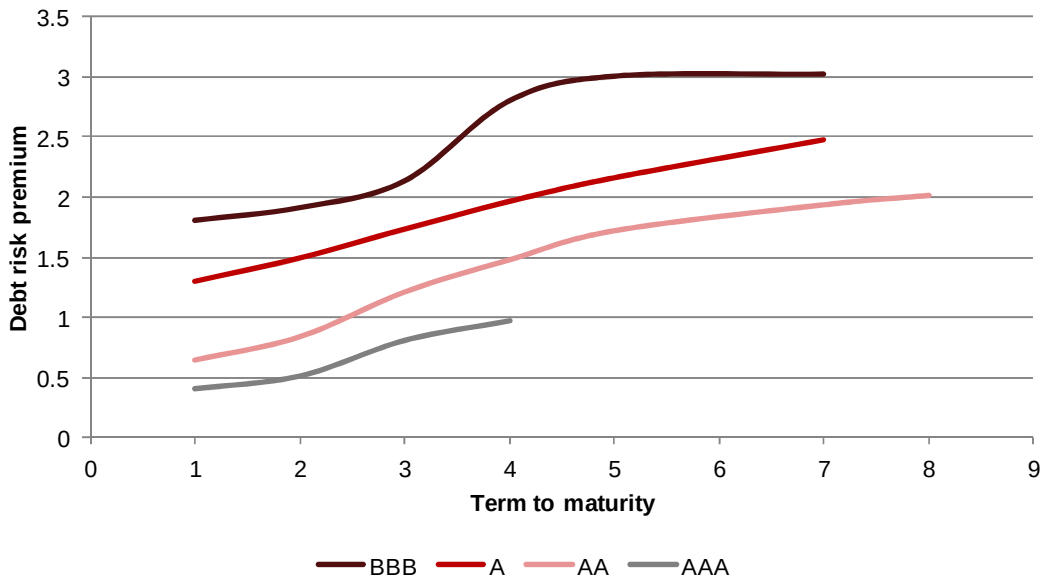
From the onset of the global financial crisis, however, Bloomberg discontinued the publication of FVCs out to 10 years, with the current situation for each credit rating band published being:

- BBB FVC – 7 years;
- A FVC – 7 years;
- AA FVC – 8 years; and
- AAA FVC – 4 years.

For the averaging period that we have applied in this study (20 business days to 28 November, 2012), the debt risk premiums based on Bloomberg's FVCs are presented in Figure 7.1 below. While the Bloomberg service has the potential to provide the Authority with information on debt risk premiums over a range of credit rating bands, it does have some practical drawbacks in not providing estimates to 10 years, and not providing estimates for finer divisions within the credit ratings, which can create some confusion.

[102] Application by United Energy Distribution Pty Limited (No 2) [2012] ACompT 4 (6 January 2012), para. 436.

Figure 7.1 – Bloomberg: debt risk premium for Australian corporate bonds by credit rating, QCA averaging period



Source: Bloomberg and PwC's analysis

Whilst Bloomberg's BBB FVC has generally been treated, by both regulators and firms, as a BBB+ FVC, there are no similar conventions with respect to the other bands provided by Bloomberg. In order to assess what reliance should be placed on the Bloomberg FVCs, we consider that the full extrapolated curve should be assessed, or cross-checked, against other data.

Based on the analysis in this report, we consider that the Bloomberg BBB FVC extrapolated to 10 years using a paired bonds analysis provides a reasonable estimate of the yield of a 10 year BBB+ bond. The Bloomberg BBB FVC also appears to provide a reasonable estimate of the 5 year BBB yield, and the extrapolated Bloomberg A curve may provide a reasonable estimate of the 10 year A- fair value yield. More generally, we recommend that reliance be placed on the econometric results using a reasonable sample of bonds pooled from neighbouring credit rating bands.

7.2.5 Is it valid to extrapolate Bloomberg yields (e.g. 7-year) to obtain longer term (e.g. 10-year) yields?

We conclude that it is valid to extrapolate Bloomberg yields to obtain a 10 year yield, but the resulting estimate should be subjected to the scrutiny of empirical validation. In other words, the resulting estimate should be cross-checked against an independent econometric analysis of observed bond yields. Bloomberg has not always produced estimates that are reflective of the yields observed in the market. During the global financial crisis we found that Bloomberg under-predicted market yields.[103] However, over the past 12-18 months the extrapolated BBB Bloomberg FVC (described below) has appeared to reasonably closely estimate the yield on 10 year BBB+ bonds based on econometric cross-checking to bond yield data.

[103] PricewaterhouseCoopers (November, 2009), *Victorian Distribution Businesses – Methodology to Estimate the Debt Risk Premium.*

In order to overcome the problem that Bloomberg does not provide a BBB credit rating FVC to 10 years, the AER has recently adopted a 'paired bonds' extrapolation methodology that was proposed by PwC.[104] Under this approach the debt risk premiums of two bonds issued by the same company for different terms are used to estimate the annual change in the debt risk premium (thereby holding constant risk factors other than term). The sample of paired bonds is limited to those where:

- the paired bonds are part of the wider sample that is used in an econometric analysis;
- the longer dated bond has a term to maturity that is close to 10 years;
- the shorter dated bond has a term that is closest to the shorter term that is of concern (i.e. closest to 7 years); and
- the match is between a pair of fixed coupon bonds, or a pair of floating rate bonds.

