Response to Final Decision, Access Arrangements for SA Gas Distribution: Cost of Capital Issues

Report Prepared for Envestra

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1. Executive Summary

This report responds to ESCOSA's Final Decision on Access Arrangements for SA Gas Distribution. In its Final Decision, ESCOSA relies heavily on advice from its consultant, the Allen Consulting Group (ACG), in relation to issues concerning the weighted-average cost of capital (WACC). This report specifically addresses the arguments in relation to WACC that have been made by ACG in their advice to ESCOSA, and the conclusions in relation to WACC that appear in ESCOSA's Final Decision. Our conclusions are as follows.

Monte Carlo Simulation Analysis

Our original report[1] illustrates how a standard Monte Carlo analysis can be used to quantify how uncertainty in individual parameter estimates impacts the aggregated WACC. The Final Decision ignores this submission. In this report, we:

1. Demonstrate the acceptance of this approach by other regulators;

2. Demonstrate that the Monte Carlo approach is consistent with the regulatory principle of transparency, with the provisions of the Gas Code, and with the principles laid out by the Australian Competition Tribunal and the Productivity Commission; and

3. Illustrate how Monte Carlo simulation is frequently used in corporate finance practice.

Equity Beta

The advice provided to ESCOSA and the conclusion in the Final Decision is as follows:

1. Our original report recommended a range of 0.9 – 1.1 for the equity beta, and that if a single point estimate were required a value of at least 1.0 would be appropriate.

2. ACG have recommended a range of 0.8 – 1.1 for the equity beta, and that if a single point estimate were required a value of 1.0 would be appropriate.

3. ESCOSA has rejected all of this advice and adopted a range of 0.8 to 1.0, with a mid-point estimate of 0.9.

In our view, the equity beta estimate adopted in the Final Decision is less than the appropriate estimate. This view is based on a number of considerations:

1. All of the advice and analysis that has been presented to ESCOSA and made available as part of this review recommends using a higher value than the one that has been adopted.

2. A proper analysis of the data supports using a higher value than the one that has been adopted.

3. The form of regulation (price cap vs. revenue cap) suggests that Envestra's gas distribution business should have a higher equity beta than the 0.9 adopted by ESCOSA for ETSA's electricity distribution business.

[1] SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006.

4. The notion that price cap regulation warrants a relatively higher beta has been endorsed in previous determinations by other Australian regulators, ACG, and ESCOSA itself.

5. We have previously concluded that it is difficult to precisely quantify the impact that the form of regulation has on equity beta. However, in previous determinations, ACG and other regulators have been able to quantify the combined impact of the form of regulation, operating leverage differences, and other factors. It is no more difficult for them to quantify the impact of the form of regulation in this case. That is, we note the regulatory precedent of making adjustments to equity betas to reflect the form of regulation even though it is difficult to precisely quantify the effect.

Value of Franking Credits: Gamma

Our original report concluded that:

1. A proper interpretation of the available empirical evidence leads to setting gamma to zero;

2. The ACG analysis, which forms the basis of the range adopted by ESCOSA, should not be relied upon; and

3. The only estimate of gamma that is consistent with observed dividend yields and with the CAPM that is used to estimate the cost of equity is to set gamma to zero.

In the Final Decision, ESCOSA has affirmed the range of 0.35 to 0.60 that was adopted in the Draft Decision. In this report, we examine the reasons that have been proposed by ESCOSA and ACG for continuing to employ this range for the estimate of gamma. We conclude that:

1. The estimate adopted in the Final Decision is demonstrably inconsistent with the CAPM that is used to estimate the cost of equity. This inconsistency causes a downward bias in the regulatory WACC. The inconsistency can be removed by setting gamma to zero.

2. The standard practice of Australian expert valuers is to set gamma to zero.

3. The standard practice of Australian companies is to set gamma to zero.

4. The ACG analysis, on which ESCOSA relies heavily, uses a methodology that is underpinned by an assumption that a tax law change in July 2000 enabled superannuation funds to redeem franking credits that could not previously be redeemed. This assumption is false and is inconsistent with the basic mechanics of dividend imputation.

5. The results of the ACG analysis imply that Australian financial markets have collectively mis-valued franking credits for long periods of time. In particular, they imply that for a three year period a dollar of franking credits was worth more than 70 cents, but the market mistakenly thought it was worth nothing. Then a market-wide epiphany occurred on 1 July 2003 and the market began to ascribe the proper value to franking credits. If market prices can diverge so substantially from true values for so long, it would be improper to rely on market data at all.

6. The ACG analysis, on which ESCOSA relies heavily, appears to contain several errors.

The ACG analysis is unpublished, untested, and has not been made fully available in any forum. It is based upon a premise that is false, it appears to contain several errors, and the results are inconsistent with economic common sense. In our view, it should not be relied upon. The only estimate of gamma that is consistent with market practice, consistent with the use of the CAPM, consistent with economic

common sense, consistent with the evidence from leading finance journals, and consistent with the objectives of the Code, is to set gamma to zero.

Inconsistency between assumptions for the market risk premium, gamma and observed dividend yields

There appears to be broad agreement that there is an inconsistency between:

1. The return from franking credits that is actually received by equityholders (which is based on dividends actually paid and franking credits actually distributed); and

2. The return from franking credits that is implied by setting gamma to 0.5 and the corporate tax rate to 30% (which is based on franking credits that are implicitly assumed to be distributed by these parameter estimates).

We have advocated that the inconsistency should be resolved by setting gamma to zero.[2] We note that this would also be consistent with market practice, empirical evidence from the leading journal, and with the assumptions that underpin the CAPM.

ESCOSA, on advice from ACG, have advocated that the inconsistency should be resolved by altering the tax rate and maintaining the assumed value of gamma. However, we show that this proposed adjustment:

1. Is outside the Officer CAPM-WACC framework that underpins ESCOSA's regulatory model; and

2. Is incorrectly estimated.

Consequently, our conclusion is that the inconsistency we have raised remains – the parameter values used in the Final Decision are collectively inconsistent with observed market data and the Officer framework. Our recommendation remains: the inconsistency should be resolved by setting gamma to zero as this would also be consistent with market practice, empirical evidence from the leading journal, and with the assumptions that underpin the CAPM.

Market risk premium

We have previously concluded that it is difficult to precisely estimate the market risk premium. The historical data is noisy and the theoretical models are complex, incomplete, and cannot reconcile with the observed data. It is for this reason that we advocate the use of a range. Our conclusion is that a range of 5-7% is appropriate. We note that this is consistent with the range of estimates from a variety of studies in Figure 2. It is also consistent with various short and long-term estimates of market volatility and the price of risk (Sharpe ratio).

We do not view the theoretical literature to be so compelling as to warrant a rejection of the historical data as being outside the bounds of reasonableness. We also note that in forming its view on MRP, ESCOSA has chosen to rely on (1) evidence from Hathaway (2005) that volatility has declined (ignoring their data showing that the price of risk is unchanged); and (2) evidence from Lettau et. al. (2006) that the price of risk has declined (ignoring their data showing that the volatility of equity markets is unchanged). That is, ESCOSA has selected from each study only that piece of the overall

[2] SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006.

evidence that supports a lower MRP. In our view, it is not appropriate to conclude that what has occurred in Australian equity markets over the last 30, 50, 75 or 100 years is so aberrant and unlikely to continue in the future that consideration of the historical data is outside the bounds of reasonableness.

We concur with ESCOSA's central point estimate of 6% but disagree with the conclusion that a single point estimate should be used for the market risk premium. For the reasons described above, MRP cannot be so precisely estimated or objectively and transparently determined to warrant a single point estimate. We advocate that a range should be used for this parameter, and suggest that an appropriate range is 5-7%.

Finally, we note that ESCOSA's view is that its estimate of MRP includes the value of franking credits. However, the Final Decision uses a range rather than a single point estimate for the value of franking credits. This necessarily implies that a range must also be used for MRP.

2. Recognising uncertainty in WACC parameter estimates

2.1 Context

In the Draft Decision, ESCOSA recognises that the Australian Competition Tribunal has found that the role of a Relevant Regulator under the Code is not to determine a correct return, but rather to decide whether what is in a proposed Access Arrangement is consistent with the Code:

> The task for the Commission in assessing Envestra's proposals is therefore to determine whether the proposed Rate of Return is consistent with the provisions of sections 8.30 and 8.31 of the Code and that the rate determined falls within the range of rates commensurate with the prevailing market conditions and the relevant risk.[3]

In essence, the Commission is required to consider whether Envestra's proposed rate lies outside "the range of rates that is commensurate with the prevailing market conditions and the relevant risk." In our original report we recommended that this "range of rates" be estimated using standard simulation techniques:

> The regulated rate of return should be selected from within an economically reasonable range that takes account of estimation uncertainty and considers the consequences of under-investment.
>
> An economically reasonable range (indeed a full probability distribution) can be established using standard Monte Carlo simulation. This technique has been endorsed by the Australian Competition and Consumer Commission (ACCC), Independent Pricing and Regulatory Tribunal (IPART) and the Queensland Competition Authority (QCA).[4]

In the Final Decision, ESCOSA did not address this recommendation. However, ESCOSA's consultants, ACG, raise a number of arguments against the use of Monte Carlo simulations:[5]

- The definition of the range of rates of return is one of legal interpretation and does not have to be derived through Monte Carlo simulations;
- Ranges derived from Monte Carlo simulations are highly sensitive to the degree of spread assumed for key parameters. This magnifies the subjectivity involved in estimating the rate of return;
- Other regulators use Monte Carlo simulations to establish where their estimate lies within the range of rate of returns, not to determine a point estimate.

We address each of these points in the following three sections.

2.2 Implementing the Objectives of the Code Using Monte Carlo Simulation

ACG argue that the definition of the range of rates of return is one of legal interpretation and does not have to be derived through Monte Carlo simulations.

[3] ESCOSA, Proposed Revisions to the Access Arrangement for the South Australian Gas Distribution System: Draft Decision, p. 63.
[4] SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006, Section 6.
[5] ACG, Advice in relation to SFG report on rate of return for gas distribution, p. 2.

However, the simulation approach is not a proposal to reject the current framework in favour of a new and untested approach. Monte Carlo simulations simply involve examining the effect of estimation errors within the current framework. That is, the question is not one of which framework to use, but one of whether to recognise or ignore estimation errors, *within the existing framework*. Ignoring estimation uncertainty does not make it go away. Estimation error is economically important, such that it is difficult to see how the objectives of the Code can be met by ignoring it.

As we identified in our earlier report:[6]

> The key issue here is that the firm must be allowed to earn a return that is sufficient to pay the returns that investors require before committing capital. If the allowed return is too low, there are implications for future investment and the long-term viability of the business. This requires the development of two key concepts: the *true cost of funds* and the *regulatory WACC*.
>
> The firm's *true cost of funds* is a forward-looking opportunity cost of capital. It is the return that investors must expect to receive before committing capital to the firm. It is based on the returns that investors could expect to receive from other comparable investments. It cannot be observed by the firm or the regulator, but must be estimated from imprecisely-estimated market data. The *regulatory WACC* is the regulator's estimate of the firm's true cost of funds. The regulator arrives at this value by estimating a number of parameters using market data and aggregating them together to form an estimate of the firm's true cost of funds. This regulatory estimate may be higher or lower than the true value, with different consequences in each case.

Although the definition of the "range of rates of return" may not specifically mention Monte Carlo simulations, any attempt to construct such a range must consider estimation uncertainty. A Monte Carlo approach allows the aggregation of reasonable estimates of the various parameter inputs into a probability distribution for the weighted average cost of capital (WACC) in a transparent fashion. This distribution can then be used to consider whether a proposed WACC is within a reasonable range.

A Monte Carlo simulation is conducted in the following fashion:

1. Estimate an appropriate distribution for each uncertain parameter;
2. Perform a random draw from these distributions for each uncertain parameter. Calculate the resultant WACC;
3. Repeat Step 2 many times to form a probability distribution of the WACC. Enough simulations should be conducted to ensure a stable distribution (around 10,000).

The rationale behind the Monte Carlo simulations is that we can not be certain that our observed parameter estimate is correct. For instance, beta can only be measured imprecisely. We may estimate a beta of 1.0 but the true unobservable beta could be between 0.9 and 1.1, for example. As such, a distribution is assumed and a random beta estimate is chosen from within this range. We can consequently compute a range of potential WACC estimates that takes into account this uncertainty. This forms the estimate of the firm's true cost of funds.

In particular, Monte Carlo analysis produces a full probability distribution for the firm's true cost of funds. Any proposed regulated WACC can then be assessed against this probability distribution. It

[6] SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006, Section 6.

allows the regulator to estimate the probability that a proposed regulatory WACC is sufficient to meet the firm's true cost of funds. For example, a regulated WACC that gives the firm a 30% chance of covering its cost of funds is likely to be considered unreasonably low under the Code. Conversely, a regulated WACC that gives the firm a 99% chance of covering its cost of funds is likely to be considered unreasonably high under the Code. Whether a proposed WACC is reasonable can be assessed by examining the probability that this return will be sufficient to cover the true cost of funds. This probability is informative about whether the proposed WACC is consistent with previous market conditions and whether it provides the incentive to develop the market. That is, a full probability distribution against which to assess a proposed return appears to be tailor made for implementing the objectives of the Code. Indeed, it is difficult to see how the requirements of the Code can be met without this information. For these reasons, our view is that the Monte Carlo simulation approach is the best technique that is available to generate the information that is required for a regulator to effectively implement the requirements of the Code.

2.3 Monte Carlo Simulations: Subjectivity or Transparency?

ACG's main argument against Monte Carlo simulations is that:[7]

> Results derived from a Monte Carlo analysis are highly sensitive to the degree of spread that is assumed for the key inputs into the rate of return as well as the central estimate. As such, the reliance on subjective judgement is magnified – we consider that attempting to determine the degree of spread for an input is highly speculative, given that many different sources of information are typically drawn upon in order to establish the best estimate.

It is difficult to understand how a simulation procedure adds to the subjectivity in estimating WACC. Regulators accept that the regulated WACC is only an estimate of the regulated entity's cost of funds, arrived at by assessing evidence on seven parameters – risk-free rate, debt premium, market risk premium, equity beta, leverage, corporate tax rate and the value of imputation tax credits – applying its judgement to the evidence presented in submissions, from other regulatory decisions and market practice, and in the finance literature. This could be described as a subjective process because there is no explicit formula to reconcile conflicting evidence. The regulator applies weights (judgment) to difference pieces of evidence to determine a final result.

In the absence of a specified range or distribution for each parameter, it is difficult to determine exactly how this regulatory judgment has been applied – whether it has been applied in an aggressive or conservative manner. Moreover, specifying the range or probability distribution for a parameter and articulating the reasons for why and how regulatory judgment has been applied would be consistent with the principle of Transparency that has been adopted by the Regulators' Forum.

> Transparency requires regulators to be open with stakeholders about their objectives, processes, data and decisions. Regulators should establish visible decision-making processes that are fair to all parties and provide rationales for decisions. Such openness can assist in gaining stakeholders' confidence and acceptance of the regulator's decisions.[8]

[7] ACG, Advice in relation to SFG report on rate of return for gas distribution, p. 2.
[8] Utility Regulators Forum, Best Practice Utility Regulation, July 1999.

In our view, specifying probability distributions for the parameters does not increase subjectivity, but reduces it. All the distributions do is provide a mechanism for determining the weight placed on different evidence. For example, in estimating a parameter with a uniform distribution, the regulator is assuming that each point within a range carries equal weight in decision-making; in estimating a parameter with a normal distribution, the regulator is assuming that points closer to the mean carry greater weight than points further away; and in estimating a parameter with a gamma distribution, the regulator is assuming that points above the median carry greater weight than points below the median.

Specifying probability distributions can in no way increase the subjectivity with which parameters are estimated. They simply provide a clear mechanism for weighting alternative pieces of evidence.

By basing its regulatory decisions on point estimates for underlying parameters, the regulator has already assumed a very specific probability distribution – one which implies that the standard error of the parameter estimate is zero. This involves at least as much subjectivity as specifying probability distributions that more realistically reflect the statistical uncertainty of parameter estimates that are known to be statistically imprecise.

2.4 Regulatory Precedent

Many regulators have advocated the use of Monte Carlo simulations. Some have not used the Monte Carlo simulations to set a point estimate, but to test whether a particular point estimate lies within a reasonable range. We agree that this is the appropriate use of Monte Carlo simulation under the Code – the role of the regulator is not to propose a particular return, but to assess where a proposed return lies within the range of rates. Indeed it is difficult to see how the regulator can meet the objectives of the Code without using this sort of approach. The New Zealand Commerce Commission, IPART, ACCC, QCA and the ERA all recognise the merits of using Monte Carlo simulation.

New Zealand Commerce Commission

The New Zealand Commerce Commission (NZCC) has recognised the uncertainty and statistical imprecision in its WACC estimates in a formal probabilistic manner.[9] Rather than producing a single point estimate, the NZCC constructs a probability distribution for the WACC and recognises that the firm's true cost of funds could come from anywhere within that distribution. The NZCC also notes the asymmetric consequences of regulatory error – that the costs of setting the regulatory WACC too low are much more severe than the costs of setting it too high. For this reason, the NZCC adopts the 75th percentile from the probability distribution as the appropriate regulatory WACC estimate. This reflects the statistical uncertainty of its WACC estimate and the balancing of the risks of regulatory error. Specifically, the NZCC (based on work conducted by its consultant, Ass Prof. Martin Lally) describes its position on this issue as follows:

> The point estimate on WACC reflects five parameters over which there is significant uncertainty i.e., the market risk premium and the four components of the asset beta. Such parameter uncertainty results in uncertainty over WACC and this can be formalised in a probability distribution for WACC…the percentiles of the WACC distribution are derived as shown in Table 9.2 below.

