Queensland Competition Authority

Final decision

Cost of capital: market parameters

August 2014

Level 27, 145 Ann Street, Brisbane Q 4000
GPO Box 2257, Brisbane Q 4001
Tel (07) 3222 0555
www.qca.org.au

We wish to acknowledge the contribution of the following staff to this report:

Michael S Blake, Daniel Kelley, Darren Page and Zach Zhang

We also acknowledge the helpful comments of Dr John Fallon.

Table of Contents

EXECUTIVE SUMMARY

The role of the Queensland Competition Authority (the QCA) is to either approve or recommend prices for monopoly infrastructure businesses in Queensland across a number of industries (e.g. ports, rail and water).

The allowed rate of return of capital, or weighted average cost of capital (WACC), is a key input in determining the revenues for the firms regulated by the QCA. While some elements of the WACC are firm-specific (e.g. the asset beta and debt/equity ratio), other components are more general in nature and are unlikely to differ from business to business — the approach to determining the risk-free rate, market risk premium and value of dividend imputation credits (i.e. 'gamma'). These 'market parameters' are key drivers of the WACC.

The QCA last undertook a comprehensive review of its WACC methodology in 2004. This review considers the QCA's methodology in light of recent developments. This review has occurred in stages, with extensive work having been undertaken on the cost of equity and the cost of debt. A range of papers have been published, forums undertaken and stakeholder submissions received. This paper considers stakeholder submissions and provides the QCA's views on the approach it will use to estimate the market parameters going forward.

Risk-free rate

The WACC is based on both an estimate of a cost of equity and a cost of debt. Both of these estimates rely on an assessment of a risk-free rate, plus a premium to reflect relevant risks.

The QCA has relied on the Commonwealth Government bond as the risk-free asset. This has not been a matter of contention in this review and is in line with the practice of other Australian regulators and with market practice. Commonwealth Government bonds are the commonly accepted proxy for the risk-free asset in Australia. The duration of the bond and the nature of the averaging period that will apply to the bond are not as well established.

The QCA's recent practice has been to adopt a short-term average rate using a Commonwealth Government bond with a term that is aligned to the term of the regulatory cycle (i.e. 'term-matching').

Stakeholders' key concerns with the QCA's 'term matching' approach have been linked to:

(a) the long life of the regulated assets suggesting that the term of the risk-free rate should reflect the term of a long-term bond (i.e. 10 years), regardless of the term of the regulatory period (e.g. five years)

(b) consistency in estimating the risk-free rate and the market risk premium

(c) refinancing risks relating to the efficient management of commercial debt.

The QCA has addressed each of these matters in this paper. The issue of debt refinancing risk and the term of the risk-free rate in the cost of debt have been addressed in a separate paper.

The QCA maintains the view that matching the term of the risk-free rate in the cost of equity to the term of the regulatory cycle (e.g. five years) best achieves the QCA's regulatory objectives.

Relevantly, term-matching will ensure that the regulated business does not systematically over- or under-recover its efficient costs. Given the current term structure of interest rates, estimating the risk-free rate based on a 10-year Commonwealth Government bond would allow a regulated business to significantly over-recover its efficient costs.

The QCA proposes to maintain its current practice of averaging the risk-free rate over a short (i.e. 20-day) period prior to the start of the regulatory period, based on a Commonwealth Government bond with a matching term.

Market risk premium

Unlike the risk-free rate, the market risk premium is not observable and must be estimated. However, there is no consensus on how it should be estimated and the various estimation methods have advantages and disadvantages (e.g. by using a long-term average, a forward-looking methodology or by referencing survey / independent expert evidence). As a result, the QCA has tended to estimate the market risk premium based on taking an equally weighted average from a range of estimation techniques and rounded to the nearest whole number.

Some stakeholders have argued that the QCA should examine additional information, for example current market indicators, and that its approach has been too rigid. The QCA accepts these criticisms and proposes to adopt a more flexible approach that relies more heavily on its own judgment in light of the evidence before it, rather than an average of equally weighted estimates.

Based on the analysis set out in this paper, this revised approach results in an increase in the market risk premium from 6.0% to 6.5%.

Gamma

The Australian tax system allows companies to provide shareholders with credits to reflect the taxes paid on profits that are distributed as dividends. Shareholders can use the imputation, or 'franking', credits to reduce their personal tax liabilities. These credits represent a return on investment and are reflected in the cash flows associated with the benchmark WACC.

The value of distributed imputation credits to the extent they are utilisable by a firm's investors is known as 'gamma'. The higher (lower) the value of gamma, the greater (lesser) the tax benefit to the firm's investors and accordingly, the lower (higher) the tax component of the firm's allowed revenues.

The QCA, in line with other regulators, has historically favoured a gamma estimate of 0.50. Several regulators lowered their previous estimates of gamma to 0.25 following an Australian Competition Tribunal decision. However, as identified in this paper, this 0.25 estimate has been brought into question following further research.

The QCA has reviewed this material and, based on the analysis set out in this paper, has determined that an appropriate estimate of gamma is 0.47.

Application

The estimates of the WACC market parameters identified in this paper should be regarded as indicative and may change over time as financial market conditions change.

In the context of a particular regulatory review, the QCA intends that stakeholders will be given an opportunity to make submissions on the WACC market parameters to apply at that time.

This market parameters paper is being published at the same time as a separate paper on estimating the cost of debt. The QCA has also published at this time a draft decision on the trailing average cost of debt proposition, requested stakeholders' submissions, and a final decision on that matter will be made in the coming months.

THE ROLE OF THE QCA – TASK AND CONTACTS

The Queensland Competition Authority (QCA) is an independent statutory authority to promote competition as the basis for enhancing efficiency and growth in the Queensland economy.

The QCA's primary role is to ensure that monopoly businesses operating in Queensland, particularly in the provision of key infrastructure, do not abuse their market power through unfair pricing or restrictive access arrangements.

In 2012, that role was expanded to allow the QCA to be directed to investigate, and report on, any matter relating to competition, industry, productivity or best practice regulation; and review and report on existing legislation.

Task

This final decision paper sets out the QCA's proposed approach to estimating the 'market parameters' — the risk-free rate, market risk premium and gamma — applied in determining the return on equity for future regulatory reviews.

Contacts

Enquiries regarding this project should be directed to:

ATTN: Michael Blake
Tel (07) 3222 0514
research@qca.org.au
www.qca.org.au

1 INTRODUCTION

The Queensland Competition Authority (QCA) approves or monitors prices for firms in the rail, ports and water sectors. The 'Building Blocks' approach is used across the sectors and firms regulated by the QCA. In each case, the QCA examines available evidence to establish the weighted average cost of capital (WACC) of the firm in question. The WACC is the opportunity cost of financing the firm's investments with debt and equity capital.

A number of inputs must be estimated or specified to determine the WACC. These include firm-specific parameters (e.g. the debt premium, the asset beta and capital structure), as well as parameters that are effectively market-based. These market parameters include the risk-free rate, the market risk premium and 'gamma', which measures the impact of tax policy on investor returns. This paper focuses on estimating the market parameters.

1.1 The cost of capital

The allowed rate of return on capital, or cost of capital, is a key input in determining the revenues for the firms regulated by the QCA. The rate of return on capital compensates investors for the opportunity cost of investing their capital in the regulated firm, consistent with the rate of return they would earn by investing in an alternative asset of equivalent risk.

As regulated natural monopolies provide services that require significant initial investment in long-lived infrastructure assets, this investment reflects a substantial proportion of the firm's total costs. As a result, the return on capital in dollar terms is an important component of the regulated firm's allowed revenues.

The cost of capital is determined by three principal components:

(a) the cost of equity capital

(b) the cost of debt capital

(c) capital structure.

It is also referred to as the weighted average cost of capital (WACC), where the weights applied to the cost of equity and the cost of debt are the respective proportion of that each source of finance contributes to the firm's total capital structure. The capital structure is typically determined by 'benchmarking' the capital structures of comparable firms.

The return on equity is estimated using the Capital Asset Pricing Model (CAPM), which adds a risk premium to a risk-free rate. The equity premium comprises the market risk premium scaled by the firm's equity beta.[1] The 'beta' reflects the relative risk of the firm to the market as a whole. The market risk premium is the expected rate of return on the equity market portfolio less the risk-free rate.

The return on debt is estimated by adding a debt risk premium to a risk-free rate, where the debt risk premium is based on the promised yields on relevant corporate debt.

The allowed return on equity also needs to reflect the tax benefits from owning shares that pay dividends with attached imputation credits. Taking the effects of dividend imputation into account can occur via an adjustment to either the allowed discount rate (i.e. the WACC) or to

[1] The equity beta is the asset beta adjusted for financial leverage.

the allowed cash flows by applying an adjustment factor known as 'gamma'. In addition, estimates of the market risk premium from certain methods must be adjusted by gamma to reflect the value of imputation credits in the total return on the market portfolio of risky assets.

The risk-free rate, the market risk premium and gamma are market-based parameters. That is, they are estimated for the market as a whole and effectively do not vary across individual firms. In contrast, the firm's benchmark asset beta, debt premium and capital structure can vary from firm to firm.

The principal focus of this position paper is on the market parameters: the risk free rate, the market risk premium and gamma. However, the overall regulatory framework and approach within which these parameters are considered are also discussed.

1.2 Process

The QCA last undertook a comprehensive review of its WACC methodology in 2004. The present review considers the QCA's methodology in light of recent developments, including the Global Financial Crisis (GFC), regulatory and statutory decisions and relevant academic research. The QCA notes that other regulators, such as the Australian Energy Regulator (AER), the Economic Regulation Authority of Western Australia (ERA) and the Independent Pricing and Regulatory Tribunal of New South Wales (IPART) have undertaken similar reviews recently.

This review has occurred in stages, with extensive work having been undertaken on the cost of equity and the cost of debt. The QCA engaged Dr Martin Lally and PricewaterhouseCoopers (PwC) to provide technical advice to inform this review. The QCA's review in the context of the cost of debt is presented in separate papers, *Cost of Debt Estimation Methodology – Final Decision* and *Trailing Average Cost of Debt – Draft Decision,* which should be read in conjunction with this paper (QCA, 2014e; QCA, 2014f).

The QCA released a discussion paper, *The Risk free Rate and the Market Risk Premium*, along with a companion paper of the same name by Dr Lally in November 2012 (QCA, 2012b; Lally, 2012c). Submissions were received from a number of stakeholders and published on the QCA's web site. The QCA subsequently asked Dr Lally to prepare a response to these submissions (Lally, 2013c). In October 2013, the QCA then published three cost of capital related papers on its web site:

(a) *Response to Submissions on the Risk-free Rate and MRP* (Martin Lally)

(b) *A Cost of Debt Estimation Methodology for Businesses Regulated by the Queensland Competition Authority* (PWC)

(c) *The Estimated Utilisation Rate for Imputation Credits* (Martin Lally)

A second paper on gamma, *Estimating Gamma*, was prepared by Dr Lally and published on the QCA's web site in November 2013. The QCA invited submissions from interested parties on all four papers, due 20 January 2014.[2]

Cost of capital issues addressed in these papers were also the subject of stakeholder consultation and submissions as part of the Aurizon Network 2013 Draft Access Undertaking (UT4) review process, which was occurring concurrently.

[2] The original due date of 6 January 2014 was subsequently extended to 20 January 2014 at stakeholders' request.

To assist stakeholders in preparing submissions, the QCA hosted a Cost of Capital Forum on 13 December 2013. The QCA's consultants and stakeholders gave presentations at the Forum on the risk-free rate, the market risk premium and gamma. The QCA subsequently received and published stakeholder submissions on matters discussed in the Forum.

This paper considers stakeholder submissions and provides the QCA's views on the approach it intends to use to estimate the market parameters going forward. The QCA's overall regulatory objectives are discussed in the following section. Principles for estimating values for each of the market parameters are discussed in the following chapters.

2 COST OF CAPITAL FRAMEWORK

2.1 Background

As indicated previously, the rate of return component of allowed revenues for regulated firms tends to be substantial. The cost of capital framework should enable a service provider an adequate opportunity to recover its efficient costs incurred in providing the regulated service to a certain quality and/or standard. At the same time, it should protect customers from excessive prices.

The QCA's cost of capital framework is described in more detail in Appendix A.

2.2 Stakeholder submissions

When providing comments on individual parameters in their submissions on the QCA's discussion papers, stakeholders raised concerns on the QCA's broader cost of capital methodological framework and its application. These concerns broadly fall into two principal areas, namely that the methodology should:

(a) aim to achieve an overall regulatory objective, including satisfying the requirements of the Queensland Competition Authority Act 1997 (QCA Act)

(b) produce a return on equity that is reasonable as a whole.

2.2.1 Cost of capital methodology objective

Several stakeholders made the point that the QCA should explicitly identify an overall regulatory objective to underpin its cost of capital methodology. DBCT Management observed that the Australian Energy Market Commission (AEMC) rule changes require the regulator to determine a rate of return consistent with an overall objective (DBCT Management, 2013: 5–6):

> *The allowed rate of return objective requires the rate of return to be commensurate with the efficient financing costs of a benchmark efficient service provider with a similar degree of risk to the service provider whose rate of return is being determined.*

Several stakeholders framed the relevant objective in terms of achieving cost of capital outcomes that satisfy the QCA Act. SFG Consulting, on behalf of Aurizon Network, Unitywater and Queensland Urban Utilities (QUU), stated that the purpose of the access arrangements is to (SFG Consulting, 2013a: 10):

> *'promote the economically efficient operation of, use of and investment in, significant infrastructure by which services are provided, with the effect of promoting effective competition in upstream and downstream markets' (footnote omitted).*

SFG Consulting also noted that (SFG Consulting, 2013a: 10):

> *'The pricing principles in relation to the price of access to a service are that the price should generate expected revenue for the service that is at least enough to meet the efficient costs of providing access to the service and include a return on investment commensurate with the regulatory and commercial risks involved' (footnote omitted).*

Queensland Treasury and Trade (QTT) also proposed that an objective be supported '...by a financial principle that focuses on the efficient financing of an efficient enterprise...' (QTT, 2013: 3).

2.2.2 Reasonableness of the return on equity

Some stakeholders raised the concern that applying the current QCA approach to estimating the return on equity will not produce an estimate that is reasonable in current market conditions. SFG Consulting argued that applying the QCA's approach to date in estimating the return on equity 'implies that equity capital is currently cheaper than at any time since 1975' (SFG Consulting, 2013b: 11-12):

> *This allowed return would only be commensurate with the prevailing conditions in the market for funds if market investors really were requiring lower returns on equity capital than ever before. But any reasonable analysis would conclude that they are not.*

QUU noted that the GFC and uncertain financial market conditions resulting from it have impacted other regulators' considerations of the cost of capital and motivated regulatory reviews of their methodologies, including by the AEMC and IPART (QUU, 2013: 1–2). SFG Consulting noted that the AEMC's changes to the National Electricity Rules (NER) and National Gas Rules (NGR) require regulators to have regard to a broader range of evidence to achieve an allowed return on equity that is reasonable in the circumstances and that the QCA should do likewise (SFG Consulting, 2013: 5).

An additional concern raised is that the QCA's approach to estimating the return on equity is too 'mechanistic'. In this respect, Aurizon Network stated that (Aurizon Network, 2013: 117):

> *At the current time, the key issue is the mechanistic approach that has been historically applied... While this has not necessarily been an issue in more stable market conditions, it can cause issues in a more difficult market environment, as is presently the case.*

These stakeholders argued that the QCA's methodology should be more adaptable in order to reflect changing market conditions. For example, QTT observed that (QTT, 2013, 1):

> *While this framework seems to have worked effectively over several years, QTT considers that changes in economic and market conditions following the Global Financial Crisis have put stress on the approach. In particular, interest rate yields have fallen considerably, leading to weighted average cost of capital (WACC) estimates falling significantly.*

In contrast, the Queensland Resources Council (QRC) supported applying a consistent methodology across regulatory periods (QRC, 2013b: 2):

> *...a consistent approach to calculating the Risk Free Rate and Market Risk Premium should be adopted across regulatory periods, unless there is a clear demonstration that the methodology is not appropriate.*

This position was also supported by Anglo American, Rio Tinto and Vale (Anglo American, 2013: 3; Rio Tinto, 2013: 6–8; Vale, 2013: 1–2).

Finally, SFG Consulting, on behalf of Aurizon Network, Unitywater and QUU, contended that there are several technical flaws in the QCA's current cost of capital methodology that lead it to producing unreasonable results, specifically (SFG Consulting, 2013a: 9-12):

(a) an allowed cost of equity that is lower than at any time since 1975

(b) the allowed return on equity is below the return on debt for some investors

(c) the allowed return on equity estimate is inconsistent with the benchmark capital structure.

2.3 QCA position

2.3.1 Regulatory objectives

The QCA agrees with stakeholders that it is important for a cost of capital methodology to have an overall regulatory objective (or possibly objectives depending on the circumstances). The QCA notes that various provisions of the QCA Act establish both economic and non-economic objectives for the Authority to follow in conducting an investigation when regulating monopoly firms.[3] The economic objectives are directly or indirectly related to economic efficiency. The QCA has previously identified these regulatory objectives and has developed pricing principles aimed at achieving these objectives.[4]

As previously identified in the pricing principles, the QCA considers that an important mechanism for achieving these objectives is the Net Present Value Principle (i.e. NPV = 0 Principle) and that its application is fully consistent with the requirements of the QCA Act. The principle states that the present value of the regulated firm's expected net cash flows should equal investors' initial investment (Marshall et al., 1981). Put another way, it states that the present value of a regulated firm's revenue stream should equal the present value of its efficient costs, including a risk-adjusted opportunity cost of capital.[5]

In the pricing principles, the QCA previously reached the following conclusions in relation to the setting of pricing principles to achieve revenue sufficiency (QCA, 2013b: 10):

> *One role of a regulator whose objective is to promote economic efficiency in natural monopoly markets is to set prices, or provide the regulated firm with incentives to set prices, that achieve economic efficiency objectives. Various means to accomplish these objectives in the face of the constraints caused by sunk costs and natural monopoly conditions are discussed below…*
>
> *...As discussed above, where there are sunk costs, and capacity investment is lumpy, marginal cost generally lies below average cost. Prices set to recover only marginal cost would prevent the regulated firm from recovering all of its costs, which the Act requires. If the firm is not allowed to recover total costs, it will not have appropriate incentives to operate and invest.*
>
> *The potential losses from a firm not participating in a market or failing to invest adequately in maintenance and expansion because regulated revenues are inadequate could be significant and exceed the potential allocative efficiency losses associated with prices that exceed short-run marginal cost. As a result, the principle of revenue sufficiency is a dominating principle in economic regulation, and is reflected in the objectives of the Act. The revenue sufficiency principle is also often applied to the government-owned enterprises even though they do not require private investors to provide funding.*
>
> *Various mechanisms have been developed to ensure that revenue is sufficient to finance total costs when natural monopoly conditions lead to marginal costs that are below average costs. An important example is the net present value (NPV) principle. The 'NPV=0 principle' means that the expected present value of the future cash flows of the regulated firm should equal the value of initial investment, using a discount rate that reflects the opportunity cost of the investment. This principle is equivalent to the statement that the regulated price should cover the firm's efficient costs, including the cost of capital (Schmalensee, 1989a). If the NPV > 0, then the implication is that the firm is earning above normal economic profits.*

As identified in the quote, the NPV = 0 Principle is not a new development in the practice of economic regulation. The Building Blocks Model applied by the QCA and economic regulators in Australia follows directly from the NPV = 0 Principle (Lally, 2012b: 7-8). The NPV = 0 Principle,

[3] A list of the relevant provisions is set out in QCA (2013b), *Statement of Regulatory Pricing Principles*.
[4] See QCA (2013b), *Statement of Regulatory Pricing Principles*.
[5] The formulation also takes into account any adjustment for efficiency rewards or penalties.

for example, operationalises requirements in the QCA Act to ensure that a regulated business is at least fully compensated for its efficient costs of providing the service, including a return on investment commensurate with regulatory and commercial risks involved (s.168A).

The QCA notes, for example, that the objective of Part 5 (s.69E) of the QCA Act, to which the QCA is required to have regard when deciding whether to approve access arrangements under that Part, is to:

> *...promote the economically efficient operation of, use of and investment in, significant infrastructure by which services are provided...*

This requirement is consistent with the objective noted by QTT and SFG Consulting. It is also consistent with the AER's Rate of Return Guideline (December 2013) for regulated electricity and gas businesses, which states that the allowed rate of return objective is (AER, 2013d: 15):

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

These objectives are consistent with the idea that revenues should be sufficient to finance the efficient, total costs of the firm. In this respect, various mechanisms have been developed to help achieve these, and related, objectives.

The QCA notes that the allowed cost of capital includes a premium for relevant risk. When the firm's cash flows are discounted at the relevant, risk-adjusted cost of capital, the net present value of investment should be zero — the NPV = 0 Principle compensates investors for relevant risk.

In terms of SFG Consulting's concerns about appropriate compensation for commercial and regulatory risks, the Building Blocks Model — and the NPV = 0 Principle that underlies its use — do not preclude such compensation for relevant risks. There is nothing inherent in applying the NPV = 0 Principle that prevents these risks, to the extent they exist, from being identified, quantified, and incorporated into the regulated firm's prices.

2.3.2 Reasonableness of the return on equity

Stakeholders raised a number of concerns with the QCA's traditional approach to estimating the return on equity. One of the central themes is that the QCA's approach of combining a variable 'spot' risk-free rate with a 'fixed' estimate of the market risk premium is too 'mechanistic' and might not adequately reflect market conditions when they are unusual, such as in a post-GFC environment.

To place this critique in the relevant context, it is important to note that Australia avoided the worst impacts of the GFC, the start of which can be dated to over seven years ago now to the collapse of Lehman Brothers. According to the Australian Bureau of Statistics (ABS, 2010: 687–688):

> *The effect of the crisis on Australia has been considerably less than in many other countries. The Australian economy has recorded markedly better growth outcomes than most other developed economies, many of which have experienced severe recessions and rises in unemployment. The Australian financial system has been markedly more resilient. Notably, Australian banks have continued to be profitable and have not required any capital injections from the Government.*
>
> *The credit and money markets in Australia have also proven to be more resilient than in many other countries, necessitating considerably less intervention by the RBA than occurred in many other countries. In large part this reflected the health of the Australian banking system. The Australian banks had almost no holdings of the "toxic" securities that severely affected other global banks. The health of the Australian banking system facilitated the effectiveness of the*

> *monetary and fiscal response, particularly by allowing much of the large easing in monetary policy to be passed through to interest rates on loans to households and businesses, in stark contrast to the outcome in other developed economies.*

While Australia has emerged from the GFC in much better condition than many other economies, the GFC did, of course, have impacts on Australia. The current low interest rate environment is likely a result of the post-GFC 'flight to quality'. Further, although world-wide and Australian risk-free rates are below historical averages, there is reason to believe that current rates could reflect the 'new normal' for the economy. As noted by Dimson, Marsh and Staunton (2013a: 7):

> *Today's low yields partly reflect the quest for safe havens, are heavily influenced by central bank policies, and may be affected by regulatory pressure on pension-fund and insurance-company asset allocations. They may also be impacted by demographic factors, such as dissaving by retiring baby boomers, but the evidence here is, at best, weak (see Poterba, 2001) Should we be concerned that today's long bond yields may be artificially low?*
>
> *This question is hard to resolve conclusively, but two points are relevant. First, many alleged 'distortions' are likely to be permanent. Regulatory pressures on insurers and pension funds are unlikely to diminish; pension funds are maturing and should lean towards higher bond weightings; baby-boomer retirement is ongoing; and, with a stock market that could easily see an increase in volatility …, the safe-haven demand for bonds could even increase.*
>
> *Second, these factors are all common knowledge. While the impact of quantitative easing (QE) and other unconventional monetary policies may be hard to measure, the policies themselves are disclosed and transparent. It would be curious, therefore, if the market prices of bonds of different maturities failed to incorporate expectations of the impact of these factors. We should therefore expect bond market prices and yields to provide a reasonable guide to prospective returns.*

So while applying the QCA's traditional approach to date might produce a rate of return on equity that is 'low' relative to historical levels, it is not necessarily inconsistent with current market conditions. It is also not correctly characterised as 'the lowest on record' as suggested by SFG Consulting. There are a number of issues with SFG Consulting's analysis on this point, and these are addressed in Appendix A.

Therefore, while the QCA understands stakeholder concerns, the QCA considers that a strength of its traditional approach to estimating the return on equity is that it has been effective in compensating investors in regulated firms for their (efficient) costs and in promoting continued investment during periods spanning different economic conditions. For instance, the Queensland Government successfully privatised Aurizon in 2011, and the firm has been successful in attracting capital from investors during the post-GFC period — its share price has climbed steadily since privatisation. This is evidence that the QCA's cost of capital determinations are reasonable and have not resulted in rates of return on equity that are too low.

Nonetheless, the QCA agrees with stakeholders that there is merit in considering a broader range of information in coming to a view on the reasonableness of the return on equity.

The QCA's starting point in making its determinations on an appropriate return on equity has been the CAPM. While the CAPM does have limitations, the QCA and other regulators have applied it because it is reasonably simple to understand, relatively easy to implement in practice, and has broad support from practitioners. The QCA proposes to retain the CAPM for these reasons. This position is also consistent with stakeholder submissions to this review.

Within the context of the CAPM, the QCA considers that the greatest scope for taking into account additional information is in estimating the market risk premium, as it is unobservable

(in contrast to the risk-free rate). The QCA's approach to estimating the market risk premium is set out in detail in chapter 4 and Appendix C.

The QCA's over-arching approach will involve:

(a) Risk-free rate — This parameter is based on the observable yields of Commonwealth Government bonds. The information source (i.e. the Reserve Bank of Australia(RBA)) is reliable, and the rates, as well as the estimation approach, are simple to understand, transparent, and auditable.

(b) Market risk premium — This parameter is unobservable, and it is difficult to estimate. As a result, the approach set out in this decision expands the traditional set of four methods to include other information and evidence to help inform an estimate. In doing so, the approach sets aside the past approach of applying an equally weighted average. Rather, it involves assessing the strengths and limitations of the methods and additional evidence and applying regulatory judgment in determining a point estimate.

(c) Equity beta – Estimates of this parameter are based on econometric analysis of equity returns of publicly listed 'comparator' companies. Triangulation across these estimates and other, relevant benchmarks are used to establish a reasonable range. The approach also draws upon additional information and judgment in choosing a point estimate from that range.

Consistent with the AER, the QCA believes that good regulatory practice in estimating the CAPM parameters using this approach produces a rate of return on equity that is reasonable.

3 RISK-FREE RATE

The risk-free rate is the rate of return on an asset with zero default risk.

Consistent with past practice, the QCA prefers Commonwealth Government bonds as the proxy for the risk-free asset, as they have very low default risk.

When making an investment decision, the relevant risk-free rate is the current risk-free rate, as it reflects the most relevant and up to date information. As a result, the QCA proposes to retain its practice of applying a current risk-free rate, rather than a long-term average. However, to avoid pricing anomalies that could affect a single day's rate, the QCA proposes to maintain its current practice of averaging the risk-free rate over a short (i.e. 20-day) period prior to the start of the regulatory cycle.

The QCA's practice in recent years has been to align the term of the Commonwealth Government bond with the term of the regulatory cycle (i.e. 'term-matching'). While some stakeholders proposed to use the 10-year bond on the basis of the long life of the regulated assets, the QCA considers that term-matching is the stronger position because the regulated firm will not systematically over- or under-recover its efficient costs (i.e. it satisfies the NPV = 0 Principle).

The QCA also considered stakeholder concerns that aligning the term of the risk-free rate with the term of the regulatory period is inconsistent with the 10-year risk-free rate implicit in certain estimates of the market risk premium. QCA analysis of the historical difference between these rates reinforces its conclusion that its estimate of the market risk premium of 6.5% is appropriate.

3.1 Introduction

The CAPM is designed to estimate the risk-adjusted rate of return on an asset. As it compensates for the time value of money, the risk-free rate of return is the base rate, to which the investor adds a premium for risk. The *current* rate of return on the risk-free asset reflects the latest market information and expectations and is, therefore, the relevant benchmark. The current risk-free rate should be used as an input to estimate both the cost of equity and the cost of debt components of the WACC.[6]

Three methodological issues arise in choosing the risk-free rate. First, a 'risk free' asset must be identified. Second, as using the risk-free rate as of a particular date is problematic, a short period of time over which daily rates are averaged must be selected to estimate the risk-free rate. Finally, the appropriate term of the risk-free rate must be determined.

In recent times, the QCA has used Commonwealth Government bonds as proxies for the risk-free asset. The term of the bond has been selected to match the term of the regulatory cycle. The proxy for the current rate has been an average rate over the 20 business days as close as practicable to the start of the regulatory cycle.

[6] The QCA has released a separate paper, *Trailing Average Cost of Debt – Draft Decision* (QCA, 2014f), on the use of a long-term average for setting the cost of debt, including applying a long-term average to one, or both, of the risk-free rate and debt margin in the total cost of debt.

3.2 The risk-free asset

Commonwealth Government bonds are the commonly accepted proxy for the risk-free asset in Australia. These bonds have very low default risk and are highly liquid. Moreover, daily Commonwealth Government bond rates are reported by the RBA and are therefore highly transparent. Stakeholder submissions, financial market analysts and academic researchers support the use of Commonwealth Government bonds as the proxy for the risk-free asset in the CAPM.

In the decision, *Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] ACompT 14*, the Australian Competition Tribunal (the Tribunal) stated (ACT, 2012c):

> *The Tribunal notes here that the risk free rate of return is a clearly defined, if abstract, concept. It measures the return on a bond that carries no risk for the investor. It is widely accepted that the closest approximation to such a bond will be government debt.*

There is no reason for the QCA to change its practice of using Commonwealth Government bonds as the proxy for the risk-free asset.

3.3 The averaging period

In making an investment decision, the relevant risk-free rate in estimating the expected rate of return is the current rate at the time of that decision. Past rates of return are less relevant because it is the currently available market rate of return that determines the opportunity cost of the investment. The current bond rate encapsulates all the information available about investor expectations of future rates of return.

The Building Blocks Model is designed to ensure that the expected return from investing in a regulated activity is sufficient to induce the investment but is not so high as to provide greater returns than necessary to do so — this is the NPV = 0 Principle. In the presence of risk, this principle is satisfied by adding a premium to the rate of return on the risk-free asset available at the start of the regulatory period that reflects the risks associated with a particular investment.

However, in practice, the QCA and other regulators set the risk-free rate by taking an average of rates over a brief period as close as practicable to the start of the regulatory cycle. This approach avoids the potential problem of pricing anomalies that could impact a single day's rate. For example, external forces such as a major news item can have a significant, but transitory, impact on a single day's trading. This approach also reduces the opportunity for strategic trading by regulated firms or lenders designed to influence a single day's rate.

Australian regulators use averaging periods in the range of 10-40 business days. The QCA has in the past applied a 20-day averaging period preceding the start of the regulatory cycle.

Some stakeholders proposed using a substantially longer averaging period. Two arguments have been made in support of using a longer averaging period. First, there is a concern that current macroeconomic conditions are responsible for an unrepresentatively low risk-free rate and that, in practice, investment decisions would be made on the basis of more representative rates. Second, there is concern that using rates based on a 'snapshot' of a brief period of time could lead to undesirable volatility in the prices paid for services. (Both of these arguments also relate to the validity of the 'Wright approach' to measuring the cost of equity, which is discussed in Chapter 4 on the market risk premium.)

As discussed above, current Commonwealth Government bond rates reflect expectations about future rates. Rates have indeed been at, or near, historically low levels in recent years. However, given the CAPM, the current rate reflects the relevant opportunity cost of capital.

There is no reason to believe that an average of rates from prior periods provides investors with more relevant information on which to make decisions.

Price volatility can be a concern in certain situations. Customers of the regulated firm often have to make their own investment decisions and these decisions will be affected by the future course of the regulated firm's prices. However, the QCA believes these concerns are secondary to setting the correct, economically efficient WACC consistent with the requirements in the Act to provide regulated firms with an adequate return. Consider the hypothetical case where current rates are historically high rather than historically low. Establishing the risk-free rate by using an average of materially lower rates when current rates are high could have the effect of leaving the regulated firms with inadequate revenues, contrary to the requirements of the Act.

Additional problems with using a long-term average, rather than the current, risk-free rate are addressed in Appendix B.

Based on the foregoing and the more detailed analysis in Appendix B, the QCA believes that the current practice of averaging the risk-free rate over a 20-day period prior to the start of the regulatory cycle remains appropriate in normal circumstances.[7]

3.4 Term of the risk-free rate

The QCA's practice in recent years has been to align the term of the Commonwealth Government bond with the term of the regulatory period (i.e. 'term-matching'). For example, for firms subject to a five-year regulatory period, the five-year bond has been used for the purpose of establishing the term of the risk-free rate. The QCA has based its decision to match the term of the risk-free bond to the term of the regulatory cycle in part on Dr Lally's research, which demonstrates that term-matching is necessary to satisfy the NPV = 0 Principle.

Some stakeholders objected to using term-matching for the purpose of setting the term of the risk-free rate, preferring the 10-year bond on the basis that its term is more consistent with the long life of the regulated assets. SFG Consulting, on behalf of Unitywater, QUU and Aurizon Network, argued that in order for Dr. Lally's analysis to be correct, the term structure of interest rates today must provide a set of unbiased expectations about future interest rates (SFG Consulting, 2013e).

Appendix B shows, by example, that the SFG Consulting argument is not correct and that term-matching will result in NPV = 0 for an investment over multiple periods. Essentially, the return on an investment over multiple periods can be expressed as income for the first year plus the NPV of return on investment in future years discounted by the risk-free rate applicable in those periods. Contrary to SFG Consulting's claim, no assumption about interest rate expectations embedded in the risk-free rate is necessary.

Queensland Treasury Corporation (QTC) maintained that the validity of using the five-year rate depends on an assumption that investors are able to recoup their full investment at the end of each regulatory period (QTC, 2014: 3-4). However, this statement is based on an incorrect interpretation by the AER of Lally's analysis. Lally states that (Lally, 2012b: 14):

> *In five years' time, ... the output price will be reset to ensure that the value at that time of the subsequent payoffs on the regulatory assets equals the regulatory asset book value prevailing at that time....*

[7] In certain circumstances, the QCA might adopt an averaging period that does not immediately precede the start of the regulatory period.

Lally's analysis does not assume that the assets will be sold at the end of the regulatory period to pay investors.

While clearly there is risk associated with the recovery of investments in future regulatory periods, systematic risk is compensated in the CAPM through the beta parameter. Providing a firm with a longer term risk-free rate as some form of compensation for this perceived risk would be double-counting.

Adjustments to cash flows may be required to the extent there is non-systematic risk. However, using a bond instrument with a maturity longer than the regulatory period is not necessary to compensate the regulated firm for these risks. More direct instruments are available.

QTC also argued that investors require extra compensation for investing in long-lived assets. On this basis, QTC concluded that a 10-year risk-free instrument is superior to a five-year instrument for the purpose of setting the risk-free rate (QTC, 2014: 4). However, the problem QTC described is not logically connected to the term of the risk-free bond. The difference between 10-year and five-year rates reflects compensation for interest rate risk. To the extent investors require compensation for committing funds for a period longer than the regulatory period, this issue has nothing to do with the appropriate term of the bond.

SFG Consulting also argued that, as long as the yield curve is upward sloping, term-matching results in a perverse outcome because investor returns can be reduced simply by reducing the regulatory period. However, a regulator would not reduce the length of the regulatory period in order to reduce allowed returns to firms as this would introduce unnecessary complexity and reduce incentives to improve performance. The regulatory objective and task seeks to balance these factors. Once these competing considerations are evaluated to determine the appropriate length of the regulatory period, the term of the bond is then aligned with it.

Stakeholders asserted that, as a key objective of economic regulation is to replicate competitive market outcomes, and firms in competitive markets base their returns on the 10-year rate, the 10-year term is therefore the more relevant term for setting the risk-free rate (QTC, 2013: 6).

However, the QCA Act requires the QCA to promote revenue adequacy and to 'promote the economically efficient operation of, use of and investment in, significant infrastructure by which services are provided, with the effect of promoting effective competition in upstream and downstream markets' (s.69E). As discussed in Chapter 2, the QCA considers that applying the NPV = 0 Principle is consistent with the objectives of the QCA Act.

SFG Consulting objected to the QCA's practice of using a 10-year rate to estimate the market risk premium while using the five-year rate for the risk-free rate (i.e. the first term in the CAPM). The QCA's specific responses to these criticisms are set out in Appendix A.

While the QCA does not agree with SFG Consulting on this matter, the QCA has examined the historical difference between the 10-year rate and five-year rate in the context of the standard access undertaking regulatory period. The QCA also examined the historical difference between the 10-year rate and the one-year rate in the context of the long-term performance monitoring framework for the south east Queensland (SEQ) water retailers. This analysis has reinforced the conclusion that a reasonable estimate of the market risk premium at this time is 6.5% (see Chapter 4).

Finally, QTC stated that both the AER and IPART have concluded that a 10-year term is preferable, based in part on practical considerations. The AER and IPART positions are discussed at length in Appendix B. In brief, IPART considers satisfying the NPV = 0 Principle to be a secondary objective. The QCA disagrees. The AER emphasised that market practitioners

use a 10-year rate to value infrastructure assets, even those subject to five-year regulatory periods. However, Lally (2014a) shows that all but one of the survey respondents applied a risk-free rate materially greater than the 10-year rate prevailing at the time. Moreover, valuation has no necessary implications for price regulation, under which regulators reset prices every regulatory period (e.g. five years) and accordingly, they revise the rate at regular intervals.

3.5 Conclusion

The QCA has considered all of the material presented to it relating to its approach to estimating the risk-free rate. As outlined in this chapter, the QCA's preferred approach to estimating the risk-free rate is to:

(a) use Commonwealth Government bonds as a proxy for a risk-free asset

(b) apply a 'current' rate, proxied by a short-term average over the 20 business days as close as possible to the start of the regulatory period

(c) align the term of the risk-free rate with the term of the regulatory cycle.

4 MARKET RISK PREMIUM

The market risk premium reflects the additional return an equity investor requires to be compensated for the additional risk of investing in a market portfolio as against purchasing a risk-free asset, such as a Commonwealth Government bond.

The market risk premium is unobservable, and there is no consensus on the best methodology to estimate it. As a result, the QCA has previously applied four different approaches to estimating it (i.e. the Ibbotson, Siegel, Cornell and survey methods). Each method has advantages and disadvantages and provides information from a slightly different perspective. In processing these estimates, the QCA took an equally weighted average and rounded the result to the nearest whole percentage point to determine an estimate of the market risk premium.

The QCA's estimate in the past has been 6.0%, which has been broadly consistent with estimates from other regulators and market analysts both in Australia and abroad. Stakeholders have said that the QCA's past approach has been unnecessarily rigid and should rely on additional, market-based information.

In response to stakeholder submissions, the QCA has refined its methodology by modifying its traditional methods and examining additional information, including current financial market-related evidence. The broader range of evidence does not readily lend itself to an averaging and rounding procedure. As a result, the QCA will assess the information at hand and exercise its judgment to reach a final view on the appropriate estimate of the market risk premium.

The QCA considers that a reasonable estimate of the long-term average market risk premium remains at 6.0%. However, a broader consideration of the evidence at hand indicates that a reasonable estimate of the current market risk premium is 6.5% at this time. As has been the practice in the past, the market risk premium estimate will be reassessed periodically.

4.1 Background

Investors require a premium for holding risky rather than risk-free assets. The market risk premium is the expected rate of return on the market portfolio of risky assets less the rate of return on the risk-free asset[8]. The market risk premium is a key component of the cost of equity and, in turn, the WACC.

Unlike the risk-free rate, the market risk premium is not observable and must be estimated. All estimation methods have advantages and disadvantages. The QCA has therefore been required to consider the different estimation methods and their utility. In the decision *Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] ACompT 14 (26 July 2012)*, the Tribunal relevantly commented:

> *It is a forward-looking concept and thus its value has to be predicted. The Tribunal recently noted in Envestra (No 2) that, as with any variable whose values have to be forecast, there is unlikely to ever be a single "right" value of the MRP, and so considerable debate generally occurs as to how this parameter can best be calculated at any given point of time.*

In the decision *Application by WA Gas Networks Pty Ltd (No 3) [2012] ACompT 12 (8 June 2012)*, the Tribunal also relevantly commented:

[8] The definition of the market risk premium depends on the particular version of the CAPM applied. Australian regulators typically employ the Officer variant of the standard CAPM. See the Appendix A for details.

