QUEENSLAND COMPETITION AUTHORITY

Discussion Paper

The Risk-free Rate and the Market Risk Premium

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SUBMISSIONS

Public involvement is an important element of the decision-making processes of the Queensland Competition Authority (the Authority). Therefore submissions are invited from interested parties concerning the matters covered in this Discussion Paper. The Authority will take account of all submissions received.

Written submissions should be sent to the address below. While the Authority does not necessarily require submissions in any particular format, it would be appreciated if two printed copies are provided together with an electronic version on disk (Microsoft Word format) or by e-mail. Submissions, comments or inquiries regarding this paper should be directed to:

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The **closing date** for submissions is 29 March 2013.

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Information about the role and current activities of the Authority, including copies of reports, papers and submissions can also be found on the Authority's website.

GLOSSARY

ACCC	Australian Competition and Consumer Commission
ACT, the Tribunal	Australian Competition Tribunal
AER	Australian Energy Regulator
CAPM	Capital Asset Pricing Model
CGS	Commonwealth Government Securities
DORC	Depreciated Optimised Replacement Cost
ERA	Economic Regulation Authority Western Australia
ESC	Essential Services Commission Victoria
GAAR	Gas Access Arrangement Review
GDP	Gross Domestic Product
GFC	Global Financial Crisis
IPART	Independent Pricing and Regulatory Tribunal
MRP	Market Risk Premium
NPV	Net Present Value
QCA, the Authority	Queensland Competition Authority
QTC	Queensland Treasury Corporation
WACC	Weighted Average Cost of Capital

FOREWORD

The Authority is currently undertaking a comprehensive review of its cost of capital methodology for regulated businesses. A series of discussion papers covering various aspects of the cost of capital will be released for public comment. The Authority will then prepare position papers on the key parameters in the cost of capital.

This discussion paper principally addresses issues relating to estimating both the risk-free rate and the market risk premium in the context of applying the Capital Asset Pricing Model (CAPM) to determine the cost of equity for regulated firms.

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EXECUTIVE SUMMARY

The Authority is currently undertaking a review of its cost of capital methodology for regulated businesses. A key aspect of this methodology is determining an appropriate rate of return on the regulated firm's equity and an appropriate rate of return on the regulated firm's debt. A key component of both the return on equity and the return on debt is the risk-free rate, which appears as the first term in the cost of equity in the Capital Asset Pricing Model (CAPM) and as the first term in the cost of debt. The risk-free rate is also implicit in the estimate of the market risk premium in the second term of the cost of equity in the CAPM.

While standard regulatory practice in Australia to date has been to reference the yields on Commonwealth government bonds to proxy the risk-free rate, several issues arise in using this approach. These include: the relevant proxy for the risk-free asset, the appropriate time period over which the rate should be set, and whether the term of the relevant bond should reflect the life of the regulatory assets or the term of the regulatory cycle. In relation to these matters at present, the Authority:

(a) uses Australian Government Commonwealth bonds as proxies for the risk-free asset;

(b) estimates the relevant rate over a 20 trading day period immediately prior to the commencement of the regulatory cycle; and

(c) sets the term of the risk-free rate in the cost of equity equal to the term of the regulatory cycle (e.g. five years), consistent with the Net Present Value = 0 Principle.

The Authority estimates the market risk premium in the CAPM using four different methods, as all methods have certain limitations. The Authority rounds the resulting estimate to the nearest whole percent to obtain a final estimate. Using this approach, the Authority has applied a market risk premium of 6.0% to date. For the purpose of this paper, the Authority has updated its estimate of the market risk premium using these methods. The updated estimate is 6.0%, as at October 2012.

Additionally, unusual and volatile conditions in bond markets have led to historically low yields on Commonwealth Government bonds due to investors' 'flight to quality'. As a result, these conditions have motivated some regulated firms to seek either an uplift factor to adjust the current risk-free rate or for a higher market risk premium in the circumstances on the basis that, without such an adjustment, they face potential 'under-compensation'.

To date, however, Australian regulators have largely resisted these appeals, primarily on the basis that:

(a) current bond yields reflect economic (i.e. demand and supply interaction) conditions in markets and there is no *a priori* reason to believe that 'low' yields signal a 'problem';

(b) in terms of compensation, the more relevant consideration is potential 'under-compensation' over the life of the assets - accordingly, some regulatory cycles will result in 'over-compensation' while others will result in 'under-compensation; and

(c) when market conditions were previously reversed a number of years ago - and bond yields were near historical highs - regulators did not *lower* the prevailing risk-free rate or market risk premium at those times, despite appeals from some users and stakeholders to do so.

The Authority has also maintained this position to date.

1. INTRODUCTION

A key component of both the return on equity and the return on debt is the risk-free rate, which appears as the first term in the cost of equity in the Capital Asset Pricing Model (CAPM) and as the first term in the cost of debt. The risk-free rate is also implicit in the estimate of the market risk premium in the second term of the cost of equity in the CAPM.

While standard regulatory practice in Australia to date has been to reference the yields on Commonwealth government bonds to proxy the risk-free rate, several issues arise in using this approach. These include the appropriate time period over which the rate should be set and whether the term of the relevant bond should reflect the life of the regulatory assets or the term of the regulatory cycle.

Additionally, the onset of the Global Financial Crisis (GFC) in 2007-08 and the recent, continuing recessions in the United States and Europe have resulted in unusual and volatile conditions in some financial markets. One such development from these events has been historically low yields on Commonwealth Government bonds due to investors' 'flight to quality'. These market conditions have led some regulated firms and commentators to call for either an uplift factor to adjust the current risk-free rate or for a higher market risk premium.

As part of the same review, the Authority is also reviewing its methodology for estimating the market risk premium to apply in the CAPM. As a result, this paper reviews the Authority's current approach, including its preferred methods of estimation, and several related, technical issues. It also provides an estimate of the market risk premium that reflects current market conditions at the time of drafting this discussion paper.

This discussion paper sets out the relevant issues and these arguments in more detail and summarises current Australian regulatory practice in these areas, including the Authority's current approaches to estimation.

2. THE RISK-FREE RATE

2.1 Background

A risk-free rate is simply the rate of return on an asset with zero risk. In estimating the risk-free rate for regulatory cost of capital purposes, it is first necessary to identify the relevant modelling context. That context is the Officer variant (1994) of the standard CAPM. The 'standard CAPM' is attributable to Sharpe (1964), Lintner (1965), and Mossin (1966) and generates an expected return on equity, specified as:

Equation 1 $$k_e = r_f + \beta_e(k_m - r_f),$$

where k_e is the expected rate of return on equity, β_e is the firm's equity beta, k_m is the expected rate of return on the market portfolio of risky assets, and r_f is the risk-free rate of return.

In the Officer variant applied in Australia, returns are defined to include dividend imputation credits to the extent that they are usable:

Equation 2 $$\hat{k}_e = r_f + \beta_e(\hat{k}_m - r_f),$$

where $\hat{k}_e$ is the expected return on equity including the value of dividend imputation credits to the extent that they are usable, β_e is the firm's equity beta defined against the Australian market index, $\hat{k}_m$ is the expected rate of return on the market portfolio including the value of dividend imputation credits to the extent that they are usable, and r_f is the risk-free rate of return. This model is identical to the standard CAPM with the exception that returns in equation (2) are defined to include imputation credits.

2.2 Methodology

In estimating the risk-free rate in this context, there are three principal considerations:

(a) the choice of proxy for the risk-free asset;

(b) the period of time at, or over, which the rate is estimated; and

(c) the term, or maturity, of bond used for setting the risk-free rate.

2.2.1 Choice of Proxy

While the standard CAPM, and implicitly, the Officer CAPM, invoke the concept of a risk-free asset (as per equations (1, 2)), the models do not specify a particular type of asset. Further, an asset with zero variance in (real) returns over the relevant term does not exist. Therefore, in estimating the risk-free rate, a principal task is choosing a relevant proxy for the risk-free asset.

In practice, a commonly accepted proxy for the risk-free asset is a government-backed security. While such securities carry some risk of default, that risk is very low in Anglo-Saxon countries such as the United States, United Kingdom, Australia, and New Zealand. As a result, in these countries, the rate on domestic government debt provides a close proxy for the risk-free rate (Lally, 2000: 18).

To date, Australian regulators have used Commonwealth Government bonds as proxies for the risk-free asset in the CAPM. This practice has been relatively uncontroversial with the exception of 2007-09 and the onset of the GFC[1]. Due to declines in government bond yields at that time, some parties proposed using alternative proxies, such as the yield on corporate bonds less the cost of insuring those bonds against default[2]. Australian regulators have not adopted these proposals to date[3].