[9] New Zealand Commerce Commission, 2004, Gas Control Enquiry: Final Report, 29 November 2004, http://www.med.govt.nz/upload/15178/chapter9.pdf.

Table 9.2: Percentiles of the WACC Distribution

Percentile	50th	60th	70th	80th	90th	95th
WACC	.072	.075	.078	.082	.087	.092

> Thus, if one wished to choose a WACC for which there is only a 20% probability that the true value was less than this (80th percentile), that WACC value would be 8.2%.
>
> The Commission notes concerns about the asymmetric nature of errors in assessing WACC, i.e., underestimation is the more serious error because it may lead to underinvestment by the regulated companies…The Commission has used the 75th percentile of the WACC distribution.

Independent Pricing and Review Tribunal

In the recent Review of Gas Access Arrangements, IPART received submissions from AGL Gas Networks (AGLGN) proposing a framework for quantifying estimation error in the WACC similar to that proposed in this paper. AGLGN proposed that probability distributions rather than point estimates should be used for several parameters that are subject to estimation error, that Monte Carlo simulation should be used to aggregate these uncertain parameter estimates into a probability distribution for the WACC, and that the regulatory WACC should be set at the 80th percentile to provide the business with a sufficient probability of being able to earn a return sufficient to recover its cost of funds.

In its Final Decision,[10] IPART accepted the use of Monte Carlo simulation to construct a probability distribution to quantify the statistical uncertainty in WACC estimates. Specifically, IPART states that[11]:

> The Tribunal's view is that use of a Monte Carlo simulation framework does allow for uncertainty through the use of probability distribution for individual parameters, and thus meets the requirements of the Code in producing a range of returns that may reflect prevailing market conditions for funds.

AGLGN made further submissions as to the probability distributions that should be used to characterise the uncertainty in relation to the estimates of each WACC parameter. In the Final Decision, IPART adopts slightly different distributions and ranges than those proposed by AGLGN for some of these parameters. Nevertheless, IPART expresses four parameters, equity beta, market risk premium, debt margin, and the value of franking credits (gamma) in terms of probability distributions rather than using point estimates.[12]

The result of aggregating IPART's parameter distributions is a probability distribution for the WACC that ranges between 5.9% and 7.3% (pre-tax real). In selecting a point from within this distribution, IPART argues that a pre-determined and fixed percentile point in the distribution should not be used,

[10] IPART, 2005, Revised Access Arrangement for AGL Gas Networks: Final Decision, April 2005, http://www.ipart.nsw.gov.au/documents/RevisedAccessArrangementforAGLGasNetworks-AGLGN-April2005-FinalDecision-PDFversion.PDF

[11] Ibid, p.95.

[12] Ibid, Table 8.6, p. 104.

but that each determination must be made with reference to the case at hand. In particular, IPART states that:[13]

> In practice, the aim of Monte Carlo simulation is to produce a wide range of possible outcomes for the rate of return. The Tribunal's view is that, in deciding where to determine the rate of return within this range, it must be guided by the factors in sections 2.24 and 8.1 of the Code. This assessment must be made on a case by case basis.

Although IPART rejects AGLGN's proposal to select the 80th percentile of the resulting WACC distribution to balance the asymmetric consequences of setting the regulatory WACC above or below the true cost of funds, IPART adopts a regulatory WACC of 7.0% (pre-tax real). Note that this value is 79% of the way between the lower and upper bounds of the WACC range constructed by IPART.[14] In this context, we note that Envestra's proposed WACC was at the 75th percentile of the WACC distribution.

In practice, IPART has accepted the Monte Carlo simulation framework to quantify the statistical uncertainty involved in estimating WACC. IPART recognises that its estimate may be higher or lower than the regulated entity's true cost of funds. It also recognises that the consequences of setting the regulatory WACC lower than the true cost of funds are more severe than the reverse. Consequently, IPART has adopted a regulatory WACC substantially above the mid-point of its WACC probability distribution.

Australian Competition and Consumer Commission

In its assessment of Telstra's ULLS and LSS monthly charge undertakings, the ACCC advocated the use of Monte Carlo simulations. The ACCC states:[15]

> Because each WACC parameter cannot be known with certainty, there is a ***range*** of input parameters which could be termed 'reasonable'. This seems to be an area of common agreement. A literal application of this argument, however, may allow a regulated firm to take a high, but reasonable, value for all input parameters and generate a WACC which is unreasonably high. A more defensible approach to determining the range of possible WACCs is to use a Monte Carlo (MC) simulation…

Queensland Competition Authority

The QCA also supports the use of Monte Carlo simulations:

> The Authority agrees with the ACCC that such an approach [Monte Carlo simulation] may be useful to test claims regarding the reasonableness of a WACC estimate. As a consequence, the Authority has applied this approach to testing the reasonableness of its WACC for QR.[16]

[13] Ibid, p. 95.

[14] That is, $\frac{7.0-5.9}{7.3-5.9}=0.79$.

[15] ACCC (2005). *Assessment of Telstra's ULLS and LSS monthly charge undertakings: Draft decision,* p.62.

[16] QCA (2005). *QR's 2005 Draft Access Undertaking: Decision*, p. 34.

Economic Regulation Authority

The ERA has not used Monte Carlo simulation, but does use ranges rather than point estimates for market risk premium, equity beta, gamma, and debt margin. This creates a range for the aggregated WACC. The ERA notes that:

> The wide ranges in estimates of the WACC result from the multiplicative effect of differences in assumptions for CAPM parameters.[17]

The ERA goes on to conclude that it would be unreasonable for any party to select values from the extreme end points of the range for each parameter. This (correctly) recognises that it is highly unlikely that the true value of *all* parameters would be at the extreme end point of the range that is considered reasonable.

> The Authority considers that the range of values that different minds acting reasonably could attribute to the cost of equity and WACC is narrower than the ranges that the extremes of ranges in CAPM parameters would suggest. An approach by a Service Provider to determination of the Rate of Return that adopted the highest value within the reasonable range for each of the relevant CAPM parameters would not, in the Authority's view, result in a value for the Rate of Return that different minds, acting reasonably, would attribute to the Rate of Return. Also, such an approach would be inconsistent with the nature of regulatory oversight because the incentive throughout the process of consideration of a Rate of Return would be for the Service Provider to contend for those values for each of the underlying parameters that would produce the highest rate of return. The process would be reduced to a consideration of what would be the highest possible Rate of Return rather than determining a best estimate of the Rate of Return on a reasonable basis.
>
> Similarly it would not be reasonable for the Authority to make a determination based on, or implying, a Rate of Return at the lower extreme of the range.[18]

The ERA concludes that

> while the Authority recognises that no reasonable person would adopt the extremes of this range, the Authority is of the view that there is no apparent rigorous statistical or other methodology for determining precisely at which point values close to the extreme values of the range do not reflect a reasonable view of the current market for funds.[19]

But this is *exactly* what the Monte Carlo simulation approach is designed to do. That is, the proposed Monte Carlo approach achieves exactly that purpose which the ERA believes to be required by the Code. The Monte Carlo approach provides the regulator with the full set of information required to determine the reasonableness of the proposed return. It provides the regulator with an indication of the probability that a proposed return is deficient or excessive. This would seem to be exactly the information the regulator requires to fulfil the requirements of the Code. The ERA, being unaware of and not having considered the Monte Carlo approach, uses an arbitrary mechanical procedure for determining reasonableness:

[17] ERA (2005), *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, p. 50. Note that this aspect of the Draft Decision was affirmed in the Final and Further Final Decisions.
[18] ERA (2005), *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, p. 50.
[19] ERA (2005), *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, p. 50.

> the Authority is of the view that the range of values that would comply with the Code should not include the values that lie within the lower 10 percent or upper 10 percent of the range that is derived by the application of the extremes of values for each of the parameters of the CAPM.[20]

2.5 Application of Regulatory Judgment

Those regulators that have employed ranges or distributions rather than a single point estimate for WACC parameters have set the regulated return above the mid-point of the range or distribution. The NZCC has specifically stated that setting the regulated return at the 75th percentile is an appropriate way to balance the competing regulatory objectives.

This issue has recently been addressed in some detail by the Productivity Commission, Australian Courts, and the Australian Competition Tribunal. For example, the Productivity Commission's Review of the National Access Regime recognises that the effects of too little infrastructure investment are far more severe than those associated with too much (or too early) investment.

Productivity Commission

The Productivity Commission states[21] that "Given that precision is not possible, access arrangements should encourage regulators to lean more towards facilitating investment than short term consumption of services when setting terms and conditions" and that "given the asymmetry in the costs of under- and over-compensation of facility owners, together with the informational uncertainties facing regulators, there is a strong in principle case to 'err' on the side of investors".

The Productivity Commission goes on to quote from a submission to the review by NECG, which stated that:

> "In using their discretion, regulators effectively face a choice between (i) erring on the side of lower access prices and seeking to ensure they remove any potential for monopoly rents and the consequent allocative inefficiencies from the system; or (ii) allowing higher access prices so as to ensure that sufficient incentives for efficient investment are retained, with the consequent productive and dynamic efficiencies such investment engenders. There are strong economic reasons in many regulated industries to place particular emphasis on ensuring the incentives are maintained for efficient investment and for continued productivity increases. The dynamic and productive efficiency costs associated with distorted incentives and with slower growth in productivity are almost always likely to outweigh any allocative efficiency losses associated with above-cost pricing. (sub. 39, p. 16)"

The Productivity Commission Review highlighted the need to modify implementation of the regime and made 33 recommendations to improve its operation. In particular it identified as a "threshold issue, the need for the application of the regime to give proper regard to investment issues" and "the need to provide appropriate incentives for investment."

[20] ERA (2005), *Draft Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, p. 51.

[21] Productivity Commission, Review of the National Access Regime: Inquiry Report, 28 September 2001, p.xxii.

This view is supported by the Commonwealth Government, which has resolved to amend the Trade Practices Act in this regard. In particular, the access regime will be modified to include a clear objects clause: "The objective of this part is to promote the economically efficient operation and use of, and investment in, essential infrastructure services thereby promoting effective competition in upstream and downstream markets…"[22]

In addition, a set of pricing principles will be included that requires "that regulated access prices should: (i) be set so as to generate expected revenue for a regulated service or services that is at least sufficient to meet the efficient costs of providing access to the regulated service or services; and (ii) include a return on investment commensurate with the regulatory and commercial risks involved…"

Australian Competition Tribunal – EPIC

The ACT decision on Epic Energy's appeal against the ACCC's refusal to approve its access arrangements for the Moomba Adelaide pipeline also provides guidance on how a regulator should select estimates under circumstances where a range of possible values exist. In particular, the Tribunal found that "regulators must give clear and substantiated reasons for reaching their conclusions regarding the values they select where a range of possible values exist."[23] This can be easily accommodated within a Monte Carlo simulation framework that quantifies the range of possible values that exist for each parameter and how they aggregate together to form the WACC.

Australian Competition Tribunal – GasNet

Important principles regarding the role and powers of the regulator can also be drawn from the recent ACT decision on GasNet's appeal against the ACCC's final decision on its access arrangements. In the GasNet appeal, the Tribunal expressed the view that it is not the regulator's role to determine specific parameter values, but rather to determine whether the proposed return is consistent with the legislation:

> "…where the AA [access arrangement] proposed by the Service Provider falls within the range of choice reasonably open and consistent with Reference Tariff Principles, it is beyond the power of the Relevant Regulator not to approve the proposed AA simply because it prefers a different AA."[24]

In relation to WACC, the Tribunal concluded that:

> "Contrary to the submission of the ACCC, it is not the task of the Relevant Regulator under s 8.30 and s 8.31 of the Code to determine a 'return which is commensurate with prevailing conditions in the market for funds and the risk involved in delivering the Reference Service'. The task of the ACCC is to determine whether the proposed AA in its treatment of Rate of Return is consistent with the provisions of s 8.30 and s 8.31 and that the rate determined falls within the range of rates commensurate with the prevailing market conditions and the relevant risk."

[22] Government Response to the Productivity Commission Review of the National Access Regime, released 17 September 2002.
[23] Application by Epic Energy South Australia Pty ltd [2003] AcompT 5, 10 December 2003, para. 32, 48, 84.
[24] Application by GasNet Australia (Operations) Pty Ltd [2003] AcompT 6, 23 December 2003, paragraph 29.

For the regulator to determine whether a proposed rate falls within the appropriate "range of rates," the regulator must first construct the range of rates that is appropriate. The most appropriate and complete way to do this is via Monte Carlo simulation.

2.6 Summary and Conclusions

Monte Carlo simulation is a common tool in finance practice. A few examples of the standard applications of Monte Carlo simulation include:

1. Simulating future stock prices to value stock and executive options;

2. Simulating future interest rates to value interest rate sensitive securities – as part of a Value-at-Risk calculation (this is very much standard practice among banks and financial institutions);

3. Simulating future electricity demand and plant outages to determine the range of possible future pool prices (this is very much standard practice among energy generators and retailers and forms the basis of their hedging policy);

4. Simulating future realizations of the key value drivers of a proposed project to generate a distribution of its value to the organization – a form of sensitivity analysis as part of the project appraisal activity.

We have advocated the use of this standard technique to quantify how the uncertainty surrounding several individual parameters affects the aggregated WACC. In our view:

1. Monte Carlo simulation is a standard technique that is frequently used for many applications in finance;

2. It has been accepted by a number of regulators as an appropriate way of quantifying the uncertainty in WACC estimates;

3. Its use is consistent with the Transparency Principle advocated by the Australian Regulators Forum;

4. Its use is consistent with the views expressed by the Productivity Commission and the Australian Competition Tribunal – it provides a framework within which a regulator can assess whether a "rate determined falls within the range of rates commensurate with the prevailing market conditions"; and

5. Its use is consistent with the application of the regulatory objectives of the Code.

3. Equity Beta

3.1 Context

The history of relevant determinations and submissions on equity beta is as follows:

- ESCOSA have determined that the appropriate equity beta for the ETSA Utilities electricity distribution business is 0.9;
- ESCOSA's consultants, ACG, have concluded that an appropriate range for the equity beta of Envestra's SA gas distribution business is 0.8 to 1.1, and that if a single point estimate were required the appropriate value would be 1.0; and
- SFG have concluded that an appropriate range for the equity beta of Envestra's SA gas distribution business is 0.9 to 1.1, and that if a single point estimate were required the appropriate value would be at least 1.0.

ESCOSA have rejected all recommendations and substituted their own conclusion that the appropriate range is 0.8 to 1.0. This implies that:

- ESCOSA believe that there is a 50% chance that the true systematic risk of Envestra's gas business is actually lower than ETSA's electricity business (for which ESCOSA determined the appropriate equity beta to be 0.9); and
- ESCOSA believe that the best point estimate recommended by its own consultants is at the extreme bound of what could be considered reasonable and that a substantial portion (i.e., the range from 1.0 to 1.1) of the reasonable range submitted by its consultants is in fact beyond the bounds of reasonableness.

ESCOSA's conclusion, in the Final Decision, is as follows:

> With regard to the issue that the Commission's own consultants (ACG) have advised the Commission that an equity beta of about 1 is appropriate for Envestra, the Commission notes that the consultant's task is limited to providing technical and economic advice on the issue. The Consultants do not make the decision of what value is consistent with the Code requirements; that is the Commission's task, which it undertakes after taking into account all relevant and available information (including any advice it receives from its consultants). As such, simply because ACG is of the view that (based on its economic analysis) an equity beta of around 1 is reasonable for Envestra, it does not imply that the Commission is obliged to accept this.[25]

Yet ESCOSA have not articulated which Code requirements lead it to reject the advice provided by Envestra's and its own economic consultants.

3.2 Errors in Final Decision

In the Final Decision, ESCOSA rejects a proposed equity beta range of 1.0 – 1.1, concluding that this does not lie within a reasonable range. However, this was not Envestra's proposed equity beta range. Envestra's revised range was, in fact, 0.9 – 1.1. The remainder of our comments in this section relate to the range of 0.9 – 1.1, which is the current Envestra proposal.

[25] ESCOSA, Proposed Revisions to the Access Arrangement for the South Australian Gas Distribution System: Final Decision, p. 70.

3.3 Consistency in Submissions

ACG's leading point, in their response to our earlier report, is an argument that they have identified an inconsistency:

> SFG proposes a range from 0.90 to 1.1, but then states, inconsistently, that Envestra's beta must be at least 1.0, which would suggest that the range actual range being proposed by SFG is 1.0 to 1.1.[26]

These statements have been taken out of context. In truth, there is no inconsistency at all. Our view remains that the appropriate range is 0.9 to 1.1, but that if a single point estimate must be selected that value should be at least 1.0. That is, our preferred approach is to specify a range for each of the parameters that are estimated with substantial uncertainty and then combine these ranges into a range or probability distribution for the aggregated WACC. As outlined in Section 2, we recommend that regulatory judgment be applied at the level of the aggregated WACC in order that the regulator can quantify how conservative (or otherwise) they have been in setting the regulatory WACC.

The alternative approach, as used by ESCOSA, is that regulatory judgment is applied multiple times – once for each parameter over which there is uncertainty. This involves selecting a single point estimate for each parameter from within the reasonable range. We recommend against this approach as it ignores the interaction between parameters, it can result in regulatory judgment being applied inconsistently between parameters, and it provides no indication of the cumulative effect of regulatory judgment on the overall regulatory WACC. For example, the point estimate for one parameter may be selected from within the reasonable range in a conservative manner and another parameter may be selected in a more aggressive manner. There is no way to determine how conservative the aggregated WACC then is, or the probability that a proposed WACC will be sufficient to meet the true cost of funds.