> *The critical issue is whether the ERA's determination of the MRP at 6% was reasonably open to it on the evidence. It made this determination after reviewing considerable material submitted to it by ATCO and material sourced by the ERA. This material was not conclusive as to the best single forward-looking estimate of the MRP. Accordingly, the ERA had to exercise its discretion in deciding on the appropriate MRP.*
>
> *As noted, the MRP is a forward-looking estimate. There is no single accepted econometric, mathematical or financial technique that can, uniquely, be deployed to ascertain an estimate of the MRP that can apply to any future period. Further, there are substantial debates among the experts as to how particular methodologies should be employed and the assumptions that are necessary to drive them effectively. These choices of methodologies and assumptions can significantly alter the resulting estimate.*

In recent decisions, the QCA has applied estimates from four principal methodologies to determine the market risk premium, comprising two historical methods and two forward-looking methods:[9]

(a) *Ibbotson historical averaging* – an historical averaging method that measures the nominal, historical (excess) market rate of return above the risk-free rate[10]

(b) *Siegel historical averaging* – an historical averaging method where the market risk premium estimated from the Ibbotson method is adjusted for the effects of unexpected inflation[11]

(c) *Cornell method* – a forward-looking method that applies a variant of the dividend growth model, where the market return is the rate of return that reconciles the current value of the market portfolio with the present value of the expected future stream of dividends

(d) *survey evidence* – forward-looking method that seeks an estimate of the market risk premium from academics, financial analysts, company managers, and other market practitioners.[12]

The QCA has previously set the market risk premium based on taking an equally weighted average of the four estimates from these methods and rounding to the nearest whole percentage point.

4.2 Stakeholder submissions

4.2.1 Proposed estimates

Proposed estimates for the market risk premium essentially fell in the range of 5.0%–8.0%.

The Australian Rail Track Corporation (ARTC) and Aurizon Network considered that a reasonable range for the market risk premium in 'normal' market conditions to be 6.0%–7.0% but argued that this range is likely to be conservative in current market conditions (ARTC, 2013: 15; Aurizon Network, 2013: 135). Professor Jerry Bowman considered that a reasonable estimate falls in the higher range of 7.5%–8.0% (Bowman, 2013).

The QRC and Rio Tinto argued that the weight of available evidence supports a range of 5.0%–6.0%, and that current conditions do not warrant an upward adjustment to their upper bound

[9] The first three methods include relevant adjustments for dividend imputation credits (see Appendix C).
[10] The Ibbotson average is taken over *ex post* market outcomes, where the annual premium is calculated as the simple difference between the nominal equity return and the nominal risk-free rate.
[11] The Siegel method is based on the premise (based on empirical evidence) that historically, unexpected inflation has artificially reduced the real returns on bonds but not the real returns on equities.
[12] See Appendix C for further details on these methods.

of 6.0% (QRC, 2013b: 13–16; Rio Tinto, 2013: 6–8). Further, the QRC noted that most regulators have consistently adopted a market risk premium of 6.0% and that the Tribunal recently upheld a regulatory estimate of 6.0% in its decision on APA GasNet (QRC, 2013b: 14–16).

4.2.2 Methodology

There was broad support from stakeholders for using multiple estimation methods and data sources to estimate the market risk premium (QTT, 2013: 2; SFG Consulting, 2013b, 2013d; QTC, 2013, 2014).

At the same time, stakeholders raised a number of concerns with the QCA's methodology, which can be grouped into three areas:

(a) specific aspects of the four traditional methods, including assumptions, data requirements and/or limitations

(b) the 'mechanical' application of the resulting estimates in determining a final estimate — in particular, the weighting and rounding procedure

(c) the consideration of additional evidence on current market conditions, which are claimed to reflect a heightened degree of investor risk aversion and market uncertainty relative to pre-GFC levels.

Four traditional methods

The four principal methodologies used by the QCA for estimating the market risk premium are explained and analysed in detail in Appendix C. The following is a summary of the key issues and conclusions from that analysis.

Ibbotson historical averaging method

SFG Consulting, on behalf of Unitywater, QUU and Aurizon Network, contended that there is an error in the earlier years of the historical data series of 1883–2013 that the QCA has previously relied upon and that correcting this error increases the estimate of the market risk premium from 6.3% to 6.6% (SFG Consulting, 2014a: 48).[13]

The QRC and Professors McKenzie and Partington argued that the Ibbotson estimates are upward biased estimates of the market risk premium due to 'survivorship' and as a result, these estimates should be treated as an upper bound (QRC, 2013b: 13–14).[14]

Siegel historical averaging method

There were competing views about the relevance of the Siegel approach. SFG Consulting argued that the basis for the approach has not been sufficiently well established. In particular, SFG Consulting submitted that other Australian regulators do not use the method, and survey respondents do not rely upon it in forming a view on the market risk premium (Gray, 2013: 9).

In contrast, the QRC argued that it is important to include the Siegel method in order to account for the impact of unexpected inflation on the market risk premium (QRC, 2014: 8).

As Siegel historical averaging involves modifying the Ibbotson estimates for the effects of unanticipated inflation, stakeholders reiterated the concerns that they raised with respect to

[13] The subset of concern spans 1883–1957. This SFG Consulting estimate assumes a utilisation rate of imputation credits of 0.625.

[14] Survivorship bias occurs when ex post returns exceed expected returns because failed firms drop out of the underlying data sample used to estimate the market risk premium.

the Ibbotson estimates (i.e. the claimed data error and the scope for upward bias due to survivorship).

Survey evidence / independent expert reports

SFG Consulting argued that surveys are difficult to interpret and have a number of other limitations. SFG Consulting submitted that surveys should meet criteria recently established by the Tribunal and, in addition, proposed that survey estimates be supplemented by estimates from independent expert reports. SFG Consulting argued that estimates from both sources should be adjusted for the value of dividend imputation credits (SFG Consulting, 2013b: 25-29).

While recognising survey limitations, McKenzie and Partington considered that surveys provide a useful source of information, particularly when 'triangulated' with survey results from other countries (McKenzie & Partington, 2013b: 25).

Cornell dividend growth model

QTC observed that, from a conceptual perspective, the implied cost of equity from the dividend growth model produces the most appropriate forward-looking estimate of the market risk premium (QTC, 2014: 9–10). Unitywater, QUU, and Aurizon Network also considered that dividend growth models provide highly relevant estimates of the market risk premium as they use current market data (SFG Consulting, 2013d: 25; SFG Consulting, 2013b: 24).

Rio Tinto and the QRC expressed reservations about using estimates from dividend growth models due to the sensitivity of the models to the input assumptions (Rio Tinto, 2013: 7; QRC, 2013b: 14). As the QCA has previously indicated that estimates from the Cornell model are 'biased upward', the QRC, Anglo American and Rio Tinto recommended that the QCA use the Cornell estimate as a cross-check only to ensure that the other estimates are not 'too high' (QRC, 2013a: 4; Anglo American, 2014: 6; Rio Tinto, 2013: 7).

Mechanical application

A number of stakeholders argued that the QCA's practice of taking an equally weighted average of estimates from the four methods and then rounding to the nearest whole percentage point is too 'mechanical' and has resulted in an 'entrenched' estimate of 6.0% for the market risk premium regardless of financial market conditions.

SFG Consulting argued that all of the methods except for the Cornell approach produce very stable estimates:

(a) the historical averaging methods rely on a very long time series of data so the average only changes slowly

(b) the survey estimates tend to be around 6.0% (SFG Consulting, 2013d: 8).

SFG Consulting noted that this stability 'feature' is reinforced by the QCA's weighting and rounding procedure (SFG Consulting, 2013d: 8–9):

(a) the three 'stable' estimates receive 75% of the total weight, while the forward-looking estimate (i.e. the Cornell estimate) receives only 25% of the weight

(b) given the QCA has historically rounded to the nearest whole percentage point, prevailing conditions must be extreme in order for the final estimate to move away from 6.0%.[15]

[15] For example, based on the indicative estimates in the QCA's discussion paper, *The Risk-free Rate and Market Risk Premium* (November 2012), SFG Consulting estimated that the Cornell estimate would have to be more

SFG Consulting stated (SFG Consulting, 2013d: 3):

> *The QCA has been using the same approach to estimate MRP since its last WACC review 10 years ago. In practice, that approach has produced a fixed estimate of 6%, which generates acceptable outcomes in "normal" market conditions but is not flexible enough to accommodate conditions such as financial crises.*

QTT suggested that the QCA allow the weights applied to vary over time depending on market conditions (QTT, 2013: 2). Similarly, the QRC considered that the methodology should take into account strengths and limitations of the approaches when determining an overall estimate (QRC, 2014: 5).

QRC argued that the rounding margin of one percentage point was too high and that fluctuations of the estimate from 6% to 7% or from 6% to 5% have the potential to increase the scope for disputes. QRC proposed a rounding margin of no more than 0.5% and preferably closer to 0.25%, noting that the AER recently adopted a margin of 0.25% when rounding the estimated return on equity (QRC, 2014: 6–7).

Current conditions

A number of stakeholders contended that post-GFC financial market conditions in Australia are not normal due to unusually low Commonwealth Government bond yields and elevated debt premiums relative to pre-GFC levels.

QTC presented evidence that investors place a material premium on Commonwealth Government bonds relative to QTC bonds. As equity is less liquid than bonds, QTC argued that such a premium is likely to be even higher relative to equities and that part of this premium is systematic in nature and would be reflected in a higher market risk premium (QTC, 2013: 3–4).

Bishop and Officer also considered that debt premiums remain elevated post-GFC and that the market risk premium is likely to be elevated as well, since the average risk premium in the riskier end of the debt market is likely to be present in the equity market as well (Bishop & Officer, 2013b: 5).

Some stakeholders advocated using the 'Wright method' to supplement the QCA's four traditional methods. The Wright method is based on the idea that a constant real return on equity over time is a better assumption than a constant market risk premium. The implication is that the market risk premium should vary one-for-one with movements in the risk-free rate.[16] SFG Consulting noted that United Kingdom regulators use the Wright approach extensively (SFG Consulting, 2014a: 26).

In contrast, the QRC argued that relatively low Commonwealth Government bond yields are forward-looking and reflective of current market conditions (QRC, 2013a: 3). McKenzie and Partington contended that the 'low' bond yields are not unusual when measured relative to a very long-term average (McKenzie and Partington, 2013b: 15–16).

The QRC and Anglo American did not support the Wright approach to estimating the market risk premium. They argued that Dr Lally has demonstrated that for Australia, the market risk

---

than 10.0% in order for the mean estimate to exceed 6.5% (and therefore not be rounded down to 6.0%) (SFG Consulting, 2013b: 8).

[16] Applying it in practice involves estimating a real rate of return on equity from historical data and converting it into a nominal rate of return. The current risk-free rate is then deducted to obtain an estimate of the market risk premium. Alternatively, the estimated nominal rate of return on equity from the Wright method can be used directly as an estimate of the return on equity.

premium is relatively more stable than the return on equity, which is contrary to the assumption underpinning the Wright method (QRC, 2014: 8–9; Anglo American, 2014: 8).

Anglo American also suggested that the QCA consider market risk premium estimates from foreign markets and that triangulating this evidence indicates a market risk premium for Australia of 5.9% (Anglo American, 2014: 6).

4.3 QCA position

The QCA considered all of the arguments made by stakeholders in reaching its decision on an appropriate methodology for estimating the market risk premium. Professor Martin Lally was engaged to provide independent analysis of many of the arguments raised in stakeholder submissions.[17] A detailed summary of the QCA's analysis is set out in Appendix C.

4.3.1 The four methods[18]

Ibbotson historical averaging method

Previous market risk premium estimates based on the Ibbotson method have relied on the longest data series available, which spans the period, 1883-2013. As discussed previously, stakeholders raised three principal concerns:

(a) a subset of the earlier data (i.e. the period, 1883–1957) contains a material error

(b) given the large number of historical observations, recent changes in the level of the market risk premium will not be reflected quickly in the resulting average estimate

(c) any average relied upon is biased upward due to survivorship.

In this methodology review, the QCA considered excess return estimates from five different sampling periods, each period having different strengths and weaknesses (see Appendix C). This approach allows for consideration that the data from earlier time periods is not likely to be as robust or relevant as more current data. While the QCA has considered all sampling periods, its preferred sampling period is 1958–2013. This series has the property of being the longest series of high quality data. It is also free from the claim of material error to which the earlier data is subject. Nonetheless, the QCA has considered all time periods in forming a view on the Ibbotson estimate.

This approach enables consideration of structural breaks in the market risk premium due to changes in economic fundamentals, such as financial market innovations and financial crises. The QCA notes that, although estimates from the most recent series (i.e. 1988–2013) are lower, this does not adequately address the concern that the market risk premium might currently be higher.[19] To address this possibility, the QCA has examined indirect evidence on current market conditions (discussed in the next section). Finally, while the QCA accepts that there is probably some upward bias to the estimates due to survivorship, this bias is difficult to quantify and there is evidence that it could modest (Li and Xu, 2002).

The Ibbotson method produces market risk premium estimates ranging from 6.0% to 6.7%, depending on the particular historical series chosen. The estimate over the longest period of high quality data (i.e. 1958–2013) is 6.5%.

[17] A detailed summary of stakeholder submissions and the QCA's responses can be found in Appendix C.
[18] QCA estimates of the market risk premium in this chapter are estimated as at December 2013 and, where relevant, are based on a 10-year risk-free rate of 4.29% as at that time (see Appendix C).
[19] The standard error of the estimate is also very large.

Siegel historical averaging method

The QCA considers that the Siegel method provides useful and relevant information about the market risk premium. In short, inflation is a significant macroeconomic variable, and there was unanticipated inflation over a substantial period in Australia. Furthermore, the QCA considers that the adjustment for unexpected inflation incorporated in the Siegel method is valid and relevant when estimating an expected as opposed to an actual return. For this reason, the QCA considers that the Siegel method better addresses the unexpected inflation issue relative to the Wright method.

The Siegel method supports a market risk premium estimate ranging from 4.0% to 6.5% for all sample periods. The estimate over the longest period of high quality data (i.e. 1958–2013) is 5.5%.

Survey evidence / independent expert reports

Some stakeholders argued that the Fernandez surveys relied upon by the QCA do not comply with the Tribunal criteria that surveys should be timely, clear and representative. The QCA agrees that survey information should be timely, but notes that the requirements that they be clear and representative require a degree of judgment by the QCA based on the circumstances. In addition, there could be other criteria that are relevant and could outweigh a survey's perceived shortcomings.

Stakeholders also maintained that survey estimates of the market risk premium are excessively stable and slow-moving and therefore do not reflect current conditions. The QCA's analysis shows that survey estimates of the market risk premium have in fact shown moderate variation, with the Fernandez survey estimates varying between 5.0% and 6.0% over recent years.

Stakeholders suggested that independent expert reports be used to supplement the survey results, and the QCA agrees with this suggestion. As discussed in Appendix C, the QCA has analysed the independent expert reports provided by SFG Consulting (SFG Consulting, 2013g). The median reported estimate of the market risk premium based on these reports is 6.0%.

In considering both surveys and independent expert reports, the QCA accepts the principle that estimates should include an adjustment for imputation credits. However, it is not always apparent whether a particular survey or report has already incorporated such an adjustment.

QCA analysis shows that both surveys and independent expert reports support a market risk premium estimate of about 6.0% (6.2% including imputation credits).

Cornell dividend growth model

The QCA considers that the dividend growth model provides a relevant estimate of the market risk premium, as the inputs involve current financial market data. The QCA assessed a number of model variants, including models proposed by stakeholders and Dr Lally. As a result of this analysis, the QCA has modified its preferred approach in several ways.

One important change is that the QCA's preferred model now incorporates an explicit adjustment to reflect the constraint that the growth rate in dividends per share must be less than the growth rate of Gross Domestic Product (GDP). Accordingly, the resulting Cornell estimates are no longer an upper bound but represent the best estimates of the market risk premium available using this approach. This change addresses stakeholder concerns that estimates from this method are biased upward.

The approach is described in detail in Appendix C and produces a range of 5.5% to 8.0%, with a median estimate of 6.9%.

4.3.2 Current conditions

The QCA has considered whether, given current, post-GFC economic conditions, the methodology applied in the past produces a market risk premium that is too low. It is claimed that the GFC and its aftermath have created a low interest rate environment and heightened financial uncertainty that have led to a higher market risk premium.

There is no question that market volatility increased during the GFC and that the market risk premium was probably elevated as a result. While volatility has largely subsided, the question is whether the market risk premium remains at an elevated level and to what extent.

The available evidence suggests that volatility has subsided since the GFC. Further, Bishop and Officer's argument that higher debt premiums imply a higher equity premium is not compelling. The GFC started as a finance sector related crisis, which was in large part the result of poor financial practices by institutions and weak governance. Therefore, one plausible explanation is that debt premiums have risen as a result, and the pre-GFC gap between the cost of debt and equity has simply closed.

However, the market risk premium is compensation for volatility and investor risk aversion (Cornell, 1999: 126). While volatility is lower than during the GFC, investor risk aversion could be elevated relative to pre-GFC levels. Evidence on this point is that Commonwealth Government bond yields are low relative to recent periods. A likely factor contributing to this phenomenon is the 'flight to quality' for relatively safe and liquid AAA-rated assets. While not mispriced, there could be implications for the expected return on other assets (e.g. equities). The QCA notes that QTC has provided some evidence on this issue.

The Wright approach has been proposed as a way to correct for the influence of currently low risk-free rates. The premise of the Wright method is that a 'better' assumption than a stable market risk premium is a stable (real) return on equity (i.e. the risk-free rate and market risk premium are perfectly, negatively correlated). The QCA notes that Dr Lally's, and its own, analysis shows that the market risk premium is relatively more stable than the return on equity for Australia. As a result, the QCA will have limited regard to the Wright estimates. The QCA notes that regulators in the United Kingdom have begun moving away from that approach in recent decisions (e.g. Competition Commission, 2013).

However, while available evidence does not support the Wright method, at the same time it also does not preclude a possible negative relationship between the risk-free rate and the market risk premium. The question is the strength of the relationship, which is difficult to determine. The QCA's view is that there could be a negative relationship at this time, but that the relationship between these two parameters also changes over time.

4.3.3 Mechanical application

Stakeholders were critical of the QCA's practice of using an equally weighted average of four methods and rounding the result to the nearest percentage point. This procedure was largely adopted on the basis that there is no one 'right' way to estimate the market risk premium. All methods have both advantages and disadvantages and estimating the market risk premium is inherently an imprecise exercise. Although this approach seems to have worked sufficiently well in the past, the QCA accepts that there is merit in considering other approaches.

Given the broader set of information to be relied upon, the QCA considers it is no longer appropriate to base the market risk premium on an average of equally weighted estimates produced by various methods. Appropriate weights will be difficult to specify and some

information will be qualitative. The QCA will consider a range of evidence and will apply judgement in arriving at an estimate of the market risk premium.

This approach will be more flexible and allow greater consideration to be given to current market conditions than in previous reviews. Accordingly, this approach will give the flexibility to move the allowed market risk premium in the cost of equity above or below its long-run average of 6.0% on a periodic basis based on current market conditions.

4.3.4 Conclusion

Taking account of all the factors discussed above and in Appendix C, the QCA considers that 6.5% is the most appropriate estimate of the market risk premium at this point in time:

(a) *Ibbotson estimates* — the Ibbotson estimates provide a range of 6.0%–6.7% over all sample periods, with an estimate of 6.5% for the period 1958–2013

(b) *Siegel estimates* — the range for the Siegel estimate is 4.0%–6.5%, with an estimate of 5.5% for the period 1958–2013

(c) *Survey evidence / independent expert report estimates* — survey data and independent experts' reports indicate a median estimate of 6.2%, including an adjustment for dividend imputation credits

(d) *Cornell dividend growth estimates* — the Cornell range is 5.5%–8.0%, with a median estimate of 6.9%

(e) *Conditional information* — additional sources of information examined include volatility measures, corporate debt premiums, and liquidity premiums on government bonds. The QCA also considered the relationship between the risk-free rate and the market risk premium.

An estimate of 6.5% is marginally above the 'mechanical' average of 6.3% from applying the previous approach. The QCA's view is that the information provided by expanding the range of information to include current conditions does not provide support for a number higher than 6.5%, but it does confirm the need to set aside the whole number rounding rule from the past approach. The QCA notes that an estimate of 6.5% sits above the long-run average of 6.0%.

The QCA has also taken into account stakeholder concerns that applying 'term-matching' creates an inconsistency due to a risk-free rate in the first term of the return on equity that has a different term than the 10-year term used in estimating the market risk premium (see Appendix B for details).

Accordingly, the QCA examined the historical difference between the 10-year rate and five-year rate in the context of the standard access undertaking regulatory period. The QCA also examined the historical difference between the 10-year rate and the one-year rate in the context of the long-term performance monitoring framework for the SEQ water retailers. This analysis has reinforced the QCA's view that an estimate of 6.5% for the market risk premium is reasonable at this time.

5 GAMMA

The Australian tax system allows companies to provide shareholders with credits to reflect the taxes paid on profits that are distributed as dividends. Shareholders then use the imputation, or 'franking', credits to reduce their own personal tax liabilities.

The value of distributed imputation credits to the extent they are utilisable by a firm's investors is known as 'gamma'. The higher (lower) the value of gamma, the greater (lesser) the tax benefit to the firm's investors and accordingly, the lower (higher) is the allowed tax component in the firm's allowed revenues.

Gamma is estimated by calculating the portion of company tax paid for which credits can be issued (the distribution rate) multiplied by the rate at which shareholders can use the credits (the utilisation rate). To date, the QCA has applied a gamma value of 0.5, based on a distribution rate of 0.8 and a utilisation rate of 0.625 (0.8 x 0.625 = 0.5).

Some stakeholders have argued that the QCA should adopt a gamma of 0.25 to reflect an Australian Competition Tribunal decision in 2011. However, at that time, the Tribunal noted the limitations in estimating gamma, and other stakeholders have argued that a broader range of evidence should be considered. This has been reflected in recent regulatory deliberations by the AER that have reconsidered both the conceptual framework and the relevant estimation methodology. This work has resulted in a move away from the estimate of 0.25.

The QCA has evaluated the approaches used by other regulators and conducted its own further analysis. Based on this review, the QCA has estimated a value for gamma of 0.47, based on a distribution rate of 0.84 and a utilisation rate of 0.56.

5.1 Introduction

5.1.1 Imputation credits

Prior to 1987, corporate profits distributed as dividends were taxed twice — once at the corporate level and once at the individual shareholder level. Double taxation of corporate income was eliminated by introducing dividend imputation, or franking, credits. Franking credits represent taxes paid by the company to the Australian Tax Office (ATO). A dividend with franking credits attached allows the shareholder to treat the franked amount as a credit against personal tax owed on the company profit.

In effect, dividend imputation reduces two layers of tax (i.e. the first at the company level and the second at the personal level) to a single layer of tax. The corporate taxes associated with dividends paid to shareholders are treated as a pre-payment of the shareholders' personal tax on the dividends. Specifically, one dollar of imputation credits allows eligible shareholders to reduce their personal tax liability by one dollar.

5.1.2 Regulatory context and gamma

Officer (1994) developed a formula for the cost of capital that reflects the impact of imputation credits on the cost of capital. The WACC formula is adjusted by a factor that Officer (1994) refers to as 'gamma' (γ). The concept of gamma has subsequently been calculated as the portion of company tax paid for which credits can be issued (the distribution rate) multiplied by the rate at which shareholders actually use the credits (the utilisation rate) when they file their taxes:

(1) $\gamma = \left(\frac{\text{IC}}{\text{Tax}}\right) \text{x U}$

where *γ* is 'gamma', *IC* represents the imputation credits assigned to dividends by a firm during a period, and *Tax* is company tax paid during that period.

Estimation of the distribution rate and the utilisation rate requires both a conceptual framework and an estimation approach. These issues are not straight forward and are discussed in greater detail in Appendix D.

As the Tribunal observed in *Application by WA Gas Networks Pty Ltd (No 3) [2012] ACompT 12*:

> *…the best way in which to measure gamma in theory, and the best way to determine the actual value of gamma, is a matter of some controversy. There is no one value of gamma that may be regarded as universally correct. One has to consider the academic models and empirical research and decide on a case-by-case basis which outcome is most relevant for the matter at hand.*
>
> *As with the estimation of many economic and financial parameters, finding the 'right' value is a process of continual refinement as new models and paradigms emerge and as better data and estimating techniques become available. As observed in Energex (No 5) at [45] this process is 'an ongoing intellectual and empirical endeavour'.*

In *Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] ACompT 14*, the Tribunal also commented:[20]

> *Determining the appropriate values of F [distribution rate] and theta [utilisation rate] has been a fiercely contested issue in Australia's regulatory history. There is no unique pair of values of F and theta that are regarded as universally correct. Therefore there is no value of gamma that is regarded as universally correct. The academic models, empirical research methods, data and relevant time periods all need to be carefully investigated. Debate is inevitable, and ultimately, which value is most relevant for the matter at hand must be decided on a case-by-case basis.*

5.2 QCA approach to date and recent developments

Under the QCA's cost of capital methodology, gamma affects the cost of equity capital by adjusting the regulatory cash flows for the effect of dividend imputation to the extent that imputation is applicable.[21]

In its Cost of Capital Methodology Review (2004), the QCA adopted a gamma value of 0.5, based on a distribution rate of 0.8 and a utilisation rate of 0.625 (0.8 x 0.625 = .5). At the time, this estimate was consistent with the determinations of most regulators in Australia.

Subsequently, the AER (2009) arrived at a gamma estimate of 0.65 by setting the distribution rate to 1.0 and the utilisation rate to 0.65 (AER, 2009: 467-468). However, on appeal, the Tribunal preferred an estimate for gamma of 0.25 on the evidence before it, based on an SFG Consulting study that provided a new estimate for the utilisation rate (ACT, 2011; SFG Consulting, 2011).

Several regulators lowered their previous estimates of gamma to 0.25 following the Tribunal's decision.[22] These regulators include the Australian Competition and Consumer Commission (ACCC) and IPART.[23]

---

[20] The terms, 'theta', and the utilisation rate are typically used interchangeably. However, they are only the same on certain circumstances. In the context of econometric estimation of theta using the traditional dividend drop-off method, treating theta as an estimate of the utilisation rate will typically *underestimate* the utilisation rate. See the discussion in Lally (2012d: 11-12).

[21] In addition, gamma also affects the imputation-adjusted tax rate in the Conine beta levering formula when translating the unlevered asset beta into a levered equity beta.

However, the AER recently adopted an estimate of 0.49 based on an updated conceptual framework and an assessment of a range of estimation approaches (AER, 2013e: 136–180). In addition, the ERA settled on a range for gamma of 0.25–0.385, based on a distribution rate of 0.7 and a range for the utilisation rate of 0.35–0.55 (ERA, 2013a: 210).

In the context of this cost of capital review and in light of these developments, the QCA has reviewed its methodology for estimating gamma. In doing so, the QCA engaged Dr Martin Lally to provide independent expert advice to inform this assessment. This advice is reflected in two papers published on the QCA's web site, *The Estimated Utilisation Rate for Imputation Credits* (December 2012) and *Estimating Gamma* (November 2013).

The remainder of this chapter and the accompanying Appendix D presents the results of this review and the QCA's reasoning.

5.3 Stakeholder submissions

The QCA received submissions on an appropriate estimate of gamma, both in the context of this cost of capital review and the Aurizon Network UT4 proceedings. Proposed estimates of gamma spanned a wide range, from 0.25 to 0.85.

Aurizon Network proposed an estimate of 0.25 based on the Tribunal's 2011 decision and provided an SFG Consulting analysis that summarised the analysis relied upon by the Tribunal. Aurizon Network submitted that the most recent empirical evidence indicates that gamma lies between 0.0 and 0.25 based on a distribution rate of 0.70 and a range for the utilisation rate of between 0.0 and 0.35. Aurizon Network proposed a distribution rate based on the results of two studies that use ATO data, while the range for the utilisation rate is based on econometric studies of stock price changes that follow dividend distributions.

However, some stakeholders made contrary submissions. For instance, the QRC disagreed with Aurizon Network's proposed value for gamma because the estimate of the utilisation rate is based on only a single study (QRC, 2013b: 20-21). McKenzie and Partington argued that evidence based on other studies did not support reducing gamma from the QCA's estimate of 0.50 (McKenzie and Partington, 2013b: 33-35). The QRC proposed a gamma estimate of 0.50, comprising an estimate of 0.70 for the distribution rate and 0.70 for the utilisation rate (QRC, 2013b: 20).

Anglo American supported an estimate for gamma of 0.85 based on a distribution rate of 0.85 and a utilisation rate of 1.0. The individual parameter estimates were based on Dr Lally's proposal (Anglo American, 2014: 9-11).

5.4 Measuring Gamma

5.4.1 Distribution rate

Previous estimates of the distribution rate have, in general, relied on ATO data. However, the ATO data contain acknowledged major discrepancies that could result in double-counting and/or aggregation problems (Lally, 2014a: 29). Moreover, the ATO data include payouts for both listed and unlisted companies, but the other CAPM parameters have been estimated relative to listed companies.

[22] See Appendix D, Annex for more details on the Tribunal's decision.
[23] For example, see IPART's decision on prices for Sydney Desalination Plant (IPART, 2011c: 92-93).

Given concerns about the ATO data, Professor Lally computed the average distribution rate of the twenty largest ASX companies directly from their financial statements from 2000 through 2013 and estimated an average distribution rate for these listed companies of 0.84. The QCA believes this estimate is robust and of a high quality. The 20 listed companies account for 62 per cent of the ASX200 by market capitalisation, which is important because companies with higher market values are likely to have a greater influence on the value of this parameter. The financial statements relied upon are subject to annual, independent audit. Original source data rather than ATO data are used, which protects against possible double-counting and other aggregation problems.

The QCA's more detailed analysis of the distribution rate is set out in Appendix D.

5.4.2 Utilisation rate

Several approaches have been used in the past by various regulators and regulated firms to estimate the utilisation rate. These include dividend drop-off studies, the redemption approach, the equity ownership approach, the Lally conceptual test and the use of other supporting evidence. Each is discussed below.

Dividend drop-off studies

SFG Consulting's proposed utilisation rate of 0.35 is based on a dividend drop-off study prepared for the Tribunal (SFG Consulting, 2011). Dividend drop-off studies compare stock prices before and after dividends are distributed to shareholders. Econometric analysis is used to infer the value of the imputation credits from the stock price changes following dividend distributions. The supposition is that the pre and post distribution share price difference reflects the value of imputation credits to investors.

There are both conceptual and empirical concerns with dividend drop-off studies. The market value of imputation credits, estimated using a dividend drop-off study, is not conceptually the same as the actual utilisation rate. Dividend drop-off studies infer a market value of imputation credits based on share trading over a short period. However, the value to investors of imputation credits is not directly observable in dividend drop-off studies. The change in stock market value after dividends are distributed is not relevant for purposes of assessing the impact of imputation credits on the cost of capital.

The return investors derive from holding the stock is related to the value of the actual imputation credits that can be utilised to reduce income taxes. This value, in turn, is a function of the relative proportion of domestic and foreign investors. Domestic investors are likely to fully utilize the credits while utilisation by foreign shareholders will depend on how foreign tax systems recognise company tax paid in Australia (and is likely to be small).

A number of well documented methodological and econometric problems are associated with dividend drop-off studies and suggest that they are unlikely to produce robust statistical results (Cannavan et al., 2004). The QCA engaged Dr Lally to review the SFG Consulting (2011) study, and Dr Lally raised both conceptual and empirical concerns with it (Lally 2012c, 2013d). Handley (2008) has also raised a number of similar concerns about the reliability and interpretation of dividend drop-off studies. The AER has also raised similar concerns (AER, 2013e: 166–177).[24]

Given the concerns identified, the QCA does not prefer an estimate of 0.35 for the utilisation rate. The estimate is the result from only one study from one class of evidence, and this class of

[24] Appendix D elaborates on these issues and discusses additional concerns with dividend drop-off studies.

evidence suffers from serious conceptual and empirical limitations. Therefore, the QCA has assessed and given more weight to alternative approaches to estimate the utilisation rate.

Redemption approach

The redemption approach uses tax statistics to estimate the proportion of imputation credits redeemed by all investors with the ATO. Hathaway (2013) and Handley and Maheswaran (2008) are the two relevant studies for the post-2000 period. These studies estimate utilisation rates of 0.44 and 0.62. As discussed in Appendix D, the QCA considers that the average of these estimates of 0.53 provides a relevant estimate of the utilisation rate based on the most recent ATO data. However, this average utilisation rate relates to both listed and unlisted firms. It would be preferable to use an estimate of an average utilisation rate for listed firms only.

Equity ownership approach

The equity ownership approach calculates the shares of domestic and foreign equity ownership and assumes utilisation rates for these two classes of investors of one and zero respectively. Using an estimate of 44 per cent as the foreign ownership share of listed equities and assuming a utilisation rate of one for domestic resident investors (and zero for foreign investors) implies an average utilisation rate for listed Australian domestic market equities of 0.56. This estimate is very similar to the average estimate from Hathaway's two approaches (0.53).

Lally conceptual test

Lally (2013d) proposed a conceptual test that can be used to evaluate the reasonableness of a particular utilisation rate. This test estimates the Australian cost of equity under complete segmentation (i.e. no international investors), and complete integration, of national equity and world equity markets. Estimates of the cost of equity that lie outside estimates from the two extreme scenarios would be unreasonable. Lally concluded that a utilisation rate of one (or close to one) is reasonable (i.e. produces a result that satisfies the conceptual test).

In the QCA's view, the Lally test is conceptually defensible and of some relevance. The QCA also considers that the test provides useful information about the market risk premium, and more importantly highlights the relevance of expected returns in international equity markets and their implications for an expected return in the Australian domestic market. However, as discussed in Appendix D, there is some uncertainty about what the bounds for the test should be.

Other supporting evidence

The QCA also considered evidence from financial market practices that can inform an estimate of the utilisation rate. The extent to which analysts and valuers recognize the value of imputation credits, government tax policy, and the existence of imputation equity funds were considered. For example, a KPMG (2013) survey of Australian practice found that 53 per cent of practitioners explicitly adjust for imputation credits when valuing businesses other than infrastructure. This figure rises to 94 per cent for infrastructure investments. Furthermore, where imputation credits were included in cash flows at a specified utilisation rate, this rate averaged 75 per cent (Lally, 2013d: 24).

The QCA believes that these indicators provide evidence that the utilisation rate is substantially higher than the estimates from the dividend drop-off studies, redemption estimates and equity ownership estimates and within the bounds of the conceptual test proposed by Lally (2013d).

5.5 Overall assessment

The QCA prefers an estimate of the distribution rate of 0.84, based on an analysis of the distribution rates of the top twenty listed companies by market capitalisation. The QCA prefers an estimate of the utilisation rate of 0.56 based on equity ownership of Australian listed companies. The resulting estimate for gamma is 0.47, which is marginally lower than its previous estimate of 0.50. As gamma is an overall Australian market parameter, and not specific to any particular market or firm, the analysis and results of this review will inform estimates of gamma in forthcoming reviews for all entities regulated by the QCA.

GLOSSARY

A	
ACCC	Australian Competition and Consumer Commission
ACT	Australian Competition Tribunal
AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
ARTC	Australian Rail Track Corporation
ASX	Australian Stock Exchange
ATO	Australian Tax Office
C	
CAPM	Capital Asset Pricing Model
E	
ENA	Energy Networks Association
ERA	Economic Regulation Authority of Western Australia
G	
GDP	Gross Domestic Product
GFC	Global Financial Crisis
I	
IPART	Independent Pricing and Regulatory Tribunal
M	
MRP	Market Risk Premium
N	
NERA	NERA Economic Consulting
NPV	Net Present Value
P	
PwC	PricewaterhouseCoopers
Q	
QCA	Queensland Competition Authority
QRC	Queensland Resources Council
QTC	Queensland Treasury Corporation
QTT	Queensland Treasury and Trade
QUU	Queensland Urban Utilities
R	
RAB	Regulatory Asset Base
RBA	Reserve Bank of Australia
S	
SEQ	South east Queensland

W

WA	Western Australia
WACC	Weighted Average Cost of Capital

LIST OF SYMBOLS

β_e	Levered equity beta
β_d	Debt beta
γ	Gamma (the product of the utilisation rate and the distribution rate)
U	Utilisation rate of imputation credits
d	Distribution rate of imputation credits (IC/Tax)
π_t	Inflation rate in year t
E( )	Expectations operator
σ^2	Variance
DF	Expected default losses
IC	Imputation credits assigned to dividends by a company during period
LQ	Allowance for illiquidity of corporate debt relative to government bonds
Tax	Tax paid by a company during a period
k_e	Expected rate of return on equity (cost of equity)
$\hat{k}_d$	Promised rate of return on debt (cost of debt)
S	Market value of equity
B	Market value of debt
V	Market value of the company
r_m	Expected rate of return on the market portfolio
r_f	Risk-free rate of return
MRPo	Market risk premium in the Officer (1994) CAPM variant
$\widehat{MRP}_O^S$	Market risk premium in the Officer (1994) CAPM variant (Siegel estimate)
$\bar{r}_f$	Average long-run, real risk-free rate
r_f^e	Expected long-run, real risk-free rate
D_m	Cash dividend yield on the market portfolio
DIV	Cash dividends paid by the company over a period
DIV_m	Cash dividends paid on the market portfolio
IC_m/DIV_m	Ratio of attached imputation credits to dividends paid with respect to the market portfolio
k_e^I	Expected rate of return on equity including the effects of imputation credits
k_e^X	Expected rate of return on equity excluding the effects of imputation credits
Ω	Expected cash dividend yield as a proportion of the expected return on equity excluding imputation credits
P_m	Current value of the market portfolio
P_N	Value of the market portfolio in N years
$g_1,..g_t...g_N$	Expected growth rates in cash dividends to existing share holders in years t = 1,...N
g	Expected constant growth rate in cash dividends to existing share holders from year N forward (i.e. expected long-run growth rate)

T_c	Statutory corporate tax rate
T_I	Imputation-adjusted tax rate ($T_I = T_C (1-\gamma)$)
$T_c/(1-T_c)$	Attachment rate (maximum) of dividend imputation credits
R_e^I	Actual rate of return on equity inclusive of imputation credits
R_e^X	Actual rate of return on equity exclusive of imputation credits
$X_0 = X_G + X_E + X_D$	Net operational cash flow expected to be distributed to the government, equity holders and debt holders respectively
Y	Reward-to-risk ratio
$\bar{Y}$	Average reward-to-risk ratio

APPENDIX A: COST OF CAPITAL FRAMEWORK

Overview

The WACC is the general form of the opportunity cost of capital (or discount rate) most commonly used and accepted in regulatory practice in Australia. It is the weighted sum of the costs of debt and equity finance, where the weights are the market values of debt and equity expressed as shares of the entity's total value.

The cost of equity is estimated using the Officer variant of the Sharpe-Lintner-Mossin Capital Asset Pricing Model (CAPM):

(1) $$k_e = r_f + \left[r_m + UD_m \frac{IC_m}{DIV_m} - r_f\right]\beta_e$$

where:

k_e is the expected rate of return on equity capital (i.e. cost of equity) inclusive of imputation credits, r_f is the risk-free rate, r_m is the expected rate of return on the market portfolio defined to exclude the credits, U is the utilisation rate of dividend imputation credits, D_m is the cash dividend yield on the market portfolio, IC_m/DIV_m is the ratio of attached imputation credits to dividends paid with respect to the market portfolio, and β_e is the levered equity beta (i.e. a measure of the non-diversifiable (or systematic) risk faced by equity holders).

The [ ] expression is the market risk premium in the Officer CAPM variant (MRP_O). The second term in the expression reflects the value of imputation credits to investors who can utilise them.

This definition of the cost of equity presumes that the cash flows being valued are post company tax, pre-personal tax, and inclusive of the benefit to investors from imputation credits. However, providing the definition of the cost of equity is consistent with the nature of the cash flows being valued, the same valuation will result.