Table 7.1 below shows how the extrapolated Bloomberg BBB curve has performed relative to econometric estimates of the 10 year BBB+ curve. The results show that over a period of more than a year the 10 year debt risk premium estimated by the extrapolated Bloomberg BBB FVC was reasonably close to those estimated by most of the econometric functions (and particularly by the linear function).

Table 7.1 – BBB+ Debt Risk Premium - Extrapolated Bloomberg FVC vs direct observation (econometric regression) in basis points

	Powerlink 40 days to 14 October 2011	ElectraNet 20 days to 18 November 2011	Victorian gas networks 20 days to 16 December 2011	Victorian transmission revenue review 20 days to 7 December 2012
Extrapolated Bloomberg FVC	391	381	392	328
Regression – quadratic function	379	383	392	345
Regression – linear function		384	399	320
Regression – exponential function		378	393	330
Regression – logarithmic function		359	376	293
Regression – power function		371	384	298

Source: PwC reports and analysis.

7.2.6 *Should reliance be placed on bonds with non-standard features?*

Should the Authority rely on bonds with non-standard features (e.g. callable or puttable bonds) in order to obtain a greater sample size? If so, what adjustments are required to make them comparable to straight debt?

As discussed in relation to the question posed in section 7.2.3 above, we consider that reasonable bond sample sizes can be obtained without reference to bonds with non-

[104] See PwC (May, 2012), p.iv.

standard features, and we therefore recommend that these bonds not be included in the sample.

7.2.7 Should the Authority rely on Australian bonds placed in overseas markets?

Should the Authority rely on Australian bonds placed in overseas markets (e.g. US bond markets) in order to obtain additional data?

As discussed in relation to question 3 above, we consider that Australian bonds placed in international markets can be translated to an Australian dollar equivalent yield and potentially used as a component of the cost of debt, or as a cross-check against the yields observed for domestic bonds. However, in order to increase the sample size, it is recommended that not only US bonds, but all international bonds placed by Australian firms be examined. In Appendices C and D below we show how these international bond yields can be converted to Australian dollar equivalent yields.

7.1 Is there any inconsistency using data for Australian bonds in international markets in a WACC model that uses 'domestic' data otherwise?

As discussed above, we consider that it is not inconsistent to apply data from Australian bonds issued in international markets into a domestic WACC model. The estimation of the cost of debt is an empirical exercise, given the fundamental observable nature of debt risk premia relative to the estimation process required owing to the fundamentally unobservable nature of the cost of equity. Nevertheless, it is recognised that even application of domestic CAPM involves foreign influences since the risk free rate and beta will be influenced by foreign investors, and economic circumstances in foreign markets.

7.2 What assumptions are required to make Australian bonds in international markets comparable to Australian placed bonds?

The methodology that we have applied in translating the yields on these foreign bonds back to Australian dollar equivalents is set out in Appendix C and Appendix D.

7.3 What transaction costs (e.g. foreign exchange swaps) are required to make Australian bonds in international markets comparable to bonds issued in Australia?

As shown below in relation to the question posed in section 6.3 (Table 6.4) the additional transaction costs associated with undertaking bond issues in foreign markets compared with issuing comparable bonds in the Australian market are in the order of 6 to 7 basis points.

7.2.8 What approach should be used to obtain relevant data?

What approach should be taken to obtain relevant data and any adjustment required to that data to ensure comparability, and be applicable to a range of possible credit ratings; that is, from the standard benchmark rating of BBB/BBB+ to higher ratings of A to AAA?

We consider that the most efficient approach that can be applied to establish a rigorous data base of bond yields is to draw on the Bloomberg and UBS services, and calculate, where possible, a simple average of the yields provided by these services. Specifically, we recommend that the bonds be filtered for the following characteristics:

- Australian issuance by an Australian entity;

- Investment grade credit rating by Standard and Poor's[105];
- The issuing entity is not a financial entity;
- The corporate bond is senior (i.e. not subordinated);
- Standard corporate bonds without special features such as call options attached;
- A term to maturity greater than one year; and
- Yields reported by either Bloomberg or UBS.

7.2.9 How should the sample data be used to estimate the cost of debt?

Where possible, we recommend that the extrapolated Bloomberg FVC be estimated. For example, if the credit rating benchmark is BBB+ or A-, the extrapolated Bloomberg curves should be estimated, and cross-referenced against an econometric analysis based on pooled observations for the two adjacent credit rating bands in order to maximise sample size. For the BBB+ credit rating band this means including BBB, BBB+ and A- bonds, and for the A credit rating band this means inclusion of A-, A and A+ bonds.

Our recommendation is that those credit rating bands that have sufficient bond observations in adjacent credit rating bands should be estimated by regression analysis, with the debt risk premium being estimated by the predicted value at the benchmark term at issuance. Examining market and annual report data for a group of 5 network infrastructure firms we found that actual term of debt at issuance is currently approximately 10 years.