Nevertheless, if this approach is to be applied (as in the Final Decision) a single point estimate must be selected from within the range. Our view on this issue is that a degree of conservatism must be applied. This is because the consequences of mis-estimating WACC parameters are asymmetric, as articulated by the Australian Competition Tribunal, the Productivity Commission, and Australian Courts.[27]

In summary, our view is that the appropriate range for equity beta is 0.9 to 1.1, but that if a single point estimate is to be selected, the appropriate value (in light of the regulatory objectives and the consequences of mis-estimation) is at least 1.0.

Finally, we note that ACG have criticized us for recommending a point estimate (if a single point estimate must be used) that is above the mid-point of what we consider to be a reasonable range. Yet this is exactly what ACG themselves do. ACG recommends that the reasonable range is 0.8 to 1.1 but that the appropriate point estimate is 1.0. If the range around the point estimate must be symmetric, as ACG suggest, the implication is that their range is actually 0.9 to 1.1, which coincides exactly with our recommendation.

3.4 Imprecision of Empirical Estimates

In the Final Decision, ESCOSA concluded that ACG

[26] ACG, Advice in relation to SFG report on rate of return for gas distribution, p. 3.
[27] See the discussion on this issue in Section 2 above.

> noted that a number of different techniques exist for defining 'outliers', which can generate materially different results. It also noted that the process of removing outliers itself can induce bias in the beta estimates – which is why a leading Australian authority[91] on beta estimation techniques advocates that, if outlier adjusted betas are to be used, account should also be taken of unadjusted beta estimates. Lastly, ACG also noted that the firms for which the Commission and Gray and Officer have estimated betas have substantial non-regulated businesses, which would be expected already to impart an upward bias in the beta estimates (although ACG also noted that it is impossible to estimate how large such a bias may be in practice).[28]

We agree that empirical estimates of beta are subject to a degree of statistical imprecision. We agree that there is a range of statistical techniques to help improve the reliability of beta estimates and that these different techniques will produce different results, although we note that Gray and Officer (2005) provide substantial reasons to support the conclusion that the appropriate equity beta for ETSA Utilities is at least 1.0. For example, Gray and Officer (2005b) argue strongly that ESCOSA has erred in rejecting the use of the Blume adjustment and other techniques designed to improve the statistical reliability of the available data. The arguments on both sides of this debate are live, but they have already been made elsewhere and are therefore not repeated here.

We also agree that the beta estimates of the set of comparable companies must be considered in light of just how comparable they are. Differences between the firm at hand and each company in the comparable set must be considered when determining how much weight to assign to the comparable firm's beta estimate. For example, it may be that unregulated assets have slightly higher systematic risk than regulated assets. It may also be that electricity assets are less risky on average than gas assets. Precisely quantifying the effect of these differences on the equity beta estimate is impossible.

This is all precisely why we recommend the use of a range (in the context of a Monte Carlo analysis), rather than a single point estimate. After analysing the available evidence and exercising economic judgment, we concluded that the appropriate range for the equity beta in this case is 0.9 to 1.1. The mid-point of this range is 1.0, which is the equity beta of the average firm. It is also the view of ACG that this represents the best point estimate for the average Australian energy distribution firm.[29] We have applied a symmetric range around this mid-point. The lower bound is the 0.9 estimate that ESCOSA has used for ETSA's electricity distribution business. We use this as a lower bound for two reasons: (1) in our view this estimate is already lower than what could be considered to be a reasonable point estimate for ETSA; and (2) the systematic risk of Envestra's gas distribution business is likely, on balance, to be higher than the electricity distribution business of ETSA. An upper bound of 1.1 completes a symmetric range and is consistent with the upper bound recommended by ACG and with the equity beta recently adopted for gas distribution by the QCA. In our view, this range is also consistent with a proper analysis of the available data.

In summary, there appears to be broad agreement that, for the reasons discussed above, equity betas cannot be precisely estimated and that it is therefore appropriate to consider a range rather than a single point estimate. Therefore, in the remainder of this Section, we focus on issues of substance that were raised in the Final Decision in relation to the impact of the form of regulation and other matters.

[28] ESCOSA, Proposed Revisions to the Access Arrangement for the South Australian Gas Distribution System: Final Decision, p. 71.
[29] QCA, Final Determination: Regulation of Electricity Distribution, April 2005.

3.5 The Effect of the Form of Regulation

The issue

In our earlier report, we concluded that a difference in the form of regulation is a relevant consideration when comparing the betas of two businesses. In particular, electricity distribution in South Australia is subject to a revenue cap whereas gas distribution is subject to a price cap. Under the former, volume risk (which may be correlated with economic conditions) rests with the customer, but under the latter it rests with the business. We concluded as follows:[30]

> ACG also recognize this difference when they note that "Since Envestra is subject to a price cap, it may be expected to have a higher level of systematic risk relative to utilities that are subject to revenue cap regulation."[31] In this regard, ACG specifically refer to Envestra likely having a higher equity beta than the Queensland electricity distribution businesses, for which ACG recommended an equity beta of 0.9.

The Commission itself has recognised this issue in relation to its estimate of the equity beta for ETSA Utilities:[32]

> A further issue that the Commission has had regard to is the likely impact of the Q-factor in setting annual prices for ETSA Utilities. The introduction of the Q-factor stabilises ETSA Utilities' revenues due to fluctuations in sales (beyond the ±0.5% band). The introduction of the Q-factor has the impact of reducing volatility in ETSA Utilities' annual returns and consequently ETSA Utilities systematic (non-diversifiable) risk.

This all implies that even if a beta of 0.9 is appropriate for ETSA Utilities, it is "artificially" low due to the form of regulation substantially reducing its volume risk. Since the form of regulation applicable to Envestra's gas distribution operations has no such risk-reducing provision, it necessarily follows that a reasonable estimate would be higher than that of ETSA.

ESCOSA's Response

In the Final Decision, ESCOSA concludes that:[33]

> …the Commission accepts ACG's advice that it is difficult to make fine distinctions in the equity beta for matters like the form of price control that is applied to a particular regulated entity…

We agree that there is a degree of statistical imprecision in equity beta estimates and it is difficult to make fine distinctions. This is precisely why we advocate the use of a range, while noting that some regulators require single point estimates.

ESCOSA also accepts ACG's views about the empirical evidence in relation to the form of regulation, the range of factors that may affect the equity beta, and the practice of Australian regulators (in particular the recent QCA determination).

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[30] SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006, Section 2.2.

[31] Allen Consulting Group (2006), Envestra's Proposed Revisions to its Access Arrangement, p.67.

[32] ESCOSA (2005), *2005-2010 Electricity distribution price determination: An application by ETSA Utilities for a review pursuant to section 31 of the Essential Services Commission Act 2002*, May, Section 10.8.3.

[33] ESCOSA, Proposed Revisions to the Access Arrangement for the South Australian Gas Distribution System: Final Decision, p. 90.

However, ESCOSA rejects ACG's advice that the appropriate equity beta estimate for the case at hand is 1.0.

Regulatory Precedent – Electricity Distribution

We note that in the recent Queensland electricity distribution review, ACG (and consequently the QCA) were able to precisely measure not just the impact of the form of price regulation, but the *combined* impact of:

1. The form of price regulation (revenue vs. price cap);

2. The extent to which Queensland distribution businesses had higher operating leverage than the Australian average;

3. The extent to which the volatility of electricity assumption is higher in Queensland; *and*

4. The effect of insulation against unforeseen demand changes (demand triggers).[34]

In that setting, ACG (and the QCA) measured the appropriate equity beta for the average Australian electricity distribution business to be 1.0 and that the combined impact of all of the factors listed amounted to a downward adjustment of exactly 0.1.

In that case, the argument involved providing a justification for *decreasing* the equity beta estimate from a benchmark (the average Australian firm's equity beta of 1.0) and it was apparently possible to quantify the amount of the downward adjustment. In this case, the same argument involves providing a justification for *increasing* the equity beta estimate from a benchmark (ESCOSA's estimate of 0.9 for ETSA) and it is argued that estimation difficulties now make it impossible to quantify the impact, so no adjustment is to be made. Whether the effect is estimable or not should not depend on whether it increases or decreases regulated returns.

We also note that the adjustment for the form of regulation that was applied in the Queensland case must be more than 0.1. This is because the appropriate beta estimate for the average Australian distribution business was assessed to be 1.0. The higher operating leverage of the Queensland businesses would increase the equity beta, so the effect of the form of regulation must have been considered to offset this plus warrant a further reduction of 0.1.

Regulatory Precedent – Gas Distribution

In its recent Final Decision in relation to gas distribution, the QCA, on advice from ACG, adopted an equity beta of 1.1. This is to be compared with the QCA's beta estimate of 0.9 for electricity distribution. One of the primary differences between gas and electricity distribution in Queensland is the form of regulation. Gas distribution is subject to a price cap whereas electricity distribution is subject to a revenue cap. The Queensland regulator has assessed the systematic risk of gas distribution to be higher, and one of the primary drivers for this decision is the different form of regulation, based on the advice of ACG. In the Final Decision, the QCA is quite explicit:

[34] QCA, Final Determination: Regulation of Electricity Distribution, April 2005, p.115.

> ACG agreed that a price-cap form of regulation that is applied to gas distribution businesses in Queensland makes that activity subject to a slightly higher element of systematic risk than is applicable for electricity distribution businesses which are regulated under a revenue cap.[35]

The QCA also notes that ACG believed that "Gas distribution is also likely to have slightly higher risk than electricity distribution in Queensland due to the form of regulation…"[36]

Summary of the SFG Position

Our view remains that an appropriate range for the equity beta in this case is 0.9 to 1.1. Our view is that empirical beta estimates are statistically imprecise and that an element of economic judgment is required. We also believe that the effect of adjustments (for the form of regulation, operating leverage, and so on) are imprecise and difficult to quantify – as we have stated in other forums. Our view is that on balance the price cap form of regulation subjects Envestra to more systematic risk relative to the revenue cap of ETSA. Our conclusion is that an appropriate range for the equity beta in this case is 0.9 to 1.1. In contrast, ESCOSA adopt a range of 0.8 to 1.0. We consider this to be unreasonable as:

1. It implies that there is a 50% probability that Envestra's gas distribution business actually has less systematic risk than ETSA's electricity distribution business[37]; and

2. It implies that the best point estimate recommended by ESCOSA's own consultants is at the extreme bound of what could be considered reasonable and that a substantial portion (i.e., the range from 1.0 to 1.1) of the reasonable range submitted by its consultants is in fact beyond the bounds of reasonableness.

We agree that equity betas are difficult to estimate with great statistical precision and that there is a range of statistical techniques that can be used to help improve precision. Various methods, data sets, and time periods can produce somewhat different results. This is why we recommend the use of a range (in the context of a Monte Carlo analysis), rather than a single point estimate. Our view is that using a range in the context of a Monte Carlo analysis helps to resolve these debates in an objective and transparent manner.

Summary of the ACG Position

ACG and SFG have reached essentially the same conclusion and made essentially the same recommendation to ESCOSA – that the appropriate equity beta to use in this case is around 1.0. In their response, ACG have criticised our reference to the effects of the different forms of regulation but they agree with our conclusions on this point (in the recent Queensland review) and with our view on the appropriate equity beta in this case (in their original report to Envestra). That is, there appears to be little difference between SFG, ACG, and the QCA in terms of the equity beta that is appropriate or the means of reaching that conclusion.

[35] QCA, Final Decision: Revised Access Arrangements for Gas Distribution: Envestra, May 2006, p.104.
[36] QCA, Final Decision: Revised Access Arrangements for Gas Distribution: Envestra, May 2006, p.104.
[37] ESCOSA determined that the appropriate equity beta for ETSA was 0.9, and 50% of the range that has been proposed for Envestra's SA gas distribution business is below this point.

4. The Value of Franking Credits: Gamma

4.1 Context

A number of issues have been raised in the Final Decision in relation to the value of franking credits. In our view, ESCOSA's estimate of this parameter is based on weak evidence that can only be taken at face value if one accepts that Australian financial markets are such poor assessors of value that market prices can diverge substantially from true values for extended periods. ESCOSA's estimate also comes from a technique that is demonstrably inconsistent with the CAPM that ESCOSA uses to estimate the cost of equity. This inconsistency can be easily resolved by simply adopting Australian commercial and expert valuation practice, which is to set gamma to zero.

4.2 Gamma and the Corporate Cost of Capital

When estimating the regulatory WACC, the parameter gamma reflects the extent to which the Australian dividend imputation system affects the cost of capital of Australian firms. Gamma does not reflect the extent to which the average global investor, the average Australian investor, or any particular class of investors might value franking credits that are distributed to them. It is well accepted that taxpaying resident investors can (and always could) redeem in full any franking credits that are distributed to them. It is also well accepted that non-resident investors cannot redeem any franking credits that are distributed to them.

This says nothing about the corporate cost of capital. The WACC is the cost to the firm of attracting capital – it is the price of capital. Like all prices that are set in competitive markets, the price of capital is set by the marginal price-setting investor. In the paper that forms the basis of the regulatory cost of capital framework, Officer (1994, p.4) explicitly refers to the "marginal shareholder…who implicitly sets the price of the shares and the price of γ and the company's cost of capital at the margin." The marginal shareholder may be an investor who values franking credits or they may not. In the former case, dividend imputation does affect the corporate cost of capital (so gamma should be greater than zero) and in the latter case it does not (so gamma is zero).

We raise this issue here to make clear that we should not conclude that gamma is greater than zero just because we can identify a group of investors who can redeem franking credits. Moreover, we do not need to identify (or assume the identity of) the marginal investor as an individual or group in order to estimate gamma. It should simply be recognised that there is more to the issue than saying that gamma must be greater than zero simply because some people can use the franking credits that are distributed to them.

Our view is that the appropriate approach is:

1. Examine the empirical data to estimate the value of franking credits, giving more weight to peer-reviewed work published in high-quality journals.

2. Examine the results to ensure that they do not defy reasonable economic explanation.

3. Examine the results for consistency with the asset pricing model (CAPM) that is being used.

4. Examine the results for consistency with observed dividend yields.

4.3 The Effect of the 1 July 2000 Rebate Provision

ESCOSA has relied upon a piece of empirical analysis conducted by ACG for its upper bound for gamma of 0.6. This analysis is based on a set of data for a small number of Australian companies supplemented with trusts, funds, stapled securities, and foreign companies.

ACG separately examine the periods before and after 1 July 2000. They do this on the basis that a change to Australian tax laws that occurred on that date may have materially increased the value of franking credits. In particular, a provision that allowed non-taxed resident entities to claim a rebate for unused franking credits was introduced on that date.

In this section, we examine whether this provision is likely to have materially changed the value of franking credits. We also identify an important and fundamental error in the understanding of the Australian dividend imputation system and the nature and effect of the rebate provision that underpins the ACG analysis.

ACG's view of the rebate provision

In their initial report, ACG state that "a major problem" with the existing empirical studies is that:

> They pre-dated (or a vast majority of their data pre-dated) the current set of taxation arrangements governing imputation credits and corporate taxation in general. Since 1 July 2000, Australian financial institutions (which are taxed at a rate of 15 per cent of income) have been able to claim a rebate from the Australian Taxation Office for tax paid at the corporate level and, since 1 July 2001, the corporate taxation rate has been 30 per cent. These are the taxation parameters relevant to the current valuation of Australian businesses, but there are no published studies estimating gamma for this period.[38]

ACG confirms this view in its recent memo in relation to the SFG Report, where they state that the results of Cannavan, Finn, and Gray (2004) "have been made redundant by the tax changes that have taken place."[39] They also re-iterate that:

> the introduction on 1 July 2000 of a rebate for taxpayers on a tax rate of less than the corporate rate (such as financial institutions) to tax paid at the corporate level.[40]

An error in the assumed mechanics of how dividend imputation

The view expressed (twice) by ACG – that the rebate provision allows superannuation funds to redeem franking credits that could not previously be redeemed – is false. This view is inconsistent with the Australian dividend imputation system, the mechanics of how it operates, and the effect of the tax law changes on 1 July 2000. The rebate does not apply to taxpayers whose marginal rate is lower than the corporate tax rate, as ACG state. Rather, it applies to taxpayers who have zero taxable income. That is, the ACG premise is that the rebate provision affects superannuation funds,[41] but it does not. The rebate provision applies only to entities with no taxable income, such as charities and some welfare

[38] ACG, Envestra's Proposed Revisions to its Access Arrangement, 16 January 2006, p.60.
[39] ACG, Advice in relation to SFG report on rate of return for gas distribution, p. 13.
[40] ACG, Advice in relation to SFG report on rate of return for gas distribution, p. 13.
[41] Presumably the reference to financial institutions refers to superannuation funds that are taxed at the rate of 15%.

recipients.[42] The relevant legislation is quite clear that it will have an effect only on those individuals and entities that pay no tax.[43]

The source of ACG's mis-interpretation of the imputation tax system is that franking credits are *credits*, as the name suggests, rather than *deductions*, as ACG imply. A credit saves the user an amount of tax equal to the face value of the credit. A deduction saves the user an amount of tax equal to their marginal rate times the face value of the deduction. Deductions depend on the marginal tax rate of the individual, credits (such as franking *credits*) do not.

Prior to July 1 2000, franking credits paid to entities with no taxable income, such as resident charities and some welfare recipients, could not be redeemed. This is because franking credits could only be redeemed against personal tax obligations and these entities had no such obligations. Since the introduction of the rebate provision, however, these entities can obtain a full rebate of the face value of these franking credits. In particular, the ATO will pay the entity the full face value of any franking credits. Thus, since 1 July 2000, franking credits have become redeemable to resident charities and welfare recipients. Prior to this date, franking credits were of no value to these entities.

