Reconciliation of dividend discount model estimates with those compiled by the AER

10 October 2013

PO Box 29, Stanley Street Plaza
South Bank QLD 4101
Telephone +61 7 3844 0684
Email s.gray@sfgconsulting.com.au
Internet www.sfgconsulting.com.au

SFG CONSULTING

Level 1, South Bank House
Stanley Street Plaza
South Bank QLD 4101
AUSTRALIA

Contents

1. Preparation of this report

This report was prepared by Professor Stephen Gray and Dr Jason Hall. Professor Gray and Dr Hall acknowledge that they have read, understood and complied with the Federal Court of Australia's Practice Note CM 7, Expert Witnesses in Proceedings in the Federal Court of Australia. Professor Gray and Dr Hall provide advice on cost of capital issues for a number of entities but have no current or future potential conflicts.

2. Introduction

2.1 Context

In June 2013, we submitted a report to the Australian Energy Regulator (AER) entitled *Dividend discount model estimates of the cost of equity* (SFG Consulting, 2013a, or our "original report"). In our original report we provided estimates of the cost of equity for the Australian listed market, and for a sample of energy network businesses previously used by the AER in comparable firm analysis. We compiled data for all Australian-listed firms for which sufficient data was available, using all individual analyst forecasts for those firms. This resulted in a dataset of 39,564 observations. This large dataset allowed us to compile estimates of the market cost of equity every six months from 2002 to 2012, estimates of the cost of equity by industry, and estimates of the cost of equity for the set of network businesses. We reported results based upon the set of individual analyst forecasts, and the set of consensus (that is, average) analyst forecasts for each company.

In August 2013 the AER released its Explanatory Statement in relation to its Draft Guideline for estimating the regulated rate of return under the National Electricity Rules (NER). Our original report was given little consideration by the AER which labelled our analysis "excessively complex (AER, 2013, p.220)." The AER presented estimates under an alternative version of the dividend discount model, under a set of alternative assumptions. At the overall market level, the estimates of the AER over 2006 to 2013 are more volatile than our estimates. For the network businesses analysed, the estimates of the AER are also more variable than our estimates over time and are considerably higher than our estimates. The AER's estimates for network businesses are so high that the AER has excluded them from consideration on the basis that they are "implausible."[1]

The reason the AER's estimates for the market cost of equity are more volatile than our estimates, and the reason the AER generates much higher estimates for network businesses, is because the AER estimation techniques and assumptions are a set of methodological choices which directly contribute to this outcome. In the current report we use the terms "estimation techniques and assumptions" and "methodological choices" interchangeably to refer to the complete set of estimation techniques and assumptions used to derive estimates of the cost of equity from the dividend discount model.

With respect to the estimation techniques and assumptions we relied upon, there was an important reason for each choice made in compiling the estimates. In our original report, we detailed each of the methodological choices we made. This detailed presentation of estimation techniques and assumptions may have given the appearance that out approach was, according to the AER, too complex. It is not the case that the approach we adopted was too complex to form the basis for regulatory decision-making. All we did was document exactly which methodological choices were made to arrive at a final answer.

In this report we directly compare each of the methodological choices made by the AER and by us in compiling dividend discount model estimates of the cost of equity. We explain how the AER could also decide to make each of these choices, and implement them in a relatively straightforward manner. We place each choice in a separate compartment, to demonstrate that each choice can be made independently of all the other choices. So it is not a matter of the AER electing to use its current dividend discount model technique versus our dividend discount model technique. The AER can make any number of changes to its estimation approach which we contend will materially improve the reliability of its cost of equity estimates from the dividend discount model. If the AER makes these choices, the cost of equity estimates will exhibit less dispersion across firms at each point in time, and less dispersion over time for the same firms.

[1] AER Explanatory Statement, Sub-section E.2 (p.188), Sub-section F.2.1 (p.195), and Sub-section H.3 (pp.224–225).

The AER has identified stability of the cost of equity estimate as important for investors and consumers. We have made extensive efforts to provide the AER with a set of cost of equity estimates that are more stable than its own dividend discount model estimates, and more stable than the AER's estimates from implementation of the Capital Asset Pricing Model (CAPM). Our technique also means that arguments over the "correct" level of growth are avoided, and resulting cost of equity estimates are less sensitive to the current dividend yield. At present, the AER's market cost of equity will be almost perfectly correlated with the dividend yield.

2.2 Terms of reference

We have been provided with terms of reference that require us to comment on six specific issues. The terms of reference are attached to this report. In our conclusion we directly address these specific items with reference to the analysis that appears throughout the report.

2.3 Outline

2.3.1 Key estimation techniques and assumptions

We recommend that the AER implement the following four key methodological choices in its implementation of the dividend discount model. In the current report we devote a separate section to each methodological choice, as outlined below.

- **Horizon.** Rather than assume long-term growth will begin from year three onwards, assume that long-term growth begins in forecast year ten, and gradually shift parameter estimates towards long-term inputs. The increased complexity from this step is minimal and is consistent with the AER's rationale that long-term growth for currently listed firms lies below the long-term growth in the economy, because the AER considers that new companies are expected to have above-average growth.[2] This issue is covered in Section 3.

- **Price.** Rather than match analyst dividend forecasts with share prices, match analyst dividend forecasts with price targets. There is no increase in complexity associated with this approach, as it is simply a matter of replacing one price input with another. It is more likely that the analyst price target (rather than the share price) reflects the present value of expected dividends made by that same analyst. When consensus dividend forecasts are used, rather than individual analyst forecasts, this issue is less troublesome.[3] But at the margin we still recommend the use of price targets as the more appropriate price. This issue is covered in Section 4.

- **Growth.** Rather than impose a growth rate that is made independent of price, earnings and dividend forecasts and then solve for the cost of equity, jointly estimate long-term growth and the cost of equity. This technique involves using a program to simultaneously solve for more than one input, so there is some increase in complexity, but there are substantial benefits. The example presented in the current paper for an individual case was compiled using Solver in an Excel spreadsheet. In a large sample it is a matter of finding inputs that fit the data for many cases. So there are more computations, but each computation itself is not complex. Most importantly, it means that the cost

[2] AER Explanatory Statement, Sub-section H.2 (p.221). The AER estimates long-term growth for listed firms as an estimate of GDP growth less 1%. We have not been asked to comment on the reasonableness of the *level* of the AER's long-term growth assumption, only whether imposing long-term growth assumption made independent of share prices, earnings and dividends is appropriate.

[3] There are two types of analyst forecast data that can be used in dividend discount model estimates of the cost of equity – individual analyst forecasts (for example, analyst Jack makes an earnings per share forecast for BHP, and analyst Jill makes an earnings per share forecast for ANZ), and consensus analyst forecasts (for example, the mean or median analyst earnings per share forecasts for BHP and ANZ).

of equity estimate is no longer almost perfectly correlated with the dividend yield. So the market cost of equity estimate is likely to be more stable over time. This issue is covered in Section 5.

- **Timing.** Match the timing of analyst earnings and dividend forecast entries into the database with prices observed on or close to the same date. The longer the time between when an analyst makes a dividend or earnings forecast and when the price is observed, the more volatile will be the cost of equity estimate over time. Share prices change because of changes in dividend expectations and changes in the cost of capital. The greater the lag between when forecasts are made and the price date, the more the price change will *appear* to be due to changes in the cost of capital. Making this change is purely a data compilation exercise. There are no computations involved. It is simply a matter of compiling a set of prices and analyst earnings and dividend forecasts made on close to the same date. This is one important reason why our estimates of the cost of equity over time are more stable than those compiled by the AER and Bloomberg. This issue is covered in Section 6.