An estimate of the cost of equity using this approach is typically coupled with an estimate of the promised yield on debt to determine the WACC. The QCA uses the Officer (1994) nominal, post-tax 'WACC3' (or 'vanilla') WACC:[25]

(2) $$k_e \frac{S}{V} + \hat{k}_d \frac{B}{V}$$

where:

k_e is the cost of equity capital, $\hat{k}_d$ is the cost of debt capital (defined as the promised yield), S/V and B/V are the proportions of equity and debt respectively in the entity's capital structure by market value weight. As a result, the cash flows are defined as:

(3) $$X_O - t_I(X_O - X_D)$$

[25] This equation corresponds to Officer's (1994) equation (12). In deriving it, Officer (1994) assumes that the firm's expected future cash flows are a level perpetuity and that taxable income is equal to pre-tax cash flow from operations. These assumptions are also made by SFG Consulting in developing its imputation adjustment (see Appendix C). However, Lally (2008) demonstrates that these two assumptions are not necessary for the WACC model corresponding to this equation. As they are not necessary, SFG Consulting's dividend imputation adjustment is based on assumptions that are not relevant to the WACC model used.

where X_O represents the net operational cash flows (earnings before interest and tax) expected to be distributed to debt holders, the government, and equity holders, where the cash flow to debt holders is given by X_D. The parameter, t_I , is the imputation-adjusted tax rate, defined as:

(4) $t_I = t_C(1 - \gamma)$,

where t_C is the statutory corporate tax rate and γ is gamma.

Technical arguments

SFG Consulting argued that there are several flaws in the QCA's cost of capital methodology, namely that it produces (SFG Consulting, 2013b: 11-16):

(a) an allowed cost of equity that is lower than at any time since 1975

(b) an allowed return on equity that is below the return on debt for some investors

(c) an allowed return on equity estimate that is inconsistent with the benchmark capital structure.

SFG Consulting argued that applying the QCA's approach of a five-year risk-free rate, 6.0% market risk premium and an equity beta of 0.8 would result in the lowest return on equity since 1975, with estimates ranging from the current value of about 7.0% to as high as 21.0% in 1982. SFG Consulting considered that this is evidence that the QCA's approach produces an unreasonable return on equity in current conditions (SFG Consulting, 2013b: 11–12).

However, the QCA notes that over about half of the period examined (i.e. 1973–1990), inflation rates were materially higher than currently, averaging 9.2% over 1973–1990 in comparison to the more recent average of 2–3%.[26] The outcome of this was higher nominal risk-free rates and, as a result, higher nominal costs of equity. However, this effect was attenuated by higher growth in the value of the regulatory asset base (RAB). Taking this factor into account suggests that the SFG Consulting conclusion is spurious.

SFG Consulting also observed that, based on estimates from the QCA's 2010 decision on Aurizon Network, the return on debt is 6.74% and the return on equity is 7.46%, where the latter includes the value of dividend imputation credits.[27] SFG Consulting then contended that non-resident investors who cannot benefit from imputation credits expect to receive a rate of return on equity of only 6.14%.[28] As this return on equity is less than the allowed return on debt of 6.74% and an investment in equity is riskier than an investment in fixed grade debt, SFG Consulting concluded that the QCA's methodology produces estimates that are implausible (SFG Consulting, 2013b: 15–16).

However, there are two principal problems with SFG Consulting's analysis. First, SFG Consulting's conversion of a return on equity of 7.46% (which includes the effect of imputation credits) to 6.14% (which excludes the effect of imputation credits) uses equation (30) in Appendix C. As indicated there, this formula assumes that expected returns to equity holders take the form of dividends and imputation credits only — in other words, it assumes there are no capital gains. As a result, the adjustment is incorrect, as it overstates the value of imputation credits and, therefore, the reduction in the return on equity.

[26] The starting point of the SFG Consulting analysis is 1973, but the in-text reference is 1975 (SFG Consulting, 2013b: 12, Figure 1).

[27] The return on equity comprises a risk-free rate of 2.66%, an equity beta of 0.80, and a market risk premium of 6.0%.

[28] SFG Consulting obtained this result by applying equation (30) in Appendix C, Technical Annex, assuming a 'gamma' of 0.50 and a statutory corporate tax rate of 0.30.

Based on the QCA's previous methodology for estimating the market risk premium, Lally estimates that the correct adjustment for dividend imputation would lower the return on equity from 7.46% to only 6.86%, the latter of which is greater than the claimed return on debt of 6.74% — this result reverses SFG Consulting's conclusion (Lally, 2013c: 10–11).

Second, the SFG Consulting return on debt estimate is in error and should be 6.33%, not 6.74%.[29] Therefore, the relevant comparison is between a return on equity of 6.86% and a return on debt of 6.33%, which further reinforces Lally's conclusion that the QCA's methodology produces results which are sensible.[30]

SFG Consulting also argued that the QCA's cost of capital methodology produces estimates that are inconsistent with the benchmark capital structure. On the basis of parameter values used in the QCA's 2010 decision on Aurizon Network, SFG Consulting observed that a firm financed entirely by equity would earn a rate of return on equity of 5.36%. Given this rate of return is less than the rate of return on debt of 6.74%, SFG Consulting claimed that the QCA's methodology implies that a firm could reduce its cost of capital by using 100% equity finance (SFG Consulting, 2013b: 16).

SFG Consulting's argument implies that the regulated firm's optimal capital structure is chosen to minimise the firm's cost of capital. However, there are a range of additional factors that firms take into account when determining their optimal capital structure. These include the disciplinary effects of debt, the signalling value of debt in the presence of asymmetric information and the reduction of underinvestment problems arising from using equity finance (Lally, 2013c: 11). As a result, SFG Consulting's analysis is overly simplistic because it does not take into account these additional considerations.

[29] SFG Consulting uses a risk-free rate of 2.66% (SFG Consulting, 2013b: 11). It also refers to a debt risk premium of 3.67% (SFG Consulting, 2013b: 15, footnote 21). The return on debt is then 2.66% + 3.67% = 6.33%.

[30] A further point is that the comparison is not 'like-with-like', as the return on equity is an expected rate of return, while the return on debt is a promised rate of return. The promised rate of return includes compensation for factors other than the time value of money and systematic risk.

APPENDIX B: RISK-FREE RATE

Background

In the CAPM, the risk-free rate is the rate of return on an asset with zero default risk. As set out in Appendix A, the relevant context for estimating the risk-free rate in the cost of equity is the Officer (1994) variant of the Sharpe-Lintner-Mossin CAPM.[31]

In estimating the risk-free rate in this context, there are three methodological issues that arise:

(a) the choice of the 'risk-free' asset

(b) the period of time at, or over, which the rate of return on the risk-free asset is estimated

(c) the maturity of the risk-free asset.

In the context of setting regulated prices in recent decisions, the QCA's approach to date has involved:

(a) using Commonwealth Government bonds as proxies for the risk-free asset

(b) applying a 'current' rate, proxied by an average rate over the 20 business days as close as practicable to the start of the regulatory period

(c) aligning the term of the bond with the term of the regulatory period.

This approach has been applied in recent decisions on Aurizon Network and the south east Queensland water and wastewater retail / distribution entities (QCA, 2010a: 33-38; 2011: 233-238).

Choice of proxy asset

Background

While the standard CAPM (and implicitly, the Officer CAPM) invokes the concept of a risk-free asset, the model does not specify a particular type of asset. In addition, an asset with zero variance in returns over the relevant period does not exist.[32] Therefore, in estimating the risk-free rate, a principal issue is the choice of a relevant proxy for the risk-free asset.

In practice, the commonly accepted proxy for the risk-free asset is a government-backed security. While such securities carry some risk of default, this risk is very low in economies with well-established property rights, legal traditions, effective domestic taxation and financial governance mechanisms. These countries include Germany, the United States, United Kingdom, Australia, and the Netherlands. As a result, in these countries, the rate on domestic government debt provides a close proxy for the risk-free rate (Lally, 2000: 18).

Australian regulators have generally used Commonwealth Government bonds as proxies for the risk-free asset in the CAPM, and this practice is largely uncontroversial. The practice is also supported by previous

[31] The context in this appendix is the risk-free rate in the first term of the cost of equity. The risk-free rate in the cost of debt is discussed further in the QCA draft decision paper, *Trailing Average Cost of Debt* (QCA, 2014f). The QCA notes that it can be argued that the risk-free rate in the cost of debt does not have to be the same risk-free rate, as the cost of equity is estimated using an asset pricing model (i.e. the CAPM), while the cost of debt is estimated using observations of the promised yield (i.e. not with regard to an asset pricing model).

[32] All government bonds face some risk of default. As a result, the yield on government bonds will overstate the true risk-free rate, all else equal.

decisions of the Tribunal. In the decision, *Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] ACompT 14*, the Tribunal stated:

> *The Tribunal notes here that the risk free rate of return is a clearly defined, if abstract, concept. It measures the return on a bond that carries no risk for the investor. It is widely accepted that the closest approximation to such a bond will be government debt.*

Stakeholder submissions

The QCA previously observed that, with the onset of the GFC in 2007, the reductions in government bond yields as a result of a 'flight to quality' led some regulated businesses and their consultants at that time to argue for an alternative asset to serve as the proxy for the risk-free asset (QCA, 2012b).[33]

However, in submissions on the QCA's discussion paper, stakeholders supported Commonwealth Government bonds as a valid and appropriate proxy for the risk-free asset (for example, Vale, 2013: 2; QRC, 2013a: 3; QTC, 2013: 1). No stakeholder presented a contrary view.

At the same time, some stakeholders did raise concerns with the recent decrease in these bond yields due to a sustained 'flight to quality'. In this context, these submissions focused on the appropriate averaging period for the risk-free rate, an adjustment to the observed risk-free rate, or an adjustment to the market risk premium to reflect the underlying economic conditions in financial markets.

QCA position

The QCA previously noted Dr Lally's view that government bonds possessed a number of desirable properties with respect to satisfying the requirements of the CAPM (QCA, 2012b: 26). In particular, they have very low default risk and are therefore very close to being risk-free, they are highly liquid assets and there are no restrictions imposed on the transactions of these assets.

The QCA maintains its view that these properties continue to be relevant to determining the choice of the risk-free asset. In addition to having these properties, government bond rates are reported by the RBA on a daily basis and, therefore, are highly transparent.

Stakeholders widely supported using Australian Commonwealth Government bonds as proxies for the risk-free asset. In addition, the QCA notes that, in their recent regulatory reviews, the AER, IPART and the ERA have concluded that government bonds are suitable proxies (ERA, 2013a: 81; AER, 2013d: 74; IPART, 2013a: 42). As identified above, the Tribunal has also endorsed this position.

For these reasons, the QCA continues to support using government bonds as the proxy for the risk-free asset.

Averaging period

Background

Strictly, the NPV = 0 Principle requires the risk-free rate in the cost of equity to be estimated using an 'on the day' rate on the first day of the regulatory period. This requirement follows from the fact that applying present values involves using a current discount rate rather than an average over some historical period. 'Current' in a regulatory context means at the start of the regulatory cycle (Lally, 2012b: 7).

However, pragmatic considerations involve using some type of average, since using an 'on-the-day' rate at the start of the regulatory cycle potentially exposes the regulated firm to a number of possible risks.

[33] For example, NERA (2007) proposed using the yield on corporate bonds less the cost of insuring those bonds against default (NERA, 2007: 14).

These risks include the possibility of pricing abnormalities on the day, collusive behaviour by lenders, opportunistic behaviour by a regulated firm and reporting errors.[34]

As a result, the QCA has tended to apply a very short term (i.e. 20 day) averaging period preceding the start of the regulatory cycle to balance the trade-off between using current information and reducing the risks to the regulated firm and regulatory process. This practice is consistent with the practice of other Australian regulators who use averaging periods in the range of 10–40 business days.

Stakeholder submissions

Several stakeholders proposed averaging periods materially longer than 20 business days, including periods spanning a number of years. The reasons for these proposals were that current short-term averages are producing risk-free rates that are either:

(a) resulting in a cost of equity that is too low relative to current financial market requirements, given the QCA's approach to estimating the market risk premium or

(b) leading to significant volatility in regulatory prices.

Regarding 'low' risk-free rates, Origin Energy stated (Origin, 2013: 5–6):

> *Origin considers that it is not appropriate to use the observed spot Government Bond rate, or a short term moving average of 20 days, as the basis for determining the Rf in conjunction with the estimate of MRP as adopted in the QCA draft report...Origin believes that using short term data reflects the cost of capital to invest at a point in time only and would not typically reflect the basis of investment decisions made over the regulated period regarding meaningful new investments in long term assets.*

On the second point, QTC expressed the concern that using short-term averages increases volatility to regulated firms and consumers and that this resulting volatility is undesirable (QTC, 2013: 1):

> *A full reset of the cost of capital parameters once every five years based on estimates made during short averaging periods exposes consumers and regulated businesses to unnecessary risks and volatility in prices between regulatory periods. The current approach of combining the prevailing CGS yield with a stable MRP results in inappropriate volatility, and other approaches which produce more stable results over time would be in the interests of consumers and investors.*

In addition, Unitywater and QUU argued that potential price volatility is inconsistent with stability that would be expected to accompany consumers' use of long-lived assets financed with long-term capital (Unitywater, 2013: 4; QUU, 2013: 5).

The ARTC also supported using long-term averages for the cost of equity parameters, noting that IPART had adopted such an approach in its recent cost of capital review (ARTC, 2013: 13).

QCA position

Principal issues

The QCA's view is that the most relevant consideration is economic efficiency. Achieving dynamic and allocative efficiency requires a current risk-free rate, which reflects all available and relevant market information. Therefore, these prevailing rates represent the reference benchmarks that a risky investment must outperform.

[34] Pricing abnormalities on the day could arise from unusually large or small volumes or from particularly strong incentives of traders to transact on that day (perhaps arising from some external event, for example, a '11 September' event).

As discussed, pragmatic considerations involve using some type of average and, in practice to date, the QCA has typically applied a short-term (i.e. 20 day) averaging period to balance the trade-off between using current information and reducing the risks identified.

After reviewing information before it on this matter, the QCA considers that this practice has worked well to date and remains the best approach available given the need to balance these competing considerations. This practice is also consistent with the practice of most Australian regulators, who apply averaging periods in the range of 10–40 business days.

In reaching this view, the QCA has considered arguments for a materially longer averaging period for the risk-free rate in the cost of equity and concluded that they are not sufficiently strong to lead it to set aside the well-established practice of applying a short-term average (e.g. 20 business days) as a proxy for a 'spot' rate.

The QCA's detailed reasoning and responses to specific points raised in stakeholder submissions are set out below.

Risk-free rate and the cost of equity

The QCA's view is that the market for government bonds appears to be liquid and well-functioning. While current bond yields are lower than some long-term averages, this deviation does not, by itself, indicate any abnormality or 'problem' in the market for government bonds that justifies using longer term rates. Rather, current rates simply reflect relevant, underlying demand and supply conditions in the market. In particular, the current yields on government bonds are likely to reflect strong demand from foreign investors. Such a situation is not inconsistent with a market-determined risk-free rate. The AER also reached a similar conclusion (AER, 2013d: 73–81).

The focus of some submissions was on the QCA's methodology, which couples a 'spot' risk-free rate with an estimate of the market risk premium that is effectively fixed. As such, this concern essentially relates to the final cost of equity estimate, rather than to the level of the risk-free rate per se. It therefore raises the issue of the relationship between the risk-free rate and the market risk premium and whether or not the cost of equity has fallen since the GFC. These issues are discussed in Chapters 2 and 4 and in Appendix C.

Volatility

QTC, Unitywater and QUU raised the issue of potential price volatility, specifically that the regulatory parameter values should contribute to smooth rather than volatile prices. The QCA notes that this concern appears to focus particularly on 'step' changes in regulated prices between regulatory periods. In other words, depending on the level of the risk-free rate at the time of a given price reset, there is the potential for a material step change in the regulated price.

While the QCA appreciates these concerns about price volatility, the QCA considers the overarching objective to be economic efficiency. This objective is best achieved using a risk-free rate that is current. To the extent that applying such a rate leads to volatility in costs then the cost of capital estimate should reflect that volatility where possible, as the current rate reflects the most relevant market information. A long-term, historical average risk-free rate can smooth some volatility but only at the cost of sending the wrong signals for investment.

However, to the extent that cost volatility can lead to price volatility that is undesirable to consumers, the QCA considers that price volatility can be dealt with in other ways such as by applying various transition mechanisms both within and across regulatory periods. Examples of such mechanisms include price smoothing and variations from straight line depreciation during the life of the asset.

Finally, it is relevant to note that the 'volatility issue' is not as straight forward as presented in submissions. Addressing volatility depends on the firm's and its customers' attitudes toward risk and the

types of risks involved, among other factors. Customers might actually have a preference for price volatility because the volatility gives them the opportunity to adjust the quantity purchased — a good example is real-time electricity pricing (Cowan, 2004a). Further, if the regulated firm and its customers are both averse to price risk, then efficiency requires some sharing of that volatility between them. In such a case, it would not be appropriate for the regulator to insulate either party entirely from price volatility (Gollier, 2004; Cowan, 2003b).

Other issues

Windfall gains and losses

The QCA also considers that applying a long-term average risk-free rate in conditions under which the current rate is 'low' (relative to a long-term average) will typically provide an inappropriate windfall gain to regulated businesses. This outcome occurs because applying a higher risk-free rate to compensate for a market risk premium that is believed to be too low over-compensates the firm when its equity beta is less than one. Regulated firms typically have equity betas less than one given that their returns are relatively stable and less impacted by economic conditions than the market. This possibility is illustrated in the following example.

Example 1

- Suppose the current risk-free rate is 3.0% and the historical average risk-free rate is 6%. Further, assume the expected return on the market portfolio is believed to be 11% (constant).
- Given these estimates, then the estimate of the current market risk premium is 8% (i.e. 11% – 3%), and the estimate of the historical average market risk premium is 5% (i.e. 11% – 6%).
- For a firm with an equity beta of 1.0 then the cost of equity (k_e) is believed to be k_e = [3% + (1.0)(8%)] = 11%.
- This cost of equity is also obtained if the analyst adds the historical average risk-free rate of 6% to the historical average market risk premium of 5% (i.e. 6% + 5% = 11%) — this second approach is consistent with the approach recommended by some stakeholders.
- However, the second approach results in the same estimate as the first approach only because the error in over-estimating the risk-free rate exactly offsets the error in under-estimating the market risk premium — and this perfect offset occurs due to the firm's equity beta being 1.0.
- However, if the firm's equity beta is less than 1.0, these two effects do not offset. Specifically, suppose the equity beta is 0.80.
- Using the first approach, a current risk-free rate of 3% and a current estimate of the market risk premium of 8% give a cost of equity of k_e = 3% + (.80)(8%) = 9.4%.
- In contrast, if the analyst uses the second approach, the historical average risk-free rate of 6% and the historical average market risk premium of 5% then the cost of equity estimate is k_e = 6% + (.80)(5%) = 10%.

As a result, a long-term, average risk-free rate will over-compensate regulated firms for the cost of equity. The over-compensation occurs because use of a higher risk-free rate to compensate for a market risk premium that is believed to be too low over-compensates when the equity beta is less than one.

Practical considerations

Finally, a long-term average over a number of years is also subject to the practical difficulty that it would be arbitrary. There is no economic basis for choosing one historical period over another, and further, any party nominating an averaging period would have an incentive to nominate a period that gives that party the most favourable cost of capital outcome. In summary, it would not be a current rate, and it would not be unbiased. The QCA notes that the AER has reached a similar conclusion on this issue (AER, 2013d: 79–80).

For these reasons, the QCA considers that a short-term average over 20 business days preceding the start of the regulatory period strikes an effective balance between efficiency objectives and pragmatism.

Term of the risk-free rate

The term of the risk-free rate refers to the appropriate maturity of the bond. In choosing a term, there have tended to be two competing views of the appropriate term, namely that it should be aligned with the term of either:

(a) the regulatory period in order to satisfy the NPV = 0 Principle

(b) the long life of the regulated assets.

Aligning the term of the bond with the term of the regulatory period is based on published research by Schmalensee (1989) and Lally (2004b, 2007a) and demonstrates that 'term-matching' is required to satisfy the NPV = 0 Principle. An important aspect of this research is that the presence of a range of risks, such as demand risk and operating cost risk, should be dealt with through a risk allowance, not by lengthening the term of the risk-free rate.

Setting the term with respect to the life of the assets (where the 10-year bond is the proxy) is an alternative position based on the view that theory does not provide a definitive guide to implementing the NPV = 0 Principle and that practical considerations and other factors, such as market practice, should inform the debate.

In the decision, *Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] ACompT 14*, the Tribunal relevantly commented:

> *The ERA had to use its discretion to determine an appropriate term to maturity for Commonwealth bonds over which to estimate the risk free rate of return. In the opinion of the Tribunal it carefully considered all the relevant material and arguments… it stated clearly its reasons for selecting the five-year term to maturity as the basis for its estimate of the risk free rate of return... Accordingly, the Tribunal finds that the ERA committed no conceptual or empirical error in its choice of the length of the term to maturity. Nor did the ERA's chosen estimation method involve any capriciousness or lack of consistency between the term to maturity used in estimating the risk free rate of return and in estimating the MRP. It exercised its discretion... to use a five-year term to maturity as the basis of its estimate of the risk free rate of return, and adequately explained its reasons for its selection of this five-year term to maturity, and this was a reasonable approach.*

Stakeholder submissions

QUU, Unitywater, Aurizon Network and QTC objected to aligning the term of the risk-free rate with the term of the regulatory cycle (QUU, 2013: 7; Unitywater, 2013: 6; SFG Consulting, 2013c; QTC, 2013: 5). For example, QTC contended that (QTC, 2013: 5):

> *The NPV=0 principle relies on assumptions which do not capture the constraints and risks faced by investors in practice, and conclusions must be tested against market evidence. QTC does not agree that satisfying the NPV=0 principle in practice requires the term of the risk-free rate to match the length of the regulatory period.*

> *Satisfying the NPV=0 principle in practice requires the best estimate of the cost of equity to be made, which means it must reflect the risks that are faced by the equity providers when providing funding for assets with economic lives of up to 50 years.*

Aurizon Network contended that market practice supports using a 10-year government bond yield. Additionally, it observed that several other regulators in Australia have concluded that satisfying the NPV = 0 Principle requires a longer duration risk-free rate (Aurizon Network, 2014: 8).

While these arguments covered a number of detailed points, the key arguments can be distilled to three principal arguments relating to:

(a) the NPV = 0 Principle

  (i) the expectations hypothesis

  (ii) the claim that the assets must be sold and the analogy drawn to very long-term bonds

(b) implications of 'term-matching'

(c) practical considerations, including taking into account the view of other regulators.

These concerns are summarised in more detail below. The first set of arguments relate to technical points about the NPV = 0 Principle and Dr Lally's research in this area.

NPV = 0 Principle

Specifically, SFG Consulting contended that the QCA's practice of matching the term of the risk-free rate with the term of the regulatory cycle (i.e. 'term-matching') is not necessary to achieve NPV neutrality. In particular, SFG Consulting argued that term-matching only holds under the assumption that the term structure of interest rates today provides a set of unbiased expectations of future interest rates (i.e. the expectations hypothesis is valid) and that there is general agreement that this hypothesis is empirically false (SFG Consulting, 2013e: 1).

QTC also raised several arguments relating to the QCA's practice in this area:

(a) Setting the term for the risk-free rate equal to the term of the regulatory cycle (i.e. 'term-matching') relies on the assumption that the business is sold at the end of the regulatory cycle, with proceeds — equal to the RAB — returned to investors in the final year (QTC, 2014: 3–4)

(b) A regulated business subject to a price reset every five years is very similar to a long-term bond with its interest rate reset every five years, but such a bond is different than a five-year bond, as the investment in the former is committed for a much longer period of time (e.g. the life of the assets) (QTC, 2014: 4–5).

Implications of term-matching

Even if 'term-matching' is accepted, SFG Consulting contended that three implications follow from it that do not make sense:

(a) As the five-year rate is typically less than the 10-year rate, 'term-matching' leads to the perverse outcome that the length of the regulatory period can be reduced in order to reduce the cost of capital and prices to consumers (SFG Consulting, 2013e: 6–7)

(b) While a regulator is attempting to estimate the price that would prevail in a competitive market, using term-matching results in a regulated price that is inconsistent with this competitive market outcome (SFG Consulting, 2013e: 9–10)

(c) Unless the regulator has changed its view on the required return on equity in the Australian market, the market risk premium must be increased (SFG Consulting, 2013e: 7–9).

Practical considerations

Finally, several stakeholders made the point that setting the term of the risk-free rate should not rely on theoretical arguments alone but also take into account practical considerations, consistent with the recent approaches of other regulators. Specifically, QTC observed that in deciding to set the term of the risk-free rate to 10 years (QTC, 2014: 8–9):[35]

(a) The AER relied on a consultant's report that independent valuation experts use a 10-year rate to value assets regulated on a five-year regulatory cycle[36]

(b) IPART considered its primary objective to set the WACC to reflect the efficient cost of capital for a benchmark firm of similar risks that operates in a competitive market and that the market practice of investors is to reference both short (e.g. 40 day) and long-term (e.g. 10 years) averages.

These arguments are now discussed in more detail.

QCA position

The QCA has considered the material presented to it on this matter. While there are arguments on both sides, the QCA finds arguments for matching the term of the risk-free rate to the term of the regulatory cycle more compelling and accordingly, 'term-matching' to be the stronger position. This is because:

(a) Term-matching satisfies the NPV = 0 Principle regardless of the term structure of interest rates while the 10-year rate in general will not satisfy it

(b) The use of a 10-year bond rate over-compensates the regulated firm's investors for interest rate risk that they do not bear when the term structure of interest rates is upward-sloping. It will also under-compensate investors when the term structure of interest rates is downward-sloping

(c) Practical reasons used to justify the use of a 10-year rate are not compelling, as they are effectively seeking to address issues that are fundamentally unrelated to economic regulation.

The QCA's responses to specific arguments raised by stakeholders are below.

The NPV = 0 Principle

Expectations Hypothesis

Aurizon Network and SFG Consulting disputed the proposition that, in order to satisfy the NPV = 0 Principle, the term of the risk-free rate used to set the allowed rate of return for a regulated business should match the regulatory term.

In particular, SFG Consulting argued that this result only holds if the expectations hypothesis characterises the term structure of interest rates (SFG Consulting, 2013e: 17). The expectations hypothesis means that current long-term interest rates reflect current short-term interest rates and forecasts of movements in the latter rates over the life of the long-term interest rates.[37]

The QCA has reviewed and considered relevant material in the stakeholder submissions, Dr Lally's responses and the related journal articles.[38] While these issues are highly technical, they can be reduced to an example as follows.

---

[35] SFG Consulting made similar observations (SFG Consulting, 2014a: 8–10).

[36] The report was authored by Incenta Economic Consulting on behalf of the Energy Networks Association (ENA) (Incenta Economic Consulting, 2013a).

[37] For example, if the one-year rate now (r_{01}) is .03 and the one-year rate in one year with certainty (r_{12}) is .10, then if the expectations hypothesis is correct, the two-year rate now (r_{02}) is determined by solving $(1+r_{02})^2 = (1+r_{01})(1+r_{12}) = (1.03)(1.10)$ for r_{02}. Therefore, $r_{02} = .064$.

[38] The journal articles are Lally (2007a), Hall (2007) and Lally (2007b).

Example 2: The NPV=0 principle and the expectations hypothesis[39]

Suppose the regulatory period is one year and there are two regulatory periods. Regulatory assets are purchased now (i.e. at the start of year one) for \$.40m with a life of two years, regulatory depreciation is \$.20m per year, and the current one-year risk-free rate is 5.0%.[40] To satisfy the NPV = 0 Principle, the regulated business should be allowed to earn 5.0% on the \$.40m investment for the first year, depreciation of \$.20m, plus whatever the one-year rate is in one year on the undepreciated residual of \$.20m (for the second year) plus depreciation again of \$.20m.

As a result, for the second year, if the one-year risk-free rate in that second year is 6.0%, the regulator would allow revenue of 6.0% of \$.20m and depreciation of \$.20m, which totals \$.212m. Because this amount, which is to be received at the end of this (second) year, is known at the beginning of that year, it is risk-free at that point and can therefore be valued at the beginning of that year using the prevailing one-year risk-free rate of 6.0% – the result would be \$.20m:

(5) $$V_2 = \frac{\$.20\text{m}(.06)+\$.20}{1.06} = \frac{\$.212\text{m}}{1.06} = \$.20\text{m},$$

where V_2 refers to the value received at the start of the second year.

Coupled with an allowed risk-free rate of return of 5.0% on \$.40m in the first year, plus depreciation of \$.20m in the first year, the total payoff on the business at the end of the first year would be revenues of \$.22m plus the residual value of \$.20m, totalling \$.42m, whose value at the start of the first year using the prevailing one-year rate of 5.0% would be \$.40m:

(6) $$V_1 = \frac{[\$.40\text{m}(.05)+\$.20\text{m}]+V_2}{1.05} = \frac{\$.22\text{m}+\$.20\text{m}}{1.05} = \$.40\text{m}.$$

This value matches the initial investment of \$.40m, and it therefore satisfies the NPV = 0 Principle.

Alternatively, if the one-year risk-free rate in one year is 4.0%, the regulator would then allow revenues for the second year of 4.0% of \$.20m, plus depreciation of \$.20m, which is \$.208m. Because this amount, which is to be received at the end of this (second) year, is known at the beginning of that year, it is risk-free at that point and can therefore be valued at the beginning of that year using the prevailing one-year risk-free rate of 4.0% – the result would be \$.20m:

(7) $$V_2 = \frac{\$.20\text{m}(.04)+\$.20\text{m}}{1.04} = \frac{\$.208\text{m}}{1.04} = \$.20\text{m}$$

Coupled with an allowed risk-free rate of return of 5.0% on \$.40m in the first year, plus depreciation of \$.20m, the total payoff on the business at the end of the first year would be revenues of \$.22m plus remaining value of \$.20m, totalling \$.42m. The value of this amount now using the prevailing one-year rate of 5.0% would be \$.40m (see equation (6)). Again, this value matches the initial investment of \$.40m, and it therefore satisfies the NPV = 0 Principle.

As a result, regardless of what the one-year rate is in one year, this approach of using the prevailing one-year rate (because the regulatory period is one year) will guarantee that the NPV = 0 Principle is satisfied. Further, nothing in this principle or example involves any assertion about whether the expectations hypothesis is correct.[41]

[39] This example is based on the numerical example in SFG Consulting's *Term to Maturity of the Risk Free Rate Estimate in the Regulated Return* (SFG Consulting, 2012b: 10-11).

[40] To simplify the example, it is also assumed that there are no operating costs or tax, and there is no regulatory risk arising from demand.

[41] If that hypothesis was correct, given the current one-year rate is 5.0% and the expected one-year rate in one year is 5.0%, then the current two-year rate would also be 5.0%. If the hypothesis was not correct, the

In contrast with the above analysis, SFG Consulting conducts its analysis entirely from the perspective of the start of the first period (at t=1) and assumes a two-year spot rate of 6.0%. SFG Consulting sets the rate allowed by the regulator for the second year at the one-year risk-free rate for that year, which is expected to be 5.0%.

In the second year, the firm would receive revenues of 5.0% of $.20m, being $.01m and $.20m depreciation, totalling $.21m. In addition, the revenues over the first year would be depreciation of $0.20m plus some rate (R) applied to the initial investment of $.40m. The year one revenues are certain and can therefore be discounted at the current one-year spot rate of 5.0%. The expected revenues for the second year are $0.21m, and are discounted at the current two-year risk-free rate of 6.0% (which is the geometric mean of the current one-year rate of 5.0% and the forward rate of 7.01%). So, the present value is:

(8) $$V_1 = \frac{\$.40\text{m}(R)+\$.20\text{m}}{1.05} + \frac{\$.20\text{m}(.05)+\$.20\text{m}}{(1.06)^2} = \frac{\$.40\text{m}(R)+\$.20\text{m}}{1.05} + \frac{\$.21\text{m}}{(1.06)^2}$$

In order to satisfy the NPV = 0 Principle, V_1 must equal the initial investment of $0.40m and therefore R is solved from equation (8) as .0594, i.e.:

(9) $$V_1 = \frac{\$.40\text{m}(.0594)+\$.20\text{m}}{1.05} + \frac{\$.21\text{m}}{(1.06)^2} = \$.40\text{m}$$

This equation corresponds to the last equation in section 3.5 of SFG Consulting's report, *Term to Maturity of the Risk-Free Rate Estimate in the Regulated Return* (SFG Consulting, 2012b: 11). The error in SFG Consulting's reasoning is discounting the *expected* revenues in the second year by the current two-year risk-free rate of 6.0%. Since these revenues are expected revenues based on an expected one-year risk-free rate at the start of the second year, the correct discount rate is not the current two-year risk-free rate of 6.0%.

The correct analytical process (i.e. underlying equations 5-7 above) recognises that the revenues to be received at the end of the second year will be known at the end of the first year, and therefore will have a value at the end of the first year of $.20m – *regardless of what the one-year risk free rate is in one year*. So, the discount rate to be applied now to this $.20m value arising in one year with certainty is the current one-year risk-free rate of 5.0%. Therefore, SFG Consulting's equation above (9) *should be*:

(10) $$V_1 = \frac{\$.40\text{m}(R)+\$.20\text{m}}{1.05} + \frac{\$.20\text{m}}{1.05} = \$.40\text{m}.$$

It follows from this equation, that R = .05, i.e., the allowed rate for the first year matches the prevailing one-year risk-free rate. Because SFG Consulting incorrectly values the uncertain revenues to be received in two years, it therefore incorrectly concludes that the allowed rate of return for the first year should be R = .0594 rather than R = .05. Put another way, SFG Consulting's rate of .0594 only satisfies the NPV = 0 Principle in the example because SFG Consulting incorrectly values uncertain cash flows. Once the latter point is recognised and the cash flows are valued correctly, then .0594 fails to satisfy the NPV = 0 Principle in the example.

---

current two-year rate might be something other than 5.0%, for example, perhaps 6.0%. However, the current two-year rate is never referenced in the example and therefore has no bearing on the question of whether the NPV = 0 Principle is satisfied.

In summary, SFG Consulting's view that the expectations hypothesis is a necessary condition for term-matching to satisfy the NPV=0 Principle is not correct. Term-matching is a requirement to satisfy the principle regardless of how interest rates are determined.[42]

NPV = 0 Principle

Claim that the asset must be sold and the analogy to long-term bonds

QTC makes several additional, technical arguments. The first is that setting the term for the risk-free rate equal to the term of the regulatory cycle (i.e. 'term-matching') relies on the assumption that the business is sold at the end of the regulatory cycle, with proceeds from the sale returned to investors in the final year (QTC, 2014: 3–4). QTC attributes this argument to the AER, as the AER states (AER, 2013c: 183):

> *...the assumption is that the investor receives a cash payment equal to the RAB in the final year of the regulatory control period. While under certain assumptions, the market value of equity is equal to the residual value of the RAB, these assumptions may not hold in reality.*

However, this statement is an *interpretation* of Lally (2012b) by the AER. The analysis in Lally (2004b, 2012b) and Schmalensee (1989) makes no such assumption about assets being sold. In the paper referenced by the AER, Lally states (Lally, 2012b: 14):

> *In five years' time, and following the analysis in the previous section, the output price will be reset to ensure that the value at that time of the subsequent payoffs on the regulatory assets equals the regulatory asset book value prevailing at that time...*

In the QCA's view, the AER's interpretation is not consistent with the analysis in either Schmalensee (1989) or in Lally (2004b, 2012b). Nonetheless, the AER considered this assumption might not hold in reality because the residual value of the RAB at the end of the regulatory cycle remains 'at risk'. In this context, the AER quoted an Incenta Economics Consulting report submitted to its *Better Regulation Rate of Return Guideline* process (AER, 2013c: 183):

> *…the residual value at the end of each 5 year period is inherently risky. This is because the residual value is not returned in cash, but rather comprises a 'value' whose recovery remains at risk from future regulatory decisions and changes in the market (both technological changes and changes to customer preferences).*

The QCA does not consider that the presence of perceived systematic or non-systematic risk applying to recovery of the RAB should suggest the term chosen for measuring the risk-free rate.

Investors might perceive that recovery of the RAB could entail some residual regulatory risk. However, to the extent such risk is systematic, it will be compensated through an appropriate estimate of the regulated firm's asset beta. The QCA's view is that providing a firm with a longer term risk-free rate as some kind of compensation for this perceived risk would be double-counting. If such risks are non-systematic, they must relate to the expectation of a loss from uncompensated risks implicit in the regulatory contract. Such risks can be dealt with through other mechanisms.

QTC's second argument is that investors in a very long-term floating-rate bond would require additional compensation (i.e. over and above the five-year risk-free rate) to commit funds for a much longer period of time. Analogously, the regulator should add a margin to the five-year risk-free rate, and applying the 10-year rate reflects this required margin (QTC, 2014: 4).

The premise of the QTC argument is that investors require compensation (i.e. in the form of a margin in addition to the five-year risk-free rate) for the long-term commitment of funds. However, long-term commitment in either case is not permanent — investors in either bonds or regulated firms can always sell their holdings of these assets.

[42] See Lally (2013a: 45-50) for further details.

Even if QTC's premise is correct, using a 10-year rather than a five-year rate does not address the alleged problem. The difference in these rates reflects expectations of future interest rates and compensation of risk related to possible changes in these future rates. Therefore, if a premium is required for committing funds for a term longer than 10 years, this issue is not solved by lengthening the term of the risk-free rate from five to 10 years.

Setting QTC's premise aside, QTC's comparison of investment in regulated assets to investment in a very long-term bond would equally apply to such a bond with periodic (e.g. five-year) coupon resetting. Accordingly, QTC's approach in this context would mean applying a 10-year rate for a five-yearly coupon reset, rather than a five-year rate. However, the correct rate to apply in this situation is a rate with a term corresponding to the length of the reset term (Lally, 2014a: 25–26).[43]

Claimed implications of 'term-matching'

Setting aside the technical arguments, SFG Consulting made the point that term-matching has several perverse implications.

Reducing the length of the regulatory period

The first implication is that, given the term structure of interest rates is typically upward-sloping (e.g. the five-year rate is less than the 10-year rate), term-matching leads to the perverse outcome that the length of the regulatory period can be reduced in order to reduce the cost of capital and prices to consumers (SFG Consulting, 2013e: 6–7).

The QCA does not agree with SFG Consulting that an upward-sloping term structure would lead to a 'free lunch' for consumers in the form of lower regulated prices (via simply reducing the length of the regulatory cycle). SFG Consulting's claim suggests that the NPV = 0 Principle gives regulators the incentive to choose the length of the regulatory period in order to minimise prices to consumers.

Choosing the length of the regulatory cycle is a much broader issue than indicated by SFG Consulting and involves considering a range of trade-offs that involve administrative and non-price considerations as well as price-related considerations. Once these competing considerations are evaluated to determine the appropriate length of the regulatory period, the term of the bond is then aligned with it. A short regulatory period could involve reducing risk to investors in the regulated firm (e.g. from protracted exposure to unexpected macroeconomic shocks) but only at the cost of imposing higher administrative costs and greater complexity.

Inconsistency with competitive market outcomes

For purposes of determining rates, the QCA Act does not require the QCA 'to estimate the price that would prevail in a competitive market'. Section 168A of the Act does require, inter alia, revenue adequacy. Benchmarking a competitive market outcome is valid in the sense that unregulated firms in competitive markets charge a price to just cover their efficient costs, including the cost of capital, and regulation should do the same with respect to costs. However, unregulated firms face advantages and disadvantages that cannot be readily replicated in a regulated environment.

The Act also requires the QCA to 'promote the economically efficient operation of, use of and investment in, significant infrastructure by which services are provided, with the effect of promoting effective competition in upstream and downstream markets' (s.69E). Section 168A(b) specifically allows for multi-part pricing and price discrimination when they aid efficiency. Price discrimination is generally not a feature of highly competitive markets.

[43] Also, see the discussion of floating rate bonds in Elton, Gruber, Brown, and Goetzmann (2010: 529–530).

More generally, regulation involves choosing a form of regulation and ancillary mechanisms, for example cost pass-throughs, review triggers, and the frequency of resets, to achieve economic efficiency and meet specific statutory objectives. The package of regulatory arrangements affects risk and the cost of capital and is designed to compensate the firm to support efficient investment.