However, the value of franking credits to an entity that pays tax at less than the corporate rate is identical before and after the rebate provision. This fact is obvious from a basic understanding of the mechanics of dividend imputation and is well-known in the relevant literature. For example, Hathaway and Officer (2004, p. 6) address this issue that represents "some confusion in the mind of some people." They state that:

> The personal taxation rate (as opposed to the tax status) of the shareholder recipient of the dividend is irrelevant. The only fact that matters is that the shareholder has an Australian taxation liability against which the imputation credits can be applied. Whether that tax liability was incurred at a marginal rate of 15% or 48% is immaterial. To see the veracity of this statement, simply ask yourself the question "if they could sell their imputation credits, what would two taxpayers, one on a 15% and the other on a 48% rate want as compensation for their imputation credits paid from a company on a 30% corporate rate?" To make this concrete, suppose that each received a $0.70 fully franked dividend. Then each would be liable for personal tax on the grossed-up amount of $1 ($0.70 cash dividend plus $0.30 imputation credit). The answer is that ***both*** would want $0.30 for their imputation credit. In this case alone, would they end up with $1 cash and their personal tax position would remain unaltered. The fact that they are on two separate marginal personal tax rates is immaterial.[44]

This is not a new revelation, nor does it only apply post July 2000. The 1997 version of the Hathaway-Officer paper contains (p. 5) a paragraph that is identical to the one above but for the use of a 36% corporate tax rate in the example (the statutory rate at the time).[45]

The likely impact of the rebate provision

If the 1 July 2000 rebate provision had actually substantially increased the value of franking credits to resident superannuation funds (as under the premise of the ACG analysis) there would be good reason

[42] In fact, many welfare recipients also pay tax. This provision only applies to that subset of welfare recipient who pay zero tax.
[43] For more detail, see Extrinsic Materials, New Business Tax System (Miscellaneous) Act (No. 1) 2000, Explanatory Memorandum – REPS, Chapter 2 - Refunding excess imputation credits.
[44] Hathaway and Officer (2004), The Value of Imputation Tax Credits, Working Paper, Capital Research, p.6.
[45] Hathaway and Officer (1997), The Value of Imputation Tax Credits, Working Paper, Capital Research, p.5.

to separately examine the data before and after this date. That is, if it really were true that the value of franking credits to a significant component of the investor base were altered, there is the possibility that this would affect estimates of gamma.

However, the rebate provision did not change the value of franking credits to superannuation funds at all. It changed the value of franking credits to charities and welfare recipients. In our view, it is highly unlikely that a change in the value of franking credits to these entities would or should impact the cost of capital of Australian firms.

If one agrees with this view, then equal weight should be placed on the ACG results from before and after 2000. If this is done, the average value of theta, using ACG's own data and methodology, is 0.17.[46] If one disagrees with this view (believing instead that making franking credits available to charities and welfare recipients really does affect the cost of capital of Australian corporations) then weight should only be placed on the post-2000 results. The estimate of theta from this period, using ACG's own data and methodology, is 0.29. Even though there are several reasons for questioning the robustness and implications of this result (as documented below), we note that these estimates are within the range proposed by Envestra of 0 to 0.35 and below the lower bound of the range proposed by ESCOSA in the Final Decision.

The actual impact of the rebate provision

Of course, there is no need to speculate on the effect of the rebate provision as this can be measured directly. The ACG argument is that the rebate provision allows more franking credits to be redeemed. That is, the provision allows certain entities to redeem more franking credits than they previously could. ACG states that superannuation funds were among those assisted by the provision, but they are not. Nevertheless, it is possible that the provision could have resulted in substantially more franking credits being redeemed if, for example, charities receive a substantial proportion of all franking credits that are distributed. Of course it is highly unlikely that providing charities and welfare recipients with access to franking credits would have much effect on the corporate cost of capital, but it is theoretically possible.

Hathaway and Officer (1997, 2004) provide some data on this. They report that for the period 1988-96 60% of the franking credits that were distributed were redeemed. For the period 1988-2002, this redemption rate had fallen to 40%. This implies that the redemption rate is falling sharply over time and certainly did not rise sharply post July 2000.

4.4 The Delayed Reaction Hypothesis

The epiphany of 1 July 2003

ACG use their data set and methodology to estimate the value of franking credits over three sub-periods. Their hypothesis is that franking credits may have increased in value after the rebate provision in 2000. They conclude that franking credits were not valued by the market until 1 July 2003, and that this is due to the market (presumably only that portion of the market that was affected by the July 2000 rebate provision) realising the value in franking credits.

In our earlier report, we questioned the extent to which any credence should be placed in this explanation. We stated that:

[46] This is computed as the weighted-average of the theta values reported by ACG for each sub-period, weighted by the number of observations in each period.

> Only for the period between July 2003 and June 2005 do they report any evidence that θ is greater than zero. The authors suggest that the increase in theta stems from a delayed response to the introduction of the cash rebate for Australian resident investors that cannot utilise the credits to offset their taxable income. This rebate was introduced in 2000, yet the 2000-03 results suggest that franking credits had zero value to the relevant investor over that period. That is, the interpretation is that this measure was announced, introduced, and in existence for three years. Over all this time investors did not realise its value. Then a market-wide epiphany occurs on 1 July 2003 and investors now realise that the change in tax laws makes franking credits valuable. This interpretation is extraordinary. If it were true that the market had so fundamentally mis-valued equity for so long, it would call into question our reliance on market data of any form for any purpose.[47] [48]

The delayed reaction puzzle: Financial market incompetence or unreliable estimates?

In their recent Memo, ACG state that:

> The fact that our methodology did not find a dividend imputation valuation effect immediately after the introduction of the tax rebate from 1 July 2000 remains a puzzle, and we accept SFG's comment in this regard.[49]

ACG then notes that other papers have also reported changes in the value of franking credits that occur at unexpected times. These other papers use effectively the same methodology, as ACG, so the fact they produce similarly strange results or "puzzles" is not surprising.

In summary, ACG note that the results of their analysis, and other similar analyses, is that:

1. The estimate of the value of franking credits *does not* change when it *should* (i.e., in response to changes in tax laws), and that

2. The estimate of the value of franking credits *does* change when it *should not*, (i.e., during periods of constant tax laws).

It seems that there are only two explanations to this "puzzle." One is that the estimates that are produced by this empirical work are unreliable. We explore the statistical basis for this in the subsequent section. The second is that Australian financial markets have collectively mis-valued franking credits for long periods of time – three years after a franking credit rebate is made available to charities and welfare recipients, the whole market suddenly realises that franking credits have a substantial value.

If we prefer the former explanation, the ACG results are affected by statistical problems and are therefore unreliable. If we prefer the second explanation, market data is so unreliable that we should not rely on it. In particular, how do we know that the market was mis-valuing franking credits from 2000-03, but has correctly valued them from 2003-05? Surely it is just as likely that the reverse is true – that the current valuation is wrong and the former was correct. That is, if we do accept that the market systematically mis-values franking credits for substantial periods, how do we know which periods contain correct valuations and which contain mis-valuations? In our view, a substantial reason must

[47] SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006, Section 4.3.
[48] Note that θ is ACG's term for the value of a franking credit that has been distributed.
[49] ACG, Advice in relation to SFG report on rate of return for gas distribution, p. 15.

underpin any decision to focus on data from a particular period. We accept that substantial tax law changes might affect the appropriate estimate of gamma. For example, a 1997 tax amendment effectively eliminated the ability of foreign investors to "sell" franking credits to residents and the empirical evidence suggests that this impacted on the value of gamma. However, the 2000 rebate provision applies only to non-taxed investors who are unlikely to have a measurable impact on broad financial markets. Moreover, the ACG results suggest that this amendment had no measurable impact on the value of franking credits for at least three years and this result is ignored when ESCOSA sets its range for gamma. That is, the ACG study is motivated by the 2000 rebate provision and an argument that data from pre-2000 is "redundant." However, in setting the range for gamma, the majority of the post-2000 data is ignored. Only two of the five years of data is considered relevant.

Neither ACG nor ESCOSA explain the basis for concluding that in a small sample over 2004-05 the market has finally got it right when the same methodology implies that the market has systematically mis-valued franking credits in the past. An alternative explanation is that it is the empirical technique that is being used to estimate gamma, rather than the collective Australian financial market, that is not up to the task. We examine this explanation in more detail below.

Empirical implications of the delayed-reaction hypothesis

Finally, there is one important aspect of our comments in relation to the delayed-reaction hypothesis that was not addressed in the ACG memo or the Final Decision. In our earlier report, we noted that a simple empirical implication of the delayed reaction hypothesis could be examined.

If credence is to be given to the delayed-reaction hypothesis, it is possible to test an empirical implication. If the risk-free rate is 6% and market risk premium is 6%, the required return on equity for the average firm is 12%. If gamma is zero prior to 1 July 2003 and (say) 0.5 after, then the cost of equity capital is reduced to:

$$r_e \frac{(1-T)}{(1-T(1-\gamma))} = 12\% \frac{(1-0.3)}{(1-0.3(1-0.5))} = 9.9\%.$$

Consequently, the present value of a $100 perpetuity of earnings rises by 21% from $833 to $1,012. This implies that on 1 July 2003 when the market realised the value of these franking credits, equity prices should have jumped 21% as a result. But they did not.[50] Hence, the interpretation of the data that underpins the range for gamma in the Final Decision is not supported by outcomes in the market.

4.5 Statistical Issues

Equivalence of methodologies

In our earlier report, we demonstrated the equivalence of the ACG methodology and the standard dividend drop-off regression approach.

In their recent memo, ACG state that "We agrees with SFG that our approach is (almost) formally equivalent to a simple regression along the lines undertaken by Hathaway and Officer" (error in original).[51]

[50] SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006, Section 4.3.
[51] ACG, Advice in relation to SFG report on rate of return for gas distribution, p. 14.

The ACG approach is not *exactly* the same as the simple regression approach as it allows for the possibility that the franked and unfranked samples have different variances. However, ACG report that a statistical test indicates that the samples do in fact have equal variances, so it turns out that the approaches are effectively equivalent. There appears to be broad agreement on this point.

Potential statistical issues

The ACG report concludes that regression analysis "suffers from numerous problems in a dividend drop-off study context."[52] Since the ACG approach is methodologically equivalent to regression analysis, their approach also must suffer from numerous problems.

One potential problem in regression analysis is that of multicollinearity. This occurs when two or more explanatory variables are correlated. In a dividend drop-off context, the dividend and associated franking credits are correlated – for a fully franked dividend and a 30% corporate tax rate the franking credit is 0.43 times the dividend. We address this issue in some detail in our earlier report.[53] Multicollinearity is a potential problem in this setting because wildly different parameter estimates can be obtained from slightly different samples of data with no logical economic explanation.

Another potential problem with regression analysis generally is heteroscedasticity. This occurs when the variance of the residuals is related to one of the explanatory variables. If for example, the regression model fits the data better when one of the explanatory variables is high than when it is low, heteroscedasticity can be a problem. Heteroscedasticity affects statistical inference – determining whether a particular regression coefficient is statistically significant.

However, the recent ACG memo rejects the notion that multicollinearity is one of the numerous problems that affects these studies and that it is heteroscedasticity that may be the real problem.[54] It is not clear what ACG meant by "numerous problems" in their earlier report. In their recent advice to ESCOSA, they refer to only a single problem, heteroscedasticity, which on further inspection actually turns out to be not a problem at all.

Symptoms of multicollinearity

In the leading textbook, Greene (2000, p. 256) states that one of the typical symptoms of multicollinearity is that "small changes in the data produce wide swings in the parameter estimates."[55] The ACG estimate of the value of franking credits changes from 0 to 0.73 on 1 July 2003, when there is no economic explanation (such as a change in tax laws) for a change on that date.

In the Final Decision, ESCOSA concludes that:

> Multicollinearity (i.e. significant correlation) between the explanatory variables is not a serious problem – and it [ACG] notes that the fact that the explanatory variables in the regression model are statistically significant supports this view.[56]

However, it is not correct to conclude that multicollinearity is absent simply because there are high *t*-statistics on some individual coefficients. In the classic textbook, Johnston (1984, p. 249) states that:[57]

[52] Allen Consulting Group (2006), Envestra's Proposed Revisions to its Access Arrangement, p. 60.
[53] SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006, Section 4.1.
[54] ACG, Advice in relation to SFG report on rate of return for gas distribution, p. 14.
[55] Greene, W.H., (2000), Econometric Analysis, 4th ed., Prentice Hall.
[56] ESCOSA, Proposed Revisions to the Access Arrangement for the South Australian Gas Distribution System: Final Decision, p. 78.
[57] Johnston, J., (1984), Econometric Methods, 3rd ed., McGraw-Hill.

> It is also possible to find highly significant *t* values on individual coefficients, even though multicollinearity is serious. This can arise if individual coefficients happen to be numerically well in excess of the true value.

This might occur, for example, if the coefficient *estimate* were 0.73 (as the ACG estimate suggests, after the 1 July 2003 epiphany) and the *true value* were actually 0.

How can we tell whether statistical problems are affecting the results?

It is impossible for us to conduct a detailed examination of the ACG data and methodology for possible statistical problems as we have been unable to replicate the raw data used in the ACG study. Consequently, we take a step back to consider the two possible views about the statistical reliability of the results:

- View 1: Statistical problems with the data and methodology cause substantial differences in coefficient *estimates* over various short time periods when there is really no change in the *true values*. This is the concern that we raised in our earlier report and is consistent with the ACG concern that a methodology that is formally equivalent to theirs "suffers from numerous problems"[58]; or

- View 2: There are no statistical problems with the data or methodology. Any changes in coefficient estimates over time reflect real economic changes in the way the market values dividends and franking credits. This is the new view that there is no problem other than heteroscedasticity, which turns out to be no problem at all.[59]

ACG prefer to retain the second view on the basis that other researchers, employing effectively the same methodology, have confronted the same problem. That is, ACG are not the only researchers who are unable to find a logical economic explanation for their results. Rather, it seems that this method consistently generates results that defy logical economic explanation. Our view is that statistical problems may explain why empirical *estimates* are difficult to reconcile with common sense.

If there are no statistical problems, the estimates can be taken at face value. But what are the economic implications of this?

If we are to rely quite squarely on these results when setting regulated prices, we must reject the notion that they are contaminated by statistical problems. This, consequently, implies that the parameter estimates from ACG and the other authors they cite (who use effectively the same technique) must be taken at face value. This implies that the history of the value of franking credits in Australia is as follows:

- Prior to the introduction of dividend imputation in July 1987, a dollar of dividends was valued at around 80 cents.[60]

- In the first two years of the imputation system, franking credits were worthless and a dollar of cash dividends had fallen to be worth only 50 cents. But then in the next two years, franking credits were worth 45% of their face value and a dollar of cash dividends was worth nearly 90

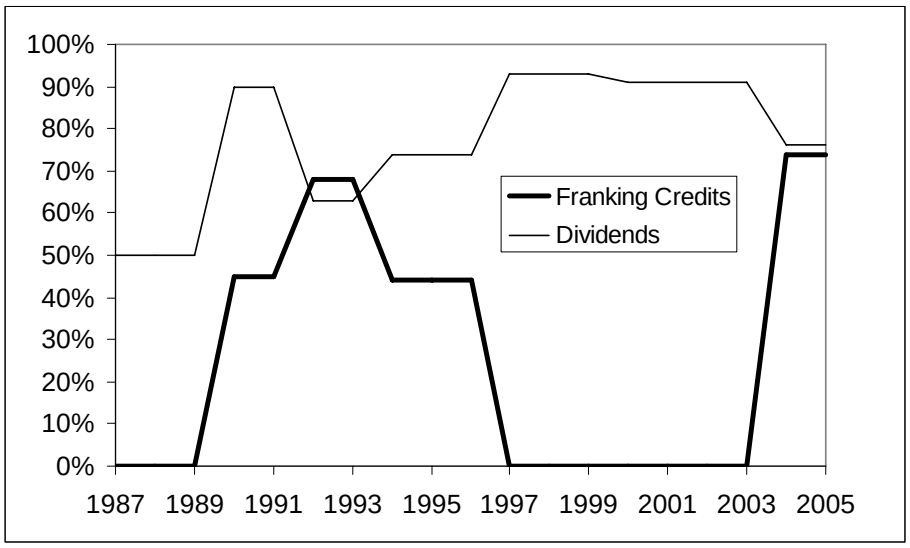
[58] Allen Consulting Group (2006), Envestra's Proposed Revisions to its Access Arrangement, p. 60.
[59] ACG, Advice in relation to SFG report on rate of return for gas distribution, p. 14.
[60] Brown and Clarke (1993), Table 2.

cents. This is because "the market has taken some time to access the implied value of the tax credits."[61]

- Then, over the next few years (7/1990-6/1993), franking credits were actually worth more than cash dividends.[62]
- This trend reversed again between 1994-97, with franking credits being worth 44% of face value and cash dividends being valued at 74%.[63]
- Then, from 1997-2003, investors again forgot that franking credits had value and they were again worthless. This persisted until the 1 July 2003 epiphany, upon which they became valued at 74% of face value. Over this period, franking credits are considered to be of equivalent value to cash dividends.[64]

The pattern of results that has been reported using the dividend drop-off technique and equivalent approaches is summarized in Figure 1 below.

Figure 1
Implied Value of Franking Credits and Cash Dividends from Dividend Drop-off Studies



Of course, an alternative explanation is that Australian equity markets are not as poor assessors of the value of financial instruments as this figure suggests, but rather that it is simply reflective of statistical noise in the *estimates*.

4.6 Consistency Between Gamma Estimates and CAPM

The issue

In our earlier report, we pointed out an inconsistency between the estimates of gamma on which ESCOSA relies, and the CAPM which ESCOSA uses to estimate the cost of equity. In particular, the

[61] Brown and Clarke (1993), p. 35, 37.
[62] Bruckner Dews and White (1994), p. 27.
[63] Hathaway and Officer (1997), The Value of Imputation Tax Credits, Working Paper, Capital Research.
[64] Allen Consulting Group (2006), Envestra's Proposed Revisions to its Access Arrangement, p. 61.