2.3.2 Comparison of outcomes from different approaches

We provide a comparison of cost of equity estimates that we compiled, compared to those compiled by the AER. We separately consider cost of equity estimates for the sample of listed energy networks, and the time-series of market cost of equity estimates over time. This discussion illustrates that the AER's preference for stability in cost of equity estimates is achieved by adopting the four key estimation techniques and assumptions summarised above.

- **Network sample.** The AER disregarded cost of equity estimates for individual firms because of concerns over sample size,[4] the magnitude of the estimates (which are labelled "implausible")[5] and the variation of estimates over time.[6] With respect to sample size, which we acknowledge is a relevant consideration, we demonstrate that individual firm estimates exhibit less dispersion than we typically observe with regression-based estimates of beta. So sample size is less of a concern for dividend discount model analysis than it is for cost of equity estimates computed using the CAPM, populated with regression-based estimates of beta. With respect to the magnitude of estimates and the time-series variation in estimates, the outcomes from the AER analysis are a direct result of the estimation techniques and assumptions incorporated by the AER. Under the alternative estimation techniques and assumptions we adopted, the cost of equity estimates for network businesses are materially lower and exhibit less variation over time.

  With respect to the interpretation of the evidence, the logic of accepting or rejecting evidence on the basis of magnitude is questionable. The AER assumed that an upper bound on the cost of equity for a listed energy network was the market cost of equity, so evidence which suggests this assumption could be incorrect is disregarded. The implication of this rationale is that evidence is more informative in decision-making if it is consistent with a pre-determined view, but is less informative in decision-making if it is inconsistent with this pre-determined view. A more appropriate interpretation of the evidence would have been that there are limitations to the estimation techniques and assumptions, and that these estimation techniques and assumptions could be improved upon. This issue is covered in Section 7.

- **Market cost of equity over time.** The AER's estimates of the market cost of equity over time are more volatile than our estimates, but have a similar time-series pattern.[7] The reason for the volatility difference can be directly attributed to the differences in methodological choices. The estimation techniques and assumptions we adopted were selected in order to improve the reliability of cost of

[4] AER Explanatory Statement, Sub-section F.2.1 (p.195), and Sub-section H.3 (p.222).
[5] AER Explanatory Statement, Sub-section E.2 (p.188), Sub-section F.2.1 (p.195), and Sub-section H.3 (pp.224–225).
[6] AER Explanatory Statement, Sub-section H.3 (p.225).
[7] AER Explanatory Statement, Sub-section H.2, Figure H.8 (p.222) and SFG Consulting (2013a), Sub-section 4.2.2, Figure 2 (p.23).

equity estimates, and this in turn leads to cost of equity estimates that are less volatile over time. This issue is covered in Section 8.

2.3.3 Treatment of imputation tax credits

We discuss the manner in which the AER considers the value of imputation credits in its dividend discount model analysis and the way the AER accounts for the value of imputation credits in its post-tax revenue model.

- **Imputation tax credits.** The way in which the AER accounts for imputation benefits in its dividend discount model analysis is inconsistent with the way in which the AER accounts for imputation benefits in its post-tax revenue model. This leads to a material understatement of allowed revenues. This issue can be resolved in a relatively straightforward manner as described in Section 9.

2.3.4 Miscellaneous technical adjustments

In the Appendix we discuss a number of miscellaneous technical adjustments that are likely to contribute to a material increase in the reliability of cost of equity estimates from dividend discount model analysis. We discuss these separately in the appendix so as not to distract from the four key methodological choices that distinguish our estimation technique from that adopted by the AER.

3. Alternative versions of the dividend growth model

3.1 Australian Energy Regulator

The AER projects dividends for two years based upon analyst forecasts and then assumes constant growth.[8]

$$P = \frac{D_1}{(1+r_e)^1} + \frac{D_2}{(1+r_e)^2} + \frac{D_2 \times (1+g)}{(r_e - g) \times (1+r_e)^2} = \sum_{t=1}^{2} \frac{D_t}{(1+r_e)^t} + \frac{D_2 \times (1+g)}{(r_e - g)(1+r_e)^2}$$

3.2 Alternative approach

We project dividends for two years based upon analyst forecasts, then assume mean-reversion in inputs over eight years, and then assume constant growth. So the only difference is the intermediate period of eight years in which there is a transition from the explicit forecast period to a terminal growth phase.

$$P = \frac{D_1}{(1+r_e)^1} + \cdots + \frac{D_{10}}{(1+r_e)^{10}} + \frac{D_{10} \times (1+g)}{(r_e - g) \times (1+r_e)^{10}}$$
$$= \sum_{t=1}^{2} \frac{D_t}{(1+r_e)^t} + \sum_{t=3}^{10} \frac{D_t}{(1+r_e)^t} + \frac{D_{10} \times (1+g)}{(r_e - g)(1+r_e)^{10}}$$

Given that the only difference in the equations relates to the intermediate period of eight years, we present a brief comparison which explains the potential impact of this difference. The AER equation is equivalent to assuming constant growth over year three to year ten. So we want to know the potential impact on the cost of equity under the assumption that growth is constant over this eight year period, compared to an assumption in which growth gradually transitions to a long-term value.

The simplest assumption to make is that growth transitions to a long-term value in equal amounts over eight years. So we compared what the cost of equity might look like under the assumptions that growth is constant over this period, compared to an assumption that growth reverts to the long-term input over an eight year period in equal amounts.

To illustrate this comparison, we first start with estimates provided by the AER in the Explanatory Statement. The AER estimated that, on average over the 7.5 years from 1 January 2006 to 30 June 2013, the cost of equity is 11.0%.[9] This is an estimate that includes the benefit of imputation credits. The AER also assumed that the long-term growth rate was 4.6%. So the average estimated long-term dividend yield, including imputation benefits, is 6.4%. If we strip out the AER's assumed imputation benefits, the estimated long-term cash dividend yield is 5.2% (that is, 0.064 ÷ 1.225 = 0.052).[10]

[8] AER Explanatory Statement, Sub-sections H.1 (p.219) for the general equation and Sub-section H.2 (p.220) for the disclosure of a two-year explicit forecast period prior to the constant growth assumption. The AER also makes adjustments to account for the timing of the financial year end relative to the date at which the cost of equity is estimated, and to account for dividend payments made throughout the year. These timing adjustments are unlikely to be the cause of any material difference in the outcomes from the AER analysis and the outcomes from our analysis. If the AER continues to rely upon its dividend discount model estimation technique, these particular assumptions need to be considered closely to ensure they are appropriate. But for the basis of this report we have assumed that the AER timing assumptions are appropriate.

[9] AER Explanatory Statement, Sub-section H.2 (p.221).

[10] The figure of 1.225 is computed using assumption that appear in the AER Explanatory Statement, Sub-section H.2 (p.221). Note that we separately consider the AER's treatment of imputation tax credits in Section 9 and document that the AER has an inconsistent view on the value of imputation tax credits in its dividend discount model analysis to its view in setting allowed revenue in its post-tax revenue model. However, we want to focus on just one issue at a time in the current report. So in the current example we simply treat imputation credits in dividend discount model analysis in exactly the same manner as the AER.

We do not have a profile of estimated dividends over the first two forecast years, so for illustrative purposes we need to make an assumption. The purpose of the analysis is to demonstrate the ease in which a transition period of eight years can be implemented, and the potential impact on the estimated cost of equity. If the AER has a view that growth will, in fact, be constant from years three through ten, the cost of equity estimates will be exactly the same. If the AER has a view that initial growth rates will gradually decline to long-term growth rates, this view can be easily incorporated into the estimated cost of equity. The increase in complexity from this one step is trivial.