Given the choice of a domestic government security as the appropriate proxy, the fundamental criterion that guides the choices with respect to (b) and (c) is the Net Present Value Principle ('NPV = 0' principle). The Net Present Value Principle is that the regulatory arrangements need to be consistent with investors expectations that the net present value of the future cash flows of the regulated firm should equal the initial investment, assuming a discount rate equal to the risk adjusted opportunity cost of capital and efficient costs. This means that from an *ex ante* perspective investors expect to be able to earn their required return on capital to invest in the regulated entity assuming capital and operating costs are at efficient levels.

If allowed revenues are less than those revenues that satisfy this principle then investors will not have an incentive to invest, and if the allowed revenues are greater than those revenues that satisfy this principle, then the incremental revenue reflects the excess profit that regulation seeks to prevent in the first place (Schmalensee, 1989).

2.2.2 The Averaging Period

Applying this principle to choose the period of time over which the risk-free rate is estimated requires using the first market price on the first day of the regulatory period. This prescription follows from the fact that present values always involve using a *current* discount rate rather than an average rate over some historical period, and 'current' in a regulatory context means at the start of the regulatory cycle (Lally, 2012a: 7).

However, using an 'on the day' rate immediately prior to the start of the regulatory cycle potentially exposes the regulatory process to a number of risks, including:

(a) aberrant pricing abnormalities on that day, arising 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);

(b) collusive behaviour by lenders, to the extent that the single day rate drives the firm to borrow or hedge on that day and lenders are aware of the regulated firm's situation;

(c) opportunistic behaviour by a regulated firm, including making a transaction for the purpose of influencing the regulated price; and

(d) reporting errors (Lally, 2004a: 62; Lally, 2012a: 7).

These pragmatic concerns are significant enough to support the alternative option of using an average of rates rather than an 'on the day' rate. This alternative approach then raises the question of over what period the rates should be averaged. On this issue, the Queensland Treasury Corporation in the past has argued that an appropriate averaging period should encompass several years in order to avoid interest rates that might be at the extreme of a cycle. The specific proposal involves using a long term (i.e. four to five year) average of rates before *each* year of the regulatory cycle for the purpose of smoothing volatility and diversifying hedging behaviour (QTC, 2001: 1).

[1] Most financial market commentators consider the GFC to span from July 2007 (the collapse of Lehman Brothers) to December 2009.
[2] See, for example, NERA (2007).
[3] The current, unusually low government bond yields are discussed further in chapter 4.

However the use of a long term average is considered to be likely to violate the net present value principle. This violation will occur if the valuation of the future cash flows is based on a long term historical (average) discount rate that is materially different to the current rate. As a current rate is required to satisfy the Net Present Value Principle, it is therefore considered necessary to use an estimate that is representative of a current rate. The approach applied by regulators to date has been to use an average of rates over a significantly shorter period that immediately precedes the commencement of the regulatory cycle in order to balance the trade-off between a potential distortion from using an 'on the day rate' and the need for current information.

In Australia, regulators typically employ averaging periods ranging from 10-40 trading days. The Authority, the Economic Regulation Authority Western Australia (ERA), and the Independent Pricing and Regulatory Tribunal (IPART) tend to use averaging periods of 20 days[4]. The Essential Services Commission Victoria (ESC) tends to use a 40-day period although, in its Gas Access Arrangement Review (GAAR) 2007, the ESC used a 20-day trading period average[5].

The AER gives the regulated firm the discretion to choose the length of the averaging period, but that period must have a span in the range of 10-40 days (AER, 2009: 170). For these regulators, the averaging period must be as close as practical to the start of the regulatory cycle.

2.2.3 The Term of the Proxy

Selecting a Term in the Regulatory Context

Rates on government debt typically vary with the term of maturity of the debt instrument. In other words, the term structure of interest rates is not 'flat' (van Horne, 2002: 533-534). Given this characteristic, a particular term must be specified in order to determine a risk-free rate to apply in the CAPM.

The CAPM is a single period model that determines an expected rate of return over a future period. Specifically, the CAPM assumes that investors share a common investment horizon that corresponds to the period between successive reassessments of their portfolios. Consequently, the relevant risk-free rate implied by this feature of the CAPM is that rate with a term that matches the length of that investment horizon (Lally, 2010: 16).

However, the CAPM does not specify the length of that period (i.e. investors' common investment horizon) (Patterson, 1995: 103; Lally, 2000: 18). The typical response to this problem in practice is to specify a term consistent with the particular issue under analysis. Accordingly, if the CAPM is being applied to a project to estimate the cost of equity over a period of time (T) then the standard assumption is that the investor horizon in the CAPM relates to interval T. As a result, the risk-free rate is estimated as the spot rate for term, T.

Therefore, in applying the CAPM to determine the regulatory cost of capital, it is necessary to determine the term relevant to that context. In regulatory circles in Australia, there has been a persistent debate about whether the relevant term for setting the risk-free rate should equal the 'life' of the regulated assets or the term of the regulatory cycle.

The argument for the former is based on the idea that the relevant term is the term that would apply for a risk-free bond that has the same maturity as the 'investment project'. For regulated infrastructure assets, the assets' lives are typically well in excess of 10 years and

[4] For example, see QCA (2012: 484-485), ERA (2012b: 119-120), and IPART (2011a: 317).
[5] For example, see ESC (2009b: 62) for application of the 40-day period and ESC (2008: 12, 83) for the 20-day period.

tend to be in the order of 20-50 years. In other words, if the regulated firm's relevant planning horizon is a long term investment in infrastructure assets then the relevant benchmark should be a long term government bond (Capital Research, 2004: 9).

The argument for the latter (i.e. matching the term of the rate to the term of the regulatory cycle) is based on Schmalensee (1989) and has been developed further by Lally (2004b, 2007). Schmalensee shows that the term must match the term of the regulatory cycle in order to satisfy the Net Present Value Principle, under the assumptions that the only source of uncertainty is over future interest rates and that the firm is financed only with equity.

Lally (2004b) extends this result to apply in a regulatory environment with, *inter alia*, cost and demand risks, and revaluation risks resulting from applying the DORC methodology. Specifically, if the term structure of interest rates is upward (downward) sloping then the resulting regulated revenue will be greater (less) than those revenues that satisfy the Net Present Value Principle. Further, Lally (2007) also extends the basic result to include the possibility that the regulated firm is financed with some debt. In this situation, Lally shows that the regulator should still choose a term for the risk-free rate equal to the term of the regulatory cycle, and in addition, the regulated firm should match its debt duration to the regulatory cycle.

To clarify these points, suppose the regulatory cycle is five years and the term structure is upward-sloping, which is the typical case (i.e. the 10-year bond rate exceeds the five-year bond rate). The regulator's objective should be to satisfy the Net Present Value Principle, which means using a five-year risk-free rate. Instead, if the regulator uses the 10-year risk-free rate, the regulator can never satisfy the Net Present Value Principle, regardless of the firm's debt policy. Further, the (positive) difference between the 10-year rate and the five-year rate will provide the firm with unjustified compensation in its allowed cost of equity.

Now suppose that the regulator satisfies the Net Present Value Principle by setting the term of the risk-free rate and the term of debt to five years. If the firm then chooses to use 10-year debt, then the firm will incur a 10-year cost of debt but the regulator will compensate it for a five-year cost of debt. As a result, the cash flows to the firm's equity holders will have a net present value that will be negative, equity holders will be exposed to interest rate risk, but they will be protected from recontracting risk[6]. Given this trade-off, if the prospect of recontracting risk motivates the firm to use ten-year debt and the firm fails to use swap contracts to match the duration of its debt to the regulatory cycle, then such behaviour will violate the Net Present Value Principle.

However, this possibility *cannot* justify the regulator switching from the five-year risk-free rate to the 10-year risk free rate, as this change would tend to exchange a net present value of cash flows to equity holders that is negative for one that is positive (i.e. as the 10-year risk-free rate exceeds the five-year risk-free rate). As a result, regardless of the firm's debt policy, the correct risk-free rate is the rate whose term matches the regulatory cycle (i.e. five years) (Lally, 2007: 79-80).

Independently, Professor Kevin Davis also reaches the same conclusion about the term of the risk-free rate using a different method (Davis, 2003, 2012).

An alternative way of avoiding the problem would be to specify that the firm had to take on the longer term debt with unders-and-overs adjustments when prices are reset every five

[6] Recontracting risk can be defined as the possibility of the debt premium (i.e. the margin over the risk-free rate) increasing and not being subsequently compensated by the regulator. The issue of recontracting risk presumes that the regulator bases the cost of debt on 'efficient' costs rather than on the firm's actual costs (Lally, 2007: 77).

years (to reflect the structure of the debt portfolio and its movement over time). As the latter is intrusive and complex it is not considered to be a realistic option. Another option would be to allow for prices to adjust to reflect more frequent resetting of the risk-free rate, consistent with the changing debt portfolio of the firm. However, it is not clear whether such approaches would satisfy the Net Present Value principle, as the potential for doing so would depend on specific details of any proposals.