CAPM assumes that dividends and capital gains are valued equally, but the estimates of gamma are based on dividends being only 80% as valuable as capital gains. This was explained fully in our earlier report:[65]

> Even if we ignore the problem of multi-collinearity, and the limitations of the ACG study, there is an inconsistency between the way gamma is estimated and the model in which it is to be used. The model that has become known in Australian regulatory circles as the Officer-CAPM[66] is based on a number of important assumptions. One of these assumptions is that dividends and capital gains are valued equally by investors. There are variations of the model that allow for dividends and capital gains to be valued differently. Brennan (1977)[67] constructs such a model for a classical tax system and Lally (1996)[68], Lally and Van Zijl (2003)[69] and Monkhouse (1993)[70] have models extending this to an imputation system.

The finance literature in the 1980s debated the relative merits of the standard CAPM and a more complex model that allows for dividends and capital gains to be valued differently. A number of theoretical and empirical arguments were made, but the practical outcome is that the standard CAPM clearly reigns as generally accepted practice in industry and commerce. However, if one firmly believed that dividends and capital gains are valued differently, there are models to accommodate this in both the classical and imputation tax systems.

The Australian regulatory system uses the standard CAPM to estimate the required return on equity and therefore is based on the assumption that dividends and capital gains are equally valued.

Hathaway and Officer (2004) use a regression model to separately estimate the value of cash dividends and franking credits. They obtain a wide range of results depending on the type of firm, data set, and empirical specification. Of the 12 sets of results reported in their Table 3, they favour the three that suggest that franking credits are worth around 50% of face value when distributed.[71] However, the same analysis that suggests that franking credits are worth 50% of face value also suggests that cash dividends are worth 80% of capital gains. Similarly, the ACG study suggests that cash dividends are worth 76.5% of capital gains. It would be inconsistent and wrong to use estimates of the value of franking credits that are based on dividends being worth substantially less than capital gains in a model that assumes dividends and capital gains are equally valued.

The intuition for this is as follows. The Hathaway-Officer and ACG result suggests that dividends are worth only around 80% of capital gains. This implies that shareholders would be indifferent between receiving a $1 dividend and an 80 cent capital gain. Therefore, firms that pay higher dividends would have to pay higher returns – the shareholders would require higher returns because they come in the form of dividends, which are less valuable.[72] But there is a potential benefit to higher dividends – a higher dividend means that more franking credits can be distributed. According to Hathaway and Officer (2004) and ACG, these franking credits are valuable to the relevant investor – at least since 1 July 2003. Thus, the corporate cost of equity capital is the shareholder's required return adjusted for the value of franking credits. If a firm pays high dividends, the Hathaway-Officer and ACG (04-05 only)

[65] SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006, Section 4.4.
[66] Officer, R.R. (1994). The cost of capital under an imputation tax system. *Accounting and Finance*, 34, 1–18.
[67] Brennan, M. (1970). Taxes, Market Valuation and Corporate Financial Policy. National Tax Journal, 23(4), 417 - 427.
[68] Lally, M. (1996). The CAPM under Dividend Imputation and International Portfolio Selection. *Pacific Accounting Review, 8*, 48-65.
[69] Lally, M., & van Zijl, T. (2003). Capital Gains Tax and the Capital Asset Pricing Model. *Accounting and Finance, 43*(2), 187-210.
[70] Monkhouse, P. (1993). The Cost of Equity under the Australian Dividend Imputation Tax System. Accounting and Finance, 33, 1-18.
[71] They then suggest that this should be multiplied by the average distribution rate of 70% to obtain an estimate for gamma of around 0.35.
[72] As noted above, there are models to accommodate this.

results suggest that the required return is higher, but that there is also a larger downward adjustment due to the value of franking credits. Based on the Hathaway-Officer and ACG (04-05) results, these two effects act to offset one another.

However, if the estimated value of franking credits is used in the standard CAPM, only one of the two offsetting effects is being considered. This is internally inconsistent and wrong. There are two ways forward:

1. If the Hathaway-Officer or ACG results are to be used, the full result (not half of it) must be used. This would require using a model that allows dividends and capital gains to be valued differently. Examples of these models were discussed above.

2. If the standard CAPM is to be retained (which is our recommendation), an assumption that dividends and capital gains are equally valued must be imposed on the estimation. That is, the value of franking credits should be estimated after restricting the value of cash dividends. Bellamy and Gray (2004)[73] have performed exactly this exercise using a data set and methodology substantially the same as in Hathaway-Officer. That is, they fix the value of dividends to be equal to the value of capital gains (consistent with the CAPM) and then estimate the value of franking credits. They report in their Table 8 that when dividends are restricted to have the same value as capital gains, the estimate of the value of franking credits is zero. Therefore, if the value of franking credits is estimated in a way that is consistent with the standard CAPM, the relevant value is zero. Moreover, Bellamy and Gray also show that this restricted estimation fits the data just as well as the unconstrained estimation. In other words, the data are equally consistent with the results reported by Hathaway and Officer (2004) or ACG and a model in which dividends are fully valued and franking credits are not valued at all by the relevant investor. Both models fit the data equally as well, but only one is consistent with the Officer-CAPM approach to WACC.

ESCOSA's response

In the Final Decision, ESCOSA accepts our conclusion that the cost of equity and the value of franking credits are estimated in an inconsistent way. Neither ESCOSA nor ACG present any arguments against our conclusion in this regard. It is clear that the regulatory estimate of the cost of equity is based on the assumptions that dividends and capital gains are equally valued, whereas the estimates of gamma are based on dividends being worth substantially less than capital gains.

Rather, ESCOSA's response is that their approach is consistent with Australian regulatory practice, that our proposed alternative is infeasible, and that we have made inconsistent arguments on this point in the past. We strongly disagree with much of this conclusion and believe that it is unfounded and unfair. In particular, the Final Decision states that:

[73] Bellamy, D., & Gray, S. (2004). Using Stock Price Changes to Estimate the Value of Dividend Franking Credits. *Working Paper, University of Queensland, Business School.*

> in relation to the consistency between the estimate of gamma (which was arrived at using a method that was not constrained by any particular assumptions about the personal taxation system), ACG has confirmed that the Commission's treatment of this matter was consistent with standard practice, and with the approach recommended by Hathaway and Officer (two leading authorities in the area). ACG argue that, given the clear need for an appropriate degree of stability and predictability in regulated outcomes, significant changes to existing approaches should be contemplated only where the flaws in the current approach are identified clearly and the alternative demonstrated to be superior, both in theoretical and practical terms – which is not presented in the SFG submission. In addition, it is noted that SFG's concern about the existing approach for incorporating gamma into the WACC logically must reflect its belief that a more theoretically correct version of the CAPM/WACC would deliver better estimates of required returns – but yet in a submission on a previous matter, SFG noted the absence of theoretical support for such an approach.[74]

First, we agree that the approach used by ESCOSA is consistent with Australian regulatory practice. However, this can not be the only test, since if it were no errors or inconsistencies could ever be corrected.

Second, we note that this approach is inconsistent with the practice of Australian corporations and with Australian independent valuation experts. More than 80% of Australian corporations and virtually all independent experts set gamma to zero.[75] They do not use an estimate that is based on dividends being worth less than capital gains. Indeed Bellamy and Gray (2004) show that if one constrains dividends and capital gains to be equally valued (consistent with the CAPM) the dividend drop-off approach produces gamma estimates of zero. Thus, the dominant market practice involves no inconsistency between the way the cost of equity and the value of franking credits are estimated. So, although ESCOSA are consistent with other Australian regulators on this matter, their approach is quite inconsistent with general market practice.

Third, we can find no reference in the Code to the "need for an appropriate degree of stability and predictability in regulated outcomes" such that "significant changes to existing approaches should be contemplated only where the flaws in the current approach are identified clearly and the alternative demonstrated to be superior, both in theoretical and practical terms." Rather, the relevant provisions of the Code refer to "replicating the outcome of an efficient market,"[76] providing "an incentive…to develop the market,"[77] and a return which is "commensurate with prevailing conditions in the market."[78] Nevertheless, we illustrate below that our proposed approach is consistent with the requirements of the Code *and* is superior in both theoretical and practical terms *and* is perfectly consistent with market practice.

Finally, we must correct the misconception that we have been in any way inconsistent in our arguments on this issue. In our earlier report, we first spell out the inconsistency – A (the way franking credits are valued) is inconsistent with B (the way the cost of equity is estimated using the CAPM). Then we note that (logically) there are two ways to restore consistency – change A to make it consistent with B, or change B to make it consistent with A.

[74] ESCOSA, Proposed Revisions to the Access Arrangement for the South Australian Gas Distribution System: Final Decision, p. 78.
[75] See Truong, Partington, and Peat (2005), and Lonergan (2001).
[76] National Gas Code, Section 8.1(b).
[77] National Gas Code, Section 8.1(f).
[78] National Gas Code, Section 8.30.

Our clear recommendation is that one should change the way the value of franking credits is estimated to make it consistent with the use of the standard CAPM. This involves setting gamma to zero, which is consistent with market practice and with what we (and one of the world's leading finance journals) believe to be the most reliable empirical evidence on the issue. SFG have been consistent in this view in all regulatory determinations and Court appearances we have been involved in.

In our original report, we state (again, as a matter of logic), that *if* a regulator were to insist on using an estimate of gamma that relied on dividends being substantially less valuable than capital gains (as ESCOSA proposes in the Final Decision), they must use a version of the CAPM that also allows for dividends to be substantially less valuable than capital gains. To do otherwise would be to admit a demonstrable inconsistency that causes a downward bias in regulated returns.

An analogy to help explain the issue

It is important to understand that the point we have raised is more than a theoretical inconsistency that has little practical implication. Rather, the inconsistency that we have demonstrated results in regulated entities being deprived of the opportunity to earn a return commensurate with prevailing conditions in the market. This, of course, has implications for the incentives for future investment, the incentive to develop the market, and the long-term viability of the business.

To illustrate the practical consequences of the demonstrated inconsistency, consider the following analogy.

> Suppose you own a coffee stand that's located next to a newsstand. You like to read two papers – the Telegraph and the Financial Review. Both cost $1. You know that the newsagent loves coffee, so you propose a barter deal. In particular, you sell regular-sized coffees for $1 each, so you propose to trade a cup of coffee for a copy of the Telegraph. "Perfect," says the newsagent, "this is exactly right – the coffee is worth 80 cents and the cup is worth 20 cents, so here's the paper."
>
> Now for the Financial Review. You propose the same deal – a cup of coffee for the Financial Review. "Perfect" says the newsagent again, "this is exactly right – the coffee is worth a dollar and the cup is worth nothing, so here's the paper."
>
> Naturally, you are curious about the demonstrable inconsistency. Why is coffee worth 80 cents when exchanged for the Telegraph, but $1 when exchanged for the Financial Review? And why is the cup worth 20 cents when exchanged for the Telegraph but worth nothing when exchanged for the Financial Review? The vendor replies that he knows there's an inconsistency, but that regulation forces him to charge this way. The Telegraph regulator treats a regular sized coffee as being worth 80 cents and a cup as being worth 20 cents. Conversely, the Financial Review regulator ascribes no value to cups, but treats the coffee itself as being worth a dollar.
>
> Now suppose that the Telegraph and Financial Review regulators merge. They immediately create two committees – one to assess the value of coffee and one to assess the value of cups. The former is dominated by ex-Financial Review regulators and ascribes one dollar to the value of the coffee. The latter is dominated by ex-Telegraph regulators and ascribes 20 cents to the value of the cups.

> Therein lies the problem. We know that a regular-sized coffee is worth a dollar. There are different views about how much of this should be ascribed to the coffee and how much to the cup. But it doesn't really matter since we know the total value is a dollar. But then the regulator mixes estimates in an inconsistent manner, taking the coffee value from the Financial Review approach and the cup value from the Telegraph approach. This leads the regulator to assume that the total value of a regular-sized coffee is $1.20. The only thing that the Telegraph approach and the Financial Review approach would agree upon is that this is wrong, and that the reason it's wrong is that the value of the coffee and the value of the cup have not been estimated in a consistent way.
>
> The consequences are that the newsagent's business becomes unsustainable. Why? Because every time you give him a coffee, he now has to give you a paper plus 20 cents change.

The same applies to the issue we have raised. When estimating WACC, we begin with an estimate of the cost of equity, r_e, and then make an adjustment for the assumed value of franking credits, $\frac{1-T}{1-T(1-\gamma)}$. The adjusted cost of equity that enters the WACC formula is then:

$$r_e \frac{1-T}{1-T(1-\gamma)}$$

The WACC will be higher if we have a high cost of equity and a small downward adjustment for the assumed value of franking credits.

The effect of the demonstrated inconsistency is illustrated in the following table, where the shaded cells denote the current Australian regulatory approach.

Approach	CAPM	Gamma Estimates
Assumption	Dividends and Capital Gains Equally Valued	Dividends worth substantially less than Capital Gains
Cost of Equity	Lower	Higher
Downward Adjustment	Small	Larger

As illustrated in the table, the current regulatory approach involves estimating the cost of equity using the CAPM under the assumption that dividends and capital gains are equally valued. Yet gamma is estimated under a quite different approach that assumes that dividends are worth substantially less than capital gains. (These are the shaded cells).

The result is that the regulator has a choice of two approaches to estimate the cost of equity and chooses to use the approach that minimizes this cost (and consequently the regulatory WACC). The regulator also has a choice of two approaches to estimate the adjustment for the value of franking credits and chooses to use the approach that maximizes the adjustment (and again minimizes the regulatory WACC). There is an inconsistency because the approaches that are used to estimate these two components are quite different and clearly inconsistent in their assumptions. If a consistent approach were used to estimate the two components (whether that be assuming that dividends and capital gains are equally or differentially valued) the result would be a higher regulatory WACC. Moreover, the inconsistent approach used by regulators differs markedly from market practice, which is

to assume that dividends and capital gains are equally valued when estimating *both* the cost of equity *and* the adjustment for franking credits.

Consequently, the result is that the regulatory approach results in regulated returns that are lower than the returns that would be assessed in a consistent manner by a competitive market. Inferior returns also destroy the incentive to develop the market.

The proposal for change

ESCOSA is reluctant to change the existing approach, stating that:

> significant changes to existing approaches should be contemplated only where the flaws in the current approach are identified clearly and the alternative demonstrated to be superior, both in theoretical and practical terms.[79]

This implies that it is incumbent those proposing change to establish that the current approach is flawed and that the proposed alternative is theoretically and practically superior. Even though this does not appear to be a requirement of the Code, our view is that our proposed approach is superior in both theoretical and practical terms *and* is perfectly consistent with market practice, *and* is consistent with the requirements that do appear in the Code.

In our view, the current regulatory approach is flawed for the reasons outlined in the previous section. There is an inconsistency that is not denied –.the current regulatory approach selects one technique that produces the smallest possible cost of equity, then a different (inconsistent) technique to produce the largest possible downward adjustment. This results in a regulated WACC that is lower than would be produced under any internally consistent method or generally accepted market practice.

Our proposed alternative is that the inconsistency should be removed. Our recommendation is to use the standard CAPM and to estimate the value of franking credits in a way that is consistent with the use of the standard CAPM. The result of this approach is to set gamma to zero. This approach removes the internal inconsistency and so is theoretically superior.

Our proposed approach is also practically superior. It is perfectly consistent with the current regulatory framework – it simply involves changing one WACC parameter. It is also consistent with the practice of Australian corporations and with Australian independent valuation experts. It is also consistent with empirical evidence published in leading journals. It would therefore seem to be commensurate with the prevailing (competitive) market and to provide the appropriate incentives to develop the market. Consequently, our proposed approach is also consistent with the Code objectives.

4.7 Gamma Estimates in a Regulatory Setting

Weighting of Evidence

In their recent memo, ACG conclude that:

[79] ESCOSA, Proposed Revisions to the Access Arrangement for the South Australian Gas Distribution System: Final Decision, p. 78.

> the fact that such unexplained phenomena continue to exist, as well as fact that estimates of the value of franking credits have differed substantially between methods and across time, underscores the imperative for regulators to be cautious about the amount of weight that is placed upon any estimate of the value of franking credits.[80]

We agree that regulators should be cautious about how much weight to give to any estimate of the value of franking credits. In our view, very little weight should be given to studies or methodologies that:

1. Are demonstrably inconsistent with the CAPM, or

2. Produce results that defy reasonable economic explanation (e.g., require one to believe that financial markets take years to properly assess the value of standard franking credits).

In addition, more weight should be placed on papers that have been peer-reviewed, with even more weight given to papers that appear in leading journals.

Problems with the ACG Analysis

The results of the ACG analysis, on which ESCOSA primarily relies, have not been peer-reviewed or published. They have not even been written up as a working paper. The data on which they rely cannot be replicated and what has been made available by them contains clear errors of double-counting. In particular, a number of observations in their data set are duplicated and dividend amounts appear to have been matched with the wrong stock prices.[81] The impact of these errors on the overall result (even in the absence of statistical problems) is unknown. However, it appears likely that the result for the last two years of the sample is impacted by errors. It is these results that determine what ESCOSA considers to be a reasonable range.

By contrast, Cannavan, Finn, and Gray (2004) has been published in one of the top three international finance journals. Yet, the results from that paper are considered by ESCOSA to be outside the bounds of what could be considered reasonable.