7.2.10 What empirical methods/statistical techniques should the Authority apply to obtain an estimate of the cost of debt?

We recommend that the following alternative functional forms be tested:

- Linear;
- Quadratic;
- Exponential;
- Cubic;
- Logarithmic; and
- Power;

We further recommend that the Schwarz Information Criterion (SIC), or 'Bayesian Information Criterion', be applied as a test to rank alternative functional forms based on the efficiency of the goodness of fit to the data. The equation providing the lowest SIC will be ranked as superior.[106] This test should be undertaken for the current averaging period as

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[105] Investment grade refers to a credit rating of BBB- and above.

[106] See, G. Schwartz, (1978), 'Estimating the Dimension of a Model', *Annals of Statistics*, Vol. 6, No. 2, pp. 461 – 464. We used the SIC methodology rather than the Ramsay Reset test, as the latter is applied to test whether a linear functional form can be

well as for a longer period of data (say the last 2 years), based on overlapping daily regressions (i.e. around 720 regressions for each alternative functional form).

If a simpler functional form (such as linear) provides an estimate that consistently ranks highly in terms of the SIC test (i.e. has a relatively low SIC), is consistent with theory and previous empirical findings, and provides estimates that are reasonable relative to the predictions of the other functional forms, then that form should be preferred. Based on our empirical analysis we have recommended that the linear form should be adopted unless there is compelling evidence demonstrating that this would provide an inaccurate estimate of the debt risk premium. The linear form has empirical backing, has been shown to perform well in tests, is easy to implement and interpret.

7.2.11 What estimation methodology is recommended to estimate the cost of debt for a range of terms to maturity and credit rating bands?

Our recommended methodology to develop a family of debt risk premium functions at a point in time is as follows:

- Assemble Australian corporate bond data with remaining terms to maturity in excess of 1 year for all credit rating categories using the average (where possible), of Bloomberg and UBS data for fixed and floating rate debt.
- Test the quality of the Bloomberg data by comparing, over a period of the last 2 years, the median value of yields provided by its 'bank feeds' against the yields that Bloomberg adopts.
- Test for potential staleness of the bond yield data using the Quandt-Andrews break point test for the 6 months prior to the averaging period.
- Where possible, i.e. if there are sufficient observations, for the major credit rating bands estimate the relationship between the debt risk premium and term based on alternative functional forms (linear, exponential, cubic, power, logarithmic) using the credit ratings adjacent to the central credit rating in order to maximise observations. For example, a regression estimating the BBB curve would use the available BBB-, BBB and BBB observations.
- Test whether the weighting of observations with different credit rating (and their term to maturity distribution) is likely to create bias away from the credit rating function being estimated.
- Using the Schwartz Information Criterion test, assess which functional form is most efficient during the averaging period and over the longer term (e.g. the last 2 years) with daily overlapping regressions (i.e. adding an observation for the next day and dropping off the last day).
- Make a judgement about which functional form has performed well on average and in the current period (we found that the linear functional form performs relatively well).
- If finer credit rating bands are required between those directly estimated by econometric analysis, they can be interpolated for each year.

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improved by applying a more complex functional form, while the SIC test is a broader test of model selection. See J. B. Ramsay, (1969), 'Tests for Specification Errors in Classical Linear Least Squares Regression Analysis,' *Journal of the Royal Statistical Association*, 72, pp.635-641.

- If the AA and AAA credit rating categories have too few observations to enable econometric analysis, their distance from the A curve should be determined by the average difference between the respective individual bond observations from the A curve.

We recommend that the cost of debt benchmark continues to be based on domestic corporate bonds, rather than on a 'portfolio' that reflects the average or benchmark capital structure (i.e. includes international bonds and bank debt). This is because:

- The benchmark term of debt at issuance is approximately 10 years (i.e. T=10);
- At a term of 9 to 10 years the weighted average cost of debt under the 'portfolio' approach has been found to approximate the cost of debt estimated with domestic bonds in the BBB+ and A credit rating categories, and this is likely to have been the case over the last 12-18 months;
- In order to estimate the cost of bank debt it has in any case been necessary to proxy this cost with the estimated debt risk premium of bonds at 5 years (T=5, which was the average term of bank debt at issuance for the benchmark companies);
- In some credit rating bands (e.g. BBB-, BBB, BBB+) the number of observations of international bond issues is likely to be too small to provide confidence in the resulting estimate; and
- The numbers of domestic bonds in the BBB and A credit rating categories (i.e. 45 and 58 respectively) provides a reasonable basis for econometric analysis to be applied, even though for higher credit ratings (i.e. there were only 6 AA bonds and 2 AAA bonds) the evidence is relatively thin due to the absence of corporates with such high credit ratings (and consequently our confidence in the cost of debt estimates for these credit rating bands is much lower).

We also recommend that the extrapolated Bloomberg FVC methodology continue to be estimated (where available), as it provides an independent and low cost alternative cost of debt estimate.