We base all of our assumptions off a representative share price of $1.00. Suppose for illustrative purposes that the year one dividend forecast was $0.0500 (plus imputation benefits) and the year two dividend forecast was $0.0548 (plus imputation benefits). This is a dividend growth rate of 9.58% in forecast year two. These assumptions would have implied a discount rate of 11.0% as shown in the equation below.

$$P = \frac{D_1}{(1+r_e)^1} + \frac{D_2}{(1+r_e)^2} + \frac{D_2 \times (1+g)}{(r_e - g) \times (1+r_e)^{20}}$$

$$P = \frac{\$0.0500 \times 1.225}{(1.1100)^1} + \frac{\$0.0548 \times 1.225}{(1.1100)^2} + \frac{\$0.0548 \times 1.225 \times (1.046)}{(0.1100 - 0.046) \times (1.1100)^2}$$

$$P = \frac{\$0.0613}{1.1100} + \frac{\$0.0671}{1.2321} + \frac{\$0.0702}{0.0789}$$

$$P = \$0.0522 + \$0.0545 + \$0.8903$$

$$P = \$1.0000$$

In Table 1 we summarise the process adopted by the AER. We present ten year projections for cash dividends (DPSC), dividends including the assumed imputation benefit (DPSI), cash flows [CF, which incorporates the present value of expected dividends from year 11 onwards, computed as DPSI × (1 + g)/(r_e – g)], present value of each cash flow (PV), growth in dividends per share (DPS g) and the share price over time. There are other columns of the table that are not populated, but we will use this same table in subsequent examples to demonstrate how our recommendations can be implemented in a relatively straightforward manner.

If the firm was already in a constant growth state, there would be no difference in the estimated discount rate from implementing any transition to long-term growth. If, however, the firm is growing at more than the long-term growth rate initially, there will be a period during which growth declines to this long-term level.

The AER's assumption that long-term growth is 4.6% is predicated on the view that, in the long-term, listed firms are expected to grow at a rate which is 1.0% below overall economic growth. This view is also consistent with a period of growth which is above the long-term assumed level. So to illustrate the impact of mean-reversion in growth, we simply reduce the growth rate of 9.58% by 0.62% each year over the next eight years. Dividends are therefore $0.0731 in forecast year three, $0.0792 in forecast year two, and so on. In forecast year ten the dividend would be $0.1134. Under this assumption of declining growth, the estimated cost of equity increases to 11.87%, as illustrated in the equation below.

Table 1. Growth assumed to be constant from year 3 onwards

Year	BVPS	EPS	DPSC	DPSI	CF	PV	EPS g	**DPS g**	DPR	ROE	Price	B/P	P/E_1
0											1.000		
1			0.050	0.061	0.061	0.055					1.049		
2			0.055	0.067	0.067	0.054		**0.096**			1.097		
3			0.057	0.070	0.070	0.051		**0.046**			1.147		
4			0.060	0.073	0.073	0.048		**0.046**			1.200		
5			0.063	0.077	0.077	0.046		**0.046**			1.255		
6			0.066	0.080	0.080	0.043		**0.046**			1.313		
7			0.069	0.084	0.084	0.040		**0.046**			1.374		
8			0.072	0.088	0.088	0.038		**0.046**			1.437		
9			0.075	0.092	0.092	0.036		**0.046**			1.503		
10			0.079	0.096	1.668	0.588		**0.046**			1.572		

Long-term growth = 4.60%; Long-term ROE = 15.33%;[11] Cost of equity = 11.00%

BVPS = Book value per share. DPSC = Cash dividends per share, computed as cash dividends per share in the previous year multiplied by 1 + the estimated growth rate. DPSI = dividends per share including imputation benefit according to AER assumptions about the benefits of imputation credits, computed as cash dividends per share × 1.225. CF = cash flow including imputation benefits, which is equal to dividends per share including imputation benefits, plus in the 10th year, the present value of expected future dividends computed as DPSI × $(1 + g)/(r_e - g)$. PV = present value of cash flow including imputation benefits, computed as $CF/(1 + r_e)^t$. EPS g = earnings per share growth. DPS g = DPS growth, computed as dividends per share dividend by dividends per share in the previous year minus one. DPR = dividend payout ratio, computed as dividends per share /dividend by earnings per share. *ROE* = return on equity. Price = present value of expected dividends including imputation benefits over time. B/P = book value per share divided by price. P/E_1 = price-earnings ratio, computed as price dividend by next year's earnings per share.

$$P = \frac{D_1}{(1+r_e)^1} + \frac{D_2}{(1+r_e)^2} + \frac{D_2 \times (1+g)}{(r_e - g) \times (1+r_e)^{10}}$$

$$P = \frac{\$0.0500 \times 1.225}{(1.1187)^1} + \frac{\$0.0548 \times 1.225}{(1.1187)^2} + \cdots + \frac{\$0.0925 \times 1.225 \times (1.046)}{(0.1187 - 0.046) \times (1.1187)^{10}}$$

$$P = \frac{\$0.0613}{1.1187} + \frac{\$0.0671}{1.2516} + \cdots + \frac{\$0.1134}{0.2234}$$

$$P = \$0.0547 + \$0.0536 + \cdots + \$0.5075$$

$$P = \$1.0000$$

In Table 2 we summarise the process by which parameter inputs revert to a long-term estimate in equal increments over ten years. In this simple case, long-term growth is the only long-term parameter input. So the only change from the previous example is the dividend growth falls by 0.62% per year, from an initial projection of 9.58% to a long-term projection of 4.60%. We have highlighted the column with the different input for dividend growth, which can be computed in a relatively straightforward manner.

The important point is that, in implementing the dividend discount model, the AER has made an assumption that dividend growth will be constant from year three onwards. This can be compared to our alternative assumption that there is a period of eight years during which parameter inputs gradually revert to a long-term estimate. Either way, the AER needs to form a view as to the time period over which there is a transition to a long-term state. The AER's current view is that this time period is zero years after the first two years for which dividends are available.

Consider the issue another way. Any implementation of the dividend discount model will necessarily result in a series of dividend projections over *all* forecast years. We contend that there is no more complexity or loss of transparency from incorporating an eight year transition period instead of a zero

[11] Note that the reporting that *ROE* = 15.33% plays no part in the computations that underpin this table. It is an outcome of the AER's assumptions that long-term growth = 4.60% and the dividend payout ratio = 70%, that is, *ROE* = $g \div RR$ = 0.046 ÷ 0.300 = 15.33%. This issue is discussed in Sub-Section 5.2 (pp.12–15).

year transition period. This is not introducing *more* assumptions to be made, just an alternative set of assumption which is more consistent with the AER's view that long-term growth is gradually eroded to 1% below GDP growth.

Table 2. Growth gradually reverts to a long-term value over years 3 to 10

Year	BVPS	EPS	DPSC	DPSI	CF	PV	EPS *g*	**DPS *g***	DPR	ROE	Price	B/P	P/E_1
0											1.000		
1			0.050	0.061	0.061	0.055					1.058		
2			0.055	0.067	0.067	0.054		**0.096**			1.116		
3			0.060	0.073	0.073	0.052		**0.090**			1.175		
4			0.065	0.079	0.079	0.051		**0.083**			1.236		
5			0.070	0.085	0.085	0.049		**0.077**			1.297		
6			0.075	0.091	0.091	0.047		**0.071**			1.360		
7			0.079	0.097	0.097	0.044		**0.065**			1.424		
8			0.084	0.103	0.103	0.042		**0.058**			1.490		
9			0.088	0.108	0.108	0.039		**0.052**			1.558		
10			0.093	0.113	1.744	0.568		**0.046**			1.630		
Long-term growth = 4.60%; Long-term ROE = 15.33%; Cost of equity = 11.87%													

BVPS = Book value per share. DPSC = Cash dividends per share, computed as cash dividends per share in the previous year multiplied by 1 + the estimated growth rate. DPSI = dividends per share including imputation benefit according to AER assumptions about the benefits of imputation credits, computed as cash dividends per share × 1.225. CF = cash flow including imputation benefits, which is equal to dividends per share including imputation benefits, plus in the 10th year, the present value of expected future dividends computed as DPSI × $(1 + g)/(r_e - g)$. PV = present value of cash flow including imputation benefits, computed as $CF/(1 + r_e)^t$. EPS *g* = earnings per share growth. DPS *g* = DPS growth, computed as dividends per share dividend by dividends per share in the previous year minus one. DPR = dividend payout ratio, computed as dividends per share /dividend by earnings per share. *ROE* = return on equity. Price = present value of expected dividends including imputation benefits over time. B/P = book value per share divided by price. P/E_1 = price-earnings ratio, computed as price dividend by next year's earnings per share.