Potential inconsistency with the term of the market risk premium

SFG Consulting, on behalf of Unitywater, QUU and Aurizon Network, indicated its concerns with the QCA's practice of applying a term of five years to estimate the risk-free rate (in the first term of the CAPM) while at the same time, continuing to apply a 10-year rate to estimate the market risk premium:

(a) It is not appropriate to justify the inconsistency on the basis of the statistical imprecision between the five-year and 10-year market risk premium estimates (SFG Consulting, 2012b: 4)

(b) Setting aside the argument in (a), the five-year estimate of the risk-free rate should be used, as the QCA's median estimate of the market risk premium depends on the Ibbotson estimate which is close to 6.5% — as a result, several basis points' difference could result in 6.5% being rounded to 7.0% (SFG Consulting, 2014a: 13)

(c) The 'consistency principle' and the Tribunal's decision on GasNet require that the same estimate should be used in both places (SFG Consulting, 2014a: 13).

The relevant term for the market risk premium should correspond to the across-investor holding period between successive portfolio reassessments. This term could be as short as one year or as long as 10 years (or possibly even longer). As this period is uncertain, pragmatic considerations with respect to data availability have supported using a 10-year rate to estimate the market risk premium.

The QCA accepts stakeholders' concerns about not making certain adjustments on the basis of statistical imprecision. However, the QCA notes that, at that time, even if the adjustment (about 0.20%) had been made, it would not have affected the final (rounded) estimate of the market risk premium of 6.0%.

Setting aside this point, the QCA has taken into account stakeholder arguments regarding consistency. The QCA's position is that the apparent inconsistency arises from applying the CAPM to satisfy the NPV = 0 Principle. This requires the first term in the cost of equity to be the risk-free rate with a term corresponding to the term of the regulatory cycle.

Nonetheless, the QCA has examined the historical difference between the 10-year rate and five-year rate in the context of the standard access undertaking regulatory period. The QCA also examined the historical difference between the 10-year rate and the one-year rate in the context of the long-term performance monitoring framework for SEQ water retailers. This analysis has reinforced the conclusion from applying the new methodology for estimating the market risk premium that 6.5% is a reasonable estimate at this time.

Practical Considerations and other regulators

QTC stated that regulators should have regard to practical considerations rather than relying on theory alone in setting the term of the risk-free rate. QTC observed that both the AER and IPART recently reviewed their positions on this issue and concluded that the 10-year rate is preferable, based in part on practical considerations.

The QCA agrees with QTC that practical considerations are relevant. For clarity, the QCA has not limited its considerations to only 'theoretical' issues. The QCA has had regard to both key regulatory principles and the QCA Act. As part of this process, the QCA has also had regard to practical considerations. However, the QCA does not agree with the conclusions drawn by the AER and IPART on the specific issues raised.

Australian Energy Regulator

In its Draft *Rate of Return Guideline Explanatory Statement*, the AER found compelling arguments for both a five-year and a 10-year term (AER, 2013c: 184). However, on balance, the AER adopted a 10-year term primarily on the basis that:

(a) a survey of market practitioners found that they use a 10-year rate to value regulated infrastructure assets subject to a five-year regulatory period

(b) long-term (e.g. 10-year) bond rates, in general, will lead to a more stable return on equity than short-term (e.g. five-year) rates (AER, 2013c: 184).

The QCA considers that conclusions about the implications of actual practice inferred from surveys can be questioned.

Respondents were asked what risk-free rate they would apply in valuing a regulated firm subject to a five-year regulatory cycle. Lally (2014a) demonstrated that all but one of the survey respondents applied a risk-free rate materially greater than the 10-year rate prevailing at the time. This practice is consistent with valuation, in which analysts undertake discounted cash flow analysis for firms with very long or infinite-lived cash flows. In this context, one would expect to observe a discount rate that reflects a risk-free with a term greater than the term of the regulatory period and, in particular, greater than 10 years (i.e. the term of the longest available, liquid bond).

However, valuation has no necessary implications for price regulation, under which regulators reset prices every regulatory period (e.g. five years) and accordingly, they revise the rate at regular intervals. In other words, observing that valuation experts apply a 10-year rate (or higher) in discounting cash flows has no implications for the correct rate to be applied in the cost of capital in determining regulated revenues.

Further, even if the respondents were reporting the *prevailing* 10-year rate, it does not follow that this rate is the relevant rate for regulatory purposes. If respondents are applying a 10-year rate (in the discount rate) to value all of the firm's cash flows, this would include both the cash flows associated with the allowed return on capital and those associated with other aspects of the business (e.g. operating costs). In this case, the 10-year rate would reflect some type of average over the rate relevant to the return on capital (i.e. the five-year rate) and the rate relevant to the additional cash flows. Accordingly, the average rate does not indicate the relevant rate for the return on capital component.

The QCA notes that a key consideration of the AER was its view that the five-year term is only valid if, after five years, the asset owners can walk away with full compensation. The QCA is not persuaded by this argument, as discussed in the previous section on the 'bond analogy'.

Independent Pricing and Regulatory Tribunal

QTC noted that IPART also took other (i.e. non-theoretical) considerations into account. For example, in its *Review of WACC Methodology Final Report*, IPART stated (IPART, 2013b: 13):

> *We also agree with SDP that the NPV neutrality argument is less likely to support retaining a 5-year TTM assumption under our new WACC methodology.... Based on advice provided by Kevin Davis,[10] we adopted a 5-year TTM to achieve the NPV neutrality of our regulatory model. However, under our new WACC model, which uses a mix of current and long-term historical rates, the NPV neutrality principle is less likely to hold [footnote omitted].*

IPART appears to have adopted a 10-year term on the basis that this term is more consistent with long-term averages applied in setting a WACC to reflect the efficient costs of a benchmark firm in a competitive market. As a result, IPART seems to consider that achieving NPV neutrality is not the most important regulatory objective (IPART, 2013b: 12–13).

The QCA does not agree that NPV neutrality should be a secondary objective. The NPV = 0 Principle simply means that the expected future cash flows of the regulated firm should equal the present value of

the initial investment, using a discount rate that reflects the risk-adjusted opportunity cost of the investment. Stated alternatively, the regulated price should cover the firm's efficient costs, including the cost of capital (Schmalensee, 1989).

Application of the NPV = 0 Principle can be seen as essential to satisfying the requirement in s.168A of the Act to 'generate expected revenue for the service that is at least enough to meet the efficient costs of providing access to the service and include a return on investment commensurate with the regulatory and commercial risks involved' and the requirement in s.69E to promote economic efficiency.

The QCA is therefore not persuaded by these regulators' justifications for using a 10-year risk-free rate. As economic efficiency is a fundamental objective of regulation, and covers the interest of both service providers and service users, satisfying the NPV = 0 Principle should be a fundamental priority unless countervailing factors are sufficiently strong to lead us to set aside that priority.

Additional arguments and responses

Additional arguments considered are addressed in Table 1.

Table 1 NPV = 0 Principle: Further arguments and responses

Stakeholder Submissions	*Lally Response*	*QCA Response*
The QCA's approach assumes investors are limiting their investment decisions and return expectations to the length of the regulatory cycle, but investors generally view these assets as 'long-term' (Aurizon Network, 2013: 114).	Not applicable.	The QCA's approach does not make this assumption. Even if investors view these assets as 'long-term', this view has no bearing on the term for the risk-free rate. If that term is not set equal to the term of the regulatory period then, in general, the allowed revenues will either under or over-compensate investors.
To satisfy the principle, the reset process at the end of the cycle must be such to equate the market value of equity to its book value, and this is not possible because factors beyond the regulatory cycle affect equity prices (QTC, 2013: 5).	If the firm's only activity is regulated but it has some growth options to potentially exercise that lie outside the regulated activity, then the equity price will change to reflect the market's perception of their value — but this has no relevance to the term of the risk-free rate for the regulated activity (Lally, 2013c: 20).	The factors alluded to by QTC cannot be appropriately dealt with by lengthening the term of the risk-free rate.
If the investor's investment horizon is driven by the regulatory cycle, combining multiple, regulated networks with different regulatory cycles into a single listed business would be inefficient. However, this practice is dominant in Australia — therefore, the investment horizon is not linked to any one of the regulatory periods (QTC, 2013: 5-6).	This argument implicitly assumes that the NPV = 0 Principle applies to the firm as a whole not to each regulated network individually. As a result, it is not relevant whether these individual networks have regulatory cycles that commence at the same time and/or have the same length (Lally, 2013c: 21).	The QCA concurs with Dr Lally's view.

APPENDIX C: MARKET RISK PREMIUM

Introduction

As discussed in Chapter 4, the QCA received a range of stakeholder submissions on the market risk premium. The QCA received comments on its approach to date for estimating the market risk premium, including on both the choice of methods and the way in which they are applied. In addition, submissions raised more general issues relating to the GFC, its aftermath and current market conditions.

In addressing stakeholder submissions, the QCA has undertaken a review of its methodology to date for estimating the market risk premium. This review has involved work in two principal areas:

(a) reassessing its traditional estimation methods

(b) considering current market conditions.

This appendix is structured in two sections that reflect these work streams.

It should be noted that QCA estimates of the market risk premium in this appendix are:

(a) estimated as at December 2013 — the QCA will re-estimate the market risk premium periodically for specific reviews

(b) based on a 10-year risk-free rate of 4.29% as at December 2013 — the QCA has considered the arguments presented for applying a five-year rate for consistency with the first term in the CAPM and re-estimated the market risk premium using a five-year rate. The results of this analysis reinforce the QCA's conclusion that a market risk premium of 6.5% is reasonable.

Traditional methods

The market risk premium in the Officer (1994) CAPM variant is defined as:

(11) $$\mathrm{MRP_O} = \mathrm{r_m} + \mathrm{U}\left[\mathrm{D_m}\left(\frac{\mathrm{IC_m}}{\mathrm{DIV_m}}\right)\right] - \mathrm{r_f}$$

where $\mathrm{MRP_O}$ is as defined in Appendix A. Unlike the risk-free rate, the market risk premium is not observable and must be estimated. All estimation methods have advantages and disadvantages. The QCA has therefore been required to consider the different estimation methods and their utility. In the decision, *Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] ACompT 14 (26 July 2012)*, the Tribunal relevantly commented:

> *It is a forward-looking concept and thus its value has to be predicted. The Tribunal recently noted in Envestra (No 2) that, as with any variable whose values have to be forecast, there is unlikely to ever be a single "right" value of the MRP, and so considerable debate generally occurs as to how this parameter can best be calculated at any given point of time.*

In the decision, *Application by WA Gas Networks Pty Ltd (No 3) [2012] ACompT 12 (8 June 2012)*, the Tribunal also relevantly commented:

> *The critical issue is whether the ERA's determination of the MRP at 6% was reasonably open to it on the evidence. It made this determination after reviewing considerable material submitted to it by ATCO and material sourced by the ERA. This material was not conclusive as to the best single forward-looking estimate of the MRP. Accordingly, the ERA had to exercise its discretion in deciding on the appropriate MRP.*
>
> *As noted, the MRP is a forward-looking estimate. There is no single accepted econometric, mathematical or financial technique that can, uniquely, be deployed to ascertain an estimate of the MRP that can apply to any future period. Further, there are substantial debates among the*

> *experts as to how particular methodologies should be employed and the assumptions that are necessary to drive them effectively. These choices of methodologies and assumptions can significantly alter the resulting estimate.*

In recent decisions, the QCA has applied four methods to estimate the (Officer) market risk premium[44]:

(a) *Ibbotson historical averaging method* – an historical averaging method that measures the nominal, historical (excess) market return above the risk-free rate

(b) *Siegel historical averaging method* – an historical averaging method where the market risk premium estimated from the Ibbotson method is adjusted for the effects of unexpected inflation

(c) *Survey evidence / independent expert reports* – a method that seeks a forward-looking estimate of the market risk premium from academics, financial analysts, company managers, and other market practitioners

(d) *Cornell dividend growth model* – a forward-looking method that applies a variant of the dividend growth model, where the market return is the rate of return that reconciles the current value of the market portfolio with the present value of the expected future stream of dividends.

The QCA has reported both the mean and the median estimates resulting from applying these methods.

Each of these methods is now reconsidered in light of the QCA's methodology review and stakeholder submissions.

Historical averaging

The most common method for estimating the forward-looking market risk premium is based on historical averaging.

This section considers two approaches:[45]

(a) Ibbotson historical averaging method

(b) Siegel historical averaging method.

Ibbotson historical averaging method

Background

The Ibbotson method assumes that an average over an appropriate historical period is a relevant estimate of the market risk premium for the regulatory period under consideration.[46] If the average does not change over time then using this method to estimate the market risk premium will result in the cost of equity varying one-for-one with movements in the risk-free rate.

Strengths of the method are that it is relatively simple, replicable, and easy to understand. It also has reasonably broad support from academics and practitioners as a basis for estimation. Limitations include that the method, by assumption, utilises the ex post realised return on the market portfolio and the risk-free rate to generate an estimate of the ex ante expected premium.

Application of the method

The Ibbotson market risk premium for a given year is the actual ex post market return less the return on the risk-free asset (typically a government bond or bill). An average estimate is based on a number of

[44] The first three methods take into account the value of dividend imputation credits (discussed later).
[45] The 'Wright method' proposed by some stakeholders is also a type of historical averaging but is discussed later.
[46] Although there may be factors that could move the forward-looking market risk premium above or below the long-term average, the approach used to date has not attempted to quantify them.

years. In the context of the Officer CAPM variant, the Ibbotson market risk premium is defined as indicated in equation (11) above, except that the expected return on the market portfolio is replaced with the *actual* rate of return on the market portfolio for a year, comprising dividends and capital gains (and where the other parameters are defined as previously).

The QCA uses the Brailsford, Handley and Maheswaran (2008, 2012) data series as the basis for estimating the historical market risk premium. From 1987 to the present, adjustments for dividend imputation are made based on using the data in Brailsford, Handley and Maheswaran (2012) and the estimates of the market risk premium that they provide for a range of values of the utilisation rate.[47]

Stakeholder submissions

Stakeholders generally supported using the Ibbotson methodology to estimate the market risk premium, although they proposed materially different estimates. On behalf of Aurizon Network, Bishop and Officer supported an arithmetic mean estimate of 7.0%, based on long-run data over 1883–2011 and over the more recent period, 1958–2011 (Bishop & Officer, 2013a: 19–20, Figures 1–2).[48]

In contrast, the QRC submitted that the available evidence supports an Ibbotson estimate of no more than 6.0%. The QRC noted support for an historical long-run average of 4.9%–6.1% based on arithmetic averaging.[49] However, they also observed that estimates are also declining over more recent periods: 6.0% (1883–2011), 5.5% (1937–2011) and 4.3% (1988–2011) (McKenzie & Partington, 2013b: 23).[50]

Stakeholders also expressed concerns with either features of the methodology or data.

Features of the methodology

SFG Consulting raised the concern that the Ibbotson method is only capable of producing estimates that reflect an average of the market premium over the entire historical period examined rather than an estimate of the market risk premium that is consistent with prevailing market conditions (SFG Consulting, 2013a: 2).

A related concern raised is that the above feature of the methodology is aggravated by the fact that, if the market risk premium changes, it drives equity prices and historical average returns in opposite directions. SFG Consulting summarised this particular concern with the method as follows (SFG Consulting, 2013a: 2–3):

> *In general, the mean of historical excess returns moves in the opposite direction to the risk premiums that are commensurate with the prevailing conditions in the market for funds. When risk premiums rise, stock prices fall and the historical mean falls, and when risk premiums fall, stock prices rise and the historical mean rises. Consequently, the mean of historical excess*

[47] For 1883-2010 (i.e. 128 years), Brailsford, Handley and Maheswaran report the market risk premium relative to long-term bonds as .064 for a utilisation rate of one (U=1.0) (Brailsford, et al., 2012: 242, Table 3). Based on the data in the appendix, the market risk premium with a utilisation rate of zero (i.e. U=0) is .06125. The effect on the average market risk premium with full utilisation (U=1.0) is then .064 – .06125 = .00275. Therefore, the effect for the QCA's preferred estimate of the utilisation rate (U = .56) is (.56)(.00275) = .00154. So the market risk premium for U=.56 is .06125 + .00154 = .06279 for the period 1883–2010 (based on 10-year bonds). This type of interpolation process is also used to infer an annual imputation adjustment in order to extend the data series to 2013, as Brailsford, Handley and Maheswaran (2008, 2012) do not report the annual imputation increments separately. The same process is used to adjust the Siegel and Wright estimates for imputation.

[48] Unless stated otherwise, mean estimates presented in this appendix are arithmetic means.

[49] The QRC also noted that the comparable, long-run geometric average is 3.0%–4.7%. Both arithmetic and geometric ranges are drawn from Handley (2012, Table 2) and are based on a utilisation rate of 0.35 for dividend imputation credits.

[50] These estimates are drawn from Handley (2012, Table 1) and do not include any adjustment for dividend imputation. Standard errors are respectively .015, .023, and .038.

> *returns does not provide an estimate of MRP that is commensurate with the prevailing conditions in the market for funds, but rather one that is commensurate with the average conditions in the market over the historical period.*

Other stakeholders, including the QRC and Professors McKenzie and Partington (2013b) contended that estimates from the Ibbotson methodology are biased upward due to 'survivorship'. Survivorship bias occurs because long-run estimates are obtained from markets free from major structural breaks such that average ex post returns exceed their expectations (i.e. failed firms drop out of the underlying data sample used to estimate the market risk premium). The QRC and McKenzie and Partington also argued that, as Ibbotson estimates are likely to be biased upward due to 'survivorship', they should be treated as an upper bound (QRC, 2013b: 13–14).

Data concerns

The second concern raised is that there is a potential error in a subset of the time series data from Brailsford, Handley and Maheswaran (2008, 2012) used by the QCA and other regulators. In forming their estimate of the market risk premium for Australia, Brailsford Handley and Maheswaran (2008) use dividend yield data from Lamberton (1958) over 1883-1957 but reduce the dividend yields by 25% to account for two sources of upward bias.[51] The 25% downward adjustment was applied by the Sydney Stock Exchange (SSE) and tested for reasonableness by Brailsford, Handley and Maheswaran (2008).

SFG Consulting argued that further testing of the time series undertaken by NERA Economic Consulting (NERA) indicates that the downward adjustment should have typically been less than 25%. NERA concluded that a more appropriate adjustment would have led to the average dividend yield being 0.63% higher in the years 1883-1957 than estimated by Brailsford, Handley and Maheswaran (2008) (NERA, 2013b: 16). SFG Consulting submitted that adopting NERA's adjustment results in an Ibbotson market risk premium over the entire historical time series (i.e. 1883-present) of 6.6% based on a utilisation rate of 0.625 (SFG Consulting, 2014a: 34).

The QRC submitted that it is unaware of any errors in the Brailsford, Handley and Maheswaran (2008, 2012) historical data. The QRC considered that any possible errors have already been corrected and that no further corrections are required (QRC, 2014: 8; Anglo American, 2014: 7).

QCA assessment

Ibbotson estimates proposed ranged from 3.0%–7.0%, the lower bound being based on the QRC's geometric average and the upper bound based on analysis by Bishop and Officer.

Features of the methodology

Bishop and Officer and SFG Consulting effectively raised two related methodological concerns:

(a) Because historical averaging produces estimates that are slow to change over time, a long-term estimate might not reflect current financial market conditions.

(b) The effect in (a) is aggravated when prevailing conditions in the market are particularly adverse or particularly buoyant, as the historical average premium moves in the opposite direction from the 'true' premium — for example, adverse market conditions lower returns, which reduce the long-term average while the true premium is actually higher due to greater equity risk.

The QCA accepts the concern that the Ibbotson estimate (and other historical estimates) are slow to change over time. This concern is essentially a point about the statistical trade-off between bias and

[51] The first is that Lamberton (1958) uses an equally-weighted rather than a value-weighted index, which will bias the (average) yield upward as small, high-yielding equities are attributed equal weight (so have undue influence). The second is that the Lamberton series excludes zero-dividend equities. As the series only includes dividend-paying equities, the yield is too high as not all equities pay dividends.

variance in an estimator. This is because reliance on more recent or current information is likely to reduce bias, but given the limited number of observations, increase the variance of the estimate. To address this limitation, the QCA has considered a range of information (discussed elsewhere in this appendix).

The QCA agrees that the 'aggravating effect' described in (b) is plausible, as it is relatively uncontroversial that volatility is greatest in adverse (i.e. depressed) economic conditions.[52] However, this effect also requires that there is a positive relationship between volatility and the market risk premium. Despite its inherent plausibility, this link is controversial on both theoretical and empirical grounds.[53]

While the literature is not unanimous on the effect of survivorship bias, there is considerable agreement that the ex post premium is upward-biased, as it is estimated from historical data that is conditioned by its survival (see Brown et al., 1995; Jorion & Goetzmann, 1999; Cornell, 1999). However, the QCA notes that the issue is how material this bias is likely to be, and the literature is mixed on this point. Earlier studies tend to show substantial upward bias but more recent research suggests only a modest upward bias.

Nonetheless, the QCA considers that examining a broader range of evidence will inform its estimate of the market risk premium and thereby better address both of these concerns.

Data concerns

The QCA has investigated the SFG Consulting concern that there is a potential error in the Brailsford, Handley and Maheswaran (2008, 2012) data series. The QCA considers that the issue in question is not one of an 'error' but whether the data reflects an appropriate adjustment. The QCA notes that the Brailsford, Handley and Maheswaran market risk premium over 1883–2013 increases 40 basis points from 6.3% to 6.7% with the NERA adjustment.

Dr Lally considered that the NERA correction is superior to the correction applied by Brailsford, Handley and Maheswaran, in the sense that NERA sampled additional periods in the times series spanning 1883–1957. However, at the same time, Dr Lally also considered that the correction was 'inadequate in any absolute sense', as NERA sampled only seven out of seventy-five years. Dr Lally concluded that there are likely to be other, potentially countervailing, errors of this type in older data (Lally, 2014a: 6).

The QCA also notes that, in its *Better Regulation Explanatory Statement Rate of Return Guideline* (December, 2013), the AER rejected NERA's adjustment for several reasons, including that the work of Brailsford, Handley and Maheswaran has been the subject of a peer-review process while NERA's work has not (AER, 2013e: 83). In any case, the QCA presents estimates with and without the NERA adjustment in the next section.

Sampling periods and time variation

In previous decisions, the QCA has looked principally at the Ibbotson estimate over the longest time series available in order to minimise the standard error of the estimate. The QCA considers that there are several valid reasons to look at other sample periods, relating to:

(a) the quality and relevance of data in the earlier years (i.e. pre-1958)

(b) evidence that the market risk premium is time-varying and the likelihood of structural breaks.

[52] See French, Schwert and Stambaugh (1987: 5–6).

[53] Glosten, Jagannathan and Runkle (1993) argue that time periods that are relatively more risky could coincide with periods in which investors are better able to bear particular types of risk (Glosten et al., 1993: 1779–1780). The empirical literature provides mixed findings on the nature of this relationship (see Cornell, 1999: 51–52).

The findings of the QCA's research suggest that the earlier (i.e. pre-1958) data suffers from material deficiencies:

(a) the first sub-series (1883-1936) does not include the financial sector while the 1936-1957 sub-series does include that sector, so the two sub-series are not directly comparable[54]

(b) the first sub-series (1883-1936) has narrow coverage with twelve equities in the index in 1905 and forty-seven in 1935

(c) Australian Government equity price controls were in effect from November 1941 to February 1947, so prices over this period are not market prices (Brailsford et al., 2008: 76–77).[55]

Setting aside the merits of any adjustments to data from this period, the QCA considers that these documented data quality issues highlight the fragility of earlier data. On this point, Brailsford, Handley and Maheswaran state (Brailsford et al., 2008: 94):

> *We find that concerns about data quality become increasingly important the further back into the past one looks and, in particular, there are sufficient deficiencies in data quality prior to 1958 to warrant any estimates based thereon to be treated with caution.*

However, a potential weakness of the older data is the extent to which it is relevant. Key developments over the last half of the twentieth century that are likely to have materially impacted risk and expected returns include:

(a) accelerated technological change, unprecedented growth in productivity, and significant advances in business management and corporate governance (Dimson et al., 2003: 14)

(b) lower business risk resulting from increased opportunities for market diversification and reduced barriers to international investment and trade (Dimson et al., 2003: 14)

(c) lower transactions and monitoring costs, resulting from financial market integration and the development of financial products (e.g. mutual funds) that have made the accumulation and maintenance of a diversified portfolio less costly (Siegel, 1999: 13)

(d) the change in composition of both equity markets (i.e. equities that are listed) and in the composition of investors who are active in the market.

The likelihood that the premium is time-varying is generally well accepted (Merton, 1973). Variation over time gives rise to the possibility of significant events, or possible 'structural breaks', such as World War II.[56] In general, it is difficult to identify structural breaks given the size of the mean market risk premium estimate relative to its standard error. In other words, most statistical tests are powerless to detect a difference between sample means across proposed breakpoints.

However, more sophisticated statistical methods have detected structural breaks in the context of United States' historical returns (Pastor and Stambaugh, 2001). Even if the likelihood of a structural break is high,

[54] The 1838-1957 data comprises equity return data compiled retrospectively by Mr Don Lamberton (Lamberton, 1958) and comprises two sub-series: i) the Commercial and Industrial price index from 1883-1936; and ii) the Sydney All Ordinary Shares price index from 1936–1957.

[55] Prior to November 1941, equity market prices were not subject to government regulation. In November 1941, a special Departmental Advisory Committee was created as an arm of the Treasury and exercised power to directly regulate equity market prices until its disbandment in December 1946. Due to thin trading, index values in January 1947 were very likely based, in part, on these prices. As a result, prices were not effectively market-based again until February 1947 (Brailsford and Easton, 1991: 71).

[56] The premise of the method is that each year's market return is an independent draw from the same probability distribution. The occurrence of a structural break implies a change in the probability distribution.

this possibility does not mean that earlier data should be discarded.[57] While such practice would seem reasonable to reduce the bias from older data, it does not address the higher variance associated with a shorter time series.

QCA estimates

The QCA has therefore examined Ibbotson historical excess return estimates over a number of different sampling periods. Estimates presented in Table 2 are based on arithmetic averages. While the QCA notes that the QRC has previously presented geometric averages (as well as arithmetic), the QCA does not consider that geometric means are consistent with applying the CAPM in a regulatory context (as discussed in Appendix C, Technical Annex).

The estimates are based on a 10-year risk-free rate and include an adjustment for dividend imputation in relevant years to reflect the QCA's preferred utilisation rate of 0.56.

Table 2 Ibbotson historical mean excess returns (U = 0.56)[58]

Sample period	*Arithmetic mean*[a]	*Std Error*	*95% C.I. — lower bound*	*95% C.I. — upper bound*
1883–2013	.063	.015	.035	.091
1937–2013	.060	.022	.016	.104
1958–2013	.065	.030	.007	.124
1984–2013	.062	.036	–.008	.131
1988–2013	.060	.036	–.011	.130

[a] *Brailsford, Handley & Maheswaran (2008, 2012); QCA analysis.*

The QCA considers that there are strengths and weaknesses associated with each sample period:

(a) The start of each sample period corresponds either to a fundamental shift in increasing data quality (1937 and 1958) or to an important structural event (the Australian dollar float (1984), or the first full year of dividend imputation (1988))[59]

(b) The three later series (1958–2013, 1984–2013, 1988–2013) are based on materially higher quality data (Brailsford, et al., 2008: 73)

(c) The longer time series (1883–2013, 1937–2013) have more observations and provide more statistically precise estimates relative to the shorter series, but the very early data in the first part of each series is less likely to be relevant to financial markets today

(d) The more recent series (1984–2013, 1988–2013) have lower precision and are more susceptible to market cyclicality and the effect of 'one-off' events

[57] For example, Pastor and Stambaugh (2001) observe that a long return series is useful in estimating the current premium as long as there remains a positive relationship between the equity premium and volatility across sub-periods.

[58] The utilisation rate of 0.56 is consistent with the preferred estimate of 0.47 for gamma.

[59] The year 1937 is the first year in which data are available on both a broad equity index (i.e. the Sydney All Ordinary Shares price index), and the year 1958 is the first year in which the Sydney All Ordinary Shares price index was calculated on a daily, rather than retrospective, basis. The Australian dollar was floated in December 1983, and the first full year of dividend imputation was 1988 (dividend imputation became effective 1 July 1987).

(e) The more recent series (1984–2013, 1988–2013) reflect financial market innovations and conditions that better align with the prevailing financial market landscape.

The different periods produce estimates spanning 6.0%–6.5%, and estimates for the last thirty years are lower. While some consideration should be given to each sample period — as each has different strengths and weaknesses — the QCA notes that the 1958–2013 sampling period provides the advantage of being the longest time series available that is wholly comprised of materially higher quality data.

The QCA notes that applying the NERA adjustment would only affect the estimates for the periods 1883–2013 and 1937–2013, which would increase from 6.3% to 6.7% and from 6.0% to 6.2% respectively.[60] This would change the range from 6.0%–6.5% to 6.0%–6.7%.

Conclusion

In summary, the Ibbotson historical averaging method for the market risk premium produces estimates ranging from 6.0% to 6.7%, depending on the particular historical series chosen. The estimate over the longest period of high quality data (i.e. 1958–2013) is 6.5%.

Siegel historical averaging method

The Siegel (1992) method is a variant of the Ibbotson methodology, based on the premise that historically, unexpected inflation has reduced the observed real return on bonds but not the real return on equities.

In the context of the United States, Siegel demonstrates that over the sub-period, 1926-1990, the Ibbotson estimate of the market risk premium is atypically high due to the unusually low real returns on bonds during that period from unexpected inflation. As only expected inflation is relevant for forming an estimate of expected real returns, Siegel argues that the Ibbotson estimate is biased upward when estimated from data in that sub-period.

Siegel's method, therefore, involves replacing the (historical) average real bond yield implicit in the Ibbotson estimate with an estimate of the expected long run real bond yield. The Siegel market risk premium (MRP_{SG}) is then calculated as:

(12) $$MRP_O^S = MRP_O + (\overline{r_f} - r_f^e)$$

where MRP_O^S is the estimate of the market risk premium in the Officer (1994) model using Siegel's method, $\overline{r_f}$ is the average long-run, real risk-free rate and r_f^e is the expected long-run, real risk-free rate. The term in brackets adjusts the Ibbotson market risk premium estimate for unexpected inflation, which should not be recognised in a measure of expected returns.

Stakeholder submissions

The QCA received competing submissions on Siegel's method.

The QRC and also McKenzie and Partington (2013b) supported including the Siegel method in the set of estimation methods. As the Siegel method is an historical approach, the QRC again contended that it should be interpreted as an upper bound due to survivorship bias (QRC, 2013b: 13–14; McKenzie and Partington, 2013b: 13).

However, other stakeholders raised objections to the Siegel method or estimates arising from it.

[60] Making the NERA adjustment results in an average increase of .63% over the period to which it applies (i.e. 1883–1957). For the full sample (1883–2013), this sub-period includes (75/131) of the total observations. Therefore, the average market risk premium over the entire period increases by (75/131)(.0063) = .0036 or from .0630 to .0666 (.063 to .067, rounded). The 1937–2013 period includes 21 observations that are affected, which increases the average premium over the entire period by (21/77)(.0063) = .0017 or from .0600 to .0617 (.060 to .062, rounded).

SFG Consulting (on behalf of Aurizon Network) and NERA (on behalf of United Energy and Multinet Gas) claimed that the QCA either used outdated data or made computational errors:

(a) SFG Consulting claimed that a current estimate of 1.0% should be used for the 'current forward-looking' real risk-free rate, with the effect being to increase the Siegel estimate by 1.0% (SFG Consulting, 2013b: 20)

(b) NERA claimed that the QCA made a computational error in calculating the Siegel estimate, specifically that the QCA should have reported an estimate of 4.11% rather than 4.32% (NERA, 2013a: 32).

SFG Consulting and NERA both questioned whether the justification for adjusting the market risk premium for the effects of unexpected inflation has been sufficiently established. SFG Consulting argued that singling out unanticipated inflation was selective and the whole point of using a long time series of data is that factors that cause equity returns to rise and to fall will 'average out' over time. As a result, SFG Consulting concluded that it is better to use the historical data 'as it is', rather than to adjust the data to reflect what it would have been if certain events or phenomena had not occurred (SFG Consulting, 2013b: 19).

NERA questioned whether historical inflation actually turned out to be higher than expected, on average, relative to the market's expectations at the time. NERA presented two United States' surveys of professional inflation forecasters using one-year-ahead forecasts of inflation that allegedly show there is no systematic tendency to under or over estimate inflation on average — in other words, the effect averages out.[61] Additionally, NERA made the point that bond returns, rather than bond yields, are more sensitive to unexpected inflation — as a result, to the extent the QCA uses (government) bond yields, any impacts on unexpected inflation will be limited (NERA, 2013a: 29-32).

SFG Consulting and QTC argued that a relevant consideration is that other Australian regulators do not use the Siegel method and less than half of one per cent of survey respondents cited this method as informing their estimate of the market risk premium (SFG Consulting, 2013b: 21; QTC, 2013: 12).

QTC also contended that, if the QCA is concerned about the effects of unanticipated inflation, an appropriate approach would be to directly estimate the expected return on the market portfolio by adding an estimate of current, expected inflation to the long-run average real return on equity (i.e. the 'Wright method') (QTC, 2014: 12–14).

Finally, SFG Consulting suggested that, if the QCA choose to retain the Siegel approach, an appropriate estimate is 5.4%[62]. SFG Consulting's estimate is based on an Ibbotson estimate of 6.6% (inclusive of the NERA adjustment) over the period, 1883–2013, a long-run average real risk-free rate of 2.4%, and a long-run average expected real risk-free rate of 3.6% (i.e. 6.6% + 2.4% – 3.6% = 5.4%) (SFG Consulting, 2014a: 38).

QCA position

The QCA's position is that the Siegel method is a valid and relevant methodology for estimating the market risk premium. As explained in detail below, the QCA does not find the 'in principle' and empirical arguments against the Siegel method to be compelling. Detailed responses to specific stakeholder concerns are set out in the remainder of this section.

The QCA's consultant, Dr Lally, has investigated claims concerning the use of outdated data or computational error and concluded that neither claim is correct (Lally, 2013c: 12, 30).

[61] These surveys are the Livingston survey and the ASA-NBER survey.

[62] This estimate assumes a utilisation rate of 0.625 for the imputation credit adjustment (SFG Consulting, 2014a: 38).

SFG Consulting contended that a current real risk-free rate of 1% should be used in the Siegel method. However, the relevant parameter from Siegel (1992) is in fact the 'expected long-run' real risk-free rate. As the parameter value required is a long-run estimate to use in conjunction with a long-run historical time series, the QCA used the average yield on inflation-indexed Commonwealth Government bonds from 1986–2012, the longest series available — the mean yield was 3.8%.

Dr Lally confirmed that the QCA's computation is correct but identified that the average historical real bond yield of 1.9% was drawn from 1900-2012, when it should have been drawn from the same time period as the data for the Ibbotson estimate (1883–2012) (Lally, 2013c: 30).[63] Making this adjustment (i.e. substituting 2.4% for 1.9%) results in a Siegel estimate (as at November 2012) of:

(13) $$MRP_O^S = .0621 + (.024 - .038) = .0481.$$

This estimate is about 0.6% higher than the estimate reported in the QCA's discussion paper but does not affect the final (rounded) estimate of 6.0% presented in that paper.

SFG Consulting contended that it is better to use the historical data 'as it is' rather than to adjust the data to reflect what would have been if certain events or phenomena had not occurred. However, the relevant concept is that of the expected return on the market portfolio. While the Siegel adjustment is not definitive, Siegel and others (e.g. Gregory (see below)) have undertaken research that justifies this particular adjustment. However, as all methods have limitations, the QCA also examines the Ibbotson results (as well as other evidence).

On this point, Siegel (1992) documents the materiality of persistent unanticipated inflationary impacts on government bond yields for the United States, and similar patterns are evident in other economies. For example, Gregory (2011) shows that over the period 1900–2006 in the United Kingdom, most of the variation in realised real returns on gilts arose from unanticipated inflation shocks (Gregory, 2011: 12–13; Table 2).

For Australia, Lally (2014a) presents evidence that inflation has been a material factor in terms of its persistent and unanticipated impacts on real bond yields over a substantial period of the historical time series. Specifically, Lally (2014a) observed that Australia's inflation experience can be divided into three major sub-periods — 1883-1939 (0.9%), 1940-1990 (6.4%), and 1991-2013 (2.5%). The corresponding average real yields on 10-year government bonds were 3.5%, 0.7%, and 3.5% respectively. In the high inflation sub-period, the (average) real yield is substantially below the real yield from the previous sub-period, which indicates 10-year inflation forecasts being too low during the high inflation sub-period (Lally, 2014a: 11).

Given this evidence, the QCA considers that the Siegel method is a relevant methodology — inflation is a significant macroeconomic variable, its impact was persistent over a substantial period in Australia, and the unanticipated effects did not 'average out'.

NERA (2013a) presented results from two surveys from the United States that report one-year ahead forecasts of inflation and considers that neither survey under estimates or over estimates inflation (NERA, 2013a: 30). However, Lally (2014a) argued that, even if one-year forecasts on average are correct, this does not imply that 10-year ahead forecasts will also be correct on average — and the latter are the forecasts that are relevant (as the focus is on 10-year government bond yields) (Lally, 2013c: 28-29; 2014a: 11).

In response to NERA's point about the limited impact of persistent inflation on bond yields (as opposed to returns), the QCA agrees that the impact will be less on yields. However, the key point is not whether inflation impacts the market risk premium estimate more when returns are used (as opposed to yields)

[63] This was due to a data transcription error.

but whether inflation has persistently impacted bond yields. As a result, the QCA does not agree with NERA on this point.

Evidence that underestimation of the future 10-year inflation rate occurred over a much longer time period than overestimation once inflation subsided is evident in Figure 1 (next section). Specifically, the 30-year moving average real yield on ten-year bonds averaged about 3.0% up to about 1950, when it then dropped precipitously due to higher inflation. It did not revert to the 3.0% level for about fifty years and then only exceeded it modestly starting in about 2002 (Lally, 2013c: 29).[64]

Additionally, some stakeholders argued that regulators (aside from the New Zealand Commerce Commission) and over 99% of survey respondents do not use the Siegel method to inform their estimates. In addition to the points made by Lally (2014a) in response to these arguments, the QCA simply notes that these arguments are not relevant, as the QCA's practice is to assess proposed methods on their merits — the QCA's view is that the Siegel method has merit.

QCA estimates

The Siegel estimate of the market risk premium requires adjusting the Ibbotson estimate, as indicated in equation (12). The historical average real bond yields are drawn from the Brailsford, Handley and Maheswaran (2012) bond return series and inflation series (Brailsford, et al., 2012: Appendix) and updated through 2013. For the estimate of the long-run, expected real bond yield, the QCA applied the average real yield on inflation-indexed bonds over the period since their issue (July 1986–December 2013), and the estimate is 3.7%.[65] Inserting these inputs into equation (12) gives the results in Table 3.

Table 3 Siegel historical mean excess returns (U = 0.56)[66]

Sample period	*Arithmetic mean*[a]
1883–2013	.050
1937–2013	.039
1958–2013	.055
1984–2013	.065
1988–2013	.060

[a] *Brailsford, Handley & Maheswaran (2008, 2012); QCA analysis.*

For reasons discussed under the Ibbotson approach, the QCA has considered all of these sample periods and notes that the estimates range from 3.9%–6.5%. Applying the NERA adjustment would affect the estimates for the periods 1883–2013 and 1937–2013, which would increase from 5.0% to 5.4% and from 3.9% to 4.0% respectively. With the NERA adjustment, the overall range would become 4.0%–6.5%.

Conclusion

In summary, the Siegel method supports a market risk premium estimate ranging from 4.0% to 6.5% for all sample periods, depending on the particular historical series chosen. The estimate over the longest period of high quality data (i.e. 1958–2013) is 5.5%.

---

[64] Inflation targeting by the RBA commenced in 1993 (shortly after the end of the high-inflation period (1940-1990)) and is one plausible explanation for the rapid subsidence of long-run inflationary expectations. This period precedes the high inflation period of 1940–1990.

[65] It is considered reasonable to extrapolate this estimate to the earlier periods as it is close to the average real risk-free rate of 3.5% from 1883–1939. (This period precedes the high inflation period of 1940–1990.) For the period 1988–2013, the average real yield of 3.6% was applied.

[66] The utilisation rate of 0.56 is consistent with the preferred estimate of 0.47 for gamma.

Survey evidence / independent expert reports

Methodology and approach

The survey approach attempts to estimate the future market risk premium on the basis of survey responses from relevant participants. These can include individual and institutional investors, independent valuation experts, financial analysts, company managers and academics.