7.2.12 What is the current estimate of annualised debt issuance costs?

Table 7.2 below summarises our results for the estimated current benchmark debt raising transaction costs that we observed for Australian and international corporate bond issues and for bank debt. We found that the cost of bond issues was approximately 10-11 basis points per annum, which is marginally higher than the number we found in our 2010 study (approximately 9.3 basis points), possibly due to the impact of the global financial crisis (most of the difference was accounted for by an increase in the underlying bond arrangement fee). The transaction costs associated with international bond issues were approximately 12 to 14 basis points, i.e. approximately 2-3 basis points more than for a domestic issue.

For bank debt we found what at first sight appears to be a materially higher transaction cost (26-27 basis points). As we explain in the text, a majority of this cost is likely to represent a risk taking component, and should therefore be more appropriately considered to be part of the debt risk premium. If bank debt were to be included as part of a 'portfolio' approach, the 'all-in' cost (i.e. all fees and risk premia) would need to be used. However, we have also concluded that estimating a debt risk premium for bank debt is not feasible given the paucity of available information.

In applying these findings, the Authority can choose to adopt:

- An overall estimate of transaction costs for debt raising (e.g. 11 basis points per annum), which is the approach that it has applied in the past (except that 12.5 basis points was provided); or

- A specific debt raising transaction cost allowance (in basis points per annum) that is based on an estimate aligned to the size of the debt component of the RAB of the regulated business, as has been the practice of the ACCC (since 2004) and the AER.

Table 7.2 Summary results for standard benchmark debt raising transaction costs

	1 issue	8 issues
Domestic corporate bonds (10 years term to maturity)		
Amount raised	$250m	$2,000m
Basis points per annum	10.8	9.9
International corporate bonds (10 years term to maturity)		
Amount raised	$150m	$1,200m
Basis points per annum	14.5	12.9
Bank debt (4 years term to maturity)		
Amount raised	$165m	$1,320m
Basis points per annum	27.2	25.5
less, 'other' bank transaction costs	6.1	4.4
Estimated risk element (to be added to the interest	**21.1**	**21.1**

Source: PwC analysis based on Bloomberg, Loan Connector and interviews with banks, credit rating agencies and legal firms.

Appendices

Appendix A Methodology to estimate benchmark capital structure and term of debt at issuance

Our Australian and UK debt database was created using information from the following sources:

- Bloomberg Financial Services;
- LoanConnector,[107] and
- Annual reports.

First, we downloaded Bloomberg's list of current and expired debt securities, including those that have pre-maturely expired, for our sample of Australian/UK companies.[108] Bloomberg provides a list of corporate bond and bank debt securities, including security information such as the date of issuance, date to maturity, whether it is current or has expired, and the principal at issuance. This enabled us to calculate the exact term at issuance for each security reported by Bloomberg or LoanConnector.

We were reasonably confident that Bloomberg's corporate bond database is comprehensive and is likely to encompass the complete record of corporate bond issues by the UK and Australian companies in our sample. However, we were concerned that Bloomberg had only identified a portion of the complete set of bank debt data relative to the total of bank debt securities issued by the companies. We therefore augmented the Bloomberg data with LoanConnector data. Finally, we cross-checked and verified the debt data with information contained in annual reports.

The Bloomberg data was cross-checked and augmented as follows:

- First, all bank debt securities in LoanConnector were downloaded, and we added securities that were not identified by Bloomberg to our database. Both LoanConnector and Bloomberg service provide information on issue date, date to maturity and value on issue.
- Then we cross-checked the Bloomberg and LoanConnector debt data against the latest published annual report. Since annual reports normally separate the outstanding debt at balance date into corporate bond and bank debt categories, this allowed us to verify our Bloomberg and LoanConnector debt data by comparing the total value of each type of debt outstanding. The values shown for bank debt and for corporate bonds, were separately reconciled by comparing the value of:

[107] LoanConnector is a debt information service provided by Thomson Reuters. It consolidates publicly available debt information for a range of companies, including Australian and UK companies. Importantly, it consolidates corporate bond issuances, and publicly available bank debt information.

[108] Debt issues could have pre-maturely expired because they were redeemed early or have had their call option exercised.

– Corporate bonds on issue in the annual report with the sum of the corporate bonds that were outstanding at the annual report date in the Bloomberg and LoanConnector database; and

– Bank debt outstanding in the annual report with the sum of the value of bank debt principal outstanding as at the annual report date, as reported by Bloomberg and LoanConnector.[109]

If the balance sheet values for outstanding debt (either bank debt or bonds) were either higher or lower than the Bloomberg/LoanConnector values:

– and the balance sheet value was higher, which only occurred for bank debt, the difference was added to the known bank debt value as a sensitivity, using issuance term assumptions of 1, 3 and 5 years;[110]

– and the balance sheet value was lower, we prorated each debt item so that the sum equalled the balance sheet values for bank debt and for bonds.

The methodology that was applied can best be explained with the use of some numerical examples:

a) Annual report value exceeds the Bloomberg/Loan Connector value

   a. $1,400m in bonds and $500m in bank debt are shown in Bloomberg and Loan Connector, for which issuance terms are available;

   b. The annual report shows $1,400m in bonds and $600m in bank debt, so there is $100m of unaccounted for bank debt.