Conventional Use of the Model

In the GasNet Appeal, the Australian Competition Tribunal concluded that:

> "When the proposed AA was delivered by GasNet to the ACCC, insofar as it contained a Rate of Return which was used to determine the Reference Tariff established by the use of the CAPM, the only issue for the ACCC to determine in respect of the Rate of Return was whether GasNet had used the model correctly. That is, whether it had used the CAPM to produce a Rate of Return which was consistent with the conventional use of the model. If GasNet had done so, then there was no occasion to refuse to approve the proposed AA on the basis that the Rate of Return had not been determined on a basis which was consistent with the objectives contained in s 8.1."[82]

[80] ACG, Advice in relation to SFG report on rate of return for gas distribution, p. 15.

[81] For example, GWA paid a dividend of 12 cents in March 2005. This appears to have been included in the ACG sample as a 10 cent ordinary dividend and separately as a 2 cent special dividend (and possibly as a third observation of unknown amount). If the stock price dropped exactly 12 cents on the ex date, consistent with franking credits not being valued, ACG would record two drop-offs in their sample, one of 12/10 = 1.2 and one of 12/2 = 6. This would cause a substantial bias in their results.

[82] Application by GasNet Australia (Operations) Pty Ltd [2003] AcompT 6, 23 December 2003, paragraph 45.

The application of the CAPM that has been proposed by ESCOSA involves estimating the cost of equity using the CAPM and then applying an adjustment that has been computed in a manner that is inconsistent with the CAPM and inconsistent with market practice. That is, ESCOSA's use of the CAPM is consistent with Australian regulatory practice, but it is clearly inconsistent with "conventional use of the model."

4.8 Summary and Conclusion

In our view, there is only one estimate of gamma that:

1. Is consistent with market practice;
2. Is consistent with the use of the CAPM;
3. Is consistent with economic common sense;
4. Is consistent with the evidence from leading finance journals; and
5. Is consistent with the objectives of the Code,

and that is to set gamma equal to zero.

5. Inconsistency between assumptions for the market risk premium, gamma and observed dividend yields

5.1 Returns from Franking Credits Assumed by ESCOSA

Our earlier report submitted that the typical assumptions used by regulators for the value of imputation credits (0.50) and the market risk premium (6%) imply that equityholders are expected to receive an unreasonably large proportion of their return from franking credits.[83] Essentially, we argued that ESCOSA's regulatory framework and assumptions implicitly require equityholders to receive a return of about 2% from franking credits, which requires an unreasonably large cash dividend yield. An extended analysis of this issue is presented in Gray and Hall (2006).

Consider for the moment the following parameters typically assumed by regulators:

- The value of imputation credits (gamma) is 0.5 which approximates the mid-point value of 0.475 used by ESCOSA (2004) (and which we assume results from a distribution rate of 80% and the value of a distributed credit of 62.5% as used by the QCA (2004));
- The equity beta for the representative firm is 1.0;
- The corporate tax rate is 30%.
- The market risk premium is 6%.
- The risk-free rate is 5.75%.

We contend that the parameters listed above, in conjunction with a regulated return set according to the perpetuity assumption of the Officer (1994) CAPM-WACC framework, imply that a firm paying fully-franked dividends is required to earn a return of 2.07% from franking credits, 7.74% from cash dividends and 1.94% from capital gains, as computed in the equations that follow.

In ESCOSA's regulatory framework the cost of equity capital under imputation takes the following form, as presented in Officer (1994):

$$r_e = \left[r_f + \beta\left(r_m - r_f\right)\right] \times \left[\frac{1-\tau}{1-\tau(1-\gamma)}\right]$$

where:

r_e = the required return to equityholders;
r_f = the risk-free rate of interest;
β = the equity beta;
$r_m - r_f$ = the market risk premium under imputation;
τ = the corporate tax rate; and
γ = the value of imputation credits which have been created.

Using the parameter values listed above, the total required return to equityholders is 11.75% (5.75% + 1.0 × 6%) and the cost of equity capital including the benefits of imputation is 9.68%, computed as follows:

[83] SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006.

$$r_e = [0.0575 + 1.0 \times 0.06] \times \left[\frac{1-0.3}{1-0.3(1-0.5)}\right] = 9.68\%$$

Hence, for equity investors to receive their total return of 11.75%, they require a return from dividends and capital gains of 9.68%, with the remaining return of 2.07% from franking credits. There is no contention from ESCOSA or ACG that, under the parameters listed above ($\gamma = 0.50$; $r_f = 0.0575$; $r_m - r_f = 0.06$; $\beta = 1$; and $\tau = 0.30$), this result holds. This is also the equation used by ESCOSA in estimating the cost of equity capital in a regulated entity's WACC. The contention between our earlier report and the Final Decision of ESCOSA relates to the assumption regarding one particular parameter – the corporate tax rate – which we come to in a moment.

For investors to receive a return of 2.07% from franking credits, what must the cash dividend yield be for the representative firm? Each $1.00 of franking credits which has been distributed is worth $0.625 to the investor (as per the first bullet point above), and each $1.00 of cash dividends is accompanied by $0.43 of franking credits $\left(\frac{\tau}{1-\tau} = \frac{0.3}{1-0.3} = 0.43\right)$. These two assumptions lead to the conclusion that, for a firm paying fully-franked dividends, the cash dividend yield must be 7.74%. This is demonstrated below in the following steps for a stock priced at $100:

1. The firm generates earnings of $9.68 on its $100 asset base (that is, it earns its cost of capital under imputation).

2. 80% of earnings (and the associated franking credits) are distributed, meaning that the firm distributes a cash dividend of $7.74.

3. The investor receives $3.32 of franking credits – that is, $7.74 \times \frac{0.3}{1-0.3} = 3.32$.

4. These franking credits are worth 62.5 cents in the dollar, meaning that they are worth $2.07 to the investor.

Hence, in a regulatory framework in which we assume that the firm earns a stream of earnings in perpetuity, it is implicitly assumed that an investor will receive 2.07% of their return from franking credits. For this to occur in relation to a firm paying fully-franked dividends, the cash dividend yield is required to be 7.74%.

5.2 Resolving the Inconsistency

The Actual Return from Franking Credits

ESCOSA has formed a view that the actual return that equityholders' receive from franking credits is around 1%. In this regard, it cites a decision by the ESC (2005) in which they computed an estimated value for the return actually received from franking credits of around 0.82% based on an assumed dividend yield of 4%. This figure would be 1.07% for a firm paying fully-franked dividends and assuming that franking credits are worth 0.625 once distributed. That is, at a 30% tax rate, 43 cents of franking credits can be attached to each dollar of dividends. So if the actual dividend yield is 4%, the actual franking credit yield is 4 × 0.43 = 1.71. If franking credits are worth 62.5% of face value, the return from franking credits is 1.71 × 0.625 = 1.07.

The Implied Return from Franking Credits

As noted above, if gamma is set to 0.5 and the corporate tax rate is set to 30%, the implied return from franking credits is 2.07%. Again, this is purely a matter of logic/algebra under the Officer framework.

The inconsistency

There appears to be broad agreement that there is an inconsistency between:

1. The return from franking credits that is actually received by equityholders (which is based on dividends actually paid and franking credits actually distributed); and

2. The return from franking credits that is implied by setting gamma to 0.5 and the corporate tax rate to 30% (which is based on franking credits that are implicitly assumed to be distributed by these parameter estimates).

Two possible resolutions

There is disagreement about how this inconsistency should be resolved. We have advocated that the inconsistency should be resolved by setting gamma to zero. We note that this would also be consistent with market practice, empirical evidence from the leading journal, and with the assumptions that underpin the CAPM.

ESCOSA and ACG argue that the inconsistency should be resolved by instead setting the corporate tax rate to 15%. ACG argue that the effective tax rate (the ratio of tax paid to pre-tax profit) is 22% and that the ratio of pre-tax profit to pre-tax "economic income" is 67%, so the ratio of tax paid to pre-tax "economic income" is 0.22 × 0.67 = 15%. For example, say the firm has an equity value of $100 and reports a pre-tax accounting profit of $9.00 (a pre-tax return of 9% as used in ACG's advice to the Commission). It pays tax of $2.00 on this accounting profit (an accounting tax rate of 22%). If its pre-tax economic income is $13.40 (a pre-tax return of 13.4% as relied upon by ACG), then tax paid relative to economic income is 15% $\left(\frac{2.00}{13.40}=15\%\right)$.

If we replaced the assumed tax rate of 30% with a value of 15%, the implied return from franking credits is around 0.92%, which is consistent with the actual return from franking credits. This requires a dividend yield of 3.43% for a firm paying fully-franked dividends. That is, a cash dividend of $3.43 includes $1.47 of franking credits $\left(3.43\times\frac{0.3}{1-0.3}=1.47\right)$ which are worth $\$0.92\left(1.47\times 0.625=0.92\right)$.

However, there are two problems with this analysis:

1. The concept of "economic income" used by ACG and ESCOSA is inconsistent with the use of the Officer-WACC framework; and

2. The relevant effective tax rate is that which applies to firms that pay franked dividends, and the effective tax rate for those firms is 29%.

These two points are each explained in the following two sections.

5.3 Economic Income and the Officer CAPM-WACC Framework

Under the Officer (1994) framework, the stock price is computed as the present value of a perpetuity:

$$P = \frac{(X_O - X_D)(1-T)}{r_e\left[\frac{1-T}{1-T(1-\gamma)}\right]},$$

where:

P = the current price or value of equity;
X_O = Operating Income (Earnings before interest and tax or EBIT);
X_D = Interest expense;
r_e = the cost of equity from the CAPM;
T = the relevant corporate tax rate; and
γ = the value of franking credits.

That is, under the Officer framework the firm generates exactly the same cash flow each year forever – a perpetuity X_O. Some of this is used to service debt, X_D, and some is used to pay corporate tax. The remainder is available for equityholders. This cash flow to equity is in the numerator of the formula above. The present value of a perpetual series of cash flows can be computed by dividing by the appropriate discount rate. This is the required return to equity (adjusted for the assumed value of franking credits) in the denominator above.

This can also be written in terms of Pre-Tax Earnings *(PTE)* or Net Profit After Tax *(NPAT)*.

$$P = \frac{(X_O - X_D)(1-T)}{r_e\left[\frac{1-T}{1-T(1-\gamma)}\right]} = \frac{PTE(1-T)}{r_e\left[\frac{1-T}{1-T(1-\gamma)}\right]} = \frac{NPAT}{r_e\left[\frac{1-T}{1-T(1-\gamma)}\right]}.$$

This necessarily implies that under the Officer framework,

$$P = \frac{PTE}{r_e / [1-T(1-\gamma)]}$$

so that

$$\frac{PTE}{P} = \frac{r_e}{1-T(1-\gamma)}.$$

These are terms used in Officer (1994).[84]

In their response to our earlier report, ACG argue that

[84] In the worked example in the Appendix of Officer (1994), NPAT=21.24, PTE=34.82, r_e=17.7%, T=39%, and γ=0.5. Inserting these figures into the relevant formulas confirms the equity value of 158.361 in Officer's Appendix.

$$\frac{PTE}{P} = 9\%$$

but that

$$\frac{r_e}{1-T(1-\gamma)} = \frac{11.3\%}{1-0.3(1-0.5)} = 13.4\%\,.$$

Clearly, this represents an inconsistency that cannot be resolved within the Officer CAPM-WACC framework that ESCOSA has chosen to use. The reason for the inconsistency is that ACG's result is implicitly from a model other than the Officer CAPM-WACC framework. The framework that ACG appear to have in mind is in fact:

$$P = \frac{PTE + \left[\begin{array}{c} Something \\ Else \end{array}\right]}{r_e / [1-T(1-\gamma)]}$$

so that

$$\frac{r_e}{1-T(1-\gamma)} = \frac{PTE}{P} + \frac{\left[\begin{array}{c} Something \\ Else \end{array}\right]}{P}\,.$$

That is, ACG argue that economic income (13.4%) is equal to the pre-tax earnings yield (9%) plus something else (4.4%). This resolves the uncertainty, but it is not the Officer CAPM-WACC framework. In particular, the "something else" that is required to resolve the uncertainty comes from outside the Officer framework. It may reflect earnings growth or something of this nature, but whatever its source it is outside the Officer framework. Under the Officer framework, economic income is equal to the pre-tax earnings yield. In his seminal paper, Officer himself specifically sets these two quantities to be equal.[85]

That is, we have identified an inconsistency between the parameter values that ESCOSA has selected within the Officer framework. ACG have argued that this inconsistency can be resolved by abandoning the Officer framework and using something else. We submit that if the Officer CAPM-WACC framework is to be abandoned, a more extensive consultation process is required.

Finally, it may be possible to provide a reconciliation within the Officer framework. Indeed Officer (1994) alludes to this solution himself when he refers to "perpetuity equivalents" and cash flows being "reconstituted to reflect the company's maintainable or sustainable income and this is consistent with the [perpetuity] definitions of cash flow."[86] That is, rather than using current or last period's earnings, one can use sustainable earnings. This is the perpetuity equivalent of the forecast earnings stream – it is the level perpetuity that has the same value as the actual (growing) earnings stream. But this is not what ACG have done – their 9% earnings yield is the value from the trailing 12 months and is not a perpetuity equivalent. To convert the historical figure to the perpetuity equivalent, they would have to add "something extra".

[85] Officer (1994), Appendix.
[86] Officer (1994), p.13.

This would bring us back within the Officer framework, but economic income and earnings yield (re-stated as a perpetuity equivalent) would be identical. Thus, the difference between economic income and earnings yield, on which the ACG argument relies, cannot be supported within the Officer framework.

5.4 Estimation of Effective Tax Rates

In relation to accounting tax rates, we estimated income tax expense relative to pre-tax accounting earnings for the ASX200 companies. We analysed data for 411 firm-years derived from the current list of ASX200 firms over financial years ended 2003 – 2005. This sample comprised 166 individual firms, with 106 of these having three years of available data, 33 having two years of data and 27 with one year of data. From an original sample of 527 firm-years for which earnings and dividends were available we excluded 58 observations where the firm recorded a loss, 55 observations for which computed tax rates were less than zero or greater than 100% (meaning that the computed tax rates were likely the result of large one-off items); and 3 firm observations where the price-earnings ratio exceeded 100 times, which is likely to result from earnings per share being unusually low in that year, but still positive.

We estimated average tax rates on a pre- and post-abnormals basis, as the ratio of income tax expense to pre-tax profit. The pre- and post-abnormals specification has no material impact on the results. We also computed the tax rates on an unweighted and market capitalisation-weighted basis. Again, this has little impact on the results. The table below summarises the results.

Of course it is only the effective tax rate of firms paying franked dividends that is relevant to the argument at hand. The entire argument concerns the amount of franking credits generated by firms that pay franked dividends, and these franking credits are created by the payment of tax by those firms. Note that the market capitalisation weighted average tax rate for firms paying fully-franked dividends is 29%. We also note that this conclusion corroborates the results from a recent study commissioned by the Australian Financial Review[87] and advice from Deloitte that has been separately submitted to this review by Envestra.

Table 1: Estimates of average tax rates of ASX200 companies from 2003-2005 (%)

	Firms paying fully-franked dividends	Firms paying partially-franked dividends	Firms paying unfranked dividends	All dividend-paying firms	Non-dividend paying firms	All firms
Market capitalisation-weighted tax rates on a pre-abnormals basis						
Mean	29	22	18	25	27	25
Median	29	24	20	29	32	29
Market capitalisation-weighted tax rates on a post-abnormals basis						
Mean	28	24	19	25	23	25
Median	29	25	22	28	27	28
Equally-weighted tax rates on a pre-abnormals basis						
Mean	30	22	16	27	31	27
Median	30	24	14	30	32	30
Equally-weighted tax rates on a post-abnormals basis						
Mean	29	23	26	26	28	26
Median	30	25	14	29	31	30
Franking						
Mean	100	50	0	66	na	65
Median	100	50	0	100	na	100
N	272	67	48	387	24	411

[87] Buffini and Fabro (2005).

5.5 Summary and Conclusion

There appears to be broad agreement that there is an inconsistency between:

1. The return from franking credits that is actually received by equityholders (which is based on dividends actually paid and franking credits actually distributed); and

2. The return from franking credits that is implied by setting gamma to 0.5 and the corporate tax rate to 30% (which is based on franking credits that are implicitly assumed to be distributed by these parameter estimates).

We have advocated that the inconsistency should be resolved by setting gamma to zero. We note that this would also be consistent with market practice, empirical evidence from the leading journal, and with the assumptions that underpin the CAPM.

ESCOSA, on advice from ACG, have advocated that the tax rate should be altered and the assumed value of gamma maintained. However, we show that the proposed adjustment:

1. Is outside the Officer CAPM-WACC framework that underpins ESCOSA's regulatory model; and
2. Is incorrectly estimated.

Consequently, our conclusion is that the inconsistency we have raised remains and our recommendation is that the inconsistency should be resolved by setting gamma to zero as this would also be consistent with market practice, empirical evidence from the leading journal, and with the assumptions that underpin the CAPM.

6. Market risk premium

6.1 Errors in Final Decision

In the Final Decision, ESCOSA rejects a proposed market risk premium range of 6 – 7%, concluding that this does not lie within a reasonable range. However, this was not Envestra's proposed MRP range. Envestra's revised range was, in fact, 5 – 7%. The remainder of our comments in this section relate to the range of 5 – 7%, which is the current Envestra proposal.

6.2 ESCOSA's Conclusions

In its revised submission, Envestra proposed that a reasonable range for the market risk premium was in the range of 5 – 7%. ESCOSA has determined that an appropriate equity premium is 6%, based on the following reasoning:

1. Historical estimates of the difference between equity market returns and Government bond yields are around 7%. But there is an argument that these realised returns may have exceeded investors' expectations over this time period. Expectations for the market risk premium can be derived from the relationship between dividend yield and expected growth in those dividends, based on historical average growth in earnings and dividends. That is, there is an assumption that actual equity returns have exceeded investor expectations over the last 30, 50, 75, or 100 years.