3.3 Implication

We recommend that the AER incorporate an eight year transition period over which parameter inputs gradually revert to long-term estimates. The current version of the AER's dividend discount model equation assumes a transition period of zero years. In the AER's version of the dividend discount model, there is only one parameter input in question, the growth rate of dividends. So the specific application would be for growth to revert to the long-term estimated value over forecast year three to year ten. Regardless of the period over which initial inputs transition to long-term estimates, or the process by which this occurs (equal increments, exponential decline, or something else) in the dividend discount model there will always be an assumption about dividends in every forecast year. So it is not a matter of the AER needing to make an extra assumption. It is a matter of the AER making an assumption that is most likely to represent the market's expectations for future dividends.

4. Share price versus price target

4.1 Australian Energy Regulator

In estimating the cost of equity from the dividend discount model, using the AER's equation presented below, we need to populate the following inputs – Dividend forecasts over years 1 and 2 (D_1 and D_2), price *(P)* and long-term growth *(g)*. Given these inputs we can estimate the cost of equity as the discount rate that sets the present value of dividends equal to price.

$$P = \frac{D_1}{(1+r_e)^1} + \frac{D_2}{(1+r_e)^2} + \frac{D_2 \times (1+g)}{(r_e - g) \times (1+r_e)^2} = \sum_{t=1}^{2} \frac{D_t}{(1+r_e)^t} + \frac{D_2 \times (1+g)}{(r_e - g)(1+r_e)^2}$$

In applying this equation the AER uses the market price as its estimate of price,[12] and consensus (that is, average) dividend forecasts from equity analysts as its estimates of D_1 and D_2.[13] The estimate of long-term growth *(g)* is held constant at 4.6%. This estimate is 1.0% below an estimate of long-term economic growth of 5.6%.[14] Growth assumptions are not considered in this sub-section. We consider growth assumptions in the following sub-section. In this section we focus on the use of share prices versus price targets for analysis.

4.2 Alternative approach

The alternative estimation techniques and assumptions we incorporated differed on two grounds that can be considered separately. We used analyst price targets (rather than market prices), and we based our primarily conclusions on individual analyst forecasts (rather than consensus forecasts). We also presented a full suite of results formed on the basis of consensus forecasts.

We submitted that an appropriate price input was the analyst's price target, because this is more likely to reflect an individual analyst's expectations for dividends. For example, if one analyst has a dividend forecast next year of $0.08 and another analyst has a dividend forecast of $0.06, the first analyst is likely to have the higher price target. For the purposes of the example, suppose that analyst one had a price target of $1.60 and analyst two had a price target of $1.00, and the share price was $1.20. The consensus dividend forecast is $0.07 and the consensus price target is $1.30.

When consensus dividend forecasts are used, the use of the market price instead of the price target is less of a concern than when individual analyst forecasts are used. To illustrate with the example, suppose we used a constant growth rate of 4.6% for both analysts. Using price targets, the estimated cost of equity is 9.6% for analyst one, and 10.6% for analyst two.[15] If, instead, the share price was used to estimate the cost of equity, we would have estimates of 11.3% for analyst one and 9.6% for analyst two.[16] So mixing the share price and an individual analyst's dividend forecasts in the one equation increases the dispersion in the estimated cost of equity estimates across the analysts.

If, however, the analysis was based upon consensus forecasts, we still recommend the use of consensus price targets rather than the share price. But this will be less problematic than when individual analyst forecasts are used. In the example presented here, the cost of equity implied by the consensus dividend

[12] In the Explanatory Statement, the AER made no comment on the use of price targets instead of share prices.
[13] AER Explanatory Statement, Sub-section H.2 (pp.220–221).
[14] AER Explanatory Statement, Sub-section H.2 (p.221).
[15] For analyst one, the cost of equity estimate using price targets is $0.08 ÷ $1.60 + 0.046 = 0.050 + 0.046 = 9.6%. For analyst two, the cost of equity estimate using price targets is $0.06 ÷ $1.00 + 0.046 = 0.060 + 0.046 = 10.6%.
[16] For analyst one, the cost of equity estimate using the share price is $0.08 ÷ $1.20 + 0.046 = 0.067 + 0.046 = 11.3%. For analyst two, the cost of equity estimate using price targets is $0.06 ÷ $1.20 + 0.046 = 0.050 + 0.046 = 9.6%.

forecast and the consensus price target is 10.0%, and the cost of equity implied by consensus dividend forecasts and the share price is 10.4%.[17]

4.3 Implication

We recommend that the AER use price targets in its analysis, rather than share prices, because there is more likely to be a reliable relationship between the analyst's earnings forecasts, dividend forecasts and price target, compared to the relationship with share prices. Implementing the analysis with price targets is no more complex than implementing the analysis with share prices. It is simply a matter of using a different price input. If analysis is conducted with consensus forecasts, this issue is less problematic than if the analysis is conducted with respect to individual analyst forecasts.

With respect to individual analyst forecasts, recall that we compiled results derived from both consensus forecasts and individual analyst forecasts. What this was intended to convey was that the overall conclusions weren't unduly affected by this choice, but that there was a reduction in dispersion of cost of equity estimates when individual forecasts were used. The only difference in performing the analysis is the number of computations to be performed. Each individual estimate is done in exactly the same way, regardless of whether we use 4,000 consensus forecasts, or 40,000 individual forecasts. So if it is useful to reduce the dispersion of outcomes merely by performing more computations, we recommend that this should be adopted. We would note, however, that combining individual analyst earnings and dividend forecasts with share prices, rather than target prices, could lead to more dispersion of outcomes.

[17] The cost of equity computed estimate using the consensus dividend forecast and the consensus price target is \$0.07 ÷ \$1.30 + 0.046 = 0.054 + 0.046 = 10.0%. The cost of equity estimate using the consensus dividend forecast and the share price is \$0.07 ÷ \$1.20 + 0.046 = 0.058 + 0.046 = 10.4%.

5. Estimation of long-term growth

5.1 Australian Energy Regulator

In this section we focus on the estimation of long-term growth. Recall from the previous section, that, in estimating the cost of equity from the dividend discount model, using the AER's equation presented below, we need to populate the following inputs – Dividend forecasts over years 1 and 2 (D_1 and D_2), price *(P)* and long-term growth *(g)*. Given these inputs we can estimate the cost of equity as the discount rate that sets the present value of dividends equal to price.

$$P = \frac{D_1}{(1+r_e)^1} + \frac{D_2}{(1+r_e)^2} + \frac{D_2 \times (1+g)}{(r_e - g) \times (1+r_e)^2} = \sum_{t=1}^{2} \frac{D_t}{(1+r_e)^t} + \frac{D_2 \times (1+g)}{(r_e - g)(1+r_e)^2}$$

In applying this equation the AER uses the market price as its estimate of price, consensus (that is, average) dividend forecasts from equity analysts as its estimates of D_1 and D_2. The estimate of long-term growth *(g)* is held constant at 4.6%. This estimate is 1.0% below an estimate of long-term economic growth of 5.6%.