Finally, it is worth restating that the importance of the Net Present Value Principle arises in the specific context of regulation. If the principle is satisfied then it means the regulated firm is earning a return that covers all of its (efficient) costs, including its cost of capital. Setting the allowed risk-free rate with respect to the term of the regulatory cycle ensures that the principle is satisfied.

If the regulator set prices without regard to this principle (e.g. applies a 10-year rate) then there would be an incentive for the regulated firm to incur short term debt and keep the difference between the long term rate and the short term rate, adjusted for the cost of refinancing in difficult market conditions. This incentive might not mean that all debt is five-year debt (rather than ten-year debt), but it is likely there would be considerable scope for violation of the Net Present Value Principle.

This incentive to take on shorter term debt does not arise in unregulated markets because prices are not regulated. Therefore, the debt policies of unregulated firms operating in an unregulated environment are not relevant to this matter. The relevance of this issue to determining the cost of debt will be discussed in a subsequent discussion paper on the cost of debt (forthcoming).

The choice of term has important implications for the choice of bond used to proxy the risk-free rate (i.e. the first term in the CAPM). Matching the term of the bond to the (long) life of the assets implies using a long term bond. Conventional practice in Australia has involved using the yield to maturity on a ten-year bond, as this term is typically the longest term liquid bond available. On the other hand, as regulatory cycles in Australia are usually five years, matching the term of bond to the term of the regulatory cycle implies using a five-year term bond[7]. As at September 2012, the difference in yields to maturity on Australian 10-year and five-year bonds was 0.44% (RBA, 2012a)[8].

Consistency with the Market Risk Premium

Application of the Net Present Value Principle requires that the term of the risk-free rate (i.e. the first term of the CAPM) should be set equal to the term of the regulatory cycle. The CAPM assumption of a common investor horizon also implies a five-year term implicit in the estimate of the market risk premium. However, due to data limitations arising from historical estimation methods, it is difficult to obtain a robust estimate of a five-year market risk premium. As a result, from a practical perspective, there is a need to compromise and use the longest available data series, which means using a 10-year estimate of the market risk premium[9].

[7] If the term of the regulatory cycle is other than five years, and a government bond with a term matching the term of the regulatory cycle is not available, then interpolation can be applied to infer the relevant rate.

[8] The published rates are simply double the half-year rates and as such, they ignore compounding (i.e. the reinvestment effect). Therefore, the published rates must be converted to annualised rates that reflect semi-annual compounding. As the adjustment for compounding is made to both the ten-year and five-year rates, the resulting impact on the difference between them is only minor. See Reserve Bank of Australia (2012b).

[9] It is argued that it is *prima facie* inconsistent to use two *different* risk-free rates in the CAPM (i.e. a five-year rate as the risk-free rate – the first term in the CAPM, and a ten-year rate implicit in the market risk premium), and this argument is widespread (NECG, 2003: 12). Specifically, if the beta of a firm is one then equation (1)

Australian Regulatory Practice

Until relatively recently, Australian regulators, in general, have adopted a 'long term' (i.e. 10 years) for the risk-free rate on the basis of the long life of the assets (ORG, 1998: 195-201)[10]. However, in 2009, in its draft decision on QR Network's 2009 Draft Access Undertaking, the Authority adopted a term matching the length of the regulatory cycle for setting the risk-free rate in the cost of equity and the cost of debt. In doing so, the Authority acknowledged the conceptual soundness of this change, as it satisfied the Net Present Value Principle (QCA, 2009: 11-13).

Stakeholders subsequently raised a number of concerns with this position. In its June 2010 draft decision on QR Network's 2010 Draft Access Undertaking - Tariffs and Schedule F, the Authority addressed these concerns and provided further detailed reasoning for its position on the term of the risk-free rate (QCA, 2010b: 33-38)[11]. A summary of key stakeholder arguments raised at that time and Dr Lally's responses to them is in the Authority's decision on QR Network's 2010 Draft Access Undertaking - Tariffs and Schedule F (QCA, 2010b: 39).

Following this decision, the Authority subsequently applied the same approach (i.e. matching the term of the risk-free rate to the term of the regulatory cycle) to the Gladstone Area Water Board (GAWB) in 2010, the SEQ Interim Price Monitoring in 2011, and to SunWater in 2012 (respectively, QCA, 2010a: 119-122; 2011: 233-238; and 2012: 483-485).

Subsequent to the Authority's 2009 decision on QR Network, the ERA and IPART changed their approach and now also set the term of the risk-free rate equal to the term of the regulatory cycle, consistent with the Net Present Value Principle[12]. However, the AER has continued to estimate the risk-free rate with respect to a ten-year term[13]. This decision to maintain its past practice on this issue followed a comprehensive review of its WACC methodology (AER, 2009: xii-xiii, 140-170).

2.3 Summary of Authority's Approach

In summary, the Authority's current approach to estimating the risk-free rate involves:

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implies that the expected return on equity should equal to the expected return on the market portfolio (i.e. the risk-free rates simply 'cancel out'). However, Lally (2004a) shows that in order for this argument to be correct, proponents of this argument must hold the belief that the term structure of the return on the market portfolio is always 'flat', and this possibility is entirely implausible (for a proof, see Appendix A) (Lally, 2004a: 69-70).

[10] An early exception was the Australian Competition and Consumer Commission (ACCC), which applied a five-year term consistent with the term of the regulatory cycle (following Lally (2003)). However, in GasNet's appeal to the Australian Competition Tribunal, the Tribunal rejected the ACCC's position on the basis that: (i) the relevant time scale is the life of the assets and the term of the investment; and (ii) the CAPM was not meant to be adapted to reference the regulatory period of five years, as this practice results in two different risk-free rates (i.e. a five-year rate in the first term of the CAPM but a ten-year rate impounded in the ACCC's estimate of the market risk premium) (ACT, 2003: paras. 40-49). Given this decision, the ACCC subsequently reverted to a term of ten years for the risk-free rate.

[11] On 18 December 2009, the Authority had published its draft decision not to approve QR Network's 2009 Draft Access Undertaking. On 15 April 2010, QR Network withdrew that undertaking and submitted a replacement undertaking, the 2010 Draft Access Undertaking. The Authority's June 2010 draft decision deals with the pricing aspects of the undertaking that the Authority approved in October 2010.

[12] For example, the ERA implemented this approach in its decisions on the Dampier to Bunbury Natural Gas Pipeline, the Western Power Network, and on its inquiry into the tariffs of the Water Corporation, Aqwest and Busselton Water (respectively, ERA, 2011: 125-129; 2012a: 318-327; and 2012b: 119). IPART applied this approach, for example, to water prices for Sydney Desalination Plant Pty Limited, following its cross-sector review of its approach to estimating the debt premium (respectively, IPART, 2011c: 85 and 2011b: 14-18).

[13] For a recent application of a ten-year term, see the AER's decision on Powerlink (AER, 2012a: 33).

(a) using Commonwealth Government bonds as a proxy for the risk-free asset in the CAPM;

(b) averaging the applicable rate over the 20 trading days immediately preceding the commencement of the regulatory cycle; and

(c) setting the term of bond equal to the term of the relevant regulatory cycle.

3. THE MARKET RISK PREMIUM

3.1 Background

The market risk premium is the expected return on the market portfolio of risky assets less the return on the risk-free asset. The market risk premium reflects the return that investors require to accept the uncertain outcomes associated with investment, relative to the return provided by a risk-free asset. The market risk premium in the standard (i.e. Sharpe-Lintner-Mossin) CAPM is:

Equation 3: $$MRP_{SLM} = k_m - r_f,$$

where MRP_{SLM} is the market risk premium in the standard CAPM, k_m is the expected return on the market portfolio including dividends and capital gains but excluding the value of dividend imputation credits, and r_f is the risk-free rate of return on the riskless asset. In the Officer (1994) variant, the market risk premium is:

Equation 4 $$MRP_O = k_m + UD_m \frac{IC_m}{DIV_m} - r_f,$$

where U is the utilisation rate of imputation credits, D_m is the cash (after company tax) dividend yield (on the market portfolio), IC_m is the attached imputation credits paid with respect to the market portfolio, DIV_m is the dividends paid with respect to the market portfolio, and the other terms are as defined previously. The central term in equation (4) represents the additional return that investors receive from dividend imputation credits. The market risk premium (in the Officer variant) since the implementation of dividend imputation in Australia is defined this way.

3.2 Australian Regulatory Practice

In the context of the CAPM, the market risk premium is forward-looking and, as such, it cannot be observed directly. As a result, while the concept of a market risk premium is relatively straight forward, its measurement is not.

Accordingly, there are a number of methods for measuring the market risk premium, and these methodologies invoke different assumptions and techniques to estimate it. Importantly, there is no single, 'correct' method of estimation, as all methods have both strengths and weaknesses.