Strengths are that the method seeks a respondent's expectation of the market risk premium, and in this sense, it aligns with the CAPM and is forward-looking. Limitations of surveys include survey design and sampling issues, such as sample size, the representativeness of the respondents, and non-response rates.

Stakeholder submissions

As a general point, Aurizon Network and QTC raised a number of general concerns with using survey data to inform an estimate of the market risk premium, namely:

(a) issues with survey design

(b) stability of survey responses

(c) adjustments for dividend imputation credits.

Aurizon Network's consultant, SFG Consulting, cited McKenzie and Partington's advice to the AER on surveys, which identified a number of potential problems with survey designs. These problems ranged from the wording of survey questions to the relevance of some surveys to the regulatory context (SFG Consulting, 2013a: 19). Additionally, QTC made the point that survey questions typically do not provide information on how the respondents intend to use their estimates of the market risk premium to determine the return on equity (QTC, 2013: 13).

SFG Consulting criticised the QCA's reliance on a single survey (i.e. the Fernandez survey) and observed that it did not meet criteria set out recently by the Tribunal, specifically that surveys should be:

(a) timely — any survey should reflect market conditions at that time; for example, as government bond yields were below 3.0% (at the time of drafting), a survey administered in materially different market conditions cannot produce a reliable estimate

(b) clear with respect to the questions in the survey so there is no ambiguity in interpreting responses

(c) reflecting the views of the market and not a sample that is small, unrepresentative, or without relevant expertise.

The second concern raised was that survey results (in particular, the Fernandez survey results) tend to be 'slow-moving' and, therefore, very stable over time. SFG Consulting observed that, this survey has produced consistent estimates of about 6.0%, over a period since 2007 spanning the last year of a bull market and the peaks of the GFC and European sovereign debt crises. SFG Consulting also noted that the majority of the respondents to the 2012 and 2013 Fernandez surveys have reported that they based their estimates on the Ibbotson estimate, historical data or textbooks (SFG Consulting, 2014a: 42–43).

The third concern was that the Fernandez surveys do not reference imputation credits. SFG Consulting interpreted this omission to mean that the survey estimates of the market risk premium exclude an adjustment for imputation credits.

Given these concerns, SFG Consulting concluded that the Fernandez surveys should not be used (SFG Consulting, 2014a: 41–44).

SFG Consulting contended that the QCA should place some weight on independent expert valuation reports (SFG Consulting, 2013a: 20-21; Gray, 2013: 9). SFG Consulting previously examined thirty-four

expert reports from the 2012–13 period and found a mean market risk premium estimate of 6.4% was applied in conjunction with an average uplift of .50% applied to the risk-free rate.

As a result, SFG Consulting concluded that a 6.9% market risk premium would have to be paired with a current government bond yield to obtain the same cost of equity for the average firm as independent experts. Applying SFG Consulting's preferred method to adjust for the value of imputation credits (gamma of 0.25) results in 6.4% and 6.9% increasing to 7.5% and 8.1% respectively (SFG Consulting, 2014a: 31–32).[67]

In contrast, the QRC contended that, although subject to limitations, surveys provide useful information on the market risk premium. The QRC noted that the most recent Fernandez survey reports a mean estimate of 6.8% and a median estimate of 5.8%. The QRC argued that the 6.8% was clearly driven by an outlier, where one respondent had provided an estimate of 25.0%. For this reason, the QRC contended that the median of 5.8% should be used and noted that the median was lower in 2013 (5.8%) than in 2012 (6.0%) (QRC, 2013b: 14; 2014: 8).

Similarly, McKenzie and Partington observed that survey evidence in Australia supports an estimate of 6.0%.[68] They also considered it important to triangulate results from Australia with those of related financial markets. In this respect, they observed that Graham and Harvey's series of surveys of United States' chief financial officers shows that estimates of the United States' market risk premium peaked in 2009 and have fallen since that time (McKenzie & Partington, 2013b: 24–25).[69]

The QRC rejected the inclusion of independent expert reports. The QRC stated that it is not familiar with the reports cited by SFG Consulting and that new data sources should only be included if they are robust (QRC, 2014: 8).

QTC considered that the QCA should consider independent expert reports. Additionally, QTC made the point that, in cases where independent experts have set the risk-free rate above the prevailing rate, this margin should be interpreted as a de facto upward adjustment to the market risk premium. QTC cited three independent expert reports in support of this practice (QTC, 2014: 15–16).

QCA position

Survey evidence

Aurizon Network, SFG Consulting and QTC were critical of surveys and contended that they suffer from a number of weaknesses. The QCA agrees with the contention that surveys have weaknesses. However, given that the market risk premium is unobservable, all valid methods have both strengths and weaknesses — the QCA considers that surveys remain a useful source of information to inform an estimate despite potential issues of survey design.

SFG Consulting identified several criteria that the Tribunal considered a survey should satisfy: the survey should be timely, clear and representative. The QCA agrees with these criteria but notes that, aside from timeliness, the other two criteria do require the QCA to exercise its judgment based on the circumstances. For example, a question that the survey designer believes is clear to one party might not be clear to another.

In addition, there could be other criteria that are relevant and could outweigh the survey's perceived shortcomings. On this point, Dr Lally considered that surveys should be timely, the product of careful

[67] SFG Consulting considered these estimates to be conservative, as some of the reports applied further uplift margins for various factors (SFG Consulting, 2014a: 31).
[68] For example, they cited KPMG (2005), Truong, Partington and Peat (2008), Fernandez, Aguirreamalloa, and Corres (2011), and Asher (2011).
[69] See Graham and Harvey (2013).

consideration, and reflect results from other markets — these criteria differ from those of the Tribunal but are also valid criteria (Lally, 2014a: 7). The QCA therefore concludes that surveys should be timely and assessed on a case-by-case basis.

SFG Consulting also raised a concern about the inherent 'stability' of the Fernandez survey estimates over time for Australia. On this point, the QCA observes that from 2008 to 2013, the median estimate fluctuated between 5.2% and 6.0%. For example, in 2010, the median estimate was 5.5% and then declined to 5.2% in 2011 before jumping to 6.0% in 2012. The most recent estimate from 2013 was 6.0% (Fernandez, Aguirreamalloa and Linares, 2013). Therefore, the estimate has changed over recent years, and in any case, this piece of evidence supports a market risk premium in the range of 5.2%–6.0%, rather than 6.0%–7.0% (Fernandez and del Campo, 2010: 4; Fernandez, Aguirreamalloa & Corres, 2011: 3; Fernandez, Aguirreamalloa & Corres, 2013: 3).

While Australian survey evidence is limited, available and relevant surveys support an estimate of 6.0%. KPMG's (2013) valuation practices survey shows that 6.0% is a common estimate used by practitioners, with only a minority using 7.0%.[70] Further, the survey authors observe that the variability around 6.0% is low in comparison to variation in reported estimates for the United States and United Kingdom in the wake of the GFC. The survey also notes that almost 70% of respondents did not revise their estimate of the market risk premium to reflect volatility (KPMG, 2013: 17–18). Both of these observations are consistent with the inference that Australia was less affected by the GFC than these countries.

As discussed, the most timely and relevant Fernandez survey is the Fernandez, Aguirreamalloa and Linares (2013) survey, which reports mean and median estimates of 6.8% and 5.8% respectively. In relation to this survey, the QCA agrees with the QRC that it is not appropriate to use the mean, as it was clearly influenced by an outlier (i.e. 25%). If the minimum and maximum responses of .03 and .25 are removed, the mean estimate falls from 6.8% to 5.8%. While this survey involved a relatively small number of responses for Australia, and should therefore be treated with caution, the Fernandez surveys contain relevant and useful information.

Dr Lally also considered that the Fernandez surveys should be used, as they are timely and report results from other markets. The latter point is also consistent with the views of McKenzie and Partington, who recommended that results can, and should, be triangulated across markets. The QCA agrees with these points, as cross-country checks provide another reference point in assessing reasonableness. Of the fifty-one countries in the survey, the median estimates for the United States and United Kingdom respectively are 5.5% and 5.0%. The median estimate for Western European countries is 5.8%. Finally, of all the developed countries in the survey, only four reported a median estimate of 7.0% or higher: Ireland, Israel, South Africa and Turkey (Fernandez, Aguirreamalloa and Linares, 2013: 3; Central Intelligence Agency (United States)).[71]

The third point raised by SFG Consulting relates to adjusting survey responses for dividend imputation credits. The QCA agrees with SFG Consulting that estimates of the market risk premium from surveys, in principle, should include the value of dividend imputation credits. To the extent that survey responses make an explicit adjustment, or are based on a source that does make an adjustment, clearly there is then no need for a subsequent adjustment to be made. Dr Lally observed that, if respondents adjust the cash flows, then presumably they would also adjust the market risk premium applied to those cash flows as well (Lally 2014a: 15). In this case, no further adjustment is warranted.

[70] It is not clear whether the reported results reflect an adjustment for imputation credits.

[71] This broader perspective is also consistent with Dimson, Marsh and Staunton (2013a), who argue that, in estimating the market risk premium, one should take a more global perspective (Dimson, et al., 2013a: 9).

However, assuming an adjustment for imputation credits is appropriate, the adjustment recommended by SFG Consulting is, in general, not correct.[72] It will, in almost all cases, materially overstate the correct adjustment. This is because SFG Consulting's adjustment formula assumes that expected returns to equity holders only take the form of dividends and imputation credits (i.e. it assumes there are no capital gains), and this assumption is completely unrealistic and also inconsistent with the empirical evidence (see Appendix C, Technical Annex).[73] The correct adjustment should be 0.18%.[74]

Given it is typically unclear as to whether the surveys in question contain such an adjustment (e.g. the Fernandez surveys), the QCA has considered the estimates without, and with, an adjustment for dividend imputation. Taking all of these factors into account, the QCA considers that survey evidence supports an estimate of about 6.0% (6.2% including imputation credits).

Independent expert reports

SFG Consulting and QTC recommended that the QCA should take into account independent expert reports, while the QRC rejected using this additional information.

The QCA agrees that independent expert reports should be taken into account. As stated by SFG Consulting, such reports are likely to be relevant, as they are prepared as part of processes that are regulated by the Australian Securities and Investments Commission and form the basis of numerous transactions involving material amounts of equity capital (SFG Consulting, 2014a: 28).

For the reasons set out in the earlier section, SFG Consulting has contended that these reports support a (base) mean market risk premium of 6.4%. SFG Consulting adjusted this base estimate to 6.9% to include a .50% average increment to the risk-free rate and then to 8.1% to include the value of imputation credits (using SFG Consulting's preferred imputation adjustment method).[75] The reports in question are discussed in a report by SFG Consulting for the ENA (SFG, 2013g) and copies were subsequently provided by SFG Consulting to the QCA, at the QCA's request.[76]

The QCA has reviewed this material, and the reports support an unadjusted mean estimate of 6.4% and a median estimate of 6.0%. The QCA considers that the median is the more relevant estimate as it protects against the influence of extreme observations (i.e. outliers). In addition, the QCA considers that estimates from these reports should be treated with some caution as they are all dated in 2012 and so do not meet the Tribunal's requirement of timeliness.

In reviewing these reports, the QCA does not agree with SFG Consulting that the estimate should be increased by 0.5% to reflect the experts' use of risk-free rates that were higher than bond rates at the time. SFG Consulting has assumed that the risk-free rate uplift is a de facto increment to the market risk premium. As noted by Dr Lally, there are other reasons the experts could have added an uplift factor to the risk-free rate. For example, it is plausible that some valuers added an increment to recognise the point that unobserved rates beyond 10 years are likely to be higher than the prevailing 10-year rate (Lally, 2014a: 14).

---

[72] SFG Consulting's proposed adjustment is presented in equation (30) in the technical annex of this appendix.

[73] Handley (2010a) raises similar concerns with SFG Consulting's proposed adjustment method (Handley, 2010a: 19–20).

[74] As shown in the technical section, this estimate is the product of the utilisation rate, the maximum attachment rate $[T_c/(1-T_c)]$ and the proportion of dividends fully franked. The QCA's preferred utilisation rate is 0.56, the statutory corporate tax rate (T_c) is 0.30, and the proportion of dividends fully franked is 0.75 (Brailsford et al., 2008: 85). Therefore, the imputation adjustment is (.56)(.3/.7)(.75) = .18.

[75] In SFG Consulting's adjustment formula (presented in equation (30)), the assumed value of gamma is 0.25, comprising a utilisation rate of 0.35 and a distribution rate of 0.70. SFG Consulting also noted that the 6.9% would increase to 9.24% if gamma is set to 0.50 rather than 0.25 (SFG Consulting, 2014a: 32).

[76] There are a total of 28 reports.

On this point, the QCA notes that QTC cited several specific valuation reports in support of its view that margins over the risk-free rate reflect de facto uplifts to the market risk premium (QTC, 2014: 15–16). However, Dr Lally found that only one report provided a clear statement supporting QTC's claim and contended that the statements in the other reports could be interpreted differently (Lally, 2014a: 21–22). The QCA also does not find this evidence persuasive.

As discussed previously, the QCA does not agree with the proposed form of the adjustment for imputation credits. The adjustment formula assumes that expected returns to equity holders only take the form of dividends and imputation credits (i.e. it assumes there are no capital gains) (Lally, 2014a: 14). Applying the adjustment of .18% (based on the correct formula) increases the median estimate from 6.0% to 6.2% (rounded from 6.18%).[77]

Conclusion

Relevant survey evidence and independent expert reports support an estimate of the market risk premium of 6.0%. Adjusting the estimate for dividend imputation credits increases the estimate to 6.2% (rounded).

Cornell dividend growth model

Forward-looking estimation techniques do not rely on historical data but invoke current information and/or forecasts. The typical starting point for such an approach is the Dividend Growth Model. In general, dividend growth estimates are obtained by finding a value of the expected return on the market portfolio that reconciles the current value of the market portfolio with the present value of the expected stream of future dividends.

A strength of dividend growth models is that they are strongly based on well established finance theory. They also use current data and estimate a market return on equity that is forward-looking and, therefore, more congruent with the CAPM's requirements. Limitations are that equity prices and dividend forecast growth rates change relatively often and, therefore, model results can vary substantially over time. In addition, the model can be sensitive to changes in input parameter values (e.g. the growth rates).

Application of the method

Starting with the general context of Gordon and Shapiro (1956), the current value of the market portfolio is:

$$(14) \quad P_m = \sum_{t=1}^{N} \frac{DIV_m(1+g_1)\ldots(1+g_t)}{(1+r_m)^t} + \frac{E(P_N)}{(1+r_m)^N}$$

where P_m is the current value of the market portfolio, DIV_m is the current level of cash dividends on the market portfolio, r_m is the expected rate of return on the market portfolio, and g_1, g_2,...g_N are the forecast growth rates in cash dividends to existing equity holders. At year N, the expected growth rate converges to the long-run growth rate in dividends per share (g), and it is constant thereafter.

The expected value of the market portfolio can be expressed in terms of the value of the expected dividend stream and equation (14) rewritten accordingly:

$$(15) \quad P_m = \sum_{t=1}^{N} \frac{DIV_m(1+g_1)\ldots(1+g_t)}{(1+r_m)^t} + \frac{\frac{DIV_m(1+g_1)\ldots(1+g_N)(1+g)}{r_m-g}}{(1+r_m)^N}$$

Defining D_m as the current dividend yield on the market portfolio and dividing through both sides by P_m gives:

[77] This estimate is the product of the utilisation rate, the maximum attachment rate $[T_c/(1-T_c)]$ and the proportion of dividends fully franked, i.e. (.56)(.3/.7)(.75) = .18.

$$(16) \quad 1 = \sum_{t=1}^{N} \frac{D_m(1+g_1)\ldots(1+g_t)}{(1+r_m)^t} + \frac{\frac{D_m(1+g_1)\ldots(1+g_N)(1+g)}{k_m-g}}{(1+r_m)^N}$$

The current market dividend yield is observable but must be adjusted for dividend imputation in Australia. The usual approach for estimating the expected growth rate in dividends per share in existing companies is to use analysts' current forecasts of dividends per share growth rates over the next few years as a proxy for these initial growth rates. The long-run growth rate is typically the long-run growth rate in GDP, comprising the long-run growth rate in real GDP and expected inflation.

However, two important and related methodological issues arise in terms of specifying the model further, namely the:

(a) period over which the short-run forecast growth rates converge to the long-run growth rate

(b) appropriate adjustment to the long-run growth rate for the formation of new companies and issuance of new shares.

Cornell (1999) argues that the short-run forecasts of the dividend growth rate are materially higher than reasonable estimates of the long-run growth rate in GDP, which introduces an inconsistency. Specifically, while existing companies' dividends might grow at a rate greater than the growth rate of the economy for several years, or even some time, such a situation is unsustainable on an indefinite basis. This is because dividends in absolute terms would eventually overtake GDP in absolute terms, and this outcome is not possible. The critical condition, therefore, is that the long-run growth rate in dividends per share eventually declines to the long-run growth rate of the economy (or less) at some point in the future (Cornell, 1999: 106).

Accordingly, Cornell (1999) argues that there must be some type of convergence of these short-run growth rates to the long-run growth rate of the economy over a period of time. Cornell (1999) suggests a period of 20 years, but the correct convergence period is unknown. Once convergence occurs, then the growth rate of dividends is assumed to occur at the same nominal rate as the economy (Cornell, 1999: 106-107). As a result, assumptions must be made about the number of years until convergence and the type of transition path (e.g. linear, etc.).

Related to this point is the long-run expected GDP growth rate. This rate is the rate for the long-run expected growth in dividends on current shares in existing companies. However, aggregate dividends paid in a future year (t>0) are distributed among: existing shares (at t=0); shares in existing companies that are issued in the future; and shares issued by new companies formed in the future. Therefore, the long-run growth rate in the aggregate dividends of existing firms must be less than the long run growth rate in GDP in order to accommodate new equity share issues and the formation of new firms over time. As a result, the estimates produced will be biased upward unless an explicit, downward adjustment is applied to the long-run growth rate of GDP (Lally, 2013e: 14–15).

Arnott and Ryan (2001) argue that the growth rate in dividends of current firms must be lower than the growth rate of GDP due to the 'dilution effect' from the creation of new firms in the future. They estimate that the dilution effect by itself reduces the expected growth rate by about 1.0%-2.0% (Arnott and Ryan, 2001: 67).

Bernstein and Arnott (2003) subsequently consider both this point and the matter of new share issues (net of share buybacks) and argue that taking both points into account reduces the expected growth rate by about 2.0% based on two comparisons. They first note that for a number of countries over the last century real GDP growth grew faster than the real growth rate in dividends per share by about 2.0%.

Second, they observe that the growth rate in market capitalisation grew at an annualised rate of 2.3% more than the growth in a capitalisation-weighted price index (Bernstein and Arnott, 2003: 50–52).[78,79]

However, Lally (2013e) considered that the 2.0% deduction is too high for several reasons and proposed a deduction of 1.0% as being reasonable.[80] As a result, if the long-run expected growth rate in real GDP is assumed to be 3.0% and expected inflation is assumed to be 2.5% then a 1.0% deduction implies a nominal, long-run growth rate of GDP of 4.6%.[81]

The QCA has typically presented estimates without an explicit adjustment but when doing so has qualified such estimates as being upper bounds.

Stakeholder submissions

Unitywater, QUU, Aurizon Network and QTC considered that dividend growth models provide relevant estimates of the market risk premium (SFG Consulting, 2013d: 25; QTC, 2014: 10; SFG Consulting, 2013b: 24).

SFG Consulting, on behalf of Unitywater, QUU and Aurizon Network, initially proposed a market risk premium estimate of 8.5% (including imputation credits) based on the Nelson–Ferrarone–McGuire multi-stage model (Nelson, Ferrarone & McGuire, 2012) and noted that estimates from this model suggest that the market risk premium is currently higher than at any point in the last twenty years (SFG Consulting, 2013a: 24). SFG Consulting, however, subsequently proposed an estimate of 8.25%, based on a range of 7.0%–9.5% estimated by Dr Lally as at December 2012 (SFG Consulting, 2014a: 39-40; Lally, 2013c: 59–60).[82]

QTC observed that, from a conceptual perspective, the implied cost of equity from the dividend growth model produces the most appropriate forward-looking estimate of the expected return. However, QTC considered that, in practice, different assumptions about the inputs can lead to a wide range of results from the model (QTC, 2014: 10).

QTC supported estimates from a SFG Consulting dividend growth model, as the model seeks to address the input sensitivity issue by jointly estimating the long-run expected growth rate in dividends per share, the long-run expected rate of return on new equity investment and the cost of equity (QTC, 2014: 9–10). QTC considered this approach to be an advantage, as the long-run expected growth rate in dividends per share is not an input, which reduces controversy over this parameter value. The visual evidence presented by QTC indicates an implied cost of equity that varies in the range of about 10%–11.5% from December 2002 to June 2013 (QTC, 2014: 10).

NERA, on behalf of United Energy and Multinet Gas, proposed a dividend growth model estimate of the market risk premium of 8.03% based on a 10-year government bond yield of 3.13%, as at September 2012 (NERA, 2013a: 56).

---

[78] For example, over a defined period, if market capitalisation increases by a factor of twenty, and the capitalisation-weighted price index increases by a factor of ten, the implication is that a 100% net share issuance has occurred over the period.

[79] The analysis is based on United States' data since 1925 (Bernstein and Arnott, 2003: 52).

[80] Lally considered that the comparison of the real growth rate in GDP to the real growth rate in dividends per share will overstate the adjustment in the presence of a declining payout rate (for which there is evidence). Second, Lally argued that the comparison of the growth rate in market capitalisation to the growth rate in a capitalisation-weighted price index will exaggerate the relevant adjustment when capitalisation increases simply due to listings of foreign companies and previously unlisted domestic firms (Lally, 2013e: 15).

[81] The nominal long-run growth rate would be [1+(.03–.01)][1+.025]–1 = .0455.

[82] The range of 7.0%–9.5% is based on a utilisation rate of .625 for imputation credits.

The QRC observed that recent estimates of the market risk premium from dividend growth models range from 5.9% to 8.4%.[83] The QRC also noted that dividend growth models produce varying estimates of the market risk premium depending on the assumptions, methodology, dataset, and time period used (QRC, 2013b: 14).

The QRC's view was that dividend growth model estimates should be interpreted with caution as they are sensitive to changes in the inputs. McKenzie and Partington contended that these models have a number of problems. They noted that typical dividend growth modelling does not adequately address certain issues, such as new equity issues (McKenzie and Partington, 2013b: 19–20).

The QRC and Anglo American stated that the QCA's version of the dividend growth model produces an upper bound. This is because the long-run growth rate in GDP is an upper bound on the long-run growth rate of aggregate dividends due to the formation of new companies and the issuance of new equity from existing companies (as described in the previous section). Anglo American and QTC both proposed that the QCA make an explicit adjustment for this effect (Anglo American, 2014: 5; QTC, 2013: 13).

Finally, QTC suggested that the QCA provide more detail on the assumptions and methodology underpinning the Cornell estimate, including information on the dividend yield, short-term dividend growth rates, adjustment for imputation credits, and value and term of the risk-free rate (QTC, 2013: 13).

QCA position - response to submissions

The QCA considers that dividend growth models can provide relevant estimates of the market risk premium as they utilise current market information. A natural place to look for information on what the market thinks the market risk premium should be is in market prices themselves. The dividend growth model uses market prices and forecasts of future dividends at a point in time to estimate the return on the market portfolio. The forward-looking concept underpinning such models is also congruent with the forward-looking basis of the CAPM.

At the same time, the QCA also agrees with the QRC that results of such modelling can be sensitive to the underlying assumptions. However, the QCA's view is that all valid estimation methods have strengths and weaknesses, and accordingly, these should be considered when weighing the evidence in determining a final estimate.

There are clearly a number of variants of the dividend growth model that can provide estimates of the market risk premium. In summary, stakeholders and Dr Lally presented several different estimates of the market risk premium based on dividend growth models, as follows (with date of the estimate in parentheses):

(a) SFG Consulting 1 (2012): 8.5%

(b) NERA (September 2012): 8.03%

(c) Dr Lally (December 2012): 7.0%–9.5%

(d) SFG Consulting 2 (December 2012): 8.25%

(e) Dr Lally (November 2013) 5.4%–7.9%

SFG Consulting proposed an estimate of 8.5% based on the model of Nelson, Ferrarone and McGuire (2012). However, Dr Lally identified several problems with this model and, therefore, the estimates arising from it. Dr Lally noted that the adjustment for imputation credits assumes there are no expected capital gains (and that the empirical evidence is otherwise) so that the resulting estimate of the market

[83] This range is drawn from Lally (2013b) and is based on a utilisation rate of 0.35 for imputation credits. If the utilisation rate is increased to 0.625, then the range increases to 7.0%–9.5%, as presented previously.

risk premium is too high (see Appendix C, Technical Annex) (Lally, 2013c: 14). Critically, the QCA notes that the Nelson-Ferrarone-McGuire (2012) model does not make a deduction from the long-run expected growth rate for the creation of new companies and issuance of new equity by existing companies. The latter is a critical factor in a valid application of the dividend growth model.

Dr Lally was also critical of NERA's estimate of 8.03% for several reasons. For instance, not only does it not make an adjustment from the expected long-run growth rate in dividends per share for new companies and the issuance of new equity by existing companies, but it also does not constrain the long-run expected growth rate in dividends per share to be less than the long-run expected growth rate in GDP (Lally, 2013c: 31-32).

The QCA notes that the SFG Consulting dividend growth model variant (proposed by QTC) also omits this important restriction.[84] This omission is critical and leads the QCA to place no weight on estimates from this model, or on the other models that have this, or a comparable, shortcoming.

Estimates (c)–(e) are based on the Cornell method, as implemented by Lally (2013c, 2014a).[85,86] Dr Lally's later range (e) differs from his previous one (c) due to updating his December 2012 data to November 2013 and applying a midpoint assumption to the timing of dividend payments. The assumptions involve a cash dividend yield of 4.44%, an expected growth rate in dividends per share of 7.06% for the first two years, and a long-term government bond yield of 4.13%. Given this updated data, the range reported previously (i.e. 7.0%–9.5% for a utilisation rate of .625) becomes 4.8%–7.1%. This reduction is a result of a decrease in the cash dividend yield, a decrease in the short-run expected growth rate in dividends per share, and an increase in the government bond yield since December 2012 (Lally, 2014a; 3). Further, applying a mid-year, rather than end-year, assumption for the timing of dividend payments increases the range moderately to 5.4%–7.9% (Lally, 2014a: 13).[87]

QCA estimates

The QCA applied the same Cornell-type methodology as Lally (2013c, 2014a), including:

(a) specifying a term structure for the return on equity, by assuming a market value of equity after 10 years that corresponds to the long-run average market return on equity of 11.80%, based on a (long-run) average risk-free rate of 5.80% and a market risk premium of 6.0% — this feature of the model recognises the reality that interest rates are currently lower, relative to historical rates[88]

(b) adjusting the long-run expected growth rate to reflect the impact of new equity issues and the formation of new companies, with the range of the adjustment being 0.5%–1.5% — incorporating this feature addresses stakeholder comments that an explicit adjustment should be made

[84] Dr Lally also noted that the model does not impose the restriction that the long-run expected rate of return on equity is equal to the cost of equity (i.e. long-run investment satisfies NPV=0) (Lally, 2014a: 8–9).

[85] SFG Consulting's proposed estimate (d) of 8.25% is the midpoint of Lally's earlier range of 7.0%–9.5%. See (Lally, 2013c: 59–60).

[86] In both (c) and (e), the ranges presented are defined by the number of years assumed until the short-run expected growth rate in dividends converges to the long-run rate and by the deduction applied to the long-run growth rate for the creation of new companies and issuance of new equity by existing companies (Lally, 2014a: 12–13).

[87] Dividends for a specific year are assumed to arise at the midpoint of the year rather than at the end of the year.

[88] The average annualised value of Commonwealth Government indexed bond yields from July 1993 to October 2013 is 3.22%. Converting this real rate to a nominal rate using an expected inflation rate of 2.50% (consistent with the midpoint of the RBA's target band) and applying the Fisher equation gives 5.80%. Mid-1993 is the starting point of the time series, as this period corresponds to the start of the RBA's inflation targeting and the point in time from which inflation has been around the target range of 2.0%–3.0% (RBA, 1999).

(c) recognising that dividends are received with an average term of receipt of six months — this feature reflects a more realistic time profile of dividends.

Based on this methodology, the relevant input data are taken as at December 2013. The basic inputs are a cash dividend yield of 4.60% (i.e. a gross dividend yield of 5.43%, which includes an adjustment for imputation credits), expected dividend growth rates of 7.03% for one and two years forward from December 2013, and a 10-year government bond yield of 4.29%.

Additionally, the QCA assumes a range for the long-run nominal growth rate in dividends per share of 4.0%–5.1%, comprising:

(a) expected inflation

(b) the expected real growth rate of GDP

(c) a deduction from the real GDP growth rate to accommodate the formation of new companies and the issuance of new equity in the future by existing companies.

The RBA's target range for inflation is 2.0%–3.0% (RBA, 2013). The QCA applied the midpoint of 2.5% of this range.

In terms of the expected real GDP growth rate, Dimson, Marsh and Staunton (2014, Table 1) report a mean real GDP growth rate of 3.35% over 1900–2013 for Australia. Bernstein and Arnott (2003) report a mean of 2.8% over a sample of sixteen developed countries over the period, 1900–2000 (Bernstein and Arnott, 2003: 51 (Table 1)). Finally, the Australian Federal Treasury has forecasted the Australian real GDP growth rate in the range of 2.5%–3.0% for the next several years (Treasury, 2013: 15 (Table 2.2)). Taking all of these factors into account supports a current estimate of 3.0% as being reasonable.

On the third point, Bernstein and Arnott (2003) suggest a deduction of 2.0% to the long-run GDP growth rate to address these issues. For the reasons discussed previously, Lally (2013e) considered that the deduction of 2.0% is too high and a lower figure of 1% is reasonable. However, the adjustment is unclear, and Lally has previously employed a range of 0.5%–1.5% to address this issue (Lally, 2004a, 2014a). The QCA does likewise.

Based on these input assumptions, Cornell estimates of the market risk premium are set out in Table 4.

Table 4 QCA Cornell market risk premium estimates

Adjusted long-run (nominal) growth rate	***Convergence period***	
	10 years	20 years
5.1%	7.2%	8.0%
4.6%	6.3%	7.3%
4.0%	5.5%	6.7%

Notes: The expected real GDP growth rate (before the Bernstein-Arnott adjustment) and expected inflation rate are assumed to be 3.0% and 2.5% respectively. The differences in the (adjusted) long-run nominal growth rates (5.1%, 4.6%, 4.0%) are the result of deductions of 0.5%, 1.0% and 1.5% respectively from the long-run real GDP growth rate.

The ranges corresponding to the 10 and 20-year convergence periods respectively are 5.5%–7.2% and 6.7%–8.0%. Therefore, it is evident that the results are sensitive to the convergence period assumed. As it is not known (or knowable) whether the relevant convergence period is 10 years or 20 years (or some other length of time), the QCA has considered the entire range of 5.5%–8.0% and note that the median estimate is 6.9%.

The QCA considers that results from dividend growth models should be treated with some caution due to the sensitivities of the results to the assumptions and inputs. Nonetheless, the QCA believes that they should be attributed reasonable weight, given that they are strongly based in theory and designed to be forward-looking.

Conclusion

In summary, the Cornell dividend growth model produces a range of 5.5%– 8.0%, with a median estimate of 6.9%.

Current conditions — conditional information on the market risk premium

Stakeholders have variously submitted that the QCA should take into account current conditions to a greater extent than previously (QTT, 2013: 2). While the QCA considers that its past methodology for estimating the market risk premium has reasonably taken into account current conditions, this section seeks to evaluate specific evidence presented by stakeholders.

Estimates can be derived on the basis of specifying a particular relationship between the market risk premium and current information, such as market volatility, debt premiums, and the level of the risk-free rate. While the QCA's dividend growth estimates and survey / independent expert estimates reflect current conditions, the QCA has also considered additional information on current market conditions. This section discusses such 'conditional' approaches to estimating the market risk premium.

Volatility measures

The seminal theoretical research relating the market risk premium to volatility is Merton (1973). Merton develops an intertemporal CAPM, in which the market risk premium can change over time. Subsequently, Merton (1980) models the time-varying market risk premium as a positive linear function of the expected (instantaneous) variance in the return on the market portfolio:

(17) $\mathrm{MRP}_t = \mathrm{Y}(\mathrm{E}[\sigma^2(\mathrm{r}_m)]),$

The coefficient Y is the reward-to-risk ratio and depends on investors' aggregate relative risk aversion. Friend and Blume (1975) argue that aggregate relative risk aversion is constant. Accepting this point means that time series data can be used to estimate the ratio of the market risk premium to market variance. The resulting estimate can then be coupled with an estimate of the current market variance to obtain an estimate of the market risk premium.

Stakeholder submissions

Bishop and Officer (2013a) proposed a Merton-type, volatility-based estimate of the market risk premium on the basis that it is more reflective of current circumstances than historical averages that do not reflect current circumstances. Bishop and Officer (2013a) also considered that it is an appropriate method to apply when circumstances are unusual, such as during the GFC and its aftermath (Bishop and Officer, 2013a: 30, 32).

They assumed a constant reward-to-risk ratio based on historical averages and coupled this ratio with a one-year forward estimate of market variance from the implied volatility of options on an equity index.[89] Applying this approach as at November 2012, the one-year forward estimate is reported as 7.9%. Bishop and Officer (2013a) then 'transitioned' this estimate to their preferred long-run market risk premium

[89] It is a one-year forward estimate because the option contract has a one year maturity. The relevant data used in the calculations is not provided in the submission.

estimate of 7.0% over the remaining three years of the regulatory period to obtain a geometric average over the regulatory period of 7.4% (Bishop and Officer, 2013a: 31–32).[90,91]

QCA assessment

Bishop and Officer (2013a) base their approach on Merton's method, but some aspects of its presentation of the approach are ambiguous. Specifically, they state that the following model is estimated:

(18) $\widehat{MRP}_t = \overline{Y}\sigma_t^2(r_m)$,

where $\widehat{MRP}_t$ is the estimate of the market risk premium in year, $\overline{Y}$ is the average reward-to-risk ratio and $\sigma_t^2(r_m)$ is the (current) variance of the market rate of return at time t. However, estimating this model (equation (18)) is not consistent with references they make to estimating the standard deviation of $\overline{Y}$ (Bishop and Officer, 2013a: 31). In particular, Merton (1980) presents both models (i.e. one based on variance and one on standard deviation) and shows that the results arising from each mode can differ substantially.

In addition, Lally has examined the general approach of Merton (1980) and concluded that the statistical precision of the method is very low (Lally, 2004a: 52). The same conclusion has also been reached by Boyle (2005).

Further, Bishop and Officer (2013a) acknowledged the lack of precision of the approach, and this position could underlie the reason that they only recommended applying it in 'unusual' market conditions (Bishop and Officer, 2013a: 30,32). However, market conditions at present no longer appear to be abnormal in relation to high volatility, as indicated in Figure 1.

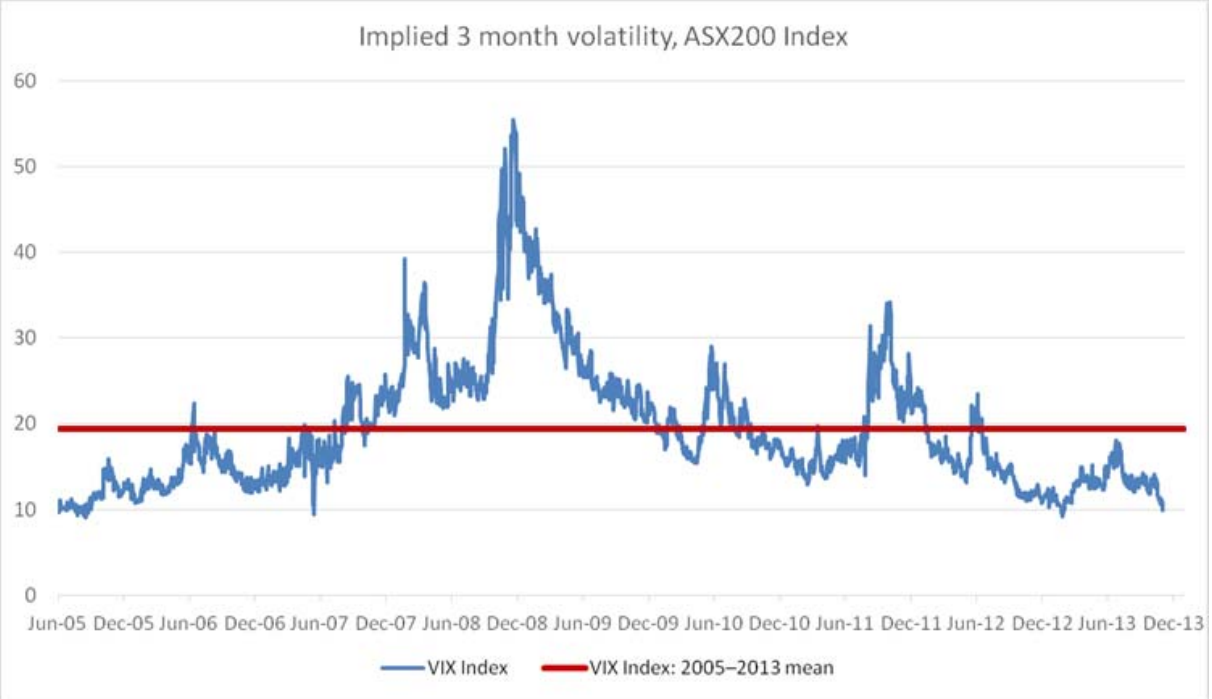
For these reasons, the QCA considers that this specific approach is informative but does not warrant material weight at this time. The QCA notes that the AER reached a similar conclusion, also identifying a number of issues with Bishop and Officer's implementation of Merton's approach in the context of its recent decisions (AER, 2013e: 98–99).

However, this issue does raise a relevant point, as measures of implied volatility can provide a relevant reference point for informing the market risk premium. Such measures reflect time-varying market conditions. In particular, Figure 1 shows implied three-month volatility from June 2005 to December 2013, based on the ASX200 Index.

[90] It can be inferred that the geometric series (for years 1–4) must be: .079, .079r, .079r^2, .07. However, .07 = .079r^3; therefore, $r = \sqrt[3]{[.07/.079]} = .9605$. The series then is .079, .07588, .07288, .07, and the geometric average is .074364, which Bishop and Officer (2013a) have (apparently) rounded to .074.

[91] The AER refer to this approach as the 'implied volatility glide path' (AER, 2013e: 98).

Figure 1 ASX200: Implied three-month volatility



Source: Bloomberg.

Volatility over the entire period (June 2005–December 2013) averaged 19.2%. Pre-GFC average volatility was 13.8%, but average volatility more than doubled to 27.4% during the GFC.[92] Volatility then subsided relatively quickly and has continued to trend downward overall since that time. From January 2010 through December 2013, volatility has averaged 16.8%, which is below the average over the entire period of 19.2%.

Importantly, this evidence is consistent with the broader picture given by Dimson, Marsh and Staunton (2013a), who observe that the history of financial markets indicates that volatility reverts rapidly to the mean. For example, out of a number of major financial crises within the last thirty years — the October 1987 crash, Dotcom bust, First Gulf War, the Iraq War, September 11, the Eurozone crisis — the crisis with the longest reversion time to the mean was the GFC / Lehman crisis, when it took about eleven months for volatility to revert to its mean. Out of all of these crises, the average mean reversion time was only five months (Dimson, Marsh & Staunton, 2013a: 12).

Corporate debt premiums

For a given debt instrument, the corporate debt premium represents the difference between the yield on a coupon-paying corporate bond and the yield on a coupon-paying government bond of the same maturity.[93]

Stakeholder submissions

Unitywater, QUU and Aurizon Network argued that debt premiums provide an important piece of indirect evidence that informs an estimate of the market risk premium.

[92] Most financial market commentators consider the GFC to span from July 2007 (the collapse of Lehman Brothers) to December 2009.

[93] The difference could also be defined between the yield on an index of bonds and the yield on government bonds.