5.2 Alternative approach

The AER has elected to estimate growth as a constant number, based upon an estimate of historical average real GDP growth, plus current estimates of inflation to estimate nominal growth, less 1%.[18] The 1% reduction is based on the view that current listed firms will have lower growth than other businesses that comprise the overall economy. In compiling this report we have not been engaged to enter into a debate about the correct *level* of long-term growth. The basis for the approach we put forward previously was that imposing a constant growth rate, without reference to the share price, earnings forecasts and dividend forecasts, does not make sense. It assumes that share price movements do not reflect any changes in estimates of long-term growth. This is exacerbated by the short explicit forecast period of two years adopted by the AER. Even if we make the assumption that long-term growth estimates are stable, it is doubtful that the market makes an assumption that an explicit forecast period of just two years is a reasonable period to return to this expectation.

The alternative view we put forward was that growth is determined by two sources – reinvestment of earnings and the issue of new shares. If there are no new shares issued, growth can be estimated as the product of the reinvestment rate and the expected return on equity on those new investments, that is, $g = RR \times ROE$. This is just a mathematical result of some basic accounting and finance assumptions. The reinvestment rate is the proportion of earnings per share not distributed as dividends. So, for example, if earnings per share was $0.07 and dividends per share was $0.05, the dividend payout ratio is 71% and the reinvestment rate is 29%. The reinvestment into the firm is $0.02. If this reinvestment manages to earn a return of, say, 20%, earnings per share will increase by $0.004 (that is $0.02 of investment times return of 20% = $0.004). The result is earnings per share next year of $0.074. Earnings per share has grown by 5.7%, which is the same as $RR \times ROE = 0.29 \times 0.20 = 5.7\%$.

Some firms grow from the issue of new shares as well as the reinvestment of dividends. In this case the equation for growth is a little more complicated, and is given by the equation below, in which C is the percentage of new shares issued, and P/E_1 is the price/earnings ratio, expressed relative to year one earnings per share. If there are no new shares issued ($C = 0$) the equation collapses to simply $g = RR \times ROE$.

[18] AER Explanatory Statement, Sub-section H.2 (p.221).

$$g = \frac{(1 + RR \times ROE)/(1 + C)}{1 - \frac{C}{1+C} \times \frac{P}{E_1} \times ROE} - 1$$

In this sub-section, we set aside the concern over growth from new share issuance. This issue is discussed in the appendix. We first want to handle the simpler case in which growth is funded only from the reinvestment of earnings. So all we are concerned about at present is the straightforward equation that $g = RR \times ROE$.

We can now directly address the issue of whether growth should be estimated as a constant input, or as a product of the reinvestment rate and the return on equity. According to the AER's assumptions for the market cost of equity, it is already making an implicit assumption about these inputs. There is an assumption that the dividend payout ratio is approximately 70%.[19] So the reinvestment rate is approximately 30%. If growth is assumed to be 4.6%, the assumed *ROE* is therefore 15.3%. That is, $ROE = g \div RR = 0.046 \div 0.30 = 15.3\%$.

This *ROE* estimate of 15.3% is below the average long-term *ROE* estimates we reported. Across all 4,567 individual firm observations we reported a long-term average *ROE* estimate of 18.1% and across each half-year period we reported a long-term average *ROE* estimate of 19.3%. It should be mentioned that our average estimates over time were growth of 5.7% and *ROE* of 19.3%, which together imply a long-term reinvestment rate of 30%. So our estimated long-term reinvestment rate is consistent with the AER's assumption, and our long-term growth rate estimate is consistent with the AER's estimate of long-term growth in the economy.

The difference between the two approaches is that we jointly estimate the rate of growth and return on equity, whereas the AER makes a growth rate assumption as a constant *input*. The criteria we used to make an estimate of long-term growth is relatively straightforward. We input different possible values for r_e, g and *ROE* into the pricing equation, and keep the combinations which set the present value of expected dividends to within 1% of the share price. These are what we call unbiased inputs because the valuation is neither too high nor too low compared to the share price. Then within these sets of unbiased parameter inputs we choose the combination that allows the smoothest transition to long-term growth. Some unbiased combinations only fit the data if growth is really high for ten years, and then collapses to a low value thereafter. Other combinations result in high growth for a few years, negative growth for a few years, and then a rebound to long-term growth. We put forward the case that expectations would most likely be for a gradual transition to long-term growth, such that growth rates don't switch from positive to negative and positive again, and that growth by the end of year ten is close to the long-term growth estimate.

We can illustrate this process with an extension to the example referred to in Section 3. The dividend forecasts in years one and two are \$0.0500 (plus imputation benefits) and \$0.0548 (plus imputation benefits). Suppose that earnings per share forecasts are \$0.0800 in year one and \$0.0830 in year two, and that the book value of equity is currently \$0.4000.

In the analysis presented in Section 3 we simply imposed a growth assumption of 4.6% from year ten onwards, and gradually shifted towards long-term growth in equal amounts over eight years. The estimated cost of equity was 11.87%. Now, all we will do is separately input an assumption for the reinvestment rate and return on equity, and gradually shift both of those input assumptions at the same time, towards long-term estimates.

[19] AER Explanatory Statement, Sub-section 8.2 (p.1119)

The return on equity in year one is projected to be 20.0% (*EPS* ÷ Book value per share = \$0.080 ÷ \$0.400 = 20.0%). The return on equity in year two is projected to be 19.3% (*EPS* ÷ Book value per share = \$0.083 ÷ \$0.430 = 19.3%; the book value increases by \$0.030 because in the first year there is EPS of \$0.080 but only \$0.050 is distributed as a dividend). The reinvestment rate is 37.5% in year one and 34.0% in year two.

If we estimate long-term growth of 4.60% and a return on equity of 18.4%, this implies a long-term reinvestment rate of 25.0%. So if we gradually shift return on equity from 19.3% to 18.4%, and gradually shift the reinvestment rate from 37.5% to 25.0%, we can project a series of earnings and dividends over the forecast period.

This part involves very little difference in assumptions to what is already incorporated. At present, over forecast year three to year ten, the AER assumes growth of 4.60%, and a reinvestment rate of 30%, which implicitly assumes a return on equity of 15.3%. In a transition period all we suggest is that the reinvestment rate gradually change toward the long-term assumption. This can be managed by adding eight rows to an Excel spreadsheet. With this small change, the estimated cost of equity in the example would be 11.82%.

However, we can make the estimate more precise by considering alternative estimates for *g* and *ROE*. There are alternative estimates for growth which the market could well be incorporating into the share price, and which have a smoother profile of growth in earnings per share. In the example presented above, growth in earnings per share would be projected to be 5.94% in forecast year three, decline to 4.20% by year ten, and then revert back to 4.60% thereafter. We suggest that the market will incorporate growth expectations which are smoother than projected here. So we used a criteria which said that the present value of expected dividends should be within 1% of the price, which had the closest ratio of year ten growth to long-term growth, and which did not allow changes in growth over time to switch from negative to positive or vice versa. The possible inputs were selected from within a very wide range as documented in our earlier report.

Applying this criteria to the example, the estimated cost of equity is 12.02%, the estimated long-term growth is 4.59% and the estimated long-term *ROE* is 18.95%, as illustrated in the equation below.

$$P = \frac{D_1}{(1+r_e)^1} + \frac{D_2}{(1+r_e)^2} + \frac{D_2 \times (1+g)}{(r_e - g) \times (1+r_e)^{10}}$$

$$P = \frac{\$0.0500 \times 1.225}{(1.1202)^1} + \frac{\$0.0548 \times 1.225}{(1.1202)^2} + \cdots + \frac{\$0.0962 \times 1.225 \times (1.0459)}{(0.1187 - 0.0459) \times (1.1202)^{10}}$$

$$P = \frac{\$0.0613}{1.1202} + \frac{\$0.0671}{1.2548} + \cdots + \frac{\$0.1178}{0.2313}$$

$$P = \$0.0547 + \$0.0535 + \cdots + \$0.5706$$

$$P = \$1.0000$$

You will note that in this example we were able to determine exact estimates of the cost of equity (12.02%), long-term growth (4.59%) and return on equity (18.95%), as opposed to rounding to the nearest percentage point. This was because we were just solving the equation for an individual case and not for thousands of cases. The reason we use increments of 1% in our large-sample analysis is because of the computation requirements of analysing the entire database of individual analyst forecasts. Across a very large sample, using increments of 1% for the analysis is unlikely to make a material difference to conclusions based upon average estimates.