3.2.1 The Authority

Current Methodology

The Authority has consistently set a market risk premium of 6.0% for the regulated firms in its jurisdiction. The Authority's estimation procedure principally involves four estimation methodologies, specifically:

(a) *Ibbotson historical averaging* – an historical averaging method that measures the historical (excess) return above the risk-free rate that investors could have earned by investing in a diversified 'market' portfolio, including applicable adjustments for any dividend imputation credits. 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;

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

(c) *Cornell method* – a forward-looking method and an advanced application of the dividend growth model where expected growth rates in dividends (proxied by the earnings per share growth rate) converge over time to the forecast, long-run GDP growth rate and once convergence occurs, the growth rate of dividends is assumed to occur at the same nominal rate as the economy[14]; and

(d) *survey evidence* – forward-looking approach that attempts to ascertain investors' expectations of the market risk premium by seeking an estimate directly from market participants and/or experts, including academics, financial analysts, and company managers. The objective is to find out what they require as a premium for investing in equity as a class relative to the risk-free rate.

Additional details on these methodologies can be found in **Appendix B**.

In arriving at a mean estimate, the Authority has attributed each method equal weight to date. The Authority then rounds the mean estimate to the nearest whole percent. The Authority's approach to both weighting and rounding are important aspects of its methodology and accordingly, are discussed further.

An important consideration in estimating the market risk premium is that all methodologies have weakness and improvements in estimation can be achieved by attributing weight to a number of estimates. In other words, difficulties in estimating the market risk premium can be reduced by combining the results from a set of estimators that are not perfectly correlated. For example, suppose there are two estimation methods that are uncorrelated with each other, and each method has a standard deviation of 0.03. An equally weighted average of the two methods will have a standard deviation of only 0.021, which reflects a 30% reduction in the standard deviation[15].

In terms of rounding, the Authority's practice to date has involved rounding its estimate to the nearest whole percent (e.g. an estimate of 6.3% would be rounded to 6.0%, and an estimate of 6.75% would be rounded to 7.0%). The Authority recently sought advice from Dr Lally on an appropriate unit of rounding as this unit of rounding is at the upper limit of typical practice.

Dr Lally considers that, first, reducing the unit of rounding improves accuracy only slightly. Further, in this context, Dr Lally considers that the more important consideration is error over the life of the regulated assets (rather than over a single regulatory cycle) and that errors from rounding will tend to offset over the life of the assets (Lally, 2012b: 28-29).

Second, reducing the unit of rounding significantly increases the probability that the final estimate is changed when, in fact, it should not be changed. In such situations, the principal factor driving the change is estimation error (with respect to the historical averaging

[14] The Dividend Growth Model values an equity by estimating the current dividend and assuming that dividends per share will increase in perpetuity by a constant growth rate. The cost of equity is found by equating the current share price to the present value of this dividend stream and solving for the discount rate. The risk premium is obtained by then deducting the risk-free rate from this cost of equity. Likewise, the model can be used in an economy-wide context by substituting market-level parameters (e.g. the current value of the market portfolio, the expected growth rate of market-level dividends) for the firm-level parameters.

[15] If the number of (uncorrelated) methods is extended to four and they are equally weighted then the standard deviation of the weighted estimate reduces further to 0.015.

methodologies) rather than a change in the premium itself[16]. For these reasons, Dr Lally recommended that the Authority retain its current practice of rounding the market risk premium to the nearest whole percent (Lally, 2012b: 29-31).

Updated Estimate of the Market Risk Premium

On the basis of the four estimation methods set out above (and described in detail in Appendix B), the Authority has updated its estimate of the market risk premium. Table 3.1 provides the resulting estimates of the mean and the median.

Table 3.1: Estimates of the Market Risk Premium (as at Oct 2012)

Method	*Estimate*
Ibbotson Historical Averaging	.0621
Siegel Historical Averaging	.0432
Cornell Method	.0870[a]
Survey Evidence	.0580
Mean	.0626
Median	.0600

[a] *The Cornell range of estimates is 0.0758 - .0957. The mean is .0870.*

The mean estimate is .0626, and the median estimate is 0.600. Both estimates will be biased upward as the Ibbotson historical average is likely to be biased upward due to the overstated dividend yield series in the pre-1958 data and due to other factors, such as 'survivorship bias' (see Appendix B for details). As a consequence, the Siegel estimate will also be biased upward, as the Siegel method uses the Ibbotson estimate as its starting point[17].

More importantly, however, the Cornell estimate is unequivocally biased upward as it is an 'upper bound' on the market risk premium. It is an upper bound because the long run growth rate in the aggregate dividends of all firms cannot exceed the growth rate of the economy (i.e. the growth rate of Gross Domestic Product (GDP)) (see Appendix B).

These results from a range of both historical and forward-looking methodologies support an estimate of .06 as being reasonable at this time.

3.2.2 Other Regulators

Australian regulators have consistently applied an estimate of 6.0% for the market risk premium. A previous exception to this practice was the AER, which increased its estimate of the market risk premium from 6.0% to 6.5% principally in response to the onset of the GFC for a short period commencing in 2009. At that time, the AER indicated that, as a result of the GFC, a higher market risk premium could reflect a temporary elevation of that premium or a structural break. Since that time, the AER has reverted to its previous estimate of 6.0%, consistent with other regulators, on the basis that no structural break occurred and that the market risk premium has subsided to pre-GFC levels (AER, 2011: 223-225).

[16] Consequently, a move to a lower unit of rounding would materially increase the frequency with which the Authority revises its estimate, and some of these revisions would be unjustified.
[17] The upward bias in the Siegel estimate only affects the mean, not the median result.

The AER relies on (Ibbotson) historical estimates, survey estimates and also considers dividend growth model estimates and market commentary as well (AER, 2012c: 105). On the basis of these approaches, the AER recently provided a market risk premium of 6.0% to the Victorian gas distributors (AER, 2012c: 104-119).

Other Australian regulators arrive at the estimate of 6.0% primarily on the basis of Ibbotson historical averaging over a long time series. The ESC provided a market risk premium of 6.0% on the basis of historical averaging and regulatory precedent in its decisions on Melbourne Water and Metro Trains Melbourne Pty Ltd (respectively, ESC (2009a: 81; 2011: 85).

Similarly, in its recent decision on Western Power, the ERA relied on an estimate of 6.0% from historical averaging, although in its 2011 decision on the Dampier to Bunbury Natural Gas Pipeline, the ERA also referenced survey estimates and qualitative financial market information (ERA, 2012a: 317; 2011: 129-130).

IPART has consistently applied a range of 5.5% to 6.5% in recent determinations on the basis of Ibbotson historical averaging. IPART has also stated that it believes that using a long term historical average adequately takes into account any impact on excess returns of recent financial market events such as the GFC. Recent decisions include determinations on prices for the Sydney Catchment Authority, bus fares for Sydney metropolitan and outer metropolitan regions from 2010-13, and water prices for Sydney Desalination Plant Pty Ltd (IPART, 2009a: 119; 2009b: 168; and 2011c: 80).

4. THE RISK-FREE RATE, MRP, AND THE GLOBAL FINANCIAL CRISIS

4.1 Recent Developments

With the onset of the GFC in 2007, yields on Australian Commonwealth Government securities (CGS) decreased significantly and have continued a downward trend since that time[18]. The largest declines in these rates occurred closely following the onset of the GFC in 2008-09 and then again during the recessions in the United States and Europe, which have been associated with sovereign debt, banking, and balance of payments crises. For example, from 1 July 2012 to 31 October 2012, the five-year and 10-year government bond yields averaged 2.66% and 3.07% respectively (Table 4.1). These present yields reflect a greater than 300 basis point decline relative to the yields prevailing in 2007-08.

Table 4.1: Mean Annualised Commonwealth Government Nominal Bond Yields

Financial Year	*5-Yr Nominal CGS*	*10-Yr Nominal CGS*
2007-08	6.44%	6.27%
2008-09	4.64%	5.06%
2009-10	5.31%	5.57%
2010-11	5.15%	5.38%
2011-12	3.59%	4.05%
2012-13 (1 Jul – 31 Oct)	2.66%	3.07%

Market commentary from a range of sources supports the contention that investors are placing a premium on Australian Commonwealth Government and state level debt instruments due to their relatively low risk and high liquidity in comparison to other assets. The consequence of this 'flight to quality' is higher bond prices and accordingly, lower yields.