Bishop and Officer (2013a) argued that increases in debt premiums during the GFC, and post-GFC, have largely been the result of an increase in economy-wide (i.e. systematic) risk rather than to an increase in default risk. As debt betas are unlikely to have risen, they attributed the systematic increase to an increase in the market risk premium and concluded that a higher market risk premium would clearly affect equity markets as well (Bishop and Officer, 2013a: 26, 32–34):[94]

> *While it is possible that the global financial crisis may have led to an increase in the difference between promised and expected yields on debt in the short - medium term, we would expect the same GFC phenomena to impact upon the required return on equity i.e. it is a macro event and is likely to be systematic or non-diversifiable. Put another way, if there is an increase in default risk then the factors driving it are macro-economic and will therefore affect the risk and required return on equity as well as debt. Consequently it is not clear that there would be any narrowing of the difference between expected returns across debt and equity.*

This line of argument is broadly consistent with the position taken by United Kingdom financial economist, Stephen Wright, who provided advice on this issue to the gas service providers during the Victorian gas access arrangement review. Citing Elton, Gruber and Agrawal (2001), Wright (2012a: 16) stated that:

> *There is also a considerable body of evidence suggesting that corporate bond spreads (which are well-known to be counter-cyclical) contain a strong risk premium element (i.e., the fluctuations in the spread cannot be explained by other factors such as default risk, tax differences, or liquidity).*

QTC made a related point but with reference to the liquidity premiums on Queensland State Government bonds and equities relative to Commonwealth Government bonds. Essentially, QTC argued that liquidity premiums have risen on Queensland State Government bonds during and post-GFC and that this effect suggests that liquidity premiums on equities would have also risen. As liquidity premiums on equities are part of the market risk premium (at least empirically), the latter would have risen as well (QTC, 2013: 18):

> *The return premiums required by investors to invest in less liquid assets such as state government bonds and equities are measured relative to the same CGS yields. As such, both premiums will be affected by changes in the value that investors attach to the superior liquidity of CGS... If equities in aggregate tend to become more illiquid in undesirable states of the world such as economic downturns and periods of crisis, then exposure to variations in illiquidity (ie, liquidity risk) should be viewed as a systematic risk.*

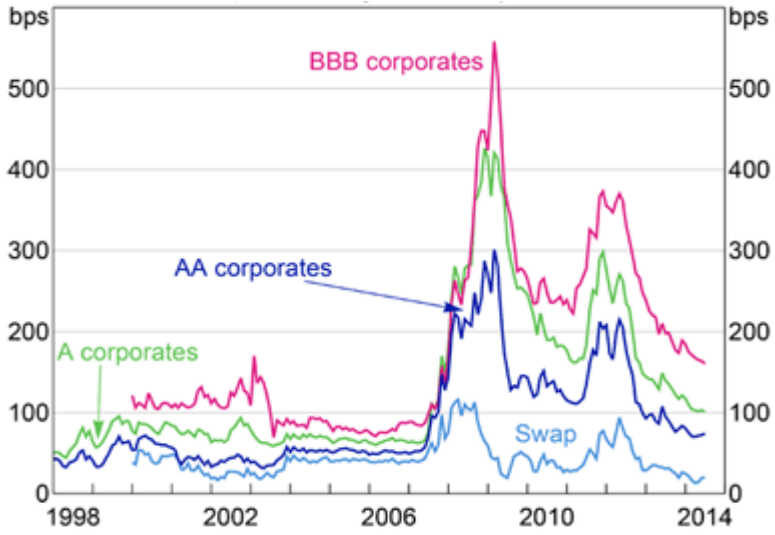
In other words, if liquidity premiums rose during the GFC then such effects are impounded in the market risk premium, and as a result, it should have also risen.

QCA position

The QCA notes that debt premiums clearly did rise during the GFC. The debt premiums for regulated firms are typically based on a BBB credit rating. Based on RBA data, BBB-rated debt premiums, although declining overall since the GFC, remain above pre-GFC levels (Figure 2) (RBA, 2014: 21).

[94] The cost of debt (i.e. the promised yield, k_d) is the rate of return that compensates for: the time value of money and systematic risk, expected default losses (DF) and for the inferior liquidity of debt relative to government bonds (L): $k_d = (r_f + \beta_d MRP) + DF + LQ$, where r_f is the risk-free rate, β_d is the debt beta, and MRP is the market risk premium.

Figure 2: Australian corporate bond spreads (over government yields)



* Swap spreads are for 3-year maturity. Corporate bond spreads are a weighted average of senior bonds with remaining maturities of 1 to 5 years; they include financial and non-financial corporates.

Source: Bloomberg; RBA; UBS AG, Australia Branch

The theme of arguments presented is that the systematic risk components of both debt and equity should move together. Debt premiums rose during, and post-GFC. As part of the increase was due to economy-wide, macroeconomic factors, then the equity premium should have risen as well (and might remain at an elevated level relative to pre-GFC conditions).

The QCA considers that the causal relationship identified is plausible but that specific arguments can be questioned. For instance, Lally considered that Bishop and Officer (2013a) might have understated the role of default risk in the debt risk premium because their estimate is based on average BBB default rates over time rather than the default rates expected since the GFC. Lally also suggested that any increase in default risk is likely to have materially increased debt betas, and this effect, rather than an increase in the market risk premium, would explain a substantial part of the increase in the debt risk premium (Lally, 2013c: 37–38).

Wright's claim that the increase in the debt premium cannot be explained by a number of factors, including illiquidity, is also questionable. This is because, Elton, Gruber and Agrawal (2001), whom Wright cited to support his claim, do not attempt to identify or quantify the liquidity allowance.[95] The lack of support for Wright's view is relevant, as there is substantial evidence that liquidity effects can be material.[96]

QTC, however, suggested a relationship between the liquidity risk of debt and the equity risk premium. QTC noted that liquidity margins on Australian State Government debt rose during the GFC and liquidity margins on equities likely rose as well. QTC claimed that, as liquidity is an element of the market risk premium, the latter should have risen as well.

[95] The liquidity allowance is compensation for investors facing a high bid-ask spread in attempting to trade securities.

[96] Chordia, Subrahmanyam and Anshuman (2001) document a negative and significant cross-sectional relationship between mean equity returns and the level of trading activity, where the latter is proxied by dollar volume and turnover.

The QCA considers that, even if the increase in debt premiums were the result of an increase in (non-systematic) default risk and illiquidity of corporate bonds relative to government bonds — rather than attributable to an increase in the systematic risk of bonds (i.e. to an increase in debt betas) — these changes are likely to be positively linked to changes in the market risk premium. This is because the market risk premium is compensation for bearing equity risk, equity risk seems to be higher in depressed economic conditions and default and illiquidity tend to rise in such conditions.

However, the question is whether these effects remain in markets at present — debt premiums have been trending downward since the GFC. Further, even if a definitive link could be established, it is not clear how quantitatively one would make an appropriate adjustment. However, the QCA will have regard to this evidence in forming a view on the market risk premium. The QCA notes that the AER has previously reached a similar conclusion on the explanatory power of such evidence (AER, 2013e: 95–97).

Relationship between the risk-free rate and the market risk premium

Stakeholder submissions

A number of stakeholders raised the concern that, due to current financial conditions, the risk-free rate is unusually low and suggested that the market risk premium is likely to be higher as a result. For example, SFG Consulting considered that risk-free rates have recently been at historically low levels relative to the average yield over the last forty years (SFG Consulting, 2014a: 17–20). In particular, QTC noted that the 10-year Commonwealth Government bond yield has fallen from 6.4% to 3.4% since the start of the GFC (QTC, 2013: 2).

These stakeholders considered that post-GFC uncertainty has created a 'flight to safety' that has had the impact of lowering the risk-free rate while at the same time increasing the market risk premium (QTC, 2013: 16–17). QTC stated (QTC, 2013: 16):

> *The factors which have contributed to the fall in CGS yields, such as a flight from risky assets to risk-free assets, increased demand due to the Basel III capital requirements and a relatively low supply of CGS, have not caused the required returns on risky assets such as equity to fall by the same amount. This also suggests that required risk premiums relative to CGS are higher than their pre-GFC levels.*
>
> *If an increase in risk aversion leads to an increase in demand for CGS, this will place downward pressure on CGS yields. It follows that the same increase in risk aversion must also be reflected in the prevailing value of the MRP, which is the market price of risk and directly related to the level of investor risk aversion.*

SFG Consulting considered that, unless the QCA believes the cost of equity capital is historically low then, by implication, the QCA should consider that the market risk premium must have risen to offset markedly lower bond yields. Otherwise, adding an estimate of 6.0% for the market risk premium to a relatively low risk-free rate will result in the current QCA approach producing a return on equity that has been lower since the GFC than at any other time post-World War II (SFG Consulting, 2013d: 13–17). The implication of this argument is that the cost of equity is relatively more stable over time than the market risk premium and that regulators should not allow the return on equity to vary one-for-one with movements in the risk-free rate.

To address this point, Aurizon Network, Unitywater, and QTC supported including the Wright method in the QCA's current set of estimation methods. As discussed in the technical supplement to this appendix, the Wright method assumes that the market risk premium varies one-for-one with the risk-free rate, resulting in a stable return on equity. As a result, the Wright method involves taking a long-run, historical

average of the real cost of equity and then either adopting that estimate of the cost of equity directly or using it to derive the market risk premium.[97]

SFG Consulting and QTC contended that the Wright method will produce an estimate of the market risk premium that better reflects market conditions when conditions are not 'average' and therefore reduce the likelihood of the return on equity being under- or over-estimated (SFG Consulting, 2014a: 25–26; QTC, 2014: 12–14). This is based on the premise that, in times of economic crisis (expansion), bond yields fall (rise) and the market risk premium rises (falls).

QTC also noted that the low variation in results from SFG Consulting's dividend growth model supports using this approach, as it produces a more stable return on equity. QTC also considered that the Wright method better addresses the concern about potential, unexpected inflation, as it directly estimates the (long-run) real return on equity (QTC, 2014: 12–14).

SFG Consulting noted that the AER has regard to the Wright method when setting the cost of equity and regulators in the United Kingdom apply it (Aurizon Network, 2014: 9; SFG Consulting, 2014a: 3). SFG Consulting proposed a Wright market risk premium estimate of 7.7% (SFG Consulting, 2014a: 45).[98]

In contrast to these stakeholders, the QRC and Vale considered that the current 'unusually low' bond rates reflect current market conditions and further that bond yields and the market risk premium are not strongly, negatively correlated (QRC, 2013a: 3; Vale, 2013: 2).

With respect to bond yields, McKenzie and Partington, on behalf of the QRC, contended that assessing whether current rates are 'low' requires assessing them relative to a benchmark. They observed that the 10-year bond yield at the time of their drafting was 4.02%. For comparison, they reported a long-term average of 4.23% over 1883–1972, which excludes the high interest rate periods since the mid-1970s, and considered that current rates were only slightly below this more representative long-term average (McKenzie and Partington, 2013b: 15–16).

On the issue of the relationship between the risk-free rate and the market risk premium, McKenzie and Partington (2012, 2013b) surveyed the academic literature and reported mixed findings. They found support for both a positive and a negative relationship, as well as for a changing relationship over time (i.e. the risk-free rate and market risk premium are positively related in some periods but negatively related in others). They concluded (McKenzie and Partington, 2013b: 18):

> *Based on the foregoing discussion... the relation between the MRP and the level of interest rates remains an unresolved question and the range of possibilities is wide open. The correct MRP adjustment for a change in the risk free rate might be zero, it might be positive, or it might be negative. The relation between the risk free rate and the MRP, if any, is not sufficiently well established to form the basis for a regulatory adjustment to the MRP.*

As a result, the QRC, McKenzie and Partington, and Anglo American did not support including the Wright method on the basis that the relationship between the risk-free rate and market risk premium is not sufficiently well established (QRC, 2014: 8-9; McKenzie & Partington, 2013b: 18). They considered that it should only be included if it can be demonstrated that the overall cost of equity is more stable over time than the market risk premium (QRC, 2014: 8; Anglo American, 2014: 8).

---

[97] To estimate the Wright market risk premium, the real return on equity is first converted to a nominal return using an estimate of current expected inflation and then the current risk-free rate is deducted. See the Technical Annex for details.

[98] SFG Consulting estimated an average real market return of 9.0%, based on correcting the early data to reflect the NERA adjustment and by applying a utilisation rate of 0.625 for dividend imputation credits. The market risk premium was then estimated on the basis of an expected inflation rate of 2.5% and a 10-year government bond rate of about 4.0% (SFG Consulting, 2014a: 45).

QCA position

The significant decline in government bond yields in economically developed countries such as Australia since 2008–09 has led many regulated firms to propose that the market risk premium should increase by an offsetting amount to maintain a relatively stable cost of equity.

There is no question that government bond yields recently have been at, or near, historical lows. Figure 3 indicates that government bond yields are materially lower than in recent years (RBA, 2014: 19). McKenzie and Partington (2013b) considered that these low rates are more the 'norm' than anomalous when looking at a very long-term average. In contrast, SFG Consulting considered them to be unusually low when compared to rates over the last forty years. The QCA notes that recent rates, while reflecting market conditions, are the lowest on record since the QCA began establishing the cost of capital for regulated firms.

Figure 3: 10-year Australian government bond yield

Whether lower bond yields have affected the market risk premium cannot be answered definitively because the market risk premium is unobservable. As a result, there are a number of plausible hypotheses.

For instance, lower bond yields could have arisen, at least in part, due to changes in monetary policy or the demand for investment projects in the private sector. Neither of these explanations by itself implies that the market risk premium should be higher as a result.

In contrast, an equally plausible, alternative explanation is that an increase in investor risk aversion, which has increased demand for bonds (and therefore lowered their yields), is also a factor affecting equity markets and, therefore, the current market risk premium is higher than its long-run average. This explanation is consistent with the claims by SFG Consulting and QTC that bond yields fall in times of economic crisis while the market risk premium rises.

The QCA has also considered the argument from stakeholders regarding whether the return on equity is more stable than the market risk premium and consider that this is ultimately an empirical matter. In the technical supplement to this appendix, the QCA has reproduced analysis undertaken by Lally (2013a) and concluded that the market risk premium is relatively more stable than the return on equity for Australia.

This evidence supports more weight being attributed to the Ibbotson and Siegel estimates than to the Wright estimates. However, the QCA will have regard to the Wright estimates in forming a view on an appropriate estimate of the market risk premium. This position is consistent with the views of Aurizon

Network, QTC and Dr Lally (Aurizon Network, 2014: 9; QTC, 2014: 18; Lally, 2013c: 3). It is also consistent with the AER's position in its Rate of Return Guideline (AER, 2013e: 26).

In addition, the QCA does not agree with QTC that the stability in the SFG Consulting dividend growth model estimates support material weight being given to the Wright method. As discussed in the earlier section, the SFG Consulting dividend growth model has too many limitations and as a result, estimates from it cannot be relied upon.

The QCA also does not agree with QTC that the Wright method is to be preferred to the Siegel method to address the unexpected inflation issue. The Siegel method adjusts the Ibbotson estimate for unexpected inflation (i.e. by taking into account the long-run average expected real risk-free rate) because the relevant objective is to obtain a measure of the expected return. The Wright estimate, however, reflects historical, average real risk-free rates, rather than expected real rates. As a result, the Wright estimate impounds unanticipated inflationary effects, which is not consistent with the relevant concept (i.e. expected return) (Arnott and Bernstein, 2002).

In conclusion, the QCA's conclusion of a relatively more stable market risk premium should not be interpreted as excluding the possibility of a negative relationship between the risk-free rate and market risk premium at a point in time. Even though there is evidence of more stability in the market risk premium relative to the return on equity, the market risk premium varies over time and its relationship with the risk-free rate likely changes.

Conclusion

In considering an estimate of the market risk premium, the QCA has considered the material presented by stakeholders and also additional evidence.

Based on the foregoing analysis, the QCA has developed a range of 5.0%–7.5% for the market risk premium at this time:

(a) The lower bound of 5.0% is based on the Siegel estimates —the lower bound is 50 basis points below 5.5%, which is the estimate from the time series of 1958–2013, the longest series of high quality data.

(b) The upper bound is based on the Cornell estimate — the upper bound of 7.5% is slightly more than 50 basis points above the median estimate of 6.9%.

The QCA notes that the lower and upper bounds of the range best reflect the estimates from the modified methods and the other information at hand. The estimates might change over time as new data and evidence is presented for consideration. Accordingly, the lower and upper bounds of the ranges could change as well.

Based on this range, the QCA considers that the most appropriate estimate of the market risk premium at this time is 6.5%, based on the material set out in this appendix:

(a) *Ibbotson estimates* — the Ibbotson estimates provide a range of 6.0%–6.7% over all sample periods, with an estimate of 6.5% for the period 1958–2013

(b) *Siegel estimates* — the range for the Siegel estimate is 4.0%–6.5%, with an estimate of 5.5% for the period 1958–2013

(c) *Survey / independent expert report estimates* — survey data and independent experts' reports indicate an estimate of 6.2%, including an adjustment for dividend imputation credits

(d) *Cornell dividend growth estimates* — the Cornell range is 5.5%–8.0%, with a median estimate of 6.9%

(e) *Conditional information* — additional sources of information examined include volatility measures, corporate debt premiums, and liquidity premiums on government bonds. The QCA also considered the relationship between the risk-free rate and the market risk premium.

An estimate of 6.5% is marginally above the 'mechanical' average of 6.3% from applying the previous approach. The QCA's view is that the information provided by expanding the range of information to include current conditions does not provide support for a number higher than 6.5%, but it does confirm the need to set aside the whole number rounding rule from the past approach. The QCA notes that an estimate of 6.5% sits above the long-run average of 6.0%.

Technical Annex

Arithmetic or geometric averaging

In the context of historical time series averaging of excess returns, a relevant issue is the use of the arithmetic or geometric average of returns. The choice is material, as for example, Brailsford, Handley and Maheswaran (2012) report arithmetic and geometric estimates of 6.3% and 4.9% respectively relative to long-term bonds for 1883–2010 based on a utilisation rate of 0.50 (Brailsford et al., 2012: 241, Table 2).

Whether the arithmetic or geometric mean should be used is context-specific. The geometric mean measures changes in wealth over more than one period using a buy-and-hold strategy (with dividends reinvested). If the average investor rebalances his portfolio each period, the arithmetic mean would provide a better measure of typical performance over a single historical period (Carleton and Lakonishok, 1985: 39).

In the context of the cost of capital, Patterson notes that Ibbotson and Sinquefield state (Patterson, 1995: 109):

> *'"...the arithmetic mean equates the expected future value of an investment with its present value. This property makes the arithmetic mean the correct return to use as the discount rate or cost of capital"'.*

The QCA notes that the QRC reported a range for the geometric mean of 3.0%–4.7% in its submission on Aurizon Network's 2013 Draft Access Undertaking and that the AER also places some reliance on geometric means of the market risk premium (QRC, 2013b: 13; AER, 2013d: 81). The AER appears to view the arithmetic mean as biased in the context of discounting an expected multi-period cost of equity (AER, 2012: 23).

To date, the QCA has considered that the arithmetic mean is the correct estimator as it is consistent with the concept of mathematical expectation of returns in the CAPM. In the further context of applying the Building Blocks Model, Lally (2012a) shows that only the arithmetic mean ensures that the expectation of the regulated asset's value equals the current regulatory book value (Lally, 2012a: 31-32). Lally concluded that the AER's concern is unfounded.

For these reasons, the QCA supports the arithmetic mean as the relevant estimator for averaging historical estimates of the market risk premium.

Adjusting for imputation credits[99]

This section presents a general model of the relationship between the costs of equity inclusive and exclusive of dividend imputation credits, and considers whether the relationship invoked by SFG Consulting to adjust equity returns for dividend imputation credits is a special case that holds only under special conditions.

Let R_e^I denote the actual return on equity over a one-year period, inclusive of the effects of imputation credits, and R_e^X denote the actual return exclusive of this effect. Further, let S be the value of equity, IC the imputation credits over the year in question, and U the utilisation rate on these credits. It follows that:

$$(19) \quad R_e^I = R_e^X + U\frac{IC}{S}$$

Let DIV denote the firm's dividends over the period in question. The last equation can then be expressed as follows:

[99] This appendix is based on Lally (2014b).

(20) $$R_e^I = R_e^X + U\left(\frac{IC}{DIV}\frac{DIV}{S}\right)$$

The same relationship holds for expected rates of return and, therefore, for equilibrium expected rates of return. Accordingly, let k_e^I denote the equilibrium expected rate of return on equity over a one-year period inclusive of the effects of imputation credits and k_e^X the equilibrium expected rate of return exclusive of this effect. It then follows that:

(21) $$k_e^I = k_e^X + U\left[\left(\frac{E(IC)}{E(DIV)}\right)\frac{E(DIV)}{S}\right]$$

Now define Ω to be the expected cash dividend yield as a proportion of k_e^X. It follows that:

(22) $$k_e^I = k_e^X + \Omega k_e^X\left[\frac{E(IC)}{E(DIV)}\right]U$$

Rearranging equation (22) gives:

(23) $$k_e^I = k_e^X\left[1 + \Omega U\left[\frac{E(IC)}{E(DIV)}\right]\right]$$

Letting T_c denote the statutory corporate tax rate, the imputation credits (IC) are subject to the following restriction:

(24) $$IC \leq DIV\frac{T_C}{(1-T_C)}$$

It follows that:

(25) $$\frac{E(IC)}{E(DIV)} \leq \frac{T_C}{(1-T_C)}$$

(26) Letting Z represent the ratio of the left side of this inequality to the right side, it follows that:

(27) $$\frac{E(IC)}{E(DIV)} = Z\frac{T_C}{(1-T_C)}$$

Substituting equation (27) into equation (23) gives:

(28) $$k_e^I = k_e^X\left[1 + \Omega UZ\left[\frac{T_C}{(1-T_C)}\right]\right]$$

This equation, in turn, is equivalent to:

(29) $$k_e^I = k_e^X\left[\frac{1-T_C(1-\Omega UZ)}{1-T_C}\right]$$

This result follows logically from definitions and therefore must be true. The formula invoked by SFG Consulting is as follows, with d being the distribution rate for imputation credits (i.e the product U x d is 'gamma'):[100]

(30) $$k_e^I = k_e^X\left[\frac{1-T_C(1-Ud)}{1-T_C}\right]$$

The issue is whether equation (30) is a special case of equation (29) and, if so, under what conditions. By inspection, equation (30) is a special case of equation (29) when both Ω and Z are one and d is also one. By definition, if Ω = 1, then the expected cash dividend yield must equal the equilibrium expected rate of return on equity exclusive of imputation credits, and this requires no expected growth in the company's share price. In turn, this would require that there is no inflation (because the formulas are in nominal terms) and no retention of net cash flows from operations. These assumptions are very unrealistic.

[100] See SFG Consulting, 2014a: 31–32.

In addition, by definition, if Z = 1, then imputation credits must be attached to dividends at the maximum possible rate shown on the right side of equation (25) (i.e. all dividends are fully franked). This is a common situation. In addition, it is compatible with firms paying all net cash flows from operations as dividends (i.e., no retention), but it is not guaranteed in that case. Even if firms are paying all cash flows from operations as dividends, their tax payments to the Australian Tax Office might not be sufficient to generate imputation credits sufficient to ensure Z = 1. A classic example would be an Australian firm whose company tax payments are all made to foreign tax authorities.

Finally, in respect of d = 1, this possibility is also common (Lally, 2014a: appendix). In addition, it is consistent with firms paying all net cash flows from operations as dividends (i.e., no retention), but it is not guaranteed in that case. Even if firms are paying all cash flows from operations as dividends, their taxable income may generate more imputation credits than they can attach to their dividends, and therefore d would be less than one. However, in invoking equation (30), SFG Consulting adopts an empirical estimate for d of 0.70 (SFG Consulting, 2014a: 32). So, on this basis alone, its equation (30) is not a special case of equation (29). Since equation (29) is derived only from definitions, equation (29) must be true and therefore (30) must be false — simply by using d = 0.70.

In summary, this section has derived a general model of the relationship between the costs of equity inclusive and exclusive of imputation credits, and this relationship is shown in equation (29). This result follows logically from definitions and therefore must be true.

This section has also considered whether the relationship invoked by SFG Consulting (shown in equation (30)) is a special case that holds only under special conditions. The conclusions are as follows: i) by invoking an empirical estimate for the distribution rate of 0.70, SFG Consulting's equation (30) could never be a special case of (29) and is therefore incorrect on that basis; and ii) even if the distribution rate that is applied is one, in which case SFG Consulting's equation would be a special case of (29), the conditions underlying that special case are completely unrealistic, in particular the assumptions that there is no inflation and that firms distribute all net cash flows as dividends rather than retaining such cash flows.

The Wright method

Background

In a report for a group of United Kingdom regulators, Wright, Mason and Miles (2003), argue that the cost of equity is relatively more stable over time than the market risk premium. Accordingly, when the (observable) risk-free rate decreases (increases), the market risk premium is assumed to increases (decrease) to maintain a relatively stable cost of equity. In other words, the implication of a relatively stable cost of equity is that when the risk-free rate changes, the (unobservable) market risk premium moves in the other direction by an offsetting amount.

This approach has informed a number of regulatory decisions in the United Kingdom in recent years. In these decisions, Ofgem and the Competition Commission have maintained a relatively stable cost of equity by not lowering risk-free rates in the allowed rate of return one-for-one with decreases in observed government bond yields (Wright, 2012a: 11).

In the context of the AER's reviews of Victorian gas distribution access arrangements, some of the firms sought advice from Dr Wright, who both recommended that the AER adopt the same approach.[101] As a result, this approach in the Australian regulatory context has become known as the 'Wright method'.

[101] For example, see the AER's decision on Envestra Ltd (AER, 2013a: 19–20) and the submissions by Wright (2012a, 2012b) and Gregory (2012). Wright (2012a, 2012b) recommends that the AER assume that the real return on equity is constant, but the AER in discussing the implications of the Wright method for the risk-free

Application of the method

The implementation of the Wright method assumes that the market risk premium varies one-for-one with movements in the risk-free rate such that the real return on equity is stable. Accordingly, an average of real equity returns is taken over a time series. For each year, realised market returns are converted into real returns using the inflation rate for that year in conjunction with the Fisher relationship:

$$(31) \quad r^{r}_{m,t} = \frac{1+r_{m,t}}{1+\pi_t} - 1$$

where $r^{r}_{m,t}$ is the real rate of return on the market portfolio in year t, $r_{m,t}$ is the nominal return on the market portfolio in year t, and π_t is the inflation rate in year t. An average is then taken over the series of N years:

$$(32) \quad \bar{r}^{r}_{m} = \frac{\sum_{t=1}^{N} r^{r}_{m,t}}{N}$$

The current, expected inflation rate (E(π)) is applied to the average real return to obtain a forward-looking nominal return:

$$(33) \quad r_m = [1 + r^{r}_{m}][1 + E(\pi)] - 1$$

Equation (33) gives a nominal return on equity that can be applied directly. Alternatively, the current risk-free rate can be deducted from it to derive the 'Wright market risk premium'.

QCA assessment

In a report for the Victorian gas distribution businesses, Wright (2012b) contended that evidence from the United States supports greater stability in the real return on equity based on examining rolling 30-year average real equity returns, real long-term bond returns, and real 'cash' returns (i.e. short-dated government bills) since 1830 (Wright, 2012b: 5–6).[102]

However, Dr Lally observed that there are several problems with Wright's analysis. The first is that, since Wright's objective is to examine the stability of expected equity returns over time relative to the market risk premium, the analysis should have examined market risk premium estimates (but it does not). Second, the analysis involves bond returns not bond yields, and the market risk premium, in general, is defined as the excess of the expected equity return over the bond yield (rather than the bond return). Further, the recent behaviour of bond returns versus bond yields has been substantially different — bond yields have been low while bond returns have been high. Finally, Dr Lally considered that the more relevant evidence would involve a comparable analysis in the Australian context (Lally, 2013a: 12–13).

Using the data from Brailsford, Handley and Maheswaran (2012), the QCA reproduced Lally's analysis and converted nominal equity market returns and nominal, long-term government bond yields to real rates for 1883–2013. The inflation measure is the annual return on a consumer price index (CPI), consistent with the inflation data of Brailsford, Handley and Maheswaran (2012).[103] A rolling 30-year average for each series was estimated, commencing in 1912 (i.e. the first year for which thirty years of data is available). The market risk premium is the difference between these two series (Figure 4).

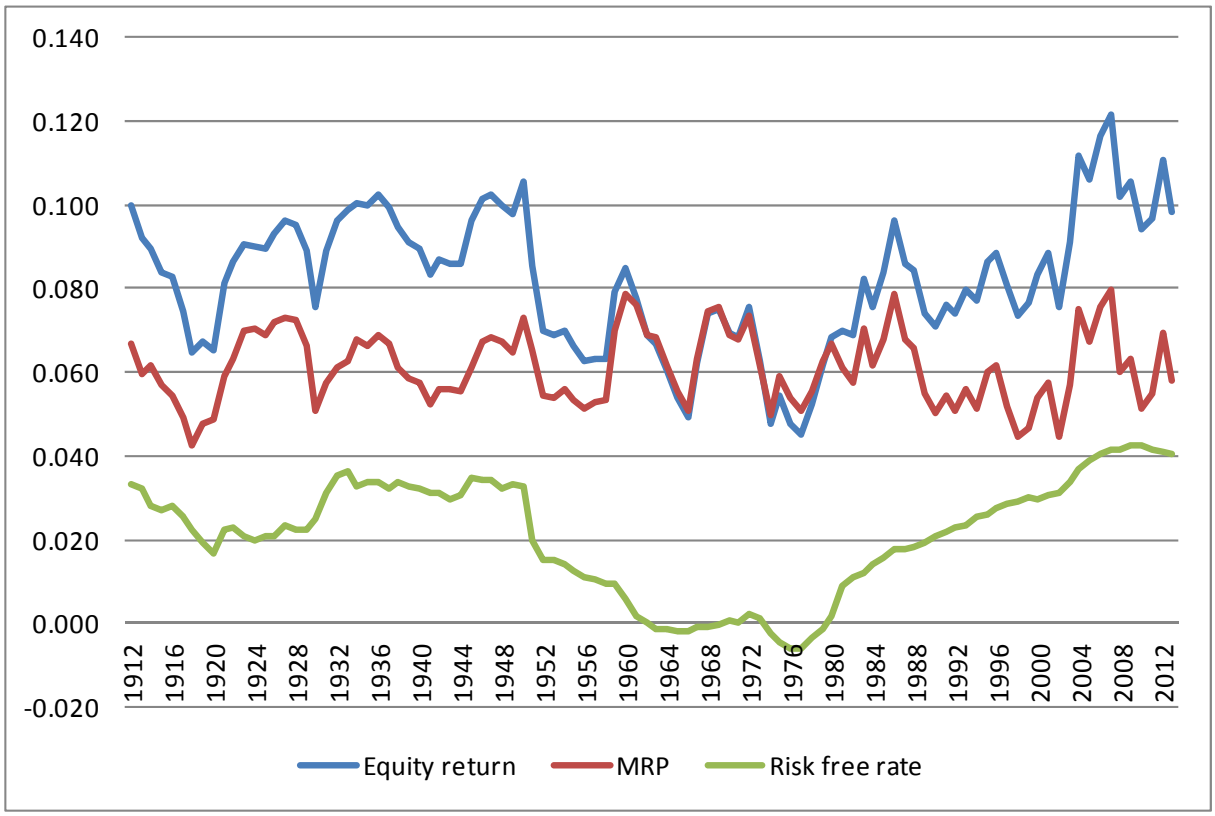
---

rate and market risk premium does not typically distinguish between nominal and real rates. Advice along the same lines was also provided to the firms by United Kingdom Professor Alan Gregory (Gregory, 2012).

[102] Again, this evidence is based on Wright, Mason and Miles (2003), which draws on Siegel (1998).

[103] The Brailsford, Handley and Maheswaran (2008, 2012) measurement approach to inflation is consistent with Dimson, Marsh and Staunton (2003) and with Officer (1989) for the majority of Officer's sample period.

Figure 4 Australia: Rolling 30-year real equity returns 1912–2013



Source: Brailsford, Handley & Maheswaran (2008, 2012); Lally (2013a); QCA analysis

The relative stability of the time series can be determined by comparing their standard deviations. The standard deviation of the real equity return is 1.61%, while the standard deviation of the market risk premium is 0.86%.

This evidence points to the market risk premium being considerably more stable than the equity return — therefore, the relevant evidence for Australia contradicts Wright's (2012b) conclusion. The QCA, therefore, considers that the weight of the empirical evidence suggests that the market risk premium is more stable than the real return on equity for Australia.

Table 5 contains mean (arithmetic) estimates of the 'Wright' market risk premium based on the method described previously (equations (31–33))[104]. For the same reasons as discussed in the section on the Ibbotson method, the QCA has considered estimates from several different time periods.

The estimates are based on a 10-year risk-free rate of 4.29% and include an adjustment for dividend imputation in relevant years to reflect the QCA's preferred utilisation rate of 0.56.[105]

[104] That is, the annual nominal return on equity in each year is converted to a real return in that year using inflation data. The annual real returns are then averaged over the time series. The average real return is then converted to a nominal equity return using expected inflation of 2.5%, consistent with the midpoint of the RBA's inflation target band. Finally, the current value of the 10-year risk-free rate is deducted to obtain the Wright market risk premium for that time series.

[105] The 7.1% estimate in Table 5 for the period 1883–2013 is 7.07% (unrounded). It is less than the SFG Consulting estimate of 7.7% for the same period because the latter estimate includes the NERA adjustment (+.36%), is based on a lower 10-year bond rate (+.29%), and is based on a higher utilisation rate (+.017%). That is, 7.07% + .36% + .29% + .017% = 7.737%, or 7.7% (rounded).

Table 5 Wright historical market risk premium

Sample period	*Arithmetic mean*
1883–2013	.071
1937–2013	.058
1958–2013	.074
1984–2013	.084
1988–2013	.079

The different periods produce estimates spanning 5.8%–8.4%. As discussed, applying the NERA adjustment would affect the estimates for the periods 1883–2013 and 1937–2013, which would increase from 7.1% to 7.4% and 5.8% to 6.0% respectively. With the NERA adjustment, the overall range would become 6.0%–8.4%.

APPENDIX D: GAMMA

Dividend imputation

Dividend imputation reduces two layers of tax (i.e. the first at the company level and the second at the personal level) to a single layer. Dividends are paid to equity holders after company tax has been levied — which means that taxation has already occurred at the company level. Dividend imputation treats the corporate taxes associated with dividends paid to shareholders as a pre-payment of shareholders' personal tax on the dividends. The dividend imputation, or 'franking', credits attached to dividends give shareholders a tax credit for the taxes already paid by the company. Specifically, one dollar of imputation credits allows eligible shareholders to reduce their tax liability by one dollar.

Eligible shareholders include Australian resident individuals, complying superannuation funds, certain trustees, complying approved deposit funds, and certain classes of non-resident investors. However, most non-resident investors are ineligible to use these credits to reduce their tax liabilities.

Relationship to the cost of capital

From the standpoint of an eligible investor who can utilise the imputation credits, the credits represent a component of the total return on investment. A rational investor will take into account the value of the credits when deciding whether to make an investment in a firm that provides imputation credits.

The impact of imputation credits on the cost of capital is reflected by modifying the WACC formula to account for the benefits of imputation credits (Officer 1994). The portion of company tax paid for which credits can be issued (the distribution rate) is multiplied by the rate at which shareholders actually use the credits (the utilisation rate) when they file their own taxes. The resulting product is called gamma (γ).

More formally, gamma is the product of two components, specifically the:

(a) *distribution rate* - the ratio of distributed imputation credits to company tax paid (IC/Tax)[106]

(b) *utilisation rate* - a value-weighted average over the utilisation rates (of imputation credits) of all investors in the market (*U*). The utilisation rate is defined as the proportion of distributed imputation credits that can be utilised as a tax credit against the personal liabilities of the shareholder.[107]

Gamma (γ) is defined as:

(34) $$\gamma = \left(\frac{\mathrm{IC}}{\mathrm{Tax}}\right)\mathrm{U}.$$

Gamma can take a value between zero and one. There is an inverse relationship between the value set for gamma and the allowed regulatory revenue (i.e. the component for the benchmark tax allowance) and, therefore, regulated prices. In other words, the closer gamma is to zero (one), the higher (lower) the allowed revenue, all else equal.

[106] This parameter is often symbolised by *F*.

[107] SFG Consulting (2011) refers to this second component as 'theta' and relates it to an empirically determined market value. This definition differs from the definition of the second component as the utilisation rate, although theta and the utilisation rate are related (and can be equal). This difference arises from differing conceptual approaches to defining this component, and the choice of definition has implications for the preferred estimation method (discussed later in this appendix).

Gamma can be estimated for a specific firm, for an industry or on a market-wide basis. The standard approach in a regulatory context is to estimate gamma on a market-wide basis.

Prior estimates

The QCA's estimate of gamma to date has been 0.50, comprising estimates of:

(a) 0.80 for the distribution rate

(b) 0.625 for the utilisation rate.

This estimate is consistent with an estimate of 0.50 that was originally proposed by Aurizon Network in the context of its 1999 Draft Access Undertaking (QCA, 2000: 222–225). In considering this estimate, the QCA reviewed relevant research at the time and took into account a number of other considerations.[108]

Several regulators lowered their previous estimates of gamma to 0.25 following a decision by the Tribunal in 2011 on the evidence before it at that time regarding an appropriate value for gamma (discussed below) (ACT, 2011). These regulators included the ACCC, the ERA, and IPART. However, more recently, in its *Better Regulation Rate of Return Guideline Explanatory Statement*, the AER adopted an estimate of 0.49 based on an updated conceptual framework and an assessment of a range of estimation approaches (discussed later) (AER, 2013e: 136–180).

Measuring gamma

Estimation of the distribution rate and the utilisation rate requires both a conceptual framework and an estimation approach. These issues are not straight forward and have been the subject of much independent expert analysis and opinion (e.g. Feuerherdt et al., 2010; Lally, 2004, 2013d).

In arriving at a preferred estimate of gamma, the QCA has considered a range of information, including:

(a) the evidence and arguments presented by the AER in its Rate of Return Guideline (AER, 2013d; 2013e)

(b) the views expressed by the Tribunal and supporting evidence in its recent decisions on gamma (ACT, 2010a; 2010b; 2011)

(c) the papers prepared by Lally (2012d, 2013d, 2014a)

(d) the stakeholder submissions and supporting research provided in the QCA's review of Aurizon Network's 2013 Draft Access Undertaking and the separate stream of research work on gamma

(e) views expressed at the Cost of Capital Forum held at the QCA on 13 December 2013.

The QCA's estimate of gamma is the product of the distribution rate and the utilisation rate, as defined at the start of this appendix. The utilisation rate is defined as the proportion of distributed imputation credits that can be utilised as tax credits against the personal liabilities of the shareholder. This interpretation is consistent with the definitions provided in Officer (1994), Monkhouse (1993), Lally and van Zijl (2003) and the AER (2013d, 2013e).

Furthermore, the QCA considers that gamma should be estimated for Australian listed companies. Estimating gamma for the Australian market rather than an international market is consistent with regulatory and market practice and the feasibility of implementation. The other CAPM parameter estimates are based on listed companies in the Australian market, and there are likely to be various impediments to efficient investment by investors in unlisted companies — specifically high transactions costs, lack of relevant information, and limited divisibility and marketability of unlisted assets.

[108] For example, see Hathaway and Officer (1999).

The use of a market-wide average for gamma and its components has been largely undisputed in submissions. However, as noted, some estimates for the components of gamma relate to both listed and unlisted companies. To reiterate, the QCA considers that it is preferable if gamma is based on estimates for listed companies because the other parameters in the CAPM (i.e. the market risk premium and beta) relate to listed companies.

The distribution rate

The QCA's estimate of the distribution rate to date has been 0.80, which was based on studies using earlier data. Changes to the tax system after 2000 in particular have given imputation credits full value to domestic investors.

Regulatory practice in Australia to date has been to set a value for this parameter within the range, 0.70–1.0 (AER, 2013b: 127-130). Aurizon Network proposed an estimate of 0.70, citing several studies that found the estimate of the distribution rate to be relatively constant over time (SFG Consulting, 2012a: 4-6). The AER has also adopted a distribution rate of 0.70 based on a NERA (2013c) estimate prepared for the ENA (AER, 2013c: 125).