2. Volatility of equity market returns is presently lower than observed historically, which economic theory implies should lead to a reduction in the market risk premium. Also, the risk premium for bearing the same level of volatility is lower, due to factors which include a reduction in the cost of holding a diversified portfolio, a reduction in the cost of access to information generally and changes in the composition of markets.

6.3 SFG Conclusions

We consider each of these two reasons in turn and conclude that a reasonable range for the market risk premium is in the range of 5 – 7%, for the following reasons which relate to points 1 – 2 given above:

1. The evidence on investors' expectations is insufficient to conclude that the historical average falls outside the reasonable range of possible estimates. We present evidence that the assumed growth rate used in a number of research papers is understated, which necessarily leads to a lower estimated risk premium. The growth rates typically assumed imply that firms will earn lower returns on new investment than returns that have been observed historically. If we assume that firms' investments will be just as profitable in the future as observed historically, assumed growth rates increase, leading to a consequent increase in the estimated cost of equity capital. We present estimates of the market risk premium in the range of 5.3 – 7.4% which account for reinvestment or which rely on historical corporate earnings growth from the US national accounts. *This is consistent with Envestra's proposed reasonable range of 5 – 7%.*

2. In forming the view that equity markets are less volatile than observed historically, ESCOSA relies on data presented in Hathaway (2005) in which we can observe lower volatility of equity market returns over the most recent five-year period, compared to a long-term average. That paper also documents that equity markets' compensation for bearing this risk (measured as the Sharpe ratio) is the same using the most recent data as observed historically. Based on this Sharpe ratio and two alternative measures of volatility (the estimates based on long-term and short-term data) the 90% confidence intervals for the market risk premium are 6.8 – 7.2% and

4.5 – 6.1%, with point estimates of 7.0% and 5.2%. *This range is consistent with Envestra's proposed reasonable range of 5 – 7%.*

ESCOSA also cites papers that document a reduction in the volatility of macroeconomic indicators. One of these papers, Lettau, Ludvigson and Wachter (2006) makes it perfectly clear that a reduction in macroeconomic volatility is not necessarily associated with a reduction in equity market volatility when they state:

> although the volatility of consumption declines in the 1990s, the model predicts that the volatility of stock returns does not – consistent with actual experience. In fact, in the data, stock market volatility appears to be, if anything, slightly higher in the late 1990s than in much of the rest of the postwar sample (p.22)."

What this paper contends is that lower macroeconomic volatility is associated with a lower price of risk for bearing volatility. That paper concludes that the US market risk premium has declined by 1.5% as a result of lower macroeconomic risk, but that volatility of equity market returns is unchanged. In this scenario, a 1.5% reduction in MRP from the historical average of 7.0% implies an estimate of MRP of 5.5%, consistent with the lower bound of Envestra's proposed range.

In forming its view on MRP, ESCOSA has chosen to rely on (1) evidence from Hathaway (2005) that volatility has declined (ignoring their data showing that the price of risk is unchanged); and (2) evidence from Lettau et. al. (2006) that the price of risk has declined (ignoring their data showing that the volatility of equity markets is unchanged). That is, ESCOSA has selected from each study only that piece of the overall evidence that supports a lower MRP.

We present a set of assumptions regarding volatility and the price of risk which are consistent with both empirical evidence and Envestra's proposed reasonable range of 5 – 7%.

6.4 Ex-ante Estimates of the Market Risk Premium

In estimating the market risk premium, ESCOSA has relied on evidence from papers which infer the market risk premium as the sum of dividend yields and an estimate of the growth in dividends from historical averages of dividend growth, earnings growth or GNP growth. Papers which rely on this estimation methodology include Fama and French (2002) and Jagannathan, McGrattan and Scherbina (2000). In its revised submission, Envestra also drew the Commission's attention to Easton, Taylor, Shroff and Sougiannis (2002).[88]

A methodological flaw

The constant growth dividend discount model upon which these papers rely requires the researcher to estimate two parameters – dividend yield and expected growth in those dividends. In estimating growth, different researchers have used realised values for dividend growth, earnings growth, GNP growth and growth in aggregate corporate earnings.

We contended that these studies suffer from a methodological flaw in that the realised growth in dividend yields is not necessarily the same growth expectations which are embedded in equity prices. Simply, we can observe a price and expected dividend for next year. With the available data we could either (a) assume that growth in dividends will continue at the same rate as observed historically (or will

[88] This material was discussed in some detail in our earlier report: SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006, Section 3.

be equal to growth in some other variable like GNP) and use this assumption to estimate the cost of equity capital ; or (b) assume that the cost of equity capital is the same as we have observed historically, and use this assumption to estimate the growth rate being assumed by the equity market.

ESCOSA concludes that we had mischaracterised these equity premium estimates by "referring to them as providing a forecast of the equity premium over a future period (and, hence, dependent upon forecasts of matters like the growth in dividends per share)".[89] However, this is exactly what the researchers are attempting to achieve. The mean dividend and earnings growth estimates computed over the entire sample period are added to mean dividend yields to infer the required return to equityholders for a future period. Our point is that the researchers assume that market participants necessarily form their expectations for growth from what they have observed historically, while it is equally possible they could form their expectations for returns from the historical data, and use these returns to infer growth rates. Indeed, in our view it is much more likely that it is earnings growth rates, rather than required returns, that vary over time.

In their response to our report, ACG states that there is no inconsistency between observed dividend yields and dividend growth because they are both realised historical values.[90] This is incorrect. Stock prices, and therefore dividend yields, reflect investors' expectations of future growth, which is a function of the expected return on reinvested earnings. The method used in these papers imposes an estimate on dividend growth equal to the historical mean – it is an assumption of the models that future growth is equal to historical growth. This takes no account of the reinvestment rate or expected returns on reinvested earnings. That is, if a smaller proportion of available funds are reinvested in the firm, future growth must also (logically) be smaller. However, the models take no account of this. We go on to show the following important results in relation to the Fama and French (2002) conclusions:

- If we assume that the reinvestment rate is 50% (the mean reinvestment rate for the period under study) and that reinvested earnings earn a real return of 7.60% (the mean value reported in the study) the estimate for the market risk premium rises to **5.3%.**

- If we estimate corporate earnings growth directly from national accounts (i.e., use growth in aggregate corporate profits rather than listed firms only) the market risk premium for the Fama and French (2002) sample period rises to **6.5%** and to **7.4%** if the most recent five-year period is included.

In a recently published paper, Easton (2006) recognises exactly this point. He notes the implicit assumption that the market's forecast of growth is equal to the growth that actually occurred and argues that this approach should be rejected against alternative approaches that *estimate*, rather than *assume*, what the market was forecasting about future growth. The objective of the paper is to elaborate on the

[89] ESCOSA, Proposed Revisions to the Access Arrangement for the South Australian Gas Distribution System: Final Decision, p. 72.
[90] ACG, Advice in relation to SFG report on rate of return for gas distribution, p. 6.

> differences between the approaches and compare the estimates of the implied expected rate of return when the growth rate is assumed with the estimates when the growth rate is (simultaneously) estimated from the data. In light of the fact that assumptions about the terminal growth rate are unlikely to be descriptively valid, the inferences based on the estimates of the expected rate of return that are based on these assumptions may be spurious. The appeal of O'Hanlon and Steele (2000), Easton, Taylor, Shroff and Sougiannis (2002) and Easton (2004) is that they simultaneously estimate the expected rate of return and the expected rate of growth that are implied by the data. The other methods assume a growth rate and calculate the expected rate of return that is implied by the data and the assumed growth rate. Differences between the true growth rate and the assumed growth rate will lead to errors in the estimate of the expected rate of return.

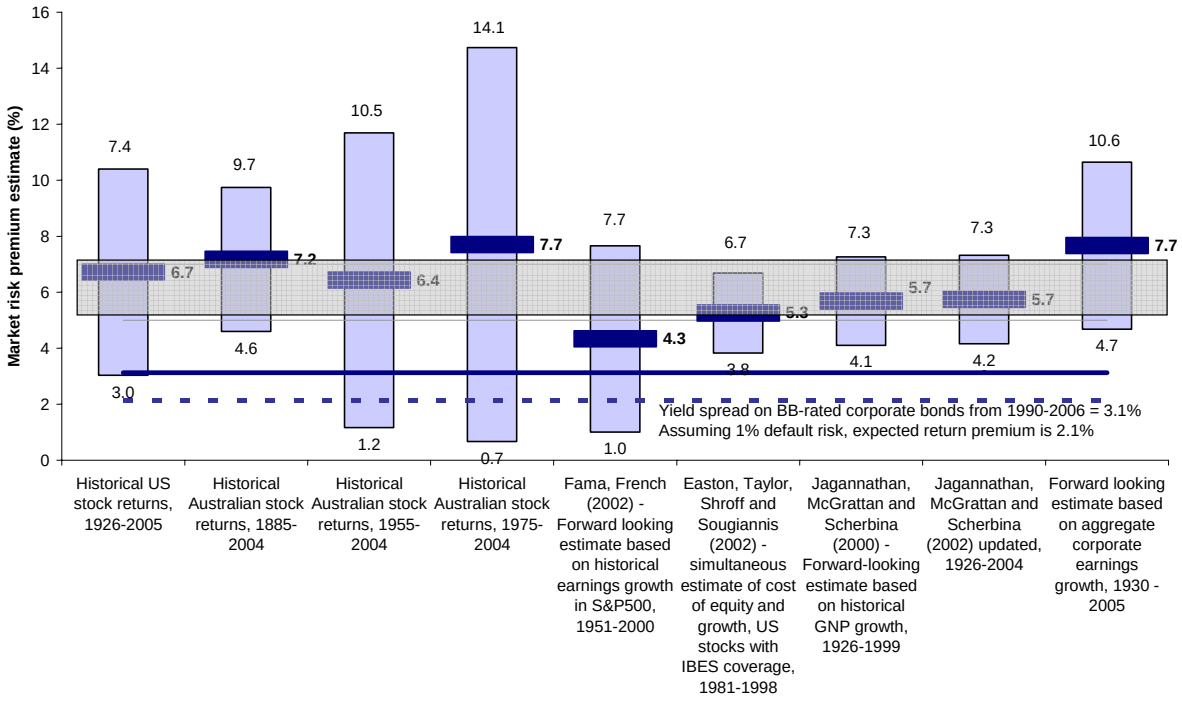
This is precisely the point we are making – differences between the true growth rate and the assumed growth rate will lead to errors in the estimate of the expected rate of return. In particular, if the market was expecting growth to be higher than what actually occurred, the MRP will be over-estimated using the models and techniques favoured by ESCOSA.

The empirical results

In our earlier report,[91] we presented a figure showing alternative estimates of the market risk premium derived from historical data and papers which derive estimates of MRP from equity prices and dividend or earnings growth. This is re-produced as Figure 2 below. This chart shows that the 90% confidence interval derived from the latter series of papers encompasses the mean estimate of MRP implied by the historical data. It also supports Envestra's proposed reasonable range of 5 – 7% on the basis that the mean estimate of MRP derived from three MRP estimates inferred from equity prices is 5.1%, compared to the mean estimate of 7.0% from Australian historical data. Furthermore, the chart includes a mean estimate of 7.7% derived from estimating corporate earnings growth from US national accounts.

[91] SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006, Section 3.

Figure 2: Mean estimates of the market risk premium



Notes: The mean and standard error used for the Australian stock returns are the same as reported by ACG. The data for US stock returns is CRSP data. Aggregate corporate earnings growth in the US is obtained from the Bureau of Economic Analysis. These growth rates are truncated at the 10th and 90th percentiles due to the presence of extreme observations. This correction has the effect of *decreasing* the mean estimate. Historical US stock returns are returns on the CRSP value-weighted index. Standard errors are computed as the standard deviation divided by the square root of the number of observations. In the case of Easton et al, standard errors are adjusted to take account of serial correlation in the estimates. We have computed the standard error for Jagannathan et. al., because they do not report the standard deviation in their results.

In discussing this figure, ESCOSA makes reference to a comparison we make with the yield premium on BB-rated corporate bonds, which averaged 2.8% from 1990 – 2004.[92] ESCOSA notes that this premium must exclude the default premium for these bonds (estimated at around 1%) for a fair comparison, and in any event is irrelevant, because the Commission uses an equity premium of around 6%.

The comparison with the yield premium on BB-rated corporate bonds was intended purely as a reasonableness check on estimates of the market risk premium. We noted that the lower bound of the confidence interval from Fama and French (2002) lies below this value (and even below a value of 1.8% assuming a default risk component of 1.0%).

We have updated this data to include the period from March 1990 to June 2006, the longest time period for which data is available. With this updated dataset, the yield spread on BB-rated corporate bonds has averaged 3.1%. Assuming a default risk premium of 1%, the expected return on BB-rated corporate bonds is estimated at 2.1%. We also computed the standard deviation of monthly returns on these bonds, which was 5.6% on an annualised basis. Hence, the Sharpe ratio for BB-rated corporate bonds can be estimated at 0.38 over this time period, where the Sharpe ratio is the premium for bearing systematic risk, relative to volatility as shown in the equation below:

[92] ESCOSA, Proposed Revisions to the Access Arrangement for the South Australian Gas Distribution System: Final Decision, p. 73.

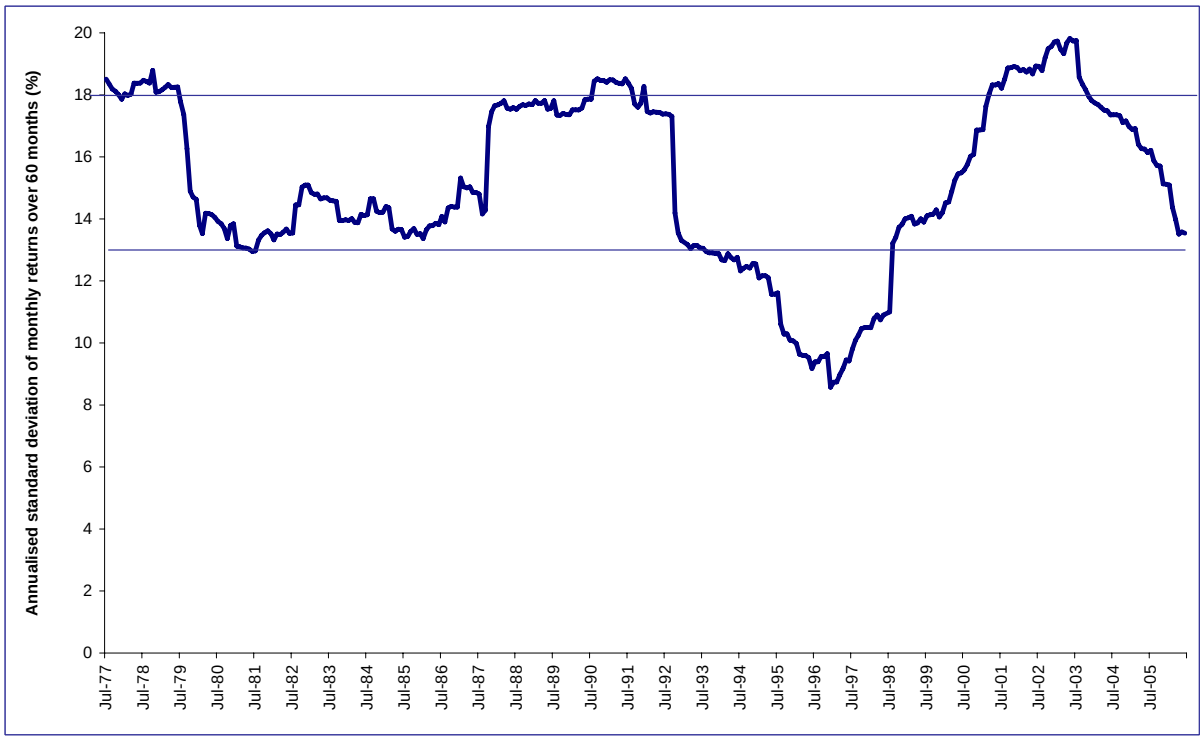
$$Sharpe = \frac{r_{BB} - r_f}{\sigma_{BB}}$$

where:

r_{BB} = the return on BB-rated bonds;
r_f = the risk-free rate of interest; and
σ_{BB} = the standard deviation of returns on BB-rated bonds.

The Sharpe ratio is considered in more detail in the section that follows. Using this estimate of the Sharpe ratio implied by the expected return on BB-rated bonds, *the Envestra proposed market risk premium of 5 – 7% is consistent with volatility estimates for US equity returns in the range of 13 – 18%.* That is, given an estimate of the price of risk (Sharpe ratio) and an estimate of the MRP, one can solve for the implied amount of risk (volatility). This estimate is entirely consistent with the volatility of US equity market returns over the past 30 years, as presented below. Furthermore, if we use 0.38 as the Sharpe ratio estimate, the Fama-French MRP estimate of 4.3% corresponds to a volatility of only 11%. Considering the data presented in Figure 3 below, this is a particularly aggressive assumption. That is, the Fama-French results seem to imply implausibly low equity risk premia (relative to corporate bonds) even after accounting for the risk of default.

Figure 3: Rolling standard deviation of US equity market returns over the last 30 years, estimated using monthly data over rolling 5 years



6.5 Volatility

The capital asset pricing model (CAPM) is based upon the relationship between the market risk premium and the volatility of market returns. This reward-for-risk trade-off is referred to as the Sharpe ratio, which appears below:

$$Sharpe = \frac{r_m - r_f}{\sigma_m}$$

where:

r_m = the expected return on the market portfolio;
r_f = the risk-free rate of interest; and
σ_m = the standard deviation of market returns.