Occurrence of this phenomenon the last several years in relevant debt markets is relatively uncontroversial. For example, in a letter of 18 July 2012 from the Australian Treasury to the Australian Competition and Consumer Commission (ACCC), Treasury stated:

> *The spread between CGS and other debt securities has widened over recent years, particularly the spread to Semis. While the absolute yields on Semis have fallen by around 180 to 200 basis points since mid-2011, the spread to CGS has increased by around 40 to 60 basis points owing to the more substantial fall in CGS yields over the same period.*
>
> *The fall in yields on CGS across the yield curve reflects a range of factors. The weak and fragile global economy has put downward pressure on benchmark global long-term bond yields. It has also driven investors into high-quality government debt (Aus Treasury, 2012: 2).*

Basel III requirements for banking have also contributed to these developments. Specifically, Basel III regulations will require banks to hold a higher proportion of their balance sheet in high quality, liquid assets for the purpose of withstanding financial stress in

[18] Most financial market commentators consider that the GFC commenced with the collapse of Lehman Brothers in July 2007.

the event of a 'run' on the banking system (Debelle, 2011). This development reflects additional demand for high grade and highly liquid Commonwealth government bonds and accordingly, it is a contributing factor to the 'flight to quality' phenomenon.

The continuing demand for high quality government bonds also comes at a time when the stock of such assets is low:

> *The issue in Australia is that there is a marked shortage of high quality liquid assets that are outside the banking sector (that is, not liabilities of the banks). As a result of prudent fiscal policy over a large run of years at both the Commonwealth and state level, the stock of Commonwealth and state government debt is low. At the moment, the gross stock of Commonwealth debt on issue amounts to around 15 per cent of GDP, state government debt (semis) is around 12 per cent of GDP. These amounts fall well short of the liquidity needs of the banking system (Debelle, 2011).*

Therefore, the confluence of unusual demand and supply conditions in bond markets is a principal driver of currently high prices and low yields on Commonwealth government debt.

4.2 Regulatory Context

Recently, a number of regulated firms have submitted (or implied) that these 'unusual' market conditions, in combination with the standard regulatory approach to estimating the cost of equity in Australia (discussed below), are producing returns that are 'too low'. For example in its proposed access arrangements to the AER, SP AusNet argued:

> *Capital market conditions remain turbulent and considerable uncertainty exists as to global macroeconomic strength through the fourth regulatory period to 2017. SP AusNet can only retain the support of its investor base by continuing to meet market expectations of stable and efficient returns. Compelling evidence demonstrates that the standard regulatory approach to estimating the cost of equity does not deliver credible results under the current market conditions (SP AusNet, 2012: 11).*

In a recent report on behalf of Envestra, SP AusNet, Multinet, and APA, the firms' consultant, CEG, advanced arguments to support this general proposition. CEG observed that recent regulatory decisions by the AER have produced 'record low' regulated return on equity estimates for the energy networks and distributors due to falling government bond yields. Specifically, CEG reports that, in decisions prior to the GFC, the regulated returns on equity averaged about 12% but since 2009, the regulated return on equity has averaged only about 10.5%, with the AER's draft decision of 9.08% for Aurora Energy being the lowest as at March 2012 (CEG, 2012: 5)[19].

CEG attributes these materially lower estimates to the 'mechanical' way in which the AER (and other Australian regulators) set the cost of equity for regulated firms, namely that regulators set:

(a) the risk-free rate (the first term in the CAPM) equal to the relevant, current government bond rate; and

(b) the market risk premium based on the AER's estimate of the historical average risk premium earned by Australian equity investors, which, by construction, is very stable.

Therefore, as the two parameters enter the CAPM as per equation (1), if the risk-free rate fluctuates significantly and the market risk premium is stable then, for a given beta estimate, the cost of equity moves in line with the risk-free rate (CEG, 2012: 5-6). That is, given that regulators apply a 'stable' market risk premium, if the risk-free rate is low (high), the cost of equity will be low (high). In reference to this (i.e. the AER's) methodology, CEG states:

[19] The AER's *final* decision on Aurora Energy in April 2012 provided a cost of equity of 8.69%.

> *In my view, the fourth methodology cannot be relied on to provide a robust estimate of the prevailing cost of equity. This is because it fixes the risk premium on equity based on historical evidence but does not similarly fix a consistent estimate of the risk free rate. Given that risk premiums and risk free rates commonly tend to move in the opposite direction this methodology will tend to underestimate the cost of equity when risk free rates are low and overestimate the cost of equity when risk free rates are high (CEG, 2012: 42).*

In support of its contention that the AER's approach will lead to under-compensation when risk-free rates are low, CEG makes the following (explicit or implied) claims:

(a) current yields on Australian Commonwealth government bonds are historically low, and this downward 'bias' undercuts their suitability as a proxy for the risk-free asset in the CAPM;

(b) variations in the risk-free rate and the market risk premium are *strongly* negatively correlated such that, when risk-free rates are materially low (high), market risk premiums will be materially high (low); and

(c) the market risk premium set by Australian regulators is a 'long term' estimate, which is inherently stable (by construction).

The implication of this set of claims is that the current regulatory approach to setting the allowed cost of equity by 'passing through' unusually low risk-free rates, without changing the market risk premium, will lead to a cost of equity that is too low at the present time and, therefore, result in under-compensating the regulated firms. On the assumption that standard regulatory practice will lead to under-compensation, CEG then proposes three alternative methods (relative to the AER's methodology) for estimating the cost of equity given current market conditions[20].

Specifically, CEG proposes three alternatives to the 'standard' regulatory approach of coupling a current risk-free rate with a 'long term' market risk premium, namely applying the:

(a) *Firm-specific Dividend Growth Model*: the model is applied to each of six Australian regulated firms, with the model estimating a cost of equity consistent with current share price, the current dividend level, and estimates of future expected dividends per share – with this model, estimates of the average cost of equity vary from 10.87% to 14.59%[21];

(b) *Long Term Average Risk-free Rate with a Long Term MRP* – the method adds a 20-year average risk-free rate of 5.99% to a 'long term' market risk premium of 6.0%; in combination with an assumed equity beta of 0.80, these parameters result in a cost of equity of 10.78%; and[22]

(c) *Market-level Dividend Growth Model*: the model is comparable to the model in (a) but applied to the market as a whole using 'market' estimates of the various parameters to obtain a market risk premium of 8.52%; in combination with an assumed equity beta of 0.80, the resulting cost of equity is 10.58%.

[20] The context is rule 87 of the National Gas Rules, which sets out provisions that guide the AER's assessment of the entities' cost of capital.

[21] The variation depends on whether the assumption for the expected dividend growth rate is 2.5% or 6.6% respectively, where the former reflects 2.5% forecast inflation (i.e. zero economic growth) and the latter reflects a long run nominal GDP growth rate of 6.6% (CEG, 2012: 19).

[22] CEG takes the average yield on inflation-indexed Government bonds from 1993 to the present, and this average is 3.40%. It then combines this estimate with an expected inflation rate of 2.5% to obtain a 5.99% nominal risk-free rate estimate over that 20-year period (CEG, 2012: 45-46).

Given CEG's report and related developments on this matter, the Authority engaged Dr Martin Lally to assess CEG's claims and, independent of his conclusions with respect to these claims, to subsequently assess CEG's alternative proposals for estimating the regulatory cost of equity. Dr Lally's responses on this matter are summarised below (see Lally (2012b) for further details).

CEG's first claim is based on the observations that Australian government bond yields are unusually low at present due to: i) a low supply of such debt; and ii) high demand for low risk, highly liquid assets like Australian governments bonds (investors' 'flight to quality'). The *implication* is that unusually low risk-free rates are 'biased down' estimates of the true risk-free rate and, on that basis, are not a suitable proxy in the CAPM (CEG, 2012: 28-29).

Dr Lally agrees that the yields on Commonwealth government bonds are presently at historical lows. However, he disputes the implication that this fact somehow disqualifies them from being a suitable proxy for the risk-free rate. Specifically, Dr Lally observes that the standard CAPM (and by implication, the Officer variant) only impose the explicit requirement that the return on the proxy for the risk-free asset be free of risk. While Dr Lally identifies several *implicit* requirements from the CAPM for the risk-free asset, these requirements, on balance, do not support CEG's claims (see **Appendix C**).

Further, Dr Lally argues that the CAPM imposes no requirements relating to the supply of the risk-free asset. As a result, while a reduction in the supply of government bonds lowers their yields, this effect does not disqualify it from being a risk-free asset. In addition, the CAPM does not require that the risk-free rate be invariant to changes in the risk of other assets (e.g. equities) or to changes in investors' aversion to these risks. Consequently, even if such changes in risk, or risk aversion behaviour, have led to a 'flight to quality', such effects are not relevant to the CAPM (Lally, 2012b: 6-8).

CEG's second claim is that the observable yields on government bonds are *strongly* negatively correlated to the market risk premium, implying that when the risk-free rate is 'low', the market risk premium must be 'high'. The primary evidence CEG presents on this point arises from applying the simple dividend growth model to directly estimate the cost of equity. The model is conceptually similar to the model in **Appendix B** (equation (12)) and basically involves finding the current cost of equity such that the present value of future dividends (including growth in the dividends) equals their current market value.