The studies in question, including the NERA study, estimated the distribution rate using data compiled by the Australian Tax Office. The AER describes the preferred NERA measure as follows (AER 2013e: 150):

> *NERA's estimate is calculated by dividing the total franking account balance at the end of 2010–11 (the most recent data available) by the total value of Australian company tax paid from 1987–88 to 2010–11 (since the imputation system commenced). The payout ratio is 1 minus this proportion.*

Researchers have recently raised some concerns with the Australian Tax Office data.[109] The QCA notes the AER's view that the concerns about the data do not warrant rejecting the NERA estimate as unsuitable. However, the QCA also notes that the NERA estimates relate to a payout ratio for all Australian companies, including both listed and unlisted companies.

Noting concerns about the ATO data, Lally has proposed an alternative estimation method that results in an average distribution rate of 0.84 for the twenty largest ASX companies based on their market capitalisation, using data from their annual reports for the period 2000-2013 (Lally, 2014a: 30, 40 (Table 2)). As noted above, the period since 2000 is more relevant than the period prior to 2000 because of a change in the tax treatment of dividends that guaranteed full refund of imputation credits to eligible investors. As explained by the AER, these changes would be expected to increase the utilisation rate relative to the situation prior to 2000 (AER, 2013e: 158).

Lally's sample accounts for 62 per cent of the ASX200 market capitalisation. This fact is important because companies with higher market value are likely to have a greater influence on the value of this parameter.

The QCA notes that the alternative estimate of 0.70 has been consistent across several studies. However, the studies in question all use the ATO data. As a result, such consistency is unsurprising. However, if the data are unreliable, then these studies will produce estimates that are consistently wrong. Finally, these studies estimate a distribution rate that applies to listed and unlisted companies, whereas a distribution rate for only listed companies is preferred, given that the other CAPM parameters have been estimated from listed company data.

Lally's estimate of the distribution rate of 0.84 is based on the 20 largest listed companies (in terms of market capitalisation) for the period 2000–2013. As this estimate covers 62 per cent of the ASX200 and

[109] For example, see Hathaway (2013: 22–39) and NERA (2013c: 5–6, 8–9 (Table 2.2)).

focuses on listed companies, it is considered to be a superior estimate to the 0.80 estimate, which is based on studies using data prior to 2000 and relates to both listed and unlisted companies.

In addition to being based on listed companies, Lally's data is sourced from firms' financial statements, and these have three distinct and highly important advantages relative to the ATO's tax statistics' data. First, the financial statements are subject to annual, independent audit. Second, the researcher is able to personally identify the *source* data — rather than having to rely upon the ATO's aggregation exercises — this feature protects against possible double-counting and other aggregation problems. Third, the financial statement data is internally consistent, in that there are no unexplained discrepancies (Lally, 2014a: 29). In contrast, researchers have found major discrepancies with the ATO data.

This fact provides a strong basis for Lally's recommended approach, as the data source is highly reliable whereas material concerns have been raised regarding the reliability of the tax statistics' data.

It should also be recognised that imputation credits that are not distributed have value to the extent that they will eventually be distributed. This value will depend on the period of retention and the extent to which they are discounted to reflect the time value loss.

Handley noted that, while undistributed imputation credits have some value to the extent they will be eventually distributed, any adjustment for the value of retained credits is not warranted given the wide confidence intervals on empirical estimates of the value of distributed franking credits (Handley, 2010b: 9-10). Lally does not support an adjustment for the value of undistributed imputation credits, noting that 'there is no strong theoretical argument for eventual distribution and therefore historical experience must be favoured as an estimator for the future' (Lally, 2013d: 55).

Taking all of the relevant factors considered into account, the QCA's preferred estimate of the distribution rate is 0.84.

Utilisation rate

In the QCA's previous decisions, the QCA has applied a value of 0.50 for gamma, comprising estimates of 0.80 for the distribution rate and 0.625 for the utilisation rate.

Several approaches have been used in the past by various regulators and regulated firms to estimate the utilisation rate. The following approaches to estimating the utilisation rate are considered below:

(a) *Dividend drop-off studies* — an approach that analyses the price change of an equity between cum-dividend and ex-dividend trading days in order to infer how much of the change is attributable to the value of the cash dividend and how much of that change is attributable to the value of the associated imputation credits

(b) *Redemption studies* — an approach that estimates the proportion of imputation credits that are redeemed with the Australian Tax Office by investors

(c) *Equity ownership* — an approach that assumes that the average utilisation rate is a weighted average of utilisation rates for domestic and foreign investors, with the weights reflecting ownership shares and utilisation rates (typically) of one for domestic resident investors and zero for foreign investors

(d) *Conceptual test* — an approach where the utilisation rate should produce a return on equity that lies between the return on equity under complete market segmentation (no foreign investment in the domestic market and no domestic investment in foreign markets) and the return on equity under complete integration of domestic and foreign markets

(e) *Other supporting evidence* — estimates applied by analysts and valuers, government tax policy, and imputation equity funds.

Dividend drop-off studies

Dividend drop-off studies attempt to estimate the utilisation rate by comparing stock prices before and after dividends are distributed to shareholders. The supposition is that the degree to which imputation credits are utilised affects the pre and post distribution share price difference. Stock prices are obviously affected by a range of factors so econometric analysis is used to attempt to infer the value of the imputation credits from the stock price changes following dividend distributions.

The estimate of 0.35 for the utilisation rate previously accepted by the Tribunal and proposed by Aurizon Network in UT4, is based on an SFG Consulting (2011) dividend drop-off study for the Tribunal. The QCA notes that SFG Consulting updated this study in June 2013 on behalf of the ENA and reaffirmed its previous recommendation of 0.35 using an updated data set (SFG Consulting, 2013e). The QCA also notes that SFG Consulting has undertaken further stability tests of its dividend drop-off results (SFG Consulting, 2014c).

The QCA is aware that the Tribunal considered the SFG Consulting dividend drop-off study in 2011 to be 'the best dividend drop-off study currently available for the purposes of estimating gamma in terms of the Rules' (ACT 2011: para. 29). However, the QCA notes that the Tribunal expressly commented that further conceptual explanation and research would be useful. The QCA also notes the AER's detailed consideration of the Tribunal's decision, including the Tribunal's focus on dividend drop-off studies. (The Tribunal decision and the AER follow-up are discussed in detail below.)

The QCA considers that dividend drop-off studies do not provide an appropriate measure of the utilisation rate. The utilisation rate is defined as the proportion of distributed imputation credits that are used by shareholders to reduce their personal income tax payments. For domestic investors since 2000, this proportion is one. For foreign investors, this proportion is likely to be very small on average but will depend on how foreign tax systems recognise company tax paid in Australia.

The QCA's interpretation is consistent with that adopted by the AER (2013d: 158-162; 2013e: 137-140). The interpretation of the utilisation rate as the proportion of distributed imputation credits used by shareholders as an offset to personal tax rather than a market value for imputation credits is also consistent with the definition set out in Officer (Officer, 1994: 4):

> *A proportion (γ) of the tax collected from the company will be rebated against personal tax and, therefore, is not really company tax but rather is a collection of personal tax at the company level.*

That is, the imputation credits effectively represent a prepayment of personal tax liabilities for those who can make use of them. Officer subsequently states in other terms that gamma is (Officer, 1994: 4):

> *...the proportion of tax collected from the company which gives rise to the tax credit associated with a franked dividend. This franking credit can be utilized as tax credit against the personal tax liabilities of the shareholder. γ can be interpreted as the value of a dollar of tax credit to the shareholder.*

Relevantly, the definition applied by the QCA is also consistent with the formal definition derived in the models of Monkhouse (1993) and Lally and van Zijl (2003). In the latter two studies, the value of imputation credits is derived as a weighted average across investors in the defined market with the weights reflecting both their investment in risky assets and their degree of risk aversion (Lally and van Zijl, 2003; AER 2013d: 166). Relevantly, the Officer CAPM variant is a special case of the Lally-van Zijl CAPM.

The weights are simplified in practice so that the utilisation rate is a weighted average across investors in proportion to the value of shares they own. Two groups of investors are recognised — domestic and foreign. The utilisation rate for domestic investors is one, as all domestic investors are able to make full use of imputation credits under the current taxation laws in Australia. The utilisation rate for foreigners is likely to be very low on average and depends on the extent to which foreign countries' tax systems

provide credit for taxes already paid in other countries. The utilisation rate for foreigners is typically assumed to be zero.

Based on the foregoing analysis, the QCA considers that interpreting the utilisation rate as a market value is not consistent with its conceptual meaning in the Officer CAPM framework that is applied for regulatory purposes and leads to an unwarranted focus on dividend drop-off studies. Dividend drop-off studies might provide some indirect information about the utilisation rate but do not provide a relevant estimate because they do not measure the actual impact of the credits on the returns shareholders expect to earn from owning the equity. Changes in share values following from short-term share market fluctuations might not accurately reflect the certain value to the shareholder of the actual imputation credits. In addition, dividend drop-off models suffer from a number of econometric problems (as discussed further below).

Empirical Issues

Based on the QCA's analysis and the expert opinion received, the QCA considers that dividend drop-off studies do not produce robust statistical results. They suffer from a number of well-documented methodological and econometric problems. To better inform its view on the SFG (2011) study, the QCA engaged Dr Martin Lally to undertake an independent expert review of this study, and he raised both conceptual and empirical concerns with it (Lally, 2012c; 2013d). Handley (2008) has raised a number of similar concerns about the reliability and interpretation of dividend drop-off studies. Similar concerns have been recognised by the AER (AER, 2013e: 159–166).

The QCA focuses on the broader messages that can be drawn from Dr Lally's critiques of SFG Consulting (2011) and of dividend drop-off studies in general. The QCA has the following specific concerns:

(a) The value of imputation credits is not directly observable in dividend drop-off studies, and any estimate will impound other effects related to differential tax rates, transaction costs, market-wide influences and risk — allowing for, and separating, these effects from each other is difficult and complex.

(b) The results are highly likely to be contaminated by the presence of unrepresentative investors (e.g. tax arbitragers) — as such, they do not inform an estimate of a value-weighted average of the utilisation rate across the market consistent with the definition of the utilisation rate.

(c) Estimates can differ widely from study to study, even over the same period of time, and are highly sensitive to the data choice, model specification, sampling error and the removal of outliers.

All of these methodological limitations are reinforced by Cannavan, Finn and Gray (2004: 174-175):

> *For these reasons, it is unlikely that the traditional ex-dividend day drop-off methodology will be able to separately identify the value of cash dividends and imputation credits.*

Further, in relation to points (a) and (b), differential personal tax rates on dividends compared to capital gains and the existence of trading risk around the ex-dividend date will mean that there are multiple, and likely complex, interpretations of the value of franking credits (Handley, 2008: 11).[110,111]

[110] All traders are subject to risk during the period of holding the equity in order to receive the dividend. In this situation, they are not protected against an adverse movement in the equity price due to, for example, the release of certain information about particular equities or the economy as a whole (e.g. the latter news in relation to monetary policy, unemployment, etc).

[111] For example, using a general equilibrium framework, Michaely and Vila (1995) show that the ex dividend price drop relative to the dividend amount is a function of the average relative tax rate of dividend and capital gains across traders weighted by their risk tolerance and a function of the total risk in the economy relative to total risk-bearing capacity.

In relation to point (b), the AER (2013d: 161) noted that:

> *The CAPM assumes investors value the equity returns over the full CAPM period, with no trading during that period. In reality, trading is ongoing. However, where the model's inputs draw on trading data, it is important that this data has arisen throughout the trading year. This ensures that the data is not especially sensitive to any specific trading circumstances at particular times.*

In relation to point (c), Cannavan, Finn and Gray (2004) observe that 'noise' in security prices causes the sampling error of the estimates from these studies to be considerable, even for large sample sizes (Cannavan, et al., 2004: 174). Moreover, recent work undertaken by the Economic Regulation Authority of Western Australia highlights the fragility of these studies. Specifically, Vo, Gellard and Mero (2013) use the same methodology and data filtering rules with data from near identical time periods as SFG Consulting. For some of the models, they obtain results that diverge widely from the SFG Consulting (2011) results.

Finally, both studies apply different, but reasonable, approaches to testing the sensitivity of their results to the removal of outliers. For example, Vo, Gellard and Mero (2013) progressively remove the thirty most extreme observations (less than 1.0% of the sample), and re-run their model after each deletion — the effect is to increase their utilisation rate estimate from 0.32 to 0.53.

In contrast, SFG Consulting (2011) progressively removes the twenty most extreme pairs of observations (i.e the observation that has the greatest upward effect along with the observation that has the greatest downward effect) and finds only a trivial effect on their results. The implication is that results from these studies are extremely sensitive to the rules applied for removing outliers. Moreover, the selection of the rules applied is arbitrary.

In addition, both studies remove firms from the sample with a market capitalisation of less than 0.03% of the All Ordinaries index. The equity in these companies is infrequently traded. Therefore, the market pricing of their equity might not be efficient, and price changes on ex-dividend days might not be representative. On the other hand, Lally observes that applying this rule removes about 5000 observations (of a total of 8000) and that these observations are least likely to produce results that are contaminated by tax arbitrage. As a result, Lally argues that applying the filtering rule could remove the superior data and that, in any event, the rule is arbitrary (Lally, 2012d: 18-20).

Additionally, the QCA notes that SFG Consulting has subsequently argued that its results are to be preferred to those of Vo, Gellard and Mero (2013) because their results have been subjected to a number of stability and robustness checks. In contrast, SFG Consulting notes that Vo, Gellard and Mero (2013) express concerns about the stability of their own results. In any case, SFG Consulting observed that most of the Vo, Gellard and Mero (2013) study estimates are below 0.45 and a significant proportion are below 0.35 (SFG Consulting, 2014c: 1-2).

While the QCA has reviewed this further information, it does not alleviate the QCA's concerns with dividend drop-off studies. A collective examination of these studies reveals substantial cross-sectional and inter-temporal variation in results that cannot be reasonably reconciled. It is likely that some of this variation simply reflects statistical uncertainty that is inherently present in these types of estimation procedures. Another important concern is the high correlation between the cash dividend and the franking credits (due to price movements related to other factors and other microstructure effects), which makes it difficult to identify the effects of the credits separately. There is also a concern in the literature that the operation of tax clienteles inappropriately drives the value of the credits.[112]

[112] A tax clientele is a group of investors who have specific preferences for a debt or equity security due to the difference between their personal tax rates and/or tax liabilities relative to other groups of investors.

To attempt to control for some of these problems, Cannavan, Finn and Gray (2004) use a different empirical method and estimate a value for the utilisation rate of zero (recently updated to 0.13), which is substantially lower than 0.35.[113] However, using a similar technique to Cannavan, Finn and Gray (2004), Cummings and Frino (2008) obtain a significantly higher estimate of the utilisation rate of 0.64.[114] Using yet another empirical method, NERA (2013c, Table 3.5) estimates the parameter to be -2.00. Setting aside the latter result as it is not economically plausible, the range from the remaining studies is very wide (i.e. 0–0.64).

In summary, dividend drop-off and related econometric studies produce a wide range of estimates that are inconsistent with one another and cannot be easily reconciled. These outcomes very likely reflect the inherent shortcomings of the underlying methodology. In any case, dividend drop-off and related studies do not directly measure the appropriate concept for gamma.

These considerations raise concerns about the reliability of using these studies and other 'market' studies to infer an estimate of the utilisation rate. Specifically, the QCA considers that such studies may produce unreliable estimates, and there is ample evidence to support this contention.

QCA Assessment

Given the concerns identified, expert opinion and the QCA's analysis above, the QCA does not find the estimate of 0.35 for the utilisation rate based on the dividend drop-off approach to be acceptable. Moreover, this result is from only one principal study using one type of estimation methodology, and this method suffers from material conceptual and empirical limitations.[115] Rather, the QCA considers that any change in the value of the utilisation rate should be informed by considering the merits of other evidence on the basis of their congruency with the relevant concept. In this respect, the QCA shares the view of McKenzie and Partington that a range of evidence should be considered (McKenzie and Partington, 2010: 11):

> *It is clear that a precise and unambiguous valuation of theta [the utilisation rate] is unlikely to be derived from traditional ex-dividend studies. It would be unwise, therefore, to rely on one ex-dividend study to determine theta. Equally, it would be unwise to just rely on combining results across several ex-dividend studies; triangulation with other evidence is desirable.*

However, the QCA does not consider it appropriate to simply use the average across all studies as that would mean giving equal weight to each study despite the nature and extent of problems that might be associated with a particular study. As noted, the QCA considers that it is important to assess classes of studies and individual studies in terms of theory, evidence and ease of understanding and application. The merits of alternative approaches are discussed below.

Redemption approach

The redemption approach uses taxation statistics to estimate the proportion of imputation credits redeemed by all investors with the ATO. Hathaway (2013) and Handley and Maheswaran (2008) are the two relevant studies for the post-2000 period.

---

[113] The update was undertaken on behalf of the Energy Networks Association. See SFG Consulting (2013f).

[114] The method involves using contemporaneous prices for an equity index and futures contracts over that index. They attribute their result to two tax changes: i) a reduction in capital gains tax from 1 Jul 1999; and ii) rebates for unused imputation credits from 1 July 2000 (Cummings and Frino, 2008: 414).

[115] This estimate of 0.35 is based on an SFG Consulting (2011) dividend drop-off study for the Tribunal, reaffirmed in June 2013 using an updated data set (SFG Consulting, 2013e).

Hathaway (2013), in a report for the ENA, provides two redemption rate estimates of 0.62 and 0.44 for the period 2004–2011.[116] The estimate of 0.62 is based on the inferred amount of franking credits distributed from the franked dividend data. The estimate of 0.44 is based on the taxation data (showing the aggregate net tax paid by Australian companies) and the change in the aggregate franking account balance. According to Hathaway, the difference in these estimates reflects a large and unexplained discrepancy between the franked dividend and franking account balance data series. However, Hathaway considers the latter estimate to be more reliable.[117]

The AER (2013e) reviewed the concerns raised by Hathaway (2013) and concluded that, when estimating the utilisation rate, it should have regard to tax statistics. Further, the AER noted that it gives more weight to Hathaway's estimate of 0.62, as it is based on one data series (the dividend data), than it gives to his estimate of 0.44, which relies on two separate data sources (taxation and franking account balance data) (AER, 2013e: 153–157). The QCA is unable to determine which of the two estimates prepared by Hathaway (2013) is likely to be more reliable. However, the AER notes that both estimates are, in effect, an estimate of a utilisation rate across all classes of investors (domestic and foreign) in both listed and unlisted firms, with the weights reflecting the proportions of credits that are redeemed by different classes of investors.

Handley and Maheswaran (2008), in their paper published in *Economic Record*, estimate the utilisation rate across individuals, funds and non-residents (end users of imputation credits) using taxation data for 1990–2004 and for two sub-periods, including 2001–2004. The average, weighted estimate of the utilisation rate across these investor groups for the period, 2001–2004, is 0.81. This estimate reflects the proportion of imputation credits received by different classes of investors, including non-residents, and their values as tax credits. This estimate reflects two explicit assumptions: i) over 2001–2004, resident individuals and funds have utilisation rates of one; and ii) from 2002, non-residents receive 25 per cent of the total dividends distributed, of which 63 per cent are franked. Over 2001–2004, non-resident investors received approximately 20 per cent of the imputation credits distributed to end users because other classes of investors have a higher ratio of franked dividends to total dividends.

In addition, the utilisation rate for non-residents does not reflect redemption of the imputation credits in the Australian tax system but recognition that franked dividends receive an exemption from dividend withholding tax.[118] There are also no estimates for superannuation funds provided by life assurance companies. The estimates also relate to an average utilisation rate across listed and unlisted companies. For the post-2000 period, the study is, in effect, more appropriately classified as an equity ownership study, given the explicit assumption about the share of imputation credits allocated to foreigners. This approach is discussed in more detail below.

Given the above considerations, an average of the Hathaway estimates of 0.44 and 0.62 is considered to provide a relevant estimate of the utilisation rate based on the most recent ATO data, which covers a

[116] Both estimates have the same numerator value, which is the estimate of $127.6 billion of net credits redeemed, but they use different denominator values. There are two approaches for estimating the total distribution of franking credits (the denominator), as Australian companies are required to report to the ATO their payments of franked dividends, and the resultant level of their franking account balances.

[117] Hathaway (2013) considers that the franking account balance data is likely to be more reliable than the dividend data. Hathaway (2013) observes that there have been large revisions to the dividend data for the period, 2000–2004, as a result of problems with double-counting of dividends. Hathaway (2013) believes this problem does not pervade the franking account balance data, as any dividend payment from one company to another requires offsetting franking account balance entries (Hathaway, 2013: 23).

[118] This definition of a utilisation rate for foreigners recognises that the dividend withholding tax system leads to a lower tax for foreigners for franked dividends compared with unfranked dividends, but in any case the impact on the overall average is minor.

period when the foreign ownership of equities has increased (see following section). The average of these estimates is 0.53. However, as noted this average utilisation estimate rate relates to listed and unlisted firms and it would be preferable to use an estimate of an average utilisation rate for listed firms.

Equity ownership

The equity ownership approach can be applied to the Australian market by calculating the shares of domestic and foreign equity ownership and assuming utilisation rates for these two classes of investors of one and zero respectively. The shares of ownership of domestic and foreign investors in Australian listed and unlisted companies have tended to be relatively constant and suggested that foreign investors held 28%–30% of the Australian market until recent years (Table 6).

However, the share of foreign ownership has increased since the GFC and averaged 45 per cent for the first three quarters of 2013. The cost of capital is a forward-looking concept over the regulatory period. Therefore, an estimate of the expected share of foreign ownership over a 4-5 year regulatory period is required. For this reason, an estimate based on the recent 4–5 year period is considered to be a better estimate for regulatory purposes at this point in time. In addition, ownership of listed shares is considered to be more relevant when estimating the utilisation rate in applying the CAPM for regulatory purposes.

Table 6: Foreign ownership of Australian equity (listed and unlisted)

Period (Quarter)	*Foreign ownership (% of total)*		
	Listed (%)	*Unlisted (%)*	*Combined (%)*
Jun 1998–Sep 2013	41.84	14.18	27.66
Mar 2013–Sep 2013	44.55	16.25	31.07
Mar 2009–Sep 2013	43.68	16.61	30.47

Source: Australian Bureau of Statistics (2013).

Using an estimate of 44 per cent as the foreign ownership share of listed equities and assuming a utilisation rate of one for domestic resident investors (and zero for foreign investors) implies an average utilisation rate for listed Australian domestic market equities of 0.56. This estimate is very similar to the average estimate from Hathaway's two approaches (0.53).

The estimate of 0.56 is considered a conservative lower bound estimate for the equity ownership approach because it excludes the impact of unlisted equities. However, it can be argued that unlisted equity is still relevant despite illiquidity concerns (Lally, 2014a: 34). If unlisted equity is included, it would lead to a utilisation rate estimate of around 0.70 (Lally, 2014a: 34–35). These estimates also assume that foreigners own shares with imputation credits in the same proportion as their ownership shares for the equity market as a whole. If imputation credits are of greater value to domestic investors, it is likely that they would own equities that distribute dividends with higher attached imputation credits more than proportionately to their holdings for the market as a whole.

Lally conceptual test

Lally (2013d) proposed a test that can be used to evaluate the reasonableness of a particular utilisation rate. This test involves estimating what the Australian cost of equity would be under complete segmentation (i.e. no international investors) and complete integration of national equity and world equity markets. If the utilisation rate is unreasonable, it will produce an estimate of the cost of equity that lies outside estimates from the two extreme scenarios.

The Officer (1994) model is used for the first scenario while the Solnik (1974) model is used for the second. The Officer model strictly applies to segmented markets. This is because it implicitly assumes all investors have the same expected returns. From a practical perspective, this assumption is not generally plausible once foreign investment is recognised.

As a result, the Officer model is typically applied pragmatically by adopting parameters that relate to the Australian domestic market that takes account of the influences of foreigners. Lally (2013d) contended that using a utilisation rate in the Officer model that reflects the presence of foreign investors in Australia represents a form of cherry-picking of parameters that has the effect of maximising the allowed revenue for regulated businesses. Nonetheless, the Officer model can be strictly applied, such that parameter estimates reflect only the influence of domestic investors, to establish a segmented markets benchmark. At the same time, the Solnik model can also be strictly applied to represent an integrated markets benchmark.

As explained in Lally (2013d), the true cost of equity associated with a partially integrated equity market must lie between the cost of equity that arises under each of the two extreme benchmark scenarios. Lally (2013d) applies the Officer model with inputs reflecting international investor presence in the Australian equity market, as is typically done in regulatory practice. Lally determines what utilisation rates produce cost of equity estimates that satisfy the test (i.e. that produce a cost of equity estimate that lies between the extremes). He concludes that a utilisation rate of one (or close to one) in conjunction with the common approach of Australian regulators is reasonable (i.e. it produces a result that satisfies the test) (Lally, 2013d: 38).

A crucial aspect of Lally's test is the assumption that the *same* risk-free rate applies in each benchmark scenario. Specifically, Lally contended that the risk-free rate in the CAPM is exogenous, such that *how* it is determined is irrelevant. In other words, Lally argued that, regardless of how the rate is determined — whether by demand / supply conditions, monetary policy, or government fiat — the rate is taken as given in the model (Lally, 2014a: 31).

However, SFG Consulting countered that using an 'exogenous' risk-free rate does not imply that the *same* risk-free rate should be applied in both extreme benchmark scenarios. SFG Consulting took an empirical perspective and produced historical evidence that government bond yields have moved up and down with the proportion of domestic ownership. SFG Consulting concluded that use of the same risk-free rate in the segmented and completely integrated market scenarios is not consistent with the historical evidence (SFG Consulting, 2014b: 23–25).

In responding to SFG Consulting's argument that the risk-free rate changes between the benchmark scenarios, Lally (2014a) argued that the relevant test applies to the risk *premiums* (i.e. the margin above the risk free rate (beta x mrp)). Specifically, Lally contended that the true risk premium associated with a partially integrated equity market must lie between those premiums that arise under the complete segmentation and complete integration scenarios. Applying this perspective, Lally (2014a) arrived at the same conclusion — that is, a utilisation rate close to one should be adopted when the Officer model is used.

In the QCA's view, the Lally test is conceptually defensible and of some relevance, but there is some uncertainty about what the bounds should be. The QCA also considers that the test provides useful information about the market risk premium, and more importantly highlights the relevance of expected returns in international equity markets and their implications for an expected return in the Australian domestic market.

Other supporting evidence

Other supporting evidence includes estimates applied by analysts and valuers, government tax policy, and the existence of imputation equity funds. The AER notes that the primary strength of this evidence is that

it relates to real world behaviour but that the primary weakness is that it does not report a utilisation rate consistent with the relevant, conceptual definition (which the QCA also adopts) (AER, 2013d: 182).

In relation to valuation practice, KPMG (2013) undertakes a survey of Australian practice and finds that the most current evidence indicates that 53% of practitioners explicitly adjust for imputation credits when valuing businesses other than infrastructure, and this figure rises to 94% for infrastructure investments. Furthermore, where imputation credits were included in cash flows at a specified utilisation rate, this rate averaged 75% (Lally, 2013d: 24).

Other evidence suggests that, while some valuers do not make an explicit adjustment, they believe the rate to be positive. Lally showed that in valuing equity, expert estimates can impound an estimate of a (positive) utilisation rate into their valuation, without making an explicit adjustment (Lally, 2013d: 25-28). Further, Lally (2013d) found a trend in the last decade toward including an adjustment for imputation credits, which indicates they have a positive value (Lally, 2013d: 24).

The AER notes two practices that signal a positive and material value for imputation credits. First, major financial institutions offer managed funds that exclusively invest in firms that pay a high level of imputation credits. Second, the Australian Government acted to close a loophole that allowed a 'dividend washing' process, which resulted in investors claiming imputation credits twice (AER, 2013e: 178–179). The AER interprets these practices as evidence that imputation credits have a positive value.

The QCA agrees that market valuation practice, the existence of imputation investment funds and dividend washing all provide evidence that imputation credits have a positive value. The QCA considers that, on balance, the evidence for Australian practice indicates that the estimate of the utilisation rate is substantially higher than the estimates from the dividend drop-off studies, redemption estimates and equity ownership estimates and within the bounds of the conceptual test proposed by Lally (2013d).

Overall assessment

Given the concerns identified, expert opinion and the QCA's analysis above, the QCA considers that:

(a) The dividend drop-off studies are of limited relevance, as they do not necessarily produce estimates that are conceptually and statistically robust or reliable. They suffer from a number of well-documented methodological and econometric problems.

(b) The redemption studies provide more reliable and robust estimates of an average utilisation rate across listed and unlisted companies, but still raise material data concerns. In addition, estimates from this approach are based on credits redeemed by investors in both listed and unlisted companies.

(c) The equity ownership approach is based on the correct conceptual concept — a weighted average of utilisation rates across investors with weights reflecting ownership shares in Australian listed companies. It is also transparent, based on reliable data and relatively easy to estimate. The equity ownership approach provides the most robust and reliable estimate of the utilisation rate of the methods analysed above, albeit as a conservative (reasonable lower bound) estimate.

(d) The Lally conceptual test is relevant but given the uncertainty about the bounds of the test, it is given less weight in establishing a final estimate of the utilisation rate.

(e) The other supporting evidence is consistent with imputation credits having substantial value. The most useful evidence in this category is the recent survey by KPMG (2013), which suggests a utilisation rate of 0.75 for infrastructure investments. This evidence is considered to imply that the utilisation rate of 0.56 from the equity ownership approach is conservative.

In summary, the QCA considers that the equity ownership approach should receive the most weight and represents a conservative estimate. The current estimate of 0.56 from this approach is lower than the

estimate of 0.625 that has been adopted by us in previous decisions. This lower utilisation rate is consistent with Australia becoming more integrated with world financial markets because the lower value reflects greater non-resident ownership of Australian equities.

However, as Australia becomes increasingly integrated with other markets, the cost of equity should fall because investors will hold more widely diversified portfolios. This inconsistency arises because the proposal here only adjusts (i.e. lowers) the utilisation rate, and not the asset beta and market risk premium, to reflect greater market integration. The utilisation rate also needs to be combined with an estimate of the distribution rate to determine the impact on the cost of equity.

Combining the preferred (conservative) estimate of the utilisation rate of 0.56 with an estimate of 0.84 for the distribution rate gives a conservative (reasonable lower bound) estimate of 0.47 for gamma. This result is marginally lower than the QCA's previous estimate of 0.50.

Annex

The Australian Competition Tribunal decision

In 2010, ENERGEX, Ergon Energy and ETSA Utilities sought a review by the Tribunal of a decision on gamma by the AER. This review and subsequent, related reviews took place under the National Electricity (Distribution) Rules (ACT, 2010a, 2010b, 2011).

On the basis of the evidence before it at the time, the Tribunal concluded that the values of the distribution rate and theta should be 0.7 and 0.35 respectively, leading to a value for gamma of 0.25 (0.7 x 0.35) (ACT 2011: 10, para. 42).

The value of the distribution rate was based on a number of considerations, including submissions from the AER that there was no empirical data capable of supporting an estimate higher than 0.7 (ACT, 2011: 3, para. 8).

The Tribunal defined theta as 'the value of imputation credits distributed to investors as a proportion of their face value' (the 'utilisation rate') (ACT, 2011: para. 6).

As discussed previously, the Tribunal commissioned a study by SFG Consulting to estimate theta using a dividend drop-off methodology (SFG Consulting, 2011). After reviewing the report and submissions on the report, the Tribunal concluded that the SFG Consulting report was 'the best dividend drop off study currently available for the purposes of estimating gamma in terms of the Rules' (ACT, 2011: para. 29). However, the Tribunal also noted some limitations about the estimation of gamma and suggested it would continue to be investigated (ACT, 2011: paras. 38, 45):

> *The Tribunal finds itself in a position where it has one estimate of theta before it (the SFG's March 2011 report value of 0.35) in which it has confidence, given the dividend drop-off methodology...Further, the Tribunal notes that estimation of a parameter such as gamma is necessarily, and desirably, an ongoing intellectual and empirical endeavour. Its decision in these proceedings is based on the material before it.*

The AER considered that the Tribunal interpreted the 'market value' of the utilisation rate as a relevant conceptual goal and concluded that dividend drop-off studies accurately identify the market value of imputation credits (AER, 2013e: 154). The AER considered that these conclusions arose from the incomplete conceptual framework that had been presented and that the complete conceptual framework, which has been set out by the AER, shows that the market value of the utilisation rate is not the relevant concept (AER, 2013d; 2013e). The QCA agrees with the AER's interpretation of the utilisation rate.

The AER summarises its previous and current view as follows (AER, 2013e: 139):

> *As we noted in the explanatory statement accompanying the draft guideline, in past regulatory processes, we have not always clearly articulated the distinction between the Officer definition of the utilisation rate and the available approaches to estimate it. Instead, we had focused too narrowly on the 'market value definition' of the utilisation rate. For instance, in our 2010 final decisions for the Queensland and South Australia electricity networks we included substantial discussion on the estimation of the utilisation rate using market prices.[602] Other approaches, such as the use of taxation statistics, were implicitly evaluated relative to the market value approach.[603] These decisions were then appealed to the Tribunal over the determination of gamma, and this focus influenced the Tribunal's interpretation of the utilisation rate[604] [footnotes omitted].*

The AER provides further details on its interpretation as follows (AER, 2013d: 161, citations omitted):

> *Further, to operate consistently with the rate of return, the value of imputation credits should fit within the Officer and Monkhouse frameworks in the presence of imputation credits.*
>
> *Those frameworks require that:*

- *The value of imputation credits is investors' expected reduction of effective company tax paid because of h (sic) imputation credits. Specifically, this is the reduction of company tax measured before personal tax.*
- *The value of imputation credits is calculated as a weighted average across investors in the defined market. Specifically, investors are weighted by their value of shares owned and their risk aversion. Consequently, the commonly referred to concept of the market price being set by the 'marginal investor' is not particularly meaningful or helpful in this context. Rather, all investors collectively set the market price, to the extent they participate in the defined market. Consistent with the 2009 WACC review, we propose that the defined market is an Australian domestic market that recognises the presence of foreign investors to the extent they invest in the Australian market. This definition reflects the realities of capital markets. It also sits between the purely theoretical definitions of a 'fully segregated' and a 'fully integrated' market. This definition has critical implications for the value of imputation credits.*
- *The CAPM assumes investors value the equity returns over the full CAPM period, with no trading during that period. In reality, trading is ongoing. However, where the model's inputs draw on trading data, it is important that this data has arisen throughout the trading year. This ensures that the data is not especially sensitive to any specific trading circumstances at particular times.*

To varying extents, these framework requirements relating to the conceptual task have been discussed in past regulatory analysis. However, we consider the implications of these requirements have not been fully considered and used in previous analysis to inform the selection of estimation methods.

From this re-evaluation, we have determined that the regulatory debate on the value of imputation credits did not fully address this conceptual task. Instead, the previous regulatory debate has included an economic and econometric debate over certain arcane details. The debate has also solely relied on a particular class of evidence that has a number of significant limitations. We consider this outcome is not in the long-term interests of energy consumers. We consider a wider appraisal of the available evidence is better regulatory practice.

Much of the regulatory debate from the 2009 WACC review and the Tribunal review focused on evaluating detailed technical issues around specific studies or pieces of evidence. It would have assisted us and the Tribunal to have taken a step back from the detail and to have started from a better conceptual understanding of imputation credits within the building block revenue model. The Tribunal stated:

"The Tribunal has found some deficiencies in its understanding of the foundations of the task facing it, and the AER, in determining the appropriate value of gamma. These issues have not been explored so far because they have not arisen between the parties, who appear to be in agreement about how the Rules should be interpreted regarding the treatment of corporate income tax. They may be matters that the Tribunal will take up in its further decision in these matters; or they may best be left until the next WACC review. Indeed, they may go to the basis for the Rules themselves."

In responding to the Tribunal's comments, we have now considered the questions raised in McKenzie and Partington's March 2011 report. We have also extended them by revisiting the foundational theory of the value of imputation credits. Having done so, we have reached views on these issues that were not before the Tribunal at the time of its review.

Further, we consider that in the 2009 WACC review and subsequent decisions, we adopted too narrow a scope of evidence to estimate the utilisation rate. Specifically, our analysis was limited only to tax statistic estimates and dividend drop off studies. Accordingly, in this guideline, we have endeavoured to draw on a broader range of evidence with regard to its strengths and weaknesses. Much of this evidence was also not before the Tribunal at the time of its review.

The QCA considers that the decisions by the Tribunal depend on the information that it had presented before it at the time and that the Tribunal recognised that there was scope for further conceptual and

empirical work to clarify the interpretation of gamma and provide better estimates of gamma. This view is consistent with the position subsequently adopted by the AER following its comprehensive review and preparation of its rate of return guideline (AER, 2013d, 2013e).

Response to technical arguments

This section seeks to respond to some further technical arguments raised in the context of estimating gamma. While the QCA has considered all material put before us, this section is not intended to be an exhaustive discourse of all of the points raised by stakeholders. Rather, it addresses key issues raised. Further details can be found in Dr Lally's accompanying papers:

(a) *The Estimated Utilisation Rate for Imputation Credits* (12 December 2012)

(b) *Estimating Gamma* (25 November 2013)

(c) *Review of Submissions to the QCA on the MRP, Risk-Free Rate and Gamma* (12 March 2014).

The distribution rate

SFG Consulting made several arguments in relation to estimating the distribution rate:

(a) Lally's concerns about the ATO data are not specific and appear to be misplaced; further, should such problems exist, Lally does not explain why his alternative approach of using company financial statements is not subject to the same problems (SFG Consulting, 2014b: 16)

(b) Lally's sample is more likely to have high distribution rates because the companies are large and, therefore, more likely to have foreign-sourced profits — the effect is to reduce their tax payments to the ATO and increase their distribution rates (SFG Consulting, 2014b: 16)

(c) Lally's estimate of the distribution rate is not indicative of the benchmark regulated firm (SFG Consulting, 2014b: 17)

(d) The QCA's estimate has maintained its estimate of 0.80, and this estimate is inconsistent with the estimate of 0.70 supported by all stakeholders (SFG Consulting, 2014b 15).

The QCA now addresses each of these concerns in turn.

The concerns raised by Lally (2013d) were originally identified by other researchers. Specifically, NERA (2013c) noted that the distribution rate might be under or over estimated due to some firms failing to report their franking account balances (NERA, 2013c: 5). Further, NERA estimated the distribution rate in two different ways (i.e. a tax measure and a dividend measure) using ATO data that should give the same result. The former approach gives an average estimate of 0.70, while the latter gives an estimate of 0.53 — these estimates are materially different (NERA, 2013c: 8–9, table 2.2).

In a recent report prepared for the ENA (as part of its submission on the AER's Rate of Return Draft Guideline), Hathaway (2013) identified a major discrepancy between two subsets of ATO data totalling 87.5 billion in franking credits over 2004–2011. Hathaway sought to reconcile the two estimates and eliminated several possible causes of the discrepancy. Ultimately, however, he was unable to reconcile the data and informed the ATO of the issue. As he had not received a response at the time of drafting the report, Hathaway stated (Hathaway, 2013: 5):

> *Until that reconciliation has occurred or it can be explained to me how to account for those credits, I urge all caution in using ATO statistics for any estimates of parameters concerned with franking credits.*

In response to SFG Consulting's related point that Lally does not explain how his approach protects against similar data problems, Lally (2014a) notes that his approach uses data from financial statements, which have three important features that 'virtually guarantee' against the types of problems afflicting the ATO data (as discussed previously in the section on the utilisation rate) (Lally, 2014a: 29).

SFG Consulting's second concern is that Lally's sample is predisposed to containing firms with high distribution rates as they are large firms (in terms of market capitalisation) and, therefore, are more likely to have foreign-sourced profits. In order to test this claim, Lally increased his sample size to include an additional ten firms (twenty in total), with a total market capitalisation of 62 per cent. The aggregate distribution rate fell very marginally from 85% to 84%. Lally further observed from the data that the common feature of companies with unusually low distribution rates is not their size but rather that they have activities related to natural resource extraction (Lally, 2014a: 30). These points reinforce the validity of Lally's sample and the suggestion that the ATO estimate of 0.70 is likely to be too low.

SFG Consulting also made the claim that Lally's estimate of the distribution rate is not consistent with the rate for a benchmark regulated firm. However, the estimate is considered to be an appropriate and relevant estimate for listed Australian companies.