Table 3. Joint estimation of growth, cost of equity and return on equity

Year	BVPS	EPS	DPSC	DPSI	CF	PV	EPS g	DPS g	**DPR**	**ROE**	Price	B/P	P/E_1
0	0.400										1.000	0.400	12.5
1	0.430	0.080	0.050	0.061	0.061	0.055			**0.625**	**0.200**	1.059	0.406	12.8
2	0.458	0.083	0.055	0.067	0.067	0.053	0.038	0.096	**0.660**	**0.193**	1.119	0.409	12.7
3	0.487	0.088	0.059	0.073	0.073	0.052	0.063	0.083	**0.672**	**0.193**	1.181	0.412	12.6
4	0.517	0.094	0.064	0.078	0.078	0.050	0.061	0.080	**0.685**	**0.192**	1.244	0.415	12.6
5	0.547	0.099	0.069	0.085	0.085	0.048	0.058	0.077	**0.697**	**0.192**	1.309	0.417	12.5
6	0.577	0.105	0.074	0.091	0.091	0.046	0.056	0.074	**0.709**	**0.191**	1.376	0.419	12.5
7	0.608	0.110	0.079	0.097	0.097	0.044	0.053	0.071	**0.721**	**0.191**	1.444	0.421	12.5
8	0.639	0.116	0.085	0.104	0.104	0.042	0.051	0.069	**0.734**	**0.190**	1.514	0.422	12.5
9	0.669	0.121	0.090	0.111	0.111	0.040	0.048	0.066	**0.746**	**0.190**	1.585	0.422	12.5
10	0.700	0.127	0.096	0.118	1.775	0.571	0.046	0.063	**0.758**	**0.190**	1.657	0.422	12.5

Long-term growth = 4.59%; Long-term ROE = 18.95%; Cost of equity = 12.02%

BVPS = Book value per share, computed as book value per share in the previous year + earnings per share – dividends per share. EPS = earnings per share, computes as book value per share in the previous year × return on equity. DPSC = Cash dividends per share, computed as earnings per share × dividend payout ratio. DPSI = dividends per share including imputation benefit according to AER assumptions about the benefits of imputation credits, computed as cash dividends per share × 1.225. CF = cash flow including imputation benefits, which is equal to dividends per share including imputation benefits, plus in the 10th year, the present value of expected future dividends computed as DPSI × $(1 + g)/(r_e - g)$. PV = present value of cash flow including imputation benefits, computed as $CF/(1 + r_e)^t$. EPS g = earnings per share growth, computed as earnings per share dividend by earnings per share in the previous year minus one. DPS g = DPS growth, computed as dividends per share dividend by dividends per share in the previous year minus one. DPR = dividend payout ratio, computed as dividends per share /dividend by earnings per share. *ROE* = return on equity – for two years *ROE* is computed as EPS dividend by the previous book value per share; in subsequent years *ROE* declines from the year two input to a long-term input in equal increments each year. Price = present value of expected dividends including imputation benefits over time. B/P = book value per share divided by price. P/E_1 = price-earnings ratio, computed as price dividend by next year's earnings per share.

In Table 3 we continue our example, but have now completely populated the table. The only changes made to populate this table were an input of initial book value per share, and earnings per share projections over forecast years one and two, and the assumptions that dividend payout ratio and *ROE* gradually shift towards long-term inputs over time. We have highlighted this gradual shift in the dividend payout ratio and *ROE*. The inputs of book value per share, and *EPS* forecasts over years one and two are available from the same sources that dividend per share forecasts are obtained. All other parts of the table flow are straightforward computations that flow directly from these initial inputs.

5.3 Implication

In the previous sub-sections we illustrated the outcomes from three alternative ways of estimating the cost of equity. The first method invokes an assumption that growth is constant at a given value from year three onwards. The second method invokes an assumption that growth gradually reverts to its long-term value over year three to year ten. The third method invokes assumptions that (1) the reinvestment rate and the return on equity revert to long-term values over year three to year ten, and (2) the estimates for g, *ROE* and r_e are those that don't allow growth to reverse course over ten years, and which mean that year ten growth is closest to long-term growth.

We recommend that the AER estimate growth as the product of a reinvestment rate and return on equity. At present, the AER already makes an implicit assumption about these inputs. Further, the AER assumes that the share price tells us nothing about prospects for growth outside of the first two forecast years. All we propose is that the AER solve for the inputs which allow growth to be estimated simultaneously with the return on equity, and have provided a useful method for this simultaneous estimation.

6. Timing of price inputs and analyst forecast inputs

6.1 Australian Energy Regulator

In implementing its analysis, the AER matches the share price each day with the consensus dividend forecasts from Bloomberg.[20] The consensus dividend forecasts have been input into the database by analysts in previous days, weeks or months. So the consensus dividend forecasts represent the views of equity analysts that have been input into the database in the past.

6.2 Alternative approach

In our analysis we compiled a set of individual analyst earnings per share and dividend per share forecasts and aligned those forecasts with prices which appeared on the same day, or close to the same day. On average there was a 1.2 day difference between the input of the dividend and earnings forecast, and the day the price target was input, and we only allowed cases in which this gap was 28 days or less. In the vast majority of cases the dividend and earnings forecasts were entered on the same day as the price target.

This is relevant because the timing mis-match between prices and earnings and dividend forecasts into the database is one likely reason why the AER's estimates of the cost of equity are more volatile than our estimates over time. It also has nothing to do with our use of price targets rather than market prices. The important issue discussed here is the timing of the earnings and dividend forecasts with the timing of the share price used in compiling the analysis. If you combine some stale earnings and dividend forecasts with current prices, the volatility of cost of equity estimates will increase. This is also the reason why the Bloomberg estimates of the cost of equity over time are more volatile than our estimates of the cost of equity over time.

We can illustrate this point with an example. On the 1st of January, the share price is $1.00. Analyst Jack believes this is a fair price, based upon his dividend forecast of $0.05 next year. Jack also believes that the cost of equity is 10% and dividends will grow at 5% per year forever. So the present value of expected dividends is $1.00. Analyst Jill has a different view. She believes dividends will be $0.06 next year, she also projects growth of 5% per year forever but she also thinks the share price of $1.00 is fair because she has a cost of equity estimate of 11%.

The summary of the case on the 1st of January is presented in the left-hand section of Table 4. It shows that if we estimate the cost of equity using the consensus forecasts, the cost of equity estimate is 10.5%. This is also the average of the cost of equity estimates from the individual analyst forecasts, of 10.0% and 11.0%. The problem with stale earnings and dividend forecasts arises because analysts do not update their forecasts on a continuous basis, but share prices are continually changing. Share price changes reflect both changes in investors' expectations for dividends and changes in the cost of capital. If we combine stale dividend forecasts with current prices (and remember, it does not matter whether we are talking about share prices or price targets) then we will attribute too much of the change in share prices to changes in the discount rate, and too little to changes in expectations for dividends. This means that we will over-estimate the true variation in the cost of equity.

[20] AER Explanatory Statement, Sub-section H.3 (p.222).