Bloomberg and Loan Connector:

(74% bonds x 12 years) + (26% bank debt x 5 years) = 10.16 years (i.e. *discover* the terms of 12 and 5 years respectively)

Annual Report:

(70% bonds x 12 years) + (25% bank debt x 5 years) + (5% unaccounted for debt x **3** years) = **9.8 years**

i.e. assign the *discovered* terms of 12 and 5 years for bonds and known bank debt, and *assume* a 3 year term for the unaccounted for bank debt.

b) Annual report value less than the Bloomberg/Loan Connector value

   a. $1,500m in bonds and $500m in bank debt are shown in Bloomberg and Loan Connector, for which issuance terms are available;

   b. The annual report shows $1,400m in bonds and $400m in bank debt.

Bloomberg and Loan Connector:

(78% bonds x 12 years) + (22% bank debt x 5 years) = 10.44 years (i.e. *discover* the terms of 12 and 5 years respectively)

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[109] One reason why the bank debt outstanding reported by Bloomberg and LoanConnector may not reconcile with the values shown in the latest accounts is that the former are current values, whereas the amounts shown in the annual report are as at the date of the annual report. For example, as some of the annual reports are more than 6 months old, the difference between the amount of debt outstanding reported by the annual reports compared with the current Bloomberg and LoanConnector data may be due to the pay-down of bank debt in the intervening period.

[110] Bank debt is usually for terms between 1 and 5 years.

Annual Report:

(75% bonds x 12 years) + (25% bank debt x 5 years) = **10.25 years**

i.e. assign terms of 12 and 5 years respectively for bonds and bank debt.

i.e. assign the *discovered* terms of 12 and 5 years for bonds and known bank debt, and *assume* a 3 year term for the unaccounted for bank debt.

Summary statistics for the Bloomberg/LoanConnector and balance sheet data for each of the Australian/UK companies as at the last balance sheet date are provided in Appendix B below.

Appendix B Annual report cross-check

This Appendix displays the differentials we observed when cross-checking Bloomberg and LoanConnector data against the balance sheet values for the terms at issuance of bond and bank debt issues by Australian and UK businesses.

Table B1 – Australia: Total debt, by debt type, reported by Bloomberg and Loan Connector, and in annual reports (AUD million)

Company	Corporate bonds				Bank debt			
	Bloomberg and Loan Connector data	Annual report	Diff-erence	%	Bloomberg and Loan Connector data	Annual report	Diff-erence	%
APA Group	2,616	3,068	-452	-17%	2,375	1,124	1,252	53%
DUET	3,419	3,224	195	6%	3,848	1,976	1,872	49%
Envestra	865	951	-86	-10%	325	297	28	9%
Spark Infrastructure	3,705	3,905	-200	-5%	710	795	-85	-12%
SP AusNet	3,529	3,401	128	4%	1,750	1,315	435	25%

Source: Bloomberg, Loan Connector, Annual reports and PwC's analysis

Table B2 – UK: Total debt, by debt type, reported by Bloomberg and Loan Connector, and annual reports (GBP million)

Company	Corporate bonds				Bank debt			
	Bloomberg and Loan Connector data	Annual report	Diff-erence	%	Bloomberg and Loan Connector data	Annual report	Diff-erence	%
National Grid	23,869	19,368	4,501	19%	1,246	3,221	-1,975	-61%
Pennon Group PLC	575.00	590.20	-15.20	-3%	642.60	139.30	503.30	361%
Scottish and Southern Energy	4,254	4,054	200	5%	1,969	1,087	883	81%
Severn Trent	3,449	3,327	122	4%	1,951	853	1,099	129%
United Utilities PLC	4,432	4,419	12	<1%	1,137	1,236	-99	-8%
Western Power Distribution	4,650	4,758	- 108	-2%	695	24	671	2769%

Source: Bloomberg, Loan Connector, Annual reports and PwC's analysis

Appendix C Methodology to convert foreign bond data to a domestic equivalent

International bond yields

The yields from international debt cannot be directly compared with domestic debt. International debt yields represent a combination of a foreign debt premium and a foreign reference yield (commonly the US Libor). For this yield to be comparable with an equivalent Australian bond yield, the yield must be converted to Australian dollar terms. This can be achieved through a series of interest rate swaps. Specifically, a series of swaps is used to convert the foreign bond payments to a stream of equivalent Australian dollar bond payments.

This Appendix elaborates the methodology we applied to convert foreign bond yields to an equivalent Australian bond yield.

Our objective

Our objective was to convert the yield of a foreign fixed rate bond to an effective Australian yield equivalent, and then to determine the spread over the Commonwealth Government Security (i.e. the debt risk premium"). The debt risk premia for the foreign fixed rate bonds that were derived in this manner could then be compared to those estimated for Australian domestic bonds for a range of different credit ratings and maturities.

We calculated as closely as possible the debt risk premium over the 20-day test averaging period (20 days to 28 November, 2012) for each foreign currency bond/ FVC yield in the bond data set. Relevant market data for each day in the 20 day period was used. The derived debt risk premium for each day in the averaging period was then averaged (simple average) to produce a 20-day average. Where a bond yield for a particular day in the averaging period was not available, this day was excluded from the averaging calculation.