Dr Lally demonstrates that observing little variation in the cost of equity over time does *not* allow one to conclude that the market risk premium has changed by an 'offsetting' amount (given a 'low' risk-free rate). Rather, Dr Lally argues that the principal reason for the 'stability' of the time series is that CEG's methodology assumes that, at any point in time, the cost of equity is the *same* for all future years. The method, therefore, is predisposed to generating significantly greater stability in the cost of equity than would otherwise arise (Lally, 2012b: 11-12).

Dr Lally also rejects CEG's third claim, specifically that the general practice of Australian regulators is to estimate a long term market risk premium (of 6.0%). Dr Lally observes that the AER and QCA both estimate a market risk premium that reflects both current and long term factors. For example, the Authority applies two methods that involve long term historical data but two other methods that are forward-looking. As a result, CEG's claim in this respect is significantly less relevant for the AER and QCA than for regulators who estimate a strictly long term market risk premium (Lally, 2012b: 12).

Dr Lally also disputed CEG's conclusion that any underestimate of the cost of equity at this time leads to under-compensation for regulated firms. Dr Lally considers that the critical feature of compensation is that it should be provided over the life of the regulatory assets rather than over each regulatory cycle within the life of the assets. As a result, while a regulator's estimation process might yield a biased estimate of a parameter (e.g. the market risk premium) under certain economic conditions, the more relevant consideration is the accuracy of the method over the life of the regulated assets. In other words, a method for estimating the market risk premium should not be rejected simply because it is biased under certain economic conditions (Lally, 2012b: 13).

In considering CEG's alternative proposals, Dr Lally identifies a number of unacceptable difficulties with proposals (a) and (b).

Dr Lally does not support applying the 'firm level' dividend growth model for several reasons. First, the methodology assumes that the current share price of the firm matches the present value of future dividends per share. As a result, if that price is actually less (greater) than the present value of future dividends, then the resulting cost of equity estimate will be too high (low). Second, with this approach, the regulated firm has an incentive to manipulate its retention rate to increase its cost of equity. Specifically, the firm would have the incentive to reduce its retention rate and pay temporarily higher dividends.[23] Third, the approach should only be applied to firms with strictly regulated activities. If it is applied to regulated firms that have some unregulated activities then the estimate of the cost of equity will be too high, as the latter have higher risk (Lally, 2012b: 17-18).

Dr Lally also does not support the use of a 'long term' (i.e. 20-year) risk-free rate. First, he argues that the proposal relies on the view that the risk-free rate and the market risk premium are 'offsetting' over time (as implied by CEG's constructed cost of equity time series). As discussed previously, however, Dr Lally shows that the principal evidence provided to support a stable cost of equity (and, therefore, an offsetting market risk premium), is predisposed to that result. Second, Dr Lally contends that the choice of an (historical) averaging period is arbitrary, subject to manipulation, and ignores an important and relevant parameter – the current risk-free rate – to offset alleged biases in another parameter (i.e. the market risk premium) (Lally, 2012b: 23-25).

With respect to proposal (c), using the dividend growth model to estimate the market risk premium (to input into a cost of equity given a current value of the risk-free rate), Dr Lally also identifies several material errors in CEG's implementation of it. Even if these are corrected, Dr Lally would only support using the resulting estimate of the market risk premium in conjunction with estimates from other methods to arrive at a final estimate of the premium (rather than using CEG's resulting (corrected) estimate on a 'stand-alone' basis). This recommendation is consistent with the Authority's approach to estimating the market risk premium.

4.3 Australian Regulatory Practice

To date, regulators have largely rejected arguments for either adding an 'uplift' factor to the current risk-free rate (via using a long term historical average) or an uplift factor to the estimate of the market risk premium. Rather, their views have been largely consistent with the principle that the unusually low risk-free rates are forward-looking and reflective of current market conditions.

For example, in its proposal on gas access arrangements to the AER, SP AusNet proposed a 'long term' risk-free rate of 5.99% based on a 20-year average on the basis of current market conditions and that the AER uses a long term market risk premium of 6.0% (SP AusNet, 2012: 180). In its recent decisions, the AER has rejected adjustments to the risk-free rate on the basis that, *inter alia*, such adjustments are not reflective of prevailing market conditions:

[23] This would only be relevant for such regulated firms that were used as benchmarks.

> *For reasons set out in this decision, the AER considers a 6 per cent MRP reflects prevailing conditions in the market for funds and also the risks from providing reference services. However, even if this was not the case, the AER considers (for the reasons outline above) adjusting the risk free rate to address a perceived problem with the MRP would not be appropriate. It does not accept this approach would be preferable to its current approach to setting parameters (AER, 2012c: 114).*

The AER's conclusion on this matter is also supported by McKenzie and Partington:

> *There seems to be an implication in some of the submissions that there is something wrong with using the government bond rate as the risk free rate when government bond rates are low. The fundamental point to be made is that the government bond rate sets the current benchmark that a risky project has to beat. Clearly there is little point in taking on a risky project if you can get the same or higher return by investing in a government bond. The government bond thus sets a benchmark; the time value of money (McKenzie and Partington, 2012: 11-12).*

In the same context of alleged under-compensation, APA GasNet proposed an alternative approach, namely a 'current' risk-free rate (i.e. consistent with the AER's standard approach) but a market risk premium of 8.5%, on the basis that both are consistent with current market conditions (APA, 2012: 146-147). The AER, however, rejected APA GasNet's proposed premium of 8.5% on the basis that the AER's preferred estimate of 6.0% was consistent with a range of evidence and commensurate with prevailing market conditions (AER, 2012b: 38).

An exception to this regulatory practice to date is IPART's final decision on Sydney Desalination Plant Pty Ltd. In this decision, IPART set the final WACC 0.80% above the range it previously determined on the basis of market uncertainty of 'short term' values:

> *...we recognise stakeholders' concerns about the inconsistency in using short term data in estimating some parameters and long term data in estimating others. We also recognise there is considerable uncertainty over the market risk premium, due to recent market instability. These factors influenced our decision to set SDP's WACC towards the top of the possible range, and we are satisfied that this decision adequately addresses stakeholders' concerns...(IPART, 2011c: 91).*

The Authority previously addressed some of the issues in this discussion paper in its December 2009 draft decision on QR Network's 2009 draft access undertaking. In that undertaking, QR Network sought an uplift of 0.45% to the risk-free rate on the basis that it was 'biased' down at the time. The Authority rejected that claim, as it considered the 'bias' to reflect changes in the supply of, and demand for, government bonds and observed that such price (and yield) changes are consistent with the CAPM (QCA, 2009: 13).

In that same context, QR Network proposed a range of 6.0%-7.0% for the market risk premium, with a point estimate of 6.75% being consistent with its submitted weighted average cost of capital (WACC) (QR Network, 2008: 81-83, 90). In settling on an estimate of 6.0% at that time, the Authority noted the AER's upward revision of its estimate from 6.0% to 6.5% due to the GFC but did not adopt the AER's approach on the basis that:

(a) the Authority's methodologies indicate that 6.0% is a reasonable estimate and sits above both the mean and median estimates;

(b) any adjustments made for short-term fluctuations in market conditions are inherently highly subjective, both in the scale of the adjustment and the period over which they would need to be subsequently reversed; and

(c) in its previous decisions, the Authority did not lower the market risk premium when market conditions at the time led some stakeholders to seek a reduction – therefore increasing the premium now would be inconsistent with its past practice that sets the market risk premium at a level to encourage investment over the medium term and not in response to short term market fluctuations (QCA, 2009: 14-15).

In submissions to the Authority, the Southeast Queensland (SEQ) water distributor-retailers, Allconnex Water, Queensland Urban Utilities, and Unitywater, engaged CEG to provide advice on an estimate of the cost of capital. In that advice, CEG proposed a market risk premium of 6.5% on the basis of forward-looking estimates (CEG, 2011: 5). However, in its SEQ Price Monitoring decision, the Authority rejected the estimate of 6.5% for principally the same reasons as previously indicated in the QR Network 2009 decision (QCA, 2011: 238-239).

In summary, Australian regulators to date have largely resisted adjusting the risk-free rate or market risk premium in the cost of equity to reflect the recent downward trend in Commonwealth Government bond rates. Principal reasons for this approach are the current risk-free rate is forward-looking and, therefore, reflects the most relevant market conditions, the question of potential under-compensation is relevant only over the entire life of the regulatory assets rather than to a specific regulatory cycle, and regulators have not previously lowered the risk-free rate in the opposite set of circumstances despite appeals from some stakeholders for such a change.

APPENDIX A: CONSISTENCY WITH THE MARKET RISK PREMIUM

The standard CAPM is:

Equation 5 $$k_e = r_f + \beta_e(k_m - r_f),$$

where k_e is the expected return on equity, β_e is the equity beta, and $(k_m - r_f)$ is the market risk premium (i.e. the expected return on the market portfolio less the risk-free rate). The argument is that, if $\beta_e = 1$, then $k_e = k_m$. As a result, using the same risk-free rates leads to an outcome that is 'consistent'. The corollary is that using two different risk-free rates in the CAPM is, therefore, inconsistent.