Under the theory used to derive the CAPM, a reduction in the market risk premium can occur for two reasons. First, there is a reduction in the market's assessment of volatility. Second, there is a reduction in investors' required compensation for bearing volatility, that is, a reduction in the Sharpe ratio. In other words, the amount of risk can be reduced, or the return required to compensate risk (the price of risk) can be reduced.

ESCOSA has formed the conclusion that the volatility of the Australian equity market is less than we have observed historically.[93] They also implicitly conclude that the reward-for-risk trade-off has declined in recent years due to "a reduction in the cost of holding a diversified portfolio of shares, the reduction in the cost of access to information generally and changes in the composition of markets."

We address each of these conclusions in turn. Then, we consider these two issues jointly in reaching the conclusion that the evidence cited by the Commission is consistent with a reasonable range for MRP of 5 – 7%.

Is the volatility of Australian stock returns lower than we have observed historically?

In our earlier report, we presented evidence that the volatility of Australian equity returns for the 20-year period ending in 2005 was consistent with the volatility of returns for the period 1901-2005.[94] For the most recent 20-year period and for the period 1901-2005, the standard deviation of annual returns on the Australian stock exchange is 18%.

In concluding that volatility had declined in recent years, ESCOSA preferred to rely on a volatility estimate from the most recent five-year period reported in Hathaway (2005). He reports that the volatility of monthly returns on the Australian stock exchanged averaged 13.5% per annum over the period from 1875 – 2005. The standard deviation of monthly returns over the five-year period ending March 2005 is 10%.[95]

Before proceeding, it is worth noting that, had this exercise been performed in 2000, Hathaway's estimate of the volatility of Australian equity market returns would have been about the historical average over the full sample period.[96] Furthermore, at the end of 1970 the volatility of returns was around 10%, which was immediately followed by a period of increased volatility which peaked at 25% in 1974 and 31% in 1987. This suggests that there is a substantial risk in placing significant weight on volatility estimates drawn from such a tiny sample period.

[93] ESCOSA, Proposed Revisions to the Access Arrangement for the South Australian Gas Distribution System: Final Decision, p. 73.
[94] SFG, Issues on the regulated rate of return for gas distribution assets, 3 May 2006, Section 3.
[95] Note that these figures are not directly comparable to the figure of 18% quoted above, which was based on the standard deviation of annual returns. The figures used in this paragraph are the annualised standard deviation of monthly returns, computed as standard deviation multiplied by the square root of 12.
[96] Refer to Hathaway (2005), Figure 18, p. 34.

The volatility estimates of 13.5% (for the entire sample period) and 10% (for the recent five-year period) are based on sample data and are therefore subject to estimation error. To quantify the extent of estimation error, we estimated the following 90% confidence intervals surrounding these estimates[97]:

- For the entire sample period, and assuming an annualised standard deviation of 13.5% from 1,560 monthly returns, the 90% confidence interval for the annualised volatility of Australian equity returns is in the range of 13.1 – 13.9%.

- For the most recent five-year period, and assuming an annualised standard deviation of 10.0% from 60 monthly returns, the 90% confidence interval for the annualised volatility of Australian equity returns is in the range of 8.7 – 11.8%.

What do these volatility estimates imply for the market risk premium? Hathaway (2005) also reports that the average annual return on the equity market relative to the yield on 10-year Government bonds is 7.0% for the period from 1882 – 2005. Relative to the 13.5% estimate of volatility, we can compute the Sharpe ratio from this historical data at 0.52:

$$Sharpe = \frac{r_m - r_f}{\sigma_m} = \frac{0.070}{0.135} = 0.52\,.$$

This estimate of the Sharpe ratio for the entire sample period (1882 – 2005) is consistent with Hathaway's (2005) estimate for the most recent 10-year period. Note that the Sharpe ratio is also estimated with uncertainty, an issue we address in the section that follows. However, for the purposes of the discussion we hold the Sharpe ratio constant for the moment.

Holding the Sharpe ratio constant at 0.52, we can derive an estimate of the reasonable range for the market risk premium based on two potential ranges for volatility: (1) a range of 13.1 – 13.9% based on the entire dataset; or (2) a range of 8.7 – 11.8% based on the most recent five years of data. Which estimate one would use depends on the trade-off one makes between reliability (longer-term) and recency (shorter-term):

- Holding the Sharpe ratio constant at 0.52, a volatility range of 13.1 – 13.9% is consistent with an estimate of the market risk premium of in the range of **6.8 – 7.2%**. The mean volatility assumption of 13.5% implies an estimate for the MRP of 7.0%, *which is Envestra's proposed upper bound for the MRP estimate of 7.0%.*

- Again holding the Sharpe ratio constant at 0.52, a volatility range of 8.7 – 11.8% is consistent with an estimate of the market risk premium in the range of **4.5 – 6.1%**, which encompasses Envestra's proposed lower bound of 5.0%. The mean volatility assumption of 10.0% implies an MRP estimate of 5.2%, *which approximates Envestra's proposed lower bound of 5.0%.*

- Hence, it appears that the evidence presented by the volatility of equity market returns is consistent with Envestra's proposed MRP range of 5 – 7%.

That is, if the price of risk remains constant, different volatility estimates (i.e., the amount of risk) imply a MRP in the range of 5-7%. ACG also cites three papers which argue that there is lower macroeconomic risk than observed historically.[98] Lettau, Ludvigson and Wachter (2006, p.2) show that, holding volatility of returns constant, a decrease in the volatility of changes in consumption implies a

[97] Confidence intervals are computed under the assumption that sample variance is distributed according to a Chi-square distribution with *n-1* degrees of freedom. This assumption is the result of the underlying assumption that the population mean is normally distributed.
[98] Lettau, Ludvigson and Wachter (2006), Sill (2005) and Freeman (2006).

lower reward-for-risk trade-off. This issue is considered at the end of the following section. We introduce it here to make it explicit that a decrease in the equity premium can occur for two reasons – a decrease in the Sharpe ratio for the equity market and/or a decrease in the volatility of equity market returns. Lettau et. al. make this conclusion perfectly clear when they state:

> "although the volatility of consumption declines in the 1990s, the model predicts that the volatility of stock returns does not – consistent with actual experience. In fact, in the data, stock market volatility appears to be, if anything, slightly higher in the late 1990s than in much of the rest of the postwar sample (p.22)."

Has the reward-for-risk trade-off declined?

Holding volatility constant, the current estimate of the market risk premium will be below historical levels if there is a decline in the reward-for-risk trade-off (that is, the Sharpe ratio). If, as suggested by ESCOSA, there is a decline in portfolio holding costs, information costs, or some other change in the composition of markets, investors may demand less compensation for bearing the same level of risk.

We first point out that Hathaway's (2005) estimate of the Sharpe ratio for the entire sample period (1882 – 2005) is consistent with the estimate for the most recent 10-year period. Hence, there is no statistical evidence in the equity market returns that the price per unit of risk in 2005 was lower than the price per unit of risk we have observed historically.[99]

ACG contend that the reward-for-risk trade off has declined in recent years due to a reduction in transaction costs. Lower transaction costs can take the form of lower direct costs such as brokerage, or lower indirect costs, such as the development of mutual funds which reduce the cost of forming a well-diversified portfolio. They cite Siegel (1999) who contends that today's lower direct transaction costs and greater ability to form diversified portfolios have a 1 – 2% impact on the market risk premium. Citing Rea and Reid (1998) he states that the average annual fee for mutual fund investors fell by 0.76% from 1980 – 1997.

However, whether this translates into a decline in the market risk premium is contentious. Transaction costs reduce the liquidity of an asset because it costs the investor more to alter their position. But it has not been established that, for the broader equity market, an illiquidity premium contributes a substantial amount to the observed market risk premium. In other words, a reduction in transaction costs does not necessarily translate into a one-for-one reduction in investors' required returns for holding the asset.

The seminal paper of Constantinides (1986) shows that only a small liquidity premium is required to compensate investors for portfolios which deviate from their optimal weightings. He concludes that "transaction costs do not explain systematic and significant deviations from assets' expected returns adjusted for risk premia" (p. 844).

The theory of Constantinides (1986) is supported by empirical evidence. Researchers have compared the return on equity investments amongst stocks with high and low transaction costs. This is typically measured as the bid-ask spread in percentage terms. Eleswarapu (1997) examined the relationship between the bid-ask spread and stock returns on the NASDAQ. He concluded that a 1% increase in the bid-ask spread corresponds to an increase in the monthly returns to equityholders in the order or 0.028 to 0.035%.

[99] We note that Hathaway and Officer (p.38) reach the conclusion that "there has been a significant downward shift in the price pre unit of risk of the Australian market in the last 75 years." But we also note that this comment refers to the reduction in the Sharpe ratio from its peak of 1.9 in 1930. It does not refer to the overall Sharpe ratio which prevailed over the period, which stands at 0.52.

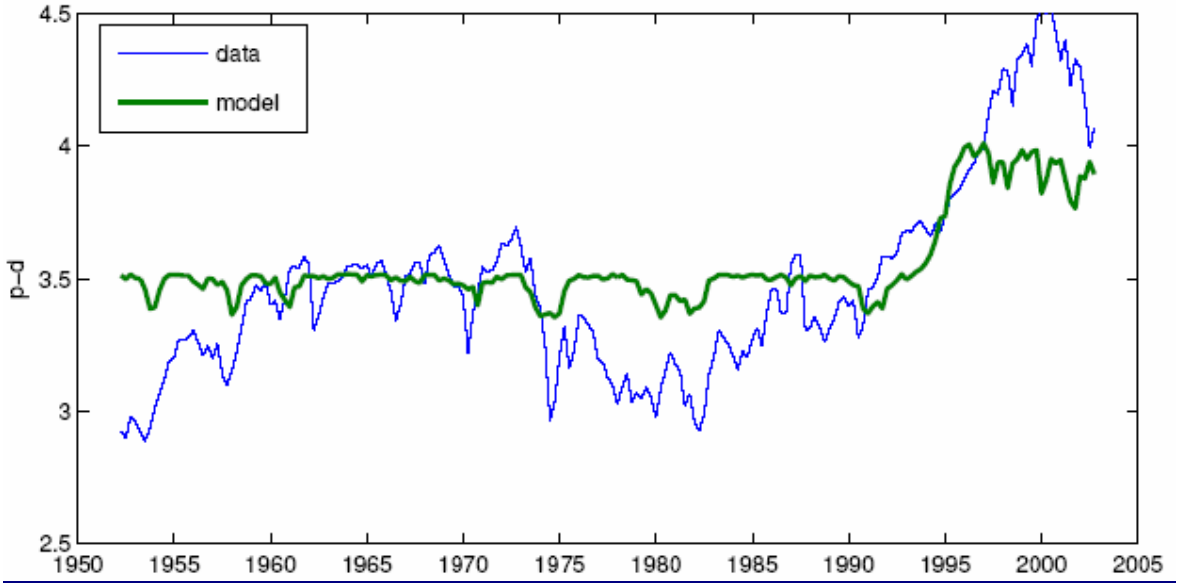
ACG also make the point that the volatility of macroeconomic variables is lower than observed historically. As noted above, this could potentially lead to a reduction in the reward-for-risk trade-off. But is there empirical evidence that this is the case?

- The results of Lettau et. al. (2006) imply that the recent reduction in the volatility of consumption growth contributed to a decline in the equity risk premium of around 1.5% in the 1990's, compared to an earlier period from 1952-1990 (referring to their Figure 7). However, their model is useful for explaining equity price movements only from 1990 onwards (and only then after excluding the period of very high equity prices around the year 2000).

  We reproduced their Figure 6 below, in which the authors compare the log multiple of price/dividends as predicted by their model and which we observe in the actual data on the US stock market. The actual data exhibits four material changes in the log price-dividend multiple – a significant rise in this multiple from over the 21-year period from 1952 to 1972, a decline in the multiple in the following 10 years, a further rise over the 17-year period until its peak in 1999, followed by a decline in the last three years of actual data.

  The figure below shows that the model was most useful in explaining the significant stock price increases which occurred in the 1990's, but could not explain variations in this ratio over an extended time period. The predicted multiples are basically flat throughout the sample period until 1990, which results from the econometric analysis which shows a break in consumption risk in the latter period. Furthermore, the rise in equity prices in this latter period could equally be attributed to changes in the market's growth expectations and an increase in reinvestment rates, as discussed above. These explanations are also consistent with a decrease in macroeconomic risk. The very reason why governments and central banks try to minimise the volatility of growth is in an attempt to increase the mean level of growth.

Figure 4: Relationship between dividend yields implied by the model of Lettau et. al. and actual data



Source: Lettau, Ludvigson and Wachter (2006)

- Freeman (2006) presents an econometric model that attempts to explain the rise in the US stock market over the 100 or so years leading up to the end of last century. This essentially models the relationship between the volatility of individuals' income and stock market returns.

> Sill (2005) models the relationship between equity returns and the volatility of real output growth. That model is calibrated to the results presented in Jagannathan et. al. (2000) which, as discussed above, are based on the assumption that expected growth rates are equal to what has been observed historically, but required returns are allowed to vary. The models presented in both these papers are derived from the following observation of the historical data: the US stock market enjoyed substantial growth over the last 100 years; and the volatility of macroeconomic variables has declined in recent years.
>
> In sum, we do not dispute that there has been a reduction in the volatility of macroeconomic variables such as consumption growth. What is uncertain is the extent to which a reduction in the variation of these macroeconomic variables flows through to a reduction in the equity risk premium. What is not adequately explained is why lower macroeconomic volatility necessarily implies lower required returns and not higher expectations for growth. In other words, would we not find the same association between the volatility of macroeconomic variables and the growth assumptions embedded in market prices?

Importantly, any reduction in the premium due to these changes occurs because the market requires less reward for taking on the same level of risk. It is clear from Lettau et. al. (2006) that this does not necessarily imply a reduction in the volatility of equity returns.

If the equity risk premium declines by around 1.5% as implied by Lettau et. al.'s (2006) results, what would this imply for the Sharpe ratio? If we hold volatility constant at 13.5% and reduce the market risk premium from 7.0 to 5.5%, the Sharpe ratio falls from 0.52 to 0.41. As discussed below, this potential reduction in the Sharpe ratio is well within the 90% confidence interval for this parameter.

What assumptions regarding volatility and the price of risk are consistent with the range of 5 – 7%?

The discussion above relate to the two reasons which can theoretically support ESCOSA's view that the historical average MRP lies outside of a reasonable range for valuation purposes. These two reasons are (1) a decline in the volatility of equity market returns' and (2) a decline in the reward-for-risk trade-off (the Sharpe ratio). Recall that Envestra submitted that a reasonable range for the market risk premium was 5 – 7%.

The table below presents a series of assumptions regarding the market risk premium which are consistent with the evidence. We estimated two ranges for the volatility of stock returns: (1) 8.7 – 11.8%, based upon the 90% confidence interval from the most recent five-years of monthly stock returns, as reported in Hathaway (2005); and (2) 13.1 – 13.9%, based upon the 90% confidence interval drawn from their full sample period. We also include three potential estimates for the Sharpe ratio. These are 0.52 as implied by both the short- and long-term data reported by Hathaway and a 90% confidence interval derived from his data. We performed 100,000 simulations of 122 years of equity market returns. In other words, we constructed a distribution of possible sets of 122 years of Australian equity market returns and computed the Sharpe ratio for each one. This allows us to estimate the full range of possible Sharpe ratios which we could have observed over the last 122 years, based on the observed data. This range is 0.36 – 0.68. Using these 18 alternative values for volatility and the Sharpe ratio, we can compute the following estimates for the market risk premium.

Our conclusion is that it is entirely reasonable to expect that the volatility of equity market returns will lie in the range of 10 – 14% and that the market will demand the same compensation for risk as it has in the past. This expectation leads to an assumed equity risk premium in the range of 5 – 7%.

Table 2: Market risk premium implied by alternative assumptions regarding volatility and the Sharpe ratio

		Sharpe ratios based on simulation of the equity risk premium using data from Hathaway (2005)		
		0.68	0.52	0.36
Volatility based on entire series of monthly returns from Hathaway (2005)	0.139	9.5	7.2	5.0
	0.135	9.2	7.0	4.9
	0.131	8.9	6.8	4.7
Volatility based on recent 5 years of monthly returns from Hathaway (2005)	0.118	8.0	6.1	4.2
	0.100	6.8	5.2	3.6
	0.087	5.9	4.5	3.1

6.6 Conclusion

It is difficult to precisely estimate the market risk premium. The historical data is noisy and the theoretical models are complex, incomplete, and cannot reconcile with the observed data. It is for this reason that we advocate the use of a range. Our conclusion is that a range of 5-7% is appropriate. We note that this is consistent with the range of estimates from a variety of studies in Figure 2. It is also consistent with various short and long-term estimates of market volatility and the price of risk (Sharpe ratio) as presented in the table above.

We do not view the theoretical literature to be so compelling as to warrant a rejection of the historical data as being outside the bounds of reasonableness. We also note that in forming its view on MRP, ESCOSA has chosen to rely on (1) evidence from Hathaway (2005) that volatility has declined (ignoring their data showing that the price of risk is unchanged); and (2) evidence from Lettau et. al. (2006) that the price of risk has declined (ignoring their data showing that the volatility of equity markets is unchanged). That is, ESCOSA has selected from each study only that piece of the overall evidence that supports a lower MRP.

We concur with ESCOSA's central point estimate of 6% but disagree with the conclusion that a single point estimate should be used for the market risk premium. For the reasons described above, MRP cannot be so precisely estimated or objectively and transparently determined to warrant a single point estimate. We advocate that a range should be used for this parameter, and suggest that an appropriate range is 5-7%.

Finally, we note that ESCOSA's view is that its estimate of MRP includes the value of franking credits. However, the Final Decision uses a range rather than a single point estimate for the value of franking credits. This necessarily implies that a range must also be used for MRP.

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