Six steps to derive the debt risk premium for a foreign fixed rate bond

Six steps are required to derive the debt risk premium for a foreign fixed rate bond:

1. Using the foreign currency fixed/ floating swap rate for the remaining term to maturity of the bond, calculate the foreign currency spread by taking the difference of the yield for the foreign currency bond and the relevant foreign currency floating swap rate index (e.g. US Libor for US bonds).

2. Convert the spread calculated in step 1 from foreign currency terms into Australian Dollar terms. This conversion recognises that the spread calculated in step 1 is a foreign spread, and cannot be used to represent an Australian spread. The 'spread conversion' for the remaining term to maturity of the bond is approximated by a relative duration method, which is to:

- Determine the present value of the periodic foreign currency spread payments using the foreign currency fixed/ floating swap rate as the discount rate[111], and
- Estimate the implied periodic Australian dollar spread payments using the present value of the foreign currency spread payments and using the Australian fixed/ floating swap rate (quarterly payment frequency) as the discount rate.

3. Add the Australian fixed/ floating swap rate (quarterly frequency) for the remaining term to maturity of the bond to the spread determined in step 2.

4. Add the Australian BBSW/ Foreign Currency basis swap for the remaining term to maturity of the bond to the value calculated in step 3. The basis swap recognises that a foreign basis point is not equivalent an Australian basis point. This calculation produces the Australian-equivalent fixed rate yield of the foreign currency bond yield.

5. Annualise the rate determined in step 4.

6. Subtract the annualised Commonwealth Government Security yield for the remaining term to maturity of the bond from the yield in step 5 to determine the annualised Debt Risk Premium.

These 6 steps recognise that the translation of a non-AUD fixed rate bond to an AUD yield equivalent is best undertaken through the mechanism of the Cross Currency Swap. The Cross Currency Swap is a well-recognised market instrument used to convert or translate fixed or floating rate assets or liabilities from one currency to another. The translation may be for hedging or for analytical purposes.

Methodology when there is no direct swap basis to Australian dollars

In some cases, there are no financial market data that allow the relevant foreign yield to be directly translated to an equivalent Australian dollar yield. Some currencies do not have a swap market that swaps the foreign currency for Australian dollars. In such cases we had to use a 'bridging' currency, This required an additional step to convert the yield for the foreign fixed rate bond to a 'bridging' currency, and then use the 'bridging' currency's swap rate to convert to Australian dollars. The additional step was used to convert the foreign spread calculated in step 1 above into 'bridging' currency basis points by using a basis swap:

- We took the foreign currency swap and subtracted the bridging currency's basis swap from the foreign currency spread – which created a bridging spread;
- We then converted this bridging spread to an Australian dollar spread by using the foreign currency's swap rate and the Australian dollar swap rate using the same process as described in step 2 above; and
- Finally, the Australian yield was estimated by summing the Australian spread, the Australian swap rate, and the basis swap between Australian dollars and the 'bridging' currency.

We have provided worked examples of both scenarios (with and without direct foreign to Australian financial market data) in Appendix D below.

[111] We have used the swap rate as the discount rate because it's the relevant reference rate that estimated the debt margin.

Another method of conversion that we could have applied is to use foreign exchange forwards to derive the Australian dollar yield equivalent. However, this approach is analytically cumbersome, and in any event, will produce the same result as the cross currency swap method given the no-arbitrage principle that broadly operates between the foreign exchange forward market and the cross currency swap market. Discrepancies between these markets may exist intra-day or from time-to-time. However, invariably these discrepancies do not persist. Generally, there are no structural differences between the foreign exchange forward market and the cross currency swap market that would give rise to a permanent difference. Market-based cross currency swap rates are available in all the foreign currencies that were used in our analysis.

Other issues

Other issues to note are:

- A simple linear interpolation method was used to approximate the market rates used in undertaking the 6 steps in respect of the remaining term to maturity of the bond for each day during the averaging period of the debt risk premium.

- Non-Australian dollar fixed rate bond yields were obtained on a *'clean'* basis, meaning that the yield was adjusted, according to Bloomberg, for interest that has accrued on the bond over the interest period falling within the averaging period.

- Market mid-rates were used. Neither bank credit charges nor execution charges were included in respect of the market instruments, even though in practice these charges would be payable should a foreign currency debt be swapped to Australian dollars

- Bloomberg data were used for the market rates, so that the data can be accessed and verified from a well-recognised independent data provider on an ongoing basis.

Appendix D Converting foreign yields - example

This section provides worked examples of the process we applied, as described in Appendix C, to convert foreign bond yields into Australian equivalent yields. As discussed, there are two scenarios for foreign bond yields. The first is when there are financial markets with data that allows foreign yields to be directly translated to Australian yields, and the second is where there are no swaps between that currency and the Australian dollar, and we must use a bridging currency. Both scenarios are presented in our examples below, and show that the second scenario follows a slightly more elaborate process.

In converting bond yields, one detail we must be careful of is coupon payment frequency. In our example, we have simplified and assumed that the securities (other than the CGS) are all paid semi-annually. However, in most cases bond yields, swap rates and basis swap rates are of different frequencies. In this situation, the most important matter is for them to be converted to a consistent frequency before any analysis. If they are not, the final Australian debt margin may be over or under-estimated.