Now suppose that the model is applied in a regulatory setting with a one-year regulatory cycle. Further, suppose that the one-year risk-free rate (r_{f1}) is used as the first term in the cost of equity but the two-year risk-free rate (r_{f2}) is used to estimate the market risk premium – this example is analogous to advocating a five-year risk-free rate as the first term in the cost of equity but a 10-year risk-free rate implicit in the market risk premium. If the equity beta is again one, then the cost of equity is:

Equation 6 $$\boldsymbol{k_e = r_{f1} + (k_m - r_{f2}).}$$

Therefore, even with a beta of one, k_e appears to diverge from k_m whenever r_{f1} is not equal to r_{f2} – and this outcome is seemingly inconsistent. The claim of inconsistency is common but overly simplistic for the following reasons.

The apparent inconsistency occurs due to the (implicit) assumption that k_m is the *same* for all future periods even though r_{f1} is not equal to r_{f2}. However, the value for k_m over the next year (k_{m1}) might differ from the (annualised) value applicable to the next two years (k_{m2}). This difference might result from r_{f1} diverging from r_{f2} due to the expectations hypothesis. For example, if $r_{f1} = 0.03$ and $r_{f2} = 0.035$ then the expectations hypothesis implies that there is a market belief that the one-year risk-free rate in one year (r_{f2}) will equal 0.04. Consequently, k_{m1} diverges from k_{m2}, and equation (6) becomes:

Equation 7 $$\boldsymbol{k_e = r_{f1} + (k_{m2} - r_{f2})}.$$

To determine whether or not $[r_{f1} + (k_{m2} - r_{f2})] = k_{m1}$, an assumption must be invoked with respect to the term structure of the market risk premium. For instance, if a proponent of the 'same r_f' argument is willing to assume:

Equation 8 $$\boldsymbol{k_{m2} - r_{f2} = k_{m1} - r_{f1},}$$

then equation (7) becomes:

Equation 9 $$\boldsymbol{k_e = r_{f1} + (k_{m1} - r_{f1}) = k_{m1}}.$$

Therefore, this assumption (equation (8)) implies 'consistency'. However, that assumption – and therefore 'consistency' - mean that the term structure in k_m is always 'flat', and this assumption is completely implausible (Lally, 2004a: 69-70).

APPENDIX B: MARKET RISK PREMIUM – ESTIMATION METHODS[24]

Ibbotson Historical Averaging

There are a number of methods available for estimating the market risk premium in the Australian context (for a survey, see Lally, 2004a: 43-61). However, the most common is historical averaging over *ex post* market outcomes of the Ibbotson and Sinquefield (1976) type, where the *ex post* outcome in any one year is:

Equation 10 $$MRP_I = R_m + UD_m \frac{IC_m}{DIV_m} - r_f,$$

where MRP_I is the (Ibbotson) *ex post* market risk premium for year *t*, R_m is the *actual* rate of return on the market portfolio in year *t*, and the other terms are defined as in section 3.1. Prior to the introduction of dividend imputation in Australia in 1987, the middle term in equation (10) vanishes, and the *ex post* outcome is $R_m – R_f$.

In terms of an Ibbotson estimate, the most widely cited sources for long term Australian estimates are Dimson *et al* (2002) and Officer (1989), who report estimates of .075 and .079 over 1900-2000 and 1882-1987 respectively, using arithmetic averaging of long term bond yields[25]. The results are very similar as Dimson *et al* (2002) draw their data from Officer (1989), and both studies utilise equity returns data developed by Lamberton and bond return data from the Reserve Bank of Australia.

However, in recent research, Brailsford *et al* (2008) make a compelling argument that the Officer and, by extension, the Dimson *et al* estimates, are materially overstated due to overstated equity returns over the pre-1958 sub-period of the data series. Specifically, Brailsford *et al* (2008) argue persuasively that the Lamberton/Sydney Stock Exchange dividend yield series used in the retrospective construction of the underlying stock accumulation index prior to 1958 involves dividend yields that are materially too high. In particular, Brailsford *et al* (2008) identify two sources of upward bias in the dividend yield series, namely:

(a) the equities are equally weighted, rather than value weighted, and the average is biased toward high yielding small equities; and

(b) the yield overstates the market average as it is based on dividend paying equities only (i.e. it effectively assumes that equities paying no dividends are paying the same dividends as the unweighted market average) (Brailsford *et al*, 2008: 79-80).

The authors attempt to correct for some of the identified bias, and the correction made is entirely defensible, as it reflects a very conservative (downward) adjustment to the market risk premium. Consequently, the pre-1958 returns used by Brailsford *et al* (2008) are still likely to result in an overstated market risk premium, and the uncorrected return series implicit in the data of both Dimson *et al* (2002, 2003) and Officer (1989) certainly generates an overstated estimate.

Drawing on alternative data sources, Brailsford *et al* (2008) adjust this series and then recalculate the market risk premium. For comparison to the Dimson *et al* (2002) and Officer (1989) market risk premium estimates (relative to bonds) over the same time periods, Brailsford *et al* (2008) report arithmetic means of 0.062 and 0.064 respectively. These estimates are materially less than the reported estimates based on Dimson *et al* (2002) and Officer (1989) of .075 and .079 respectively (Brailsford *et al*, 2008: 91). These estimates take into account cash dividends and capital gains only.

[24] This section draws significantly in the material in Lally (2004a).
[25] The Dimson estimate of 0.075 is derived by subtracting the nominal return on ten-year bonds (0.058) from the nominal return on equities (0.133) (Table 18-1).

In an update of that paper, Brailsford *et al* (2012) update their estimates through 2010 (i.e. the complete data series is 1883-2010), and the corresponding arithmetic mean for that series is 0.061 for cash dividends and capital gains only and 0.064 for cash dividends, capital gains, and the value of dividend imputation credits, assuming distributed credits are valued at 100 cents on the dollar (Brailsford *et al*, 2012: Tables 1, 3). Brailsford *et al* (2012) also estimate a market risk premium of 0.063 if distributed credits are valued at 50 cents on the dollar (Brailsford *et al*, 2012: Table 2). The parameter value of 0.50 is consistent with a utilisation rate of 0.50.

The Authority currently uses the Brailsford *et al* (2008, 2012) data series to estimate the historical market risk premium, including any relevant adjustments for the effects of dividend imputation since its introduction. As discussed previously, the Brailsford *et al* data identifies and corrects significant errors in a part of the early (i.e. pre-1958) return series. Importantly, the problems and adjustments made are well identified and documented.

Siegel Historical Averaging

Siegel (1992) proposes a variant of the Ibbotson methodology based on the hypothesis (supported by empirical evidence) that historically, unexpected inflation has reduced the observed real return on bonds but not the real return on equities. Specifically, 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 unanticipated inflation. Only anticipated inflation is relevant for forming an estimate of expected real returns. As a result, in the context of the 'standard' market risk premium, 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_S) is then:

Equation 11 $$\boldsymbol{MRP_S = MRP_I + (\bar{r}_r - r_r^e)},$$

where $\bar{r}_r$ is the average long term real risk-free rate and $r^e{}_r$ is the expected long term real risk-free rate.

Lally (2004a) invokes an average real yield of 0.019 based on Dimson *et al* (2002, Table 18-1) and an estimate of 0.04 for the expected long run real yield based on Siegel (1992) and RBA data. As at 2004, the resulting Siegel estimate is 0.054 (Lally, 2004a: 47). The Authority applies Siegel's method to the Ibbotson estimate derived from the Brailsford *et al* (2008, 2012) data series.

Regardless of whether Ibbotson or Siegel historical averaging is used, there are controversies associated with historical averaging approaches. First, the standard errors of the estimates are substantial (even if the 'true' value has not changed over time). These errors can be reduced if the average is taken over a long time series (e.g. 100 years). This approach then introduces a trade-off between using a longer times series that consequentially reduces the standard error of the estimate and the distinct possibility that using data from older periods involves sampling from those periods in which the premium was fundamentally different. Accordingly, controversies arise with respect to the trade-off between statistical reliability and data relevance. The Authority uses a long term data series to obtain better statistical reliability.

Another issue that arises is whether the time series average estimate should be based on a geometric or arithmetic mean. The geometric mean is the relevant measure of returns when measuring the change in investor wealth over a number of periods in succession with a 'buy and hold' (i.e. dividend reinvestment strategy) (Carleton and Lakonishok, 1985: 39). On the other hand, the arithmetic mean is the relevant measure for measuring performance for a given length of time when returns are realised in different periods during that time. In particular, the arithmetic mean equates the expected future value of an investment with its net present value, which makes it the correct measure when applied in a discount rate or cost of capital context (Ibbotson and Sinquefield, 1989: 126-127). Accordingly, the Authority uses the arithmetic mean.