Finally, SFG Consulting contended that the QCA's past estimate of 0.80 should be replaced with an estimate of 0.70, as it is consistent with the estimate preferred by stakeholders. While the QCA has maintained its estimate of 0.80 for some time, there has been good reason for it. When setting the value of gamma at its previous value of 0.50 (including a distribution rate of 0.80), the QCA did so, in part, as a compromise over a contentious parameter estimate. In addition, the significant issues with the ATO data have only been recently identified (Hathaway, 2013; NERA, 2013c) and, therefore, given the QCA cause to assess its approach from first principles.

The utilisation rate

SFG Consulting also levelled several criticisms of the QCA's prior estimate of 0.625 for the utilisation rate, specifically that it is:

(a) internally inconsistent with its asset pricing model (i.e. the CAPM) (SFG Consulting, 2012a: 18–20)

(b) outdated and should be re-estimated with respect to market data, consistent with the estimation of the other parameters — it should not be set with reference to a theoretical construct that omits foreigners (SFG Consulting, 2012a: 22–23).

Consistency with the CAPM

With respect to the first criticism, SFG Consulting argued that an inherent inconsistency arises from applying the Officer CAPM and a utilisation rate of 0.625. This is because the Officer CAPM values cash dividends at 100 cents on the dollar.[119] However, a utilisation rate of 0.625 implies that cash dividends are valued at materially less. To illustrate this point, if the combined value is one dollar and D is the cash dividend then:[120]

(35) $$D = 1 - (U)\left[\frac{T_C}{1-T_C}\right] = 1 - (.625)\left[\frac{0.3}{1-0.3}\right] = .73$$

where $[T_c/(1-T_c)]$ is the maximum attachment rate of imputation credits. In other words, two different values for cash dividends are being used in two different places in the same estimation exercise. The implication is that the required return on equity is reduced (i.e. by using a positive value for imputation credits) while, at the same time, dividends are less than fully valued.

[119] This assumption is not explicit in Officer (1994) but must underlie his model. Officer (1994) adopts the standard CAPM subject to defining dividends as gross dividends. The standard CAPM assumes that all sources of investment income are taxed at the same tax rate, for any given investor. As a result, Officer (1994) must be adopting the same assumption; that is, that gross dividends, capital gains, interest, etc are all taxed at the same tax rate, for a given investor.

[120] The argument is presented with reference to the AER's estimate, but it is clear that the same argument is being made with respect to the QCA's parameter values.

In order to restore consistency, SFG Consulting recommended continued use of the Officer CAPM, which values cash dividends at 100 cents on the dollar, while invoking the assumption that imputation credits have no value (i.e. the utilisation rate is zero) (SFG Consulting, 2012a: 18–20). SFG Consulting then argued that, as the *combined* value of a cash dividend of one dollar and the maximum attached imputation credits of 43 cents equals one dollar, there remains no value to attribute to the imputation credits (i.e. the utilisation rate is zero).

In summary, consistency is restored by continuing to use the Officer CAPM, as that model is based on cash dividends being valued at 100 cents on the dollar, and this approach necessarily requires assuming a value of zero for the imputation credits.

The QCA does not agree with this set of arguments for several reasons. First, SFG Consulting claimed that the combined value of one dollar of cash dividends with the maximum attached credits is estimated at one dollar (SFG Consulting, 2012a: 20). Both Lally's analysis (2013d) and other research does not support this claim. For example, results from Beggs and Skeels (2006) indicate a range of 0.93 (1989–90) to 1.23 (2000).[121] Similarly, Brown and Clarke (1993, Table 7) estimate a combined value of $1.17 for the period 1989-1991 (Lally, 2013d: 51).

Second, SFG Consulting's reasoning is internally inconsistent. In its study for the Tribunal, SFG Consulting reported a range of 0.85–0.90 for the value of cash dividends. Even if one accepts the SFG Consulting claim that the combined value of one dollar of dividends with maximum imputation credits is one dollar (in total), then SFG Consulting's own argument implies that the utilisation rate must be 0.29, rather than zero.[122] This outcome is inconsistent with SFG Consulting's conclusion (SFG Consulting, 2012a: 19-20).

Finally, Lally (2013d) stated that SFG Consulting's approach is inappropriate, as it involves choosing a parameter value (i.e. zero) in order to overcome the limitations of the model, specifically the fact that the Officer CAPM assumes cash dividends are valued at 100 cents per dollar of dividend. Rather, Lally (2013d) argued that empirical evidence indicates that this phenomenon arises as cash dividends and capital gains are not equally valued. As a result, Lally proposes that the weight of evidence supports rejecting the Officer CAPM and adopting a CAPM that does make this distinction. However, until such a model is applied, it is not a valid solution to set the value of the utilisation rate (and gamma) to zero to address the unrealistic assumptions of the Officer CAPM (Lally, 2013d: 51-52).

Estimation consistency with other parameter estimates

SFG Consulting maintained that the utilisation rate should be empirically estimated with respect to market data.

To clarify, the QCA has never excluded the possibility of estimating the 'gamma' components from empirically-based market evidence (QCA, 2005: 30). As discussed previously, the key issue is that the estimation method should be guided by the relevant conceptual framework.

[121] For example, for 2000, Beggs and Skeels (2006) estimate a cash drop-off ratio of 1.168 and a credit drop-off ratio of 0.128. Given a corporate tax rate of 34% at that time, the combined value is (1.168 x $1.00) + (0.128 x (.34/.66)) = $1.23.

[122] The midpoint of the cash dividend range is .875. The utilisation rate (U*)*, therefore, must satisfy: [.30/(1-.30)] x U = 0.125. Solving for U gives 0.29.

REFERENCES

Amihud, Y & Mendelson, H 1986, 'Asset Pricing and the Bid-Ask Spread', Journal of Financial Economics, vol. 17, pp. 223–249.

Andersson, M, Krylova, E, & Vahamaa, S 2008, 'Why Does the Correlation Between Stock and Bond Returns Vary Over Time?', Applied Financial Economics, vol. 18, no. 2, pp. 139–151.

Anglo American 2013, Queensland Competition Authority Pricing Papers, Submission to Queensland Competition Authority, July.

Anglo American 2014, Anglo American Submission in Relation to the WACC Consultation Papers and WACC Forum, Submission to Queensland Competition Authority, January.

Arnott, R & Ryan, R 2001, 'The Death of the Risk Premium', Journal of Portfolio Management, Spring, pp. 61–74.

Arnott, R & Bernstein, P 2002, 'What Risk Premium Is "Normal"?', Financial Analysts Journal, vol. 58, no. 2, pp. 64–85.

Asciano 2013, Letter to Queensland Competition Authority, 28 March 2013, viewed 8 February 2014, <http://www.qca.org.au/getattachment/0e8ef2aa-dc28-4bad-91e1-a91d3535e499/Asciano-(Apr-13).aspx>.

Asher, A 2011, 'Equity Risk Premium Survey — Results and Comments', Actuary Australia, July, 13–14.

Ashton, D 1989, 'The Cost of Capital and the Imputation Tax System', Journal of Business Finance & Accounting, vol. 16, no. 1, pp. 75-88.

Ashton, D 1991, 'Corporate Financial Policy: American Analytics and UK Taxation', Journal of Business Finance & Accounting, vol. 18, no. 4, pp. 465-482.

Aurizon Network 2013, 2013 Draft Access Undertaking — Volume 3: Maximum Allowable Revenue and Reference Tariffs, 30 April.

Aurizon Network 2014, 2013 Draft Access Undertaking: Return on Capital Response — Summary Paper, 20 January.

Australian Bureau of Statistics 2010, Article – The Global Financial Crisis and Its impact on Australia, 4 June 2010, pp. 687-688, viewed 18 August 2014, <http://www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/AC72C92B23B6DF6DCA257737001B2BAB/$File/13010_2009_10.pdf>.

Australian Competition and Consumer Commission 2011, Inquiry to Make Final Access Determinations for the Declared Fixed Line Services: Final Report, Public Version, July.

Australian Competition Tribunal 2010a, Application by Energex Limited (No 2) [2010] ACompT 7, 13 October 2010.

Australian Competition Tribunal 2010b, Application by Energex Limited (Distribution Ratio (Gamma)) (No 3) [2010] ACompT 9, 24 December 2010.

Australian Competition Tribunal 2011, Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9, 12 May.

Australian Competition Tribunal 2012a, Application by Envestra Ltd (No 2) [2012] ACompT 3, 11 January.

Australian Competition Tribunal 2012b, Application by WA Gas Networks Pty Ltd (No 3) [2012] ACompT 12, 8 June.

Australian Competition Tribunal 2012c, Application by DBNGP (WA) Transmission Pty Ltd (No 3) [2012] ACompT 14, 26 July.

Australian Energy Regulator 2008, Electricity Transmission and Distribution Network Service Providers: Review of the Weighted Average Cost of Capital (WACC) Parameters — Explanatory Statement, December.

Australian Energy Regulator 2009, Electricity Transmission and Distribution Network Service Providers: Review of the Weighted Average Cost of Capital (WACC) Parameters — Final Decision, May.

Australian Energy Regulator 2012, Aurora Energy Pty Ltd 2012–13 to 2016–17 — Final Distribution Determination, Appendixes, April.

Australian Energy Regulator 2013a, Envestra Ltd 2013–17 — Access Arrangement Final Decision, Part 3: Appendices, March.

Australian Energy Regulator 2013b, Consultation Paper: Rate of Return Guidelines, May.

Australian Energy Regulator 2013c, Better Regulation Explanatory Statement: Draft Rate of Return Guideline, August.

Australian Energy Regulator 2013d, Better Regulation Explanatory Statement: Rate of Return Guideline, December.

Australian Energy Regulator 2013e, Better Regulation Explanatory Statement: Rate of Return Guideline (Appendices), December.

Australian Rail Track Corporation 2013, Risk & the Form of Regulation / Risk-free Rate & Market Risk Premium, ARTC Response to the Authority's Discussion Papers, 28 March.

Australian Tax Office 2006, Refunding Imputation Credits: Overview, available at <http://www.ato.gov.au/Business/Imputation/In-detail/Refunding-imputation-credits--Overview/, accessed 12 November 2013>.

Barry, Ross 2013, The Split Cost of Capital, Report for the Queensland Competition Authority by First Principles, 7 November.

Beggs, D & Skeels, C 2006, 'Market Arbitrage of Cash Dividends and Franking Credits', Economic Record, vol. 82, no. 258, pp. 239-252.

Bernstein, W & Arnott, R 2003, 'Earnings Growth: The Two Percent Dilution', Financial Analysts Journal, September / October, pp. 47–55.

Bishop, S, Fitzsimmons, M & Officer, R 2011, 'Adjusting the Market Risk Premium to Reflect the Global Financial Crisis', JASSA The Finsia Journal of Applied Finance, Iss. 1, pp. 8-14.

Bishop, S & Officer, R 2013a, Review of Debt Risk Premium and Market Risk Premium, Report for Aurizon Network on behalf of Value Adviser Associates, February.

Bishop, S & Officer, R 2013b, Options for Estimating a Weighted Average Cost of Capital for Water Utilities: A Preliminary Discussion Paper, Draft Report for Unitywater on behalf of Education & Management Consulting Services Pty Ltd, March.

Bowman, R 2013, Submission on the Risk-free Rate and the Market Risk Premium, viewed 18 February 2014, <http://www.qca.org.au/getattachment/f98c1894-2a68-4c53-bc11-973d11229507/Dr-Robert-Bowman-Submission-(Apr-13).aspx>.

Boyle, G 2005, 'Risk, Expected Return, and the Cost of Equity Capital', New Zealand Economic Papers, vol. 39, no. 2, pp. 181–194.

Brailsford, T and Easton, S 1991, 'Seasonality in Australian Share Price Indices between 1936 and 1957', Accounting and Finance, vol. 31, pp. 69–85.

Brailsford, T, Handley, J & Maheswaran, K 2008, 'Re-examination of the Historical Equity Risk Premium in Australia', Accounting and Finance, vol. 48, pp. 73-97.

Brailsford, T, Handley, J & Maheswaran, K 2012, 'The Historical Equity Risk Premium in Australia: Post-GFC and 128 Years of Data', Accounting and Finance, vol. 52, no. 1, pp. 237-247.

Brown, P & Clarke, A 1993, 'The Ex-Dividend Day Behaviour of Australian Share Prices Before and After Dividend Imputation', Australian Journal of Management, vol. 18, no. 1, pp. 1-40.

Brown, S, Goetzmann, W & Ross, S 1995, 'Survival', Journal of Finance, vol. 50, no. 3, pp. 853-873.

Cannavan, D, Finn, F & Gray, S 2004, 'The Value of Dividend Imputation Tax Credits in Australia', Journal of Financial Economics, vol. 73, pp. 167-197.

Carleton, W & Lakonishok, J 1985, 'Risk and Return on Equity: The Use and Misuse of Historical Estimates', Financial Analysts Journal, vol. 41, no. 1, pp. 38–47, 62.

Central Intelligence Agency United States, The World Factbook, <https://www.cia.gov/library/publications/the-world-factbook/appendix/appendix-b.html>, accessed 16 March.

Chordia, T, Subrahmanyam, A & Anshuman, R 2001, 'Trading Activity and Expected Stock Returns', Journal of Financial Economics, vol. 59, pp. 3–32.

Competition Commission 2013, Northern Ireland Electricity Limited Price Determination, A Reference under Article 15 of the Electricity (Northern Ireland) Order 1992, Provisional Determination, 8 November.

Competition Economists Group 2012, Internal Consistency of Risk Free Rate and MRP in the CAPM, Report for Envestra, SP AusNet, Multinet, and APA, March.

Cooper, I & Davydenko, S 2007, 'Estimating the Cost of Risky Debt', Journal of Applied Corporate Finance, vol. 19, no. 3, pp. 90–95.

Cornell, B 1999, The Equity Risk Premium: The Long Run Future of the Stock Market, John Wiley & Sons, New York, New York, United States.

Cowan, S 2004a, 'Utility Regulation and Risk Allocation: The Roles of Marginal Cost Pricing and Futures Markets', Journal of Regulatory Economics, vol. 26, no. 1, pp. 23–40.

Cowan, S 2004b, 'Optimal Risk Allocation for Regulated Monopolies and Consumers', Journal of Public Economics, vol. 88, nos. 1–2, pp. 285–303.

Cummings, J & Frino, A 2008, 'Tax Effects on the Pricing of Australian Stock Index Futures', Australian Journal of Management, vol. 33, no. 2, pp. 391-406.

DBCT Management 2013, DBCTM Submission to the QCA's Cost of Capital Methodology Review, 9 April.

Davis, K 2005, 'The Systematic Risk of Debt: Australian Evidence', Australian Economic Papers, vol. 44, no. 1, pp. 30–46.

Dimson, E, Marsh, P & Staunton, M 2002, Triumph of the Optimists, Princeton University Press: Princeton, New Jersey, United States.

Dimson, E, Marsh, P & Staunton, M 2003, 'Global Evidence on the Equity Risk Premium', London Business School, Institute of Finance and Accounting Working Paper No. 385, August.

Dimson, E, Marsh, P & Staunton, M 2013a, Credit Suisse Global Investment Returns Yearbook 2013, February.

Dimson, E, Marsh, P & Staunton, M 2013b, Credit Suisse Global Investment Returns Sourcebook 2013, February.

Dimson, E, Marsh, P & Staunton, M 2014, Credit Suisse Global Investment Returns Yearbook 2014, February.

Economic Regulation Authority Western Australia 2011, Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline, October.

Economic Regulation Authority Western Australia 2013a, Rate of Return Guidelines: Meeting the Requirements of the National Gas Rules, 16 December.

Economic Regulation Authority Western Australia 2013b, Appendices to the Explanatory Statement for the Rate of Return Guidelines — Meeting the Requirements of the National Gas Rules, 16 December.

Elton, E & Gruber, M 1970, 'Marginal Stockholder Tax Rates and the Clientele Effect', The Review of Economics and Statistics, vol. 52, no. 1, pp. 68–74.

Elton, E, Gruber, M & Agrawal, D 2001, 'Explaining the Rate Spread on Corporate Bonds', Journal of Finance, vol. 56, no. 1, pp. 247–277.

Elton, E, Gruber, M, Brown, S & Goetzmann, W 2010, Modern Portfolio Theory and Investment Analysis, 8th edition, John Wiley & Sons, Hoboken, New Jersey, United States.

Ernst & Young 2012, Market Evidence on the Cost of Equity — Victorian Gas Access Arrangement Review 2013–17, Report for Envestra, Multinet, SP AusNet, Envestra (Albury), and APA GasNet, 8 November.

ESQUANT Statistical Consulting 2013, A Review of NERA's Analysis of McKenzie and Partington's EGARCH Analysis, Report for Multinet Gas, 9 April.

Fama, E & French, K 2002, 'The Equity Premium', Journal of Finance, vol. 57, no. 2, pp. 637–659.

Fernandez, P & del Campo, J 2010, 'Market Risk Premium Used in 2010 by Analysts and Companies: A Survey with 2,400 Answers', Working Paper, IESE Business School, University of Navarra, 21 May.

Fernandez, P, Aguirreamalloa, J, & Corres, L 2011, 'Market Risk Premium Used in 56 Countries in 2011: A Survey with 6,014 Answers', Working Paper, IESE Business School, University of Navarra, 25 April.

Fernandez, P, Aguirreamalloa, J, & Linares, P 2013, 'Market Risk Premium and Risk Free Rate Used for 51 Countries in 2013: A Survey with 6,237 Answers', Working Paper, IESE Business School, University of Navarra, 26 June.

Fernandez, P, Aguirreamalloa, J, & Corres, L 2013, 'Market Risk Premium Used in 82 Countries in 2012: A Survey with 7,192 Answers', Working Paper, IESE Business School, University of Navarra, 23 November.

Feuerherdt, C, Gray, S & Hall, J 2010, 'The Value of Imputation Tax Credits on Australian Hybrid Securities', International Review of Finance, vol. 10, no. 3, pp. 365–401.

French, K, Schwert, G & Stambaugh, R 1987, 'Expected Stock Returns and Volatility', Journal of Financial Economics, vol. 19, pp. 3–29.

Friend, I, Blume, M 1975, 'The Demand for Risky Assets', American Economic Review, vol. 65, no. 5, pp. 900–922.

Gibbard, P 2013, 'Estimating the Market Risk Premium in Regulatory Decisions: Conditional versus Unconditional Estimates', ACCC/AER Working Paper Series, Working Paper No. 9, September.

Glosten, L, Jagannathan, R & Runkle, D 1993, 'On the Relation between the Expected Value and the Volatility of the Nominal Excess Return on Stocks', Journal of Finance, vol. 48, no. 5, pp. 1779–1801.

Gollier, C 2004, The Economics of Risk and Time, MIT Press: Cambridge, Massachusetts, United States.

Gordon, M and Shapiro, E 1956, 'Capital Equipment Analysis: The Required Rate of Profit', Management Science, vol. 3, pp. 102–10.

Graham, J & Harvey, C 2010, The Equity Risk Premium in 2010, available <http://ssrn.com/abstract=1654026> or <http://dx.doi.org/10.2139/ssrn.1654026>.

Graham, J & Harvey, C 2013, The Equity Risk Premium in 2013, NBER Working Paper, available <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2206538>.

Gray, S 2013, Regulatory Estimates of the Market Risk Premium, Powerpoint presentation, WACC workshop at the Queensland Competition Authority, Brisbane, December, available <http://www.qca.org.au/files/R-SFGC-Presentation-AurizonNetwork2013DAU-CostOfCapital-WACCForum-REMRP-1213.pdf>.

Gray, S & Hall, J 2006, 'Relationship between Franking Credits and the Market Risk Premium', Accounting and Finance, vol. 46: 405–428.

Gray, S & Officer, R 2005, A Review of the Market Risk Premium and Commentary on Two Recent Papers, Report for the Energy Networks Association, 15 August.

Gregory, A 2011, 'The Expected Cost of Equity and the Expected Risk Premium in the UK', Review of Behavioral Finance, vol. 3, pp. 1–26.

Gregory, A 2012, The AER Approach to Establishing the Cost of Equity — Analysis of the Method Used to Establish the Risk Free Rate and the Market Risk Premium, Report for Envestra, Multinet, SP AusNet and APA GasNet, 5 November.

Hall, J 2007, 'Comment on Regulation and the Term of the Risk Free Rate: Implications of Corporate Debt', Accounting Research Journal, vol. 20, no. 2, pp. 81–86.

Handley, J 2008, A Note on the Valuation of Imputation Credits, Report (Final) for the Australian Energy Regulator, 12 November.

Handley, J 2010a, On the Estimation of Gamma, Report for the Australian Energy Regulator, 19 March.

Handley, J 2010b, Further Issues Relating to the Estimation of Gamma, Report for the Australian Energy Regulator — Final, 26 October.

Handley, J 2012, An Estimate of the Historical Equity Risk Premium for the Period 1883 to 2011, Report for the Australian Energy Regulator, April.

Handley, J & Maheswaran, K 2008, 'A Measure of the Efficiency of the Australian Imputation Tax System', The Economic Record, vol. 84, no. 264, pp. 82–94.

Hathaway, N 2010, Imputation Credit Redemption - ATO Data 1998-2008, Report on behalf of United Energy, Citipower and Powercor, Capital Research Pty Ltd, July.

Hathaway, N 2013, Imputation Credit Redemption: ATO Data 1988-2011 - Where Have All the Credits Gone?, Capital Research Pty Ltd, Report for the Energy Networks Association, September.

Hathaway, N & Officer, R 1999, 'The Value of Imputation Tax Credits', Working Paper, Finance Research Group, Melbourne School of Business.

Hathaway, N & Officer, R 2004, The Value of Imputation Tax Credits - Update 2004, Capital Research Pty Ltd, November.

Incenta Economic Consulting 2013a, Term of the Risk Free Rate for the Cost of Equity, Report for the Energy Networks Association, June.

Incenta Economic Consulting 2013b, Aurizon Network: Review of Benchmark Credit Rating and Cost of Debt, Report for the Queensland Competition Authority, November.

Independent Pricing and Regulatory Tribunal 2011a, Review of Prices for the Water Administration Ministerial Corporation: For the NSW Office of Water - from 1 July 2011, Water – Final Report, February.

Independent Pricing and Regulatory Tribunal 2011b, Review of Imputation Credits (Gamma): Analysis and Policy Development - Discussion Paper, December.

Independent Pricing and Regulatory Tribunal 2011c, Review of Water Prices for Sydney Desalination Plant Pty Limited, From 1 July 2012: Water - Final Report, December.

Independent Pricing and Regulatory Tribunal 2012, Review of Imputation Credits (Gamma): Research — Final Decision, March.

Independent Pricing and Regulatory Tribunal 2013a, WACC Methodology: Research — Draft Report, September.

Independent Pricing and Regulatory Tribunal 2013b, Review of WACC Methodology: Research — Final Report, December.

Jorion, P & Goetzmann, W 1999, 'Global Stock Markets in the Twentieth Century', Journal of Finance, vol. 54, no. 3, pp. 953–980.

Kalay, A 1982, 'The Ex-Dividend Day Behavior of Stock Prices: A Re-Examination of the Clientele Effect', The Journal of Finance, vol.37, no. 4, pp. 1059–1070.

KPMG 2005, Cost of Capital — Market Practice in Relation to Imputation Credits, Victorian Electricity Distribution Price Review 2006–10, Report for Powercor, Citipower, SP AusNet, United Energy, and the Australian Gas Light Company, August.

KPMG (2013). Corporate Finance Valuation Practices Survey 2013, available at <http://www.kpmg.com/au/en/issuesandinsights/articlespublications/valuation-practices-survey/pages/valuation-practices-survey-2013.aspx>.

Lally, M 1992, 'The CAPM Under Dividend Imputation', Pacific Accounting Review, vol. 4, no. 1, pp. 31–44.

Lally, M 2000, The Cost of Equity Capital and Its Estimation, McGraw-Hill Series in Advanced Finance, vol. 3, Brailsford, T and Faff, R (eds.), McGraw-Hill Book Company Australia Pty Limited: Roseville, New South Wales, Australia.

Lally, M 2004a, The Cost of Capital for Regulated Entities, Report for the Queensland Competition Authority, February.

Lally, M 2004b, 'Regulation and the Choice of the Risk Free Rate', Accounting Research Journal, vol. 17, no. 1, pp. 18-23.

Lally, M 2006, 'Regulatory Revenues and the Choice of CAPM: Australia Versus New Zealand', Australian Journal of Management, vol.31, no. 2, pp. 313–331.

Lally, M 2007a, 'Regulation and the Term of the Risk Free Rate: Implications of Corporate Debt', Accounting Research Journal, vol. 20, no. 2, pp. 73–80.

Lally, M 2007b, 'Rejoinder: Regulation and the Term of the Risk Free Rate: Implications of Corporate Debt', Accounting Research Journal, vol. 20, no. 2, pp. 87–88.

Lally, M 2008, 'Relationship between Franking Credits and the Market Risk Premium: A Comment', Accounting and Finance, vol. 48: 143–151.

Lally, M 2010, The Appropriate Term for the Risk Free Rate and the Debt Margin, Report for the Queensland Competition Authority, 27 April.

Lally, M 2012a, The Cost of Equity and the Market Risk Premium, Report for the Australian Energy Regulator, 25 July.

Lally, M 2012b, The Risk Free Rate and the Present Value Principle, Report for the Australian Energy Regulator, 22 August.

Lally, M 2012c, The Risk Free Rate and the Market Risk Premium, Report for the Queensland Competition Authority, 23 August.

Lally, M 2012d, The Estimated Utilisation Rate for Imputation Credits, Report for the Queensland Competition Authority, 12 December.

Lally, M 2013a, Review of the AER's Methodology for the Risk Free Rate and the Market Risk Premium, Report for the Australian Energy Regulator, 4 March.

Lally, M 2013b, The Dividend Growth Model, Report for the Australian Energy Regulator, 4 March.

Lally, M 2013c, Response to Submissions on the Risk-free Rate and the MRP, Report for the Queensland Competition Authority, 22 October.

Lally, M 2013d, Estimating Gamma, Report for the Queensland Competition Authority, 25 November.

Lally, M 2013e, Review of the AER's Proposed Dividend Growth Model, Report for the Australian Energy Regulator, 16 December.

Lally, M 2014a, Review of Submissions to the QCA on the MRP, Risk-Free Rate and Gamma, Report for the Queensland Competition Authority, 12 March.

Lally, M 2014b, The Relationship Between the Cost of Equity Capital Inclusive and Exclusive of Imputation Credits, Capital Financial Consultants, 1 April.

Lally, M & Randal, J 2012, 'Estimating the Market Risk Premium Using Data from Multiple Markets', Working paper, Victoria University of Wellington.

Lally, M & van Zijl, T 2003, 'Capital Gains Tax and the Capital Asset Pricing Model', Accounting and Finance, vol.43, pp. 187-210.

Lamberton, D 1958, Share Price Indices in Australia, Law Book Company of Australasia, Sydney, New South Wales, Australia.

Lettau, M & Ludvigson, S 2001, 'Consumption, Aggregate Wealth, and Expected Stock Returns', Journal of Finance, vol. 56, no. 3, pp. 815–849.

Li, H & Xu, Y 2002, 'Survival Bias and the Equity Premium Puzzle', Journal of Finance, vol. 47, pp. 1981–1995.

Marshall, W, Yawitz, J & Greenberg, E 1981, 'Optimal Regulation Under Uncertainty', Journal of Finance, vol. 36, no. 4, pp. 909-921.

McKenzie, M & Partington, G 2010, Evidence and Submissions on Gamma, Report to the AER on behalf of the Securities Industry Research Centre of Asia-Pacific (SIRCA) Ltd, 25 March.

McKenzie, M & Partington, G 2012, Supplementary Report on the Equity Risk Premium, Report to the AER on behalf of the Securities Industry Research Centre of Asia-Pacific (SIRCA) Ltd, 22 February.

McKenzie, M & Partington, G 2013a, Review of the AER's Overall Approach to the Risk Free Rate and Market Risk Premium, Report to the AER on behalf of the Securities Industry Research Centre of Asia-Pacific (SIRCA) Ltd, 28 February.

McKenzie, M & Partington, G 2013b, Review of Aurizon Network's Draft Access Undertaking, Report to Queensland Resources Council, 5 October.

Mehra, R 2003, 'The Equity Premium: Why Is It a Puzzle?', Financial Analysts Journal, vol. 59, no. 1, pp. 54–69.

Mendenhall, W, Scheaffer, R, & Wackerly, D 1986, Mathematical Statistics with Applications, 3rd edition, Duxbury Press, Boston, Massachusetts, United States.

Merton, R 1973, 'An Intertemporal Capital Asset Pricing Model', Econometrica, vol. 41, no. 5, pp. 867–887.

Merton, R 1980, 'On Estimating the Expected Return on the Market: An Exploratory Investigation', Journal of Financial Economics, vol. 8, pp. 323–361.

Michaely, R & Vila, J-L 1995, 'Investors' Heterogeneity, Prices and Volume Around the Ex-Dividend Day', Journal of Financial and Quantitative Analysis, vol. 30, no. 2, pp. 171–198.

Monkhouse, P 1993, 'The Cost of Equity Under the Australian Dividend Imputation System', Accounting and Finance, vol. 33, no. 2, pp. 1-18.

Mossin, J 1966, 'Equilibrium in a Capital Asset Market', Econometrica, vol. 34, no. 4, pp. 768-783.

Nelson, N, Ferrarone, C & McGuire, J 2012, 'Implied Equity Risk Premium', UBS Global Investment Strategy, October.

NERA 2007, Absolute Bias in (Nominal) Commonwealth Government Securities, 7 June.

NERA 2013a, The Cost of Equity for a Regulated Energy Utility: A Response to the QCA Discussion Paper on the Risk-Free Rate and the MRP, Report for United Energy and Multinet Gas, March.

NERA 2013b, The Market Size and Value Premiums, Report for the Energy Networks Association, June.

NERA 2013c, The Payout Ratio, Report for the Energy Networks Association, June.

NERA 2013d, Imputation Credits and Equity Prices and Returns, Report for the Energy Networks Association, October.

Officer, R 1994, 'The Cost of Capital of a Company Under an Imputation Tax System', Accounting and Finance, vol. 34, pp. 1-17.

Officer, R & Bishop, S 2008, Term of Risk Free Rate - Commentary, Report for Energy Networks Association, Australian Pipeline Industry Association and Grid Australia, September.

Ofwat 2014, Setting Price Controls for 2015–20 — Risk and Reward Guidance, January.

Origin Energy Retail Ltd 2013, Submission on Discussion Paper: The Risk Free Rate and the Market Risk Premium, 28 March.

Pastor, L & Stambaugh, R 2001, 'The Equity Premium and Structural Breaks', Journal of Finance, vol. 56, no. 4, pp. 1207–1239.

Patterson, C 1995, The Cost of Capital: Theory and Estimation, Quorum Books, Westport, Connecticut.

Pindyck, R & Rubinfeld, D 1991, Econometric Models and Economic Forecasts, 3rd edition, McGraw-Hill, Inc., New York, New York, United States.

PricewaterhouseCoopers Australia 2013, A Cost of Debt Estimation Methodology for Businesses Regulated by the Queensland Competition Authority, Report for the Queensland Competition Authority, June.

Productivity Commission 2004, Review of the Gas Access Regime, Productivity Commission Inquiry Report No. 31, Canberra, 11 June.

Queensland Competition Authority 2000, Draft Decision on QR's Draft Undertaking, Volume 3 – Reference Tariffs, December.

Queensland Competition Authority 2004, Dalrymple Bay Coal Terminal Draft Access Undertaking: Draft Decision, October.

Queensland Competition Authority 2005, QR's 2005 Draft Access Undertaking: Draft Decision, July.

Queensland Competition Authority 2010a, QR Network's 2010 DAU - Tariffs and Schedule F: Draft Decision, June.

Queensland Competition Authority 2010b, Dalrymple Bay Coal Terminal 2010 Draft Access Undertaking — Final Decision, September.

Queensland Competition Authority 2011, SEQ Interim Price Monitoring for 2010/11, Part B – Detailed Assessment, March.

Queensland Competition Authority 2012a, SunWater Irrigation Price Review: 2012-17, Volume 1 - Final Report, May.

Queensland Competition Authority 2012b, The Risk-free Rate and the Market Risk Premium - Discussion Paper, November.

Queensland Competition Authority 2012c, Risk and the Form of Regulation - Discussion Paper, November.

Queensland Competition Authority 2013a, 'UT4 WACC Averaging Period', Letter to Aurizon Network, 23 August 2013, viewed 19 December 2013, <http://www.qca.org.au/files/R-QCA-letter-AurizonNetworkReUT4AveragingPeriod-1113.pdf>.

Queensland Competition Authority 2013b, Statement of Regulatory Pricing Principles, Final Report, August.

Queensland Competition Authority 2014a, The Split Cost of Capital Concept: Information Paper, February.

Queensland Competition Authority 2014b, Financial Capital Maintenance and Price Smoothing: Information Paper, February.

Queensland Competition Authority 2014c, Issues in the Application of Annuities: Information Paper, February.

Queensland Competition Authority 2014d, Trailing Average Cost of Debt: Issues Paper, March.

Queensland Competition Authority 2014e, Cost of Debt Estimation Methodology, Final Decision Paper, August.

Queensland Competition Authority 2014f, Trailing Average Cost of Debt, Draft Decision Paper, August.

Queensland Resources Council 2013a, The Risk Free Rate and the Market Risk Premium, QRC Submission to the QCA, March.

Queensland Resources Council 2013b, QRC's WACC Submission, Annex to QRC Main Submission on Aurizon Network's Draft 2013 Undertaking, 10 October.

Queensland Resources Council 2014, Further WACC Submission: QRC Response to QCA WACC Consultation Papers, Submission to Queensland Competition Authority, January.

Queensland Treasury Corporation 2013, The Risk-Free Rate and the Market Risk Premium, Submission to the Queensland Competition Authority, 28 March.

Queensland Treasury Corporation 2014, The Risk-Free Rate and the Market Risk Premium, Second Submission to the Queensland Competition Authority, 20 January.

Queensland Treasury and Trade 2013, Letter to Queensland Competition Authority, 15 April 2013, viewed 3 February 2014, <http://www.qca.org.au/getattachment/c7befc4e-7426-40ac-8981-908fcd164229/Queensland-Treasury-and-Trade-(Apr-13.aspx>.

Queensland Urban Utilities 2013, Letter to Queensland Competition Authority, 28 March 2013, viewed 8 February 2014, <http://www.qca.org.au/getattachment/05e48f7b-4c2b-44c4-8c83-57dfefec718e/Queensland-Urban-Utilities-(Apr-13)).aspx>.

Reserve Bank of Australia 1999, 'Six Years of Inflation Targeting', Reserve Bank of Australia Bulletin, May, viewed 24 March 2014, <http://www.rba.gov.au/publications/bulletin/1999/may/pdf/bu-0599-2.pdf>.

Reserve Bank of Australia 2012, 'The Commonwealth Government Securities Market', Letter to Australian Competition & Consumer Commission, 16 July 2012.

Reserve Bank of Australia 2013, Statement on the Conduct of Monetary Policy, viewed 2 May 2014, http://www.rba.gov.au/monetary-policy/framework/stmt-conduct-mp-6-24102013.html.

Reserve Bank of Australia 2014, The Australian Economy and Financial Markets, Chart Pack, August.

Rio Tinto Coal Australia Limited Pty 2013, Submission to the QCA's Cost of Capital Methodology Review, 29 March.

Schmalensee, R 1989, 'An Expository Note on Depreciation and Profitability Under Rate-of-Return Regulation', Journal of Regulatory Economics, vol. 1, pp. 293-298.

Siegel, J 1992, 'The Equity Premium: Stock and Bond Returns Since 1802', Financial Analysts Journal, vol. 48, no. 1, pp. 28-38, 46.

Siegel, J 1998, Stocks for the Long Run, 2nd edition, McGraw Hill.

Siegel, J 1999, 'The Shrinking Equity Premium: Historical Facts and Future Forecasts', Journal of Portfolio Management, pp. 10-17, Fall.

Solnik, B 1974, 'An Equilibrium Model of the International Capital Market', Journal of Economic Theory, vol. 8, pp. 500–524.

Strategic Finance Group Consulting 2011, Dividend Drop-off Estimate of Theta: Final Report, Re: Application by Energex Limited (No 2) [2010] ACompT7, Report for the Australian Competition Tribunal, 21 March.

Strategic Finance Group Consulting 2012a, Estimating Gamma, Report for QR National, Annex D to Aurizon Network 2013 Draft Access Undertaking, 25 January.

Strategic Finance Group Consulting 2012b, Term to Maturity of the Risk Free Rate Estimate in the Regulated Return, Annex C to Aurizon Network 2013 Draft Access Undertaking, 29 August.

Strategic Finance Group Consulting 2013a, Testing the Reasonableness of the Regulatory Allowance for the Return on Equity, Annex A to Aurizon Network 2013 Draft Access Undertaking, 11 March.

Strategic Finance Group Consulting 2013b, Response to the QCA Discussion Paper on Risk-free Rate and Market Risk Premium, Report for Aurizon Ltd, 19 March.

Strategic Finance Group Consulting 2013c, Response to the QCA Approach to Setting the Risk-free Rate, Report for Aurizon Ltd., 25 March.

Strategic Finance Group Consulting 2013d, Response to the QCA Discussion Paper on Risk-free Rate and Market Risk Premium, Report for Unitywater and Queensland Urban Utilities, 25 March.

Strategic Finance Group Consulting 2013e, Response to the QCA Approach to Setting the Risk-free Rate, Report for Unitywater and Queensland Urban Utilities, 25 March.

Strategic Finance Group Consulting 2013f, Updated Dividend Drop-off Estimate of Theta, Report for the Energy Networks Association, 7 June.

Strategic Finance Group Consulting 2013g, Evidence on the Required Return on Equity from Independent Expert Reports, Report for the Energy Networks Association, 24 June.

Strategic Finance Group Consulting 2013h, Using Market Data to Estimate the Equilibrium Value of Distributed Imputation Tax Credits, Report for the Energy Networks Association, 3 October.

Strategic Finance Group Consulting 2013i, Cost of Equity Estimates Implied by Analyst Forecasts and the Dividend Discount Model, Report for Citipower, Powercor, United Energy, SP AusNet and Jemena, 18 October.

Strategic Finance Group Consulting 2014a, An Appropriate Regulatory Estimate of the Market Risk Premium, Report for Aurizon Ltd, 16 January.

Strategic Finance Group Consulting 2014b, An Appropriate Regulatory Estimate of Gamma, Report for Aurizon Ltd, 16 January.

Strategic Finance Group Consulting 2014c, Estimating Gamma, Report for Aurizon Network, 6 March.

Treasury 2012, The Commonwealth Government Securities Market, Letter to Australian Competition and Consumer Commission, 18 July.

Treasury 2013, Mid-Year Economic and Fiscal Outlook 2013–14, December.

Truong, G, Partington, G & Peat, M 2008, 'Cost-of-Capital Estimation and Capital-Budgeting Practice in Australia', Australian Journal of Management, vol.33, no. 1, pp. 95-121.

Unitywater 2013, Letter to Queensland Competition Authority, 28 March 2013, viewed 8 February 2014, <http://www.qca.org.au/getattachment/2d5ae3b0-7282-46a2-94f8-4ca6ed052fce/Unity-Water-(Apr-13).aspx>.

Vale 2013, Letter to Queensland Competition Authority, 28 March 2013, viewed 8 February 2014, <http://www.qca.org.au/getattachment/f81d09e3-55d6-4ba5-934b-83db545345ea/Vale-(Apr-13).aspx>.

Vo, D, Gellard, B & Mero, S 2013, 'Estimating the Market Value of Franking Credits: Empirical Evidence from Australia', Working Paper, April.

Vo, D, Mero, S, Gellard, B & Sarawat, R 2013, 'Is There a Relationship Between the Risk-free Rate and the Market Risk Premium in Australia? Empirical Evidence', Working Paper, April.

Welch, I & Goyal, A 2008, 'A Comprehensive Look at the Empirical Performance of Equity Premium Prediction', Review of Financial Studies, vol. 21, no. 4, pp. 1455–1508.

Wright, S 2012a, Review of Risk Free Rate and Cost of Equity Estimates: A Comparison of UK Approaches with the AER, Report for APT Petroleum Pipeline, APA GasNet (Australia) Operations and SPI Networks (Gas), 25 October.

Wright, S 2012b, Response to Professor Lally's Analysis, Report for APT Petroleum Pipeline, APA GasNet (Australia) Operations and SPI Networks (Gas), 2 November.

Wright, S, Mason, R & Miles, D 2003, A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the U.K., Report on behalf of Smithers & Co Ltd, 13 February.