Table D1 – Example of converting a foreign yield to an Australian margin when it can be directly converted (10 years term to maturity)

Item #	Description	Payment frequency	Calculation	Value
Required data				
(a)	Foreign yield data	Semi-annual		10.00%
(b)	Foreign swap rate data	Semi-annual		5.00%
(c)	Basis swap data–AUD for foreign currency	Semi-annual		0.50%
(d)	Australian swap rate data	Semi-annual		6.00%
(e)	Commonwealth government security data	Annual		4.00%
Calculation steps				
(f)	Step 1–Foreign margin	Semi-annual	(a) - (b)	5.00%
(g)	Step 2–Converting a foreign debt margin to an Australian debt margin	Semi-annual	^	5.24%
(h)	Step 3–Estimating an Australian yield	Semi-annual	(g) + (d) + (c)	11.74%
(i)	Step 4–Annualising the Australian yield	Annual	$(1+\frac{(i)}{2})^2-1$	12.08%
(j)	Step 5–Estimating a debt margin	Annual	(i)-(e)	8.08%

^ First, we estimate the present value of payments implied by (f), using the number of payments to maturity (20 in this case) and (b) as the discount rate. We then estimate the implied payments using the same number of payments to maturity and (d) as the discount rate). This provides the Australian margin over the Australian swap rate.

Table D2 – Example of converting a foreign yield to an Australian margin when it can't be directly converted (10 years term to maturity)

Item #	Description	Payment frequency	Calculation	Value
Required data				
(a)	Foreign yield data	Semi-annual		10.00%
(b)	Foreign swap rate data	Semi-annual		5.00%
(c)	Basis swap data – Foreign and Bridging currency	Semi-annual		-0.20%
(d)	Australian swap rate data	Semi-annual		6.00%
(e)	Basis swap data – AUD and bridging currency	Semi-annual		0.50%
(f)	Commonwealth government security data	Annual		4.00%
Calculation steps				
(g)	Step 1–Foreign margin	Semi-annual	(a) - (b)	5.00%
(h)	Step 2–Estimate a foreign margin in bridging currency terms	Semi-annual	(g) - (c)	5.20%
(i)	Step 3–Converting a foreign margin to an Australian margin	Semi-annual	^	5.45%
(j)	Step 4–Estimate an Australian yield	Semi-annual	(i) + (d) + (e)	11.95%
(k)	Step 5–Annualising the Australian yield	Annual	$(1+\frac{(j)}{2})^2-1$	12.31%
(l)	Step 6–Estimating a debt margin	Annual	(k)-(f)	8.31%

^ First, we estimate the present value of payments implied by (g), using the number of payments to maturity (20 in this case) and (b) as the discount rate. We then estimate the implied payments using the same number of payments to maturity and (d) as the discount rate). This provides the Australian margin over the Australian swap rate

Appendix E Schwarz Information Criterion

The statistical test that we employed to differentiate these alternative functional forms is the Schwarz Information Criterion (SIC), otherwise known as the 'Bayesian Information Criterion'. The SIC value ranks alternative functional forms based on the efficiency of the goodness of fit to the data, with the equation providing the lowest SIC being ranked as superior. The SIC is calculated as the negative of the goodness of fit of a given function relative to the data via a likelihood value, which takes account of the number of variables that the function needed to achieve that goodness of fit.[112] Hence, the SIC rewards a functional form if it achieves a higher goodness of fit (with a lower value), and punishes a functional form that uses more variables to achieve that higher goodness of fit (with a higher value). The SIC discovers the functional form that fits the data best, and uses the minimum number of variables to do so. The SIC test was applied as it:

- Is a robust, well established, and widely used methodology for selecting the superior functional form; and
- Allows us to objectively select superior functional forms based on their efficiency.

An 'efficient' function is desirable, since it minimises the problem of 'over-fitting', which arises when more variables are used than necessary to explain the underlying relationship. An over-fitted function has a range of undesirable qualities and is likely to be a poor predictor. [113]

[112] See, G. Schwartz, (1978), 'Estimating the Dimension of a Model', *Annals of Statistics*, Vol. 6, No. 2, pp. 461 – 464.

[113] D. Hawkins, (2004), 'The Problem of Overfitting', *Journal of Chemical Information and Computing Science*, 44, pp. 1-12.

Appendix F Bibliography

Allen Consulting Group, (December, 2004), *Debt and Equity Raising Transaction Costs*.

AMPCI (April, 2011), *Cost of Debt Summary Paper – Dampier Bunbury Pipeline (DBP)*

Andrews , Donald W. K., '(July, 1993), 'Tests for Parameter Instability and Structural Change With Unknown Change Point', *Econometrica*, Vol. 61, No. 4 pp. 821-856.

Australian Competition Tribunal, *Application by ActewAGL Distribution [2010] ACompT 4*.

Australian Competition Tribunal, *Application by Jemena Gas Networks (NSW) Ltd (No. 5) [2011] ACompT10*.