Importantly, there are significant reasons to believe that historical estimates of the Ibbotson and Siegel type are upward biased. The first possible reason is 'survivorship'; that is, estimates are based on data from equities and equity markets that have 'survived' history[26]. In contrast, equities and markets that have not survived are not reflected in historical returns. As a result, returns estimated using historical averaging will be biased upward if survivorship is significant (Jorion and Goetzmann, 1999).

In addition, it is plausible that the market risk premium has decreased over time, as it is affected by a number of factors, including *inter alia*, business risk and investment risk. Dimson *et al* (2003), for example, attribute reductions in business risk, *inter alia*, to removal of international trade barriers and higher international trade flows. They attribute reductions in investment risk to the benefits of diversification, through a wider range of quoted securities and through the use of intermediaries, such as mutual funds (Dimson *et al*, 2003: 14). On a related matter, Siegel (1999) argues that reductions in transactions costs and a greater ability to diversify have likely resulted in higher *realised* (partly unobservable) returns to investors, which importantly, are not reflected in returns estimated from an equity index (Siegel, 1999: 13)[27][28].

Cornell Method

Forward estimation techniques do not rely on historical data but rather invoke current information and/or forecasts. In general, forward-looking 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 forecasts of future dividends.

The typical starting point for such an approach is a variation of the Dividend Growth Model. In the context of this model, an especially simple case of its application involves assuming that the expected return on the market equals the current, long run dividend yield of the market plus the expected, constant dividend growth rate. Implicit in this version of the model is that the long term growth rate in dividends per share is constant and applies immediately. So that based on a perpetuity value:

Equation 12

$$\mathbf{1 = \frac{D_m(1+g)}{k_m - g},}$$

where k_m is the expected return on the market portfolio (as before), D_m is the current 'market' dividend yield, and g is the (constant) expected growth rate in dividends per share for the market for all future years. The current market dividend yield is observable. The assumption of constant growth is not unreasonable for mature firms, and the usual approach for estimating the expected growth rate in dividends is to use analysts' current forecasts of earnings per share over the next few years as a proxy.

However, Cornell (1999) argues that these short term forecasts are materially higher than long run estimates of the growth rate of GDP, which introduces an inconsistency. Specifically, while a company's dividends might grow at a rate greater than the growth rate of the economy for several years, such a situation is unsustainable on an indefinite basis as the company would eventually engulf the entire economy.

Therefore, 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, and Cornell suggests a

[26] Markets can also be suspended or closed due to financial crisis, political upheaval, and wars.

[27] For example, the development of mutual funds has materially reduced the cost of maintaining a diversified portfolio, and the cost of investing in mutual funds has decreased over the last several decades

[28] See Rea and Reid (1998) for an analysis of trends in declining total shareholder costs of holding mutual fund shares.

period of 20 years. 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).

Applying Cornell's argument and assuming linear convergence (such that in year N the expected growth rate in dividends (g) becomes constant), yields:

Equation 13

$$1 = \left[\sum_{t=1}^{N} \frac{D_m(1+g_1)\ldots(1+g_t)}{(1+k_m)^t}\right] + \left\{\frac{\left[\frac{D_m(1+g_1)\ldots(1+g_N)(1+g)}{k_m - g}\right]}{(1+k_m)^N}\right\},$$

where t = time (year), $t = N$ is the year of convergence, and g_t is the expected growth rate of dividends on the market portfolio in year t. Equation (12) is a special case of (13) with N=0, where the latter assumption implies 'instantaneous' convergence.

Solving (13) requires assumptions regarding the expected growth rates of dividends for the market (proxied by earnings per share forecasts) and regarding the expected long run nominal GDP growth rate of the economy, where the latter comprises a forecast of long run real GDP growth rate and a forecast of expected inflation. Again, given these parameter values, the objective is to find the value of the expected return on the market portfolio that equates the current value of the market portfolio with forecasts of future market dividends.

While this approach produces a forward-looking estimate of the market risk premium, a weakness of the Cornell method is that the estimate is sensitive to the expected growth rate in dividends per share and to the period required before this growth rate converges to the long run rate (Lally, 2004a: 57). To account for this sensitivity, the Authority produces Cornell estimates over convergence periods of 5, 10, 15, and 20 years and with a combination of expected real GDP growth rates of .025, .03, and .035.

It is also important to note that the resulting Cornell estimates will be biased upward and reflect an upper bound on the market risk premium. The reason is that the long run growth rate in the aggregate dividends of existing firms in Australia 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[29].

Survey Evidence

Surveys attempt to ascertain investors’ expectations of the market risk premium by seeking an estimate directly from market participants and/or experts, including academics, financial analysts, and company managers. The objective is to find out what they require as a premium for investing in equity as a class relative to the risk-free rate. The advantage of survey-based estimates is that they produce a forward-looking measure of the market risk premium that is suitable for the CAPM.

The weaknesses of survey estimates are that they are sensitive to recent equity price movements. The implication is that the estimates tend to reflect the immediate past rather than the future, which is the opposite of the expectation being sought. Survey estimates are also sensitive to the way in which the survey questions are asked (i.e. ‘framing bias’). Finally, survey estimates are sample-dependent. For example, surveys of academics tend to provide lower estimates than surveys of investors (Damodaran, 2012: 18).

One of the most commonly cited (repeated) surveys of the US market risk premium is Welch (2000), who conducts several surveys of academic financial economists over the period 1998-1999. The mean

[29] Arnott and Ryan (2001) argue that the distinction between current firms and all firms in the economy by itself reduces the expected growth rate by 1.0-2.0%. Bernstein and Arnott (2003) 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%. The Authority’s adjustment for these two points is materially less than 2.0%.

market risk premium is 0.07 for a ten-year term and 0.071 for a 30-year term. Welch subsequently conducted the survey again in 2001 and the mean 30-year market risk premium had fallen to 0.055[30] (Welch, 2001). In 2007, Welch undertook the survey again, and the updated 30-year market risk premium increased slightly to about 0.057 (Welch, 2008).

These results are not directly applicable to Australia for obvious reasons. In 2008, however, Fernández (2009) conducted a survey of finance and economics professors regarding their estimates of the market risk premium. The mean estimate for Australia was 0.059 (23 responses). More recently, Fernández (2011) undertook a global survey of academics, finance practitioners, and company managers in 2011, seeking their estimates of the required market risk premium for Australia (40 responses). The mean was 0.058, with about 80% of the Australian respondents providing an estimate of 0.06 or less (Fernández, 2011)[31]. The Australian mean of 0.058 compares to means of 0.055 for the United States and 0.053 for the United Kingdom (Fernández, 2011: 3).

The Authority is not aware of more recent, comprehensive survey evidence.

[30] Welch (2001) does not report a survey result for a 10-year term.

[31] In both cases, it is not stated whether the estimate is an arithmetic or geometric mean. but the cost of capital and valuation context implies arithmetic.

APPENDIX C: 'BIAS' IN THE RISK-FREE RATE

To consider the claim of 'bias', the relevant context is the Officer variant of the CAPM, which includes a risk-free asset but does not specify its type. In choosing an asset as the proxy for the risk-free asset, the only explicit requirement in the CAPM is that the return on that asset is risk-free.

The CAPM also contains several additional, implicit requirements. First, the model assumes no transaction costs and since illiquidity is the result of, *inter alia*, high transaction costs, a highly illiquid asset would not qualify as a risk-free asset. Second, the model assumes that investors face no restrictions with respect to their asset purchases. Third, there is an implicit requirement that investors are not attracted or repelled from an asset for reasons other than the probability distribution on its return. This requirement arises because the model assumes that investors choose their portfolios only on the basis of their return distributions (Lally, 2012b: 6).

In summary, the CAPM either explicitly or implicitly requires that:

(a) the return on the asset is certain;

(b) the asset is liquid;

(c) there are no restrictions on the purchase of the asset by any investor; and

(d) investors are not attracted or repelled from the asset for reasons other than the probability distribution on its return.

Finally, the argument that Basel III requirements could lead to a higher demand for Australian government bonds could be viewed as violating requirement (d), namely that investors are only attracted to assets on the basis of their return distributions. The effect of such demand would be to bias the yields on such bonds down. However, government bonds will not be entirely risk-free, as they will be subject to (very low) default risk, which will bias their yields upward, in a countervailing direction. As a result, the net effect of these two violations is indeterminate and likely to be small (Lally, 2012b: 6-8).

Lally (2012b) also argues that the CAPM imposes no requirements relating to the supply of the risk-free asset. As a result, while a reduction in the supply of government bonds lowers their yields, this effect does not disqualify it from being a risk-free asset. In addition, the CAPM does not require that the risk-free rate be invariant to changes in the risk of other assets (e.g. equities) or to changes in investors' aversion to these risks. Consequently, even if such changes in risk or risk aversion behaviour have led to a 'flight to quality', such an effect is not relevant to the CAPM (Lally, 2012b: 6-8).

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