Table 4. Illustration of the mis-match between price dates and earnings dates

	1 January (Price = $1.00)			1 February (Price = $1.20)		
Analyst	*DPS*	*g*	r_e implied by share price, DPS and *g*	*DPS*	*g*	r_e implied by share price, DPS and *g*
Jack	0.050	0.050	0.100	0.050	0.050	0.092
Jill	0.060	0.050	0.110	0.072	0.050	0.110
Consensus	0.055	0.050	0.105	0.061	0.050	0.101

Suppose in our example Jack does not update his dividend projections for a month, so on the 1st of February the database says that Jack is still projecting dividends of $0.05 next year. He may be assuming dividends of something else, but has not made a formal change to the forecast in the database, or he may still believe that a dividend forecast of $0.05 is correct. We cannot measure this directly but the longer the time since the forecast was updated, the less chance it reflects his true expectation. This is not a criticism of the analyst, just a reflection that the analyst will make a trade-off between timeliness of updating forecasts, and the benefits of performing other tasks. Jill updates her forecast of dividends to $0.072. The share price has risen to $1.20 over the course of the month.

Under these inputs, the consensus dividend forecast is $0.061, which implies a consensus dividend yield of 5.1%, based upon the share price of $1.20. Adding a growth rate of 5.0% would imply that the cost of equity had fallen from 10.5% to 10.1%. But this overstates the change in the cost of equity, because it only *looks* like the cost of equity has fallen because Jack did not update his dividend forecast. According to Jane's timely estimate, the cost of equity is unchanged.

A more appropriate way to perform the analysis is to only retain analyst forecasts which are made at a point in time reasonably close to the price date (regardless of whether that price is a market price or a price target). In the example presented here, Jack's dividend estimate at the 1st of February would be discarded because it was entered into the database a month prior to measuring the price.

6.3 Implication

We contend that an important reason why our cost of equity estimates over time are more stable than those compiled by the AER and by Bloomberg is that we closely match the date at which analysts enter their dividend and earnings forecasts into the database, with the date used to measure prices. If consensus estimates are to be relied upon, a matched dataset can be compiled with price targets or share prices, and then averages computed to generate a set of consensus forecasts for each company over time.

This is purely a data compilation exercise and does not involve any complicated mathematics. The AER has commented that stability in the cost of equity over time is appealing to both investors and consumers.[21] Given the increase in stability that is likely to result from this date matching, we recommend that the AER implement this technique. It can be done independently of any other methodological choices made in the implementation of the dividend discount model.

[21] AER Explanatory Statement, Sub-section H.3 (p.224).

7. Cost of equity estimates for the benchmark firm

7.1 Australian Energy Regulator

The AER has reached a decision that dividend discount model estimates will only be used to estimate the market cost of equity and the market risk premium, and not to estimate the cost of equity for a network businesses.[22]

7.2 Alternative approach

7.2.1 AER concerns with the dividend discount model

The first concern raised by the AER is over sample size. In particular the AER (2013) states that (p.222):

> Given the strong assumptions made by DGM, we potentially have a concern about forming a benchmark estimate of the return on equity based upon the data of five businesses. In contrast, the DGM estimate of the return on equity for the market, which is based on the S&P/ASX 200 index, draws on information about the prices and expected dividends of 200 companies. In the United States, when DGM estimates are calculated for energy infrastructure proxy groups, there are often more than five businesses in the proxy group.

At the outset it should be noted that the sample firms are exactly the same firms the AER has previously relied upon to perform a regression-based estimate of beta for implementation into the CAPM.[23] So the AER is making the assumption that a sample of five businesses is sufficiently large to estimate the cost of equity using the CAPM and a regression-based estimate of beta, but a sample size of five firms is not large enough to estimate the cost of equity using the dividend discount model.

Both the CAPM and the dividend discount model provide *estimates* of the cost of equity. The challenge in determining the reliability of each cost of capital estimate is that we are unable to observe the true cost of equity, so we are in the position of comparing one estimate with another. However, the AER has identified stability of the cost of equity as an important concern.[24] We were aware of this concern, so performed analysis to determine whether the cost of equity estimates we compiled for individual firms exhibited more or less dispersion that what we typically observe with regression-based estimates of beta. We reported that our firm-level estimates exhibited less dispersion than typically observed in regression-based estimates of beta (SFG Consulting, 2013a, pp.18–19). This implies that the AER should have no more confidence in regression-based estimates of beta to estimate the cost of equity in small samples, than in dividend discount model estimates, *provided appropriate methodological choices are taken to generate reliable dividend discount model estimates,* as documented in earlier sections. We discuss this issue in more detail in subsequent sub-sections.

The key point is that researchers and analysts make assumptions about the process by which dividend expectations are incorporated into dividend discount model analysis. They are not "strong assumptions made by DGM." The only assumption that is implicit in the dividend discount model is that price is the present value of expected future dividends. If a set of assumptions lead to unreliable outcomes then

[22] AER Explanatory Statement, Sub-section 5.3.2 (p.62).

[23] In the Explanatory Statement the AER states that it will consider the use of international comparable firms for estimating systematic risk. (Sub-section G.3.1, p.216). However, the AER has requested an update of the beta estimates from regression analysis that were compiled prior to the 2009 review of the weighted average cost of capital, and this update does not include any computation of beta estimates for international listed firms (p.5).

[24] AER Explanatory Statement, Sub-section 5.4.2 (pp.68–69) which is devoted entirely to stability in the return on equity, Sub-section G.3.2 (p.217) in which the AER notes the "importance of regulatory stability," and Sub-section H.3 (p.234) in which the AER states that "[b]oth service providers and customers have a preference, all else equal, for greater stability in the estimated return on equity."

those assumptions could be addressed. The AER was not constrained to implement a particular set of assumptions used to compile data and forecast dividends.

The second concern of the AER is that its estimates for listed energy networks were simply too high to be plausible. The AER states that the dividend discount model estimates (emphasis added, p.224):

> fail a basic "sanity check": for each of the five infrastructure businesses, the average return on equity over the period is more than 400 basis points higher than the average return on equity for the market. Given the **stylized fact** that the systematic risk of such infrastructure businesses is not in excess of the systematic risk of the market, DGM estimates for the five infrastructure businesses are not plausible.

In the highlighted section of this quote, the AER states its view that it is simply not plausible for the benchmark energy network to have an equity beta above one, despite taking on leverage of 60% (AER, 2013, p.177). It is an empirical question as to whether the combination of below average cash flow risk and above average financial risk leads to a cost of equity which is below the market return, equal to the market return, or above the market return.

The first problem with the AER's rationale is that the consideration given to dividend discount model estimates appears to be contingent upon the magnitude of those estimates. All cost of capital estimates, whether computed using the dividend discount model or otherwise, can be considered an evaluation of whether the cost of equity is more or less than the cost of equity for the market. The statement of the AER suggests that, if the cost of equity estimates for network businesses were equal to or below the market return, they would be given consideration, but if they are above the market return they are implausibly high. We do not see how it is possible to perform a measurement of the cost of capital if that measurement is only going to be accepted if it accords with a pre-determined view.

The second problem with the AER's rationale is that the cost of equity estimates it derived resulted from the very methodology and assumptions adopted by the AER. The AER adopted an approach that is considered to be an appropriate trade-off between reliability, simplicity and transparency. Then it observed a result that it considered by be unreliable. Having observed what it considered to be an anomaly it made no adjustments whatsoever to its method with the intent of increasing the reliability of those estimates. This is despite being presented with the estimation techniques we put forward that were specifically designed to increase the reliability of cost of equity estimates. An alternative approach would have been to implement some or all of the estimation techniques presented to the AER, or at least give consideration in the Draft Guideline to results based upon more detailed analysis.