Australian Competition Tribunal, *Application by WA Gas Networks Pty Ltd (No 3) [2012] A CompT12*.

Australian Competition Tribunal, *Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] A CompT14*.

Australian Energy Regulator (May, 2013), *Better Regulation – Rate of return guidelines – Consultation Paper*.

Covitz, Dan, and Chris Downing (October, 2007), 'Liquidity or Credit Risk? The Determinants of Very Short-Term Corporate Yield Spreads,' *Journal of Finance*, Vol. 62, No. 5, pp. 2303-2328.

Davis, Kevin, (13 December, 2010), *Determining Debt Costs in Access Pricing*, Appendix A in IPART (February, 2011), pp.37-47.

DBNGP (WA) Transmission Pty Limited (14 April, 2010), *Submission 8: Rate of Return – Public Version*, p.22; and AMPCI (April, 2011) *Cost of Debt Summary Paper – Dampier Bunbury Pipeline (DBP),* p.7

Economic Regulation Authority Western Australia, (1 December, 2010), *Measuring the Debt Risk Premium: A Bond-Yield Approach*.

Economic Regulation Authority Western Australia, (14 March, 2012), *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline - Submitted by DBNGP (WA) Transmission Pty Ltd*.

Economic Regulation Authority Western Australia, (29 March, 2012), *Draft Decision on Proposed Revisions to the Access Arrangement for the Western Power Network*.

Economic Regulation Authority Western Australia, (28 February, 2011), *Final decision on WA Gas Networks Pty Ltd proposed revised access arrangement for the Mid-West and South-West Gas Distribution Systems*, pp. 75-92.

Economic Regulation Authority Western Australia, (25 September, 2012), *Draft Report – Inquiry into the Efficient Costs and Tariffs of the Water Corporation, Aqwest and the Brusselton Water Board*, p. 119.

Elton, Edwin, Martin J. Gruber, Deepak Agrawal, and Christopher Mann (February, 2001), 'Explaining the rate spread on corporate bonds', *Journal of Finance*, Vol. LVI, No. 1.

ETSA Utilities, Citipower, Powercor Australia (13 April, 2012), *Joint Response to AEMC Directions Paper* (ERC0134/ERC0135).

He, Jia, Wen Wei Hu, and Larry H.P. Lang, (11 August, 2000), 'Credit Spread Curves and Credit Ratings', *Working Paper*, Chinese University of Hong Kong.

Helwege, Jean, and Christopher M. Turner (1999), 'The Slope of the Credit Yield Curve for speculative-Grade Issuers,' *The Journal of Finance*, Vol. 54, No. 5, October, p.1872.

Hawkins, D., (2004), 'The Problem of Overfitting', *Journal of Chemical Information and Computer Sciences*, 44, pp. 1-12.

IPART, (February, 2011), *Developing the approach to estimating the debt margin: Other Industries – Draft Decision*.

IPART, (April, 2011), *Developing the approach to estimating the debt margin: Other Industries – Final Decision*.

IPART, (December, 2001), *Review of water prices for Sydney Desalination Plant Pty Limited*.

Litterman, Robert, and Thomas Iben (Spring, 1991), 'Corporate bond valuation and the term structure of credit spreads,' *Corporate Journal of Portfolio Management*, p.54.

Merton, Robert C., (1974), 'On the pricing of corporate debt: The risk structure of interest rates', *Journal of Finance*, Vol. 29, pp.449-470.

Neal, Penelope, (June, 1993), 'The determination of interest rates and the effectiveness of monetary policy in deregulated financial markets,' *Economic and Labour Relations Review*, Vol. 4, No. 1.

Oakvale Capital (February, 2011), *Report on the cost of debt during the averaging period: the impact of callable bonds*, Report to the AER.

PricewaterhouseCoopers (November, 2009), *Victorian Distribution Businesses – Methodology to Estimate the Debt Risk Premium*.

PricewaterhouseCoopers, (April, 2012) *Powerlink: debt and equity raising costs*.

PricewaterhouseCoopers, (May 2012), *ElectraNet: Estimating the benchmark debt risk premium*.

Ramsey, J.B., (1969), 'Tests for Specification Errors in Classical Linear Least Squares Regression Analysis, *Journal of the Royal Statistical Association*, 72, --. 635-641.

Reserve Bank of Australia, (August, 2008), *Statement on Monetary Policy*.

Schwartz, G., (1978), 'Estimating the Dimension of a Model', Annals of Statistics, Vol. 6, No. 2, pp. 461 – 464.

Smyczynski, Henryk, and Igor Popovic (April, 2013), *Estimating the Cost of Debt – A Possible Way Forward*, Regulatory Development Branch, Australian Competition and Consumer Commission, pp. 24-25.

Sorge, Marco, and Blaise Gadanecz (2008), 'The term structure of credit spreads in project finance,' *International Journal of Finance and Economics*, Vol. 123, p.80.

Sydney Water, (December, 2010), *Sydney Water submission*.

Synergies, (December, 2010), *Synergies submission*.

Warga, Arthur D., (June, 1995), 'Review of Valuation of Fixed Income securities, by Frank Fabrozzi', *The Journal of Finance*, Vol. 50, No. 2, p762.

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