The third concern of the AER is that the dividend discount model estimates for listed networks are unreasonably variable over time (AER, 2013, Figure H.9, p.223). There is a far greater increase in the cost of equity for listed network businesses in 2008 and 2009 than for the broader market. Again, this outcome is a direct result of the methodology implemented by the AER, which is to assume a constant growth rate in dividends from just year three onwards, estimated irrespective of price, earnings and dividends. The time series outcome for listed energy networks reported by the AER was a signal that there was a limitation to its estimation techniques and assumptions, yet there has been no adjustment to those estimation techniques and assumptions.

We acknowledge that dividend discount model approaches to estimating the cost of equity can be improved upon, and our approach is no exception. In subsequent analysis we could make further refinements to our estimation technique in order to increase the reliability of the estimates. We also acknowledge the need to rely upon samples that are sufficiently large enough to mitigate the noise associated with the combination of an estimation process that needs to be applied consistently across firms and unusual inputs from sample data. Where we take issue with the AER's consideration of dividend discount model estimates is that it adopted a process that generated what it considered to be

anomalous results, made no changes to its process that might have addresses this anomaly, and then ignored a process that did not lead to anomalous results. The application of our alternative approach to listed energy networks is presented below.

7.2.2 AER concerns mitigated by specific estimation techniques and assumptions

In our original report, we compiled estimates of the cost of equity for nine listed network businesses that were previously used by the AER in performing comparable firm analysis. The table below appears in Sub-section 4.4 (p.28) of our original report. For each six month period it shows the average market cost of equity (Column 3) and the average cost of equity for a listed network business (Column 4). We then report the risk-free rate (Column 5) and the market cost of equity and average cost of equity for a network business as a risk premium, relative to the firm-free rate (Columns 6 and 7). We refer to this relative risk premium as a risk premium ratio and report this in Column 9.

The figure that appears in Table 5 from which we draw conclusions is reported in the last row and is 0.96. This is the equal-weighted average of the risk premium ratio for all 85 observations in which we were able to compute a cost of equity estimate for a listed energy network. The reason we rely upon this figure to draw conclusions is because we want to draw conclusions from a sufficiently large sample to mitigate estimation error. The objective is to make a timely estimate of the cost of equity for a network business. However, if we rely upon only the most recent six month period to derive an estimate of the cost of equity, this will be influenced too heavily by noise in the data.

The implication is that, on average, the risk premium for a listed energy network is 96% of the market risk premium. To illustrate how this impacts upon the cost of equity estimate for a listed energy network over time, in the last two columns we report the "time series network risk premium" and the "time series network cost of equity." The time series network risk premium is the figure of 0.96 multiplied by the estimate of the market risk premium from Column 6. For example, in the second half of 2012, the market risk premium was estimated at 7.9%, which implies a network risk premium of 7.6% (that is, $0.96 \times 0.079 = 7.6\%$). In the last column we report the cost of equity estimate for a network business if we add the risk-free rate to the time series network risk premium. For example, in the second half of 2012, we add 3.1% and 7.6% to report a figure of 10.7%.

The AER identified three concerns with its dividend discount model estimates of the cost of equity for listed networks: (1) potential error associated with a small sample of firms; (2) instability of estimates over time; and (3) the magnitude of cost of equity estimates in comparison to the estimate of the market return. We address each of these issues in turn.

Table 5. Estimation of the cost of equity for a network business over time (%)

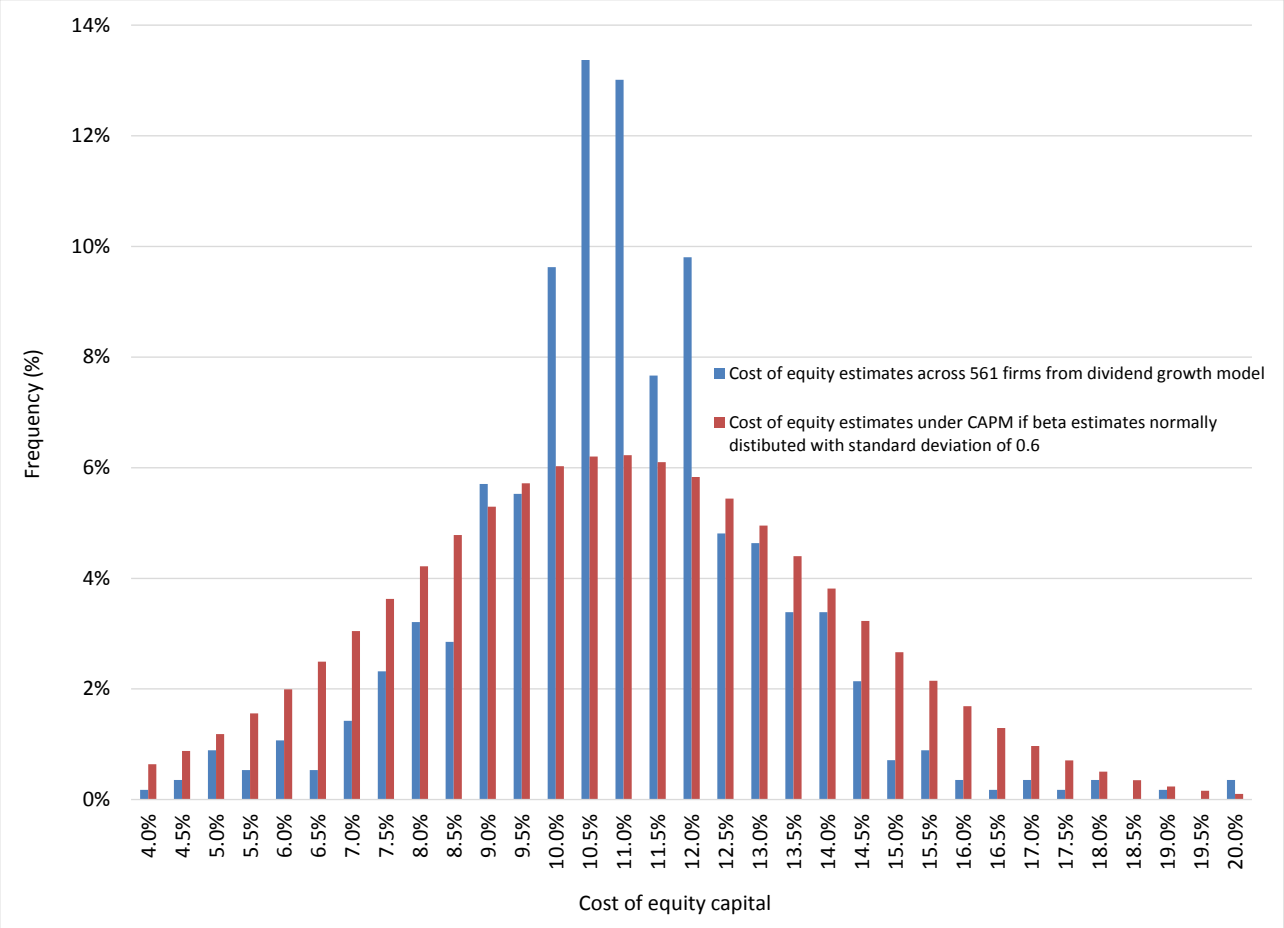
Period	N	Market cost of equity	Network cost of equity	Risk-free rate	Market risk premium	Network risk premium	Risk premium ratio	Time series network risk premium	Time series network cost of equity
2H02	2	10.3	11.1	5.6	4.7	5.5	1.19	4.5	10.1
1H03	1	10.0	12.0	5.1	4.8	6.9	1.41	4.6	9.8
2H03	2	10.3	11.5	5.6	4.7	5.9	1.26	4.5	10.1
1H04	3	10.8	9.8	5.7	5.1	4.1	0.81	4.9	10.6
2H04	3	10.8	9.3	5.5	5.3	3.8	0.72	5.1	10.5
1H05	2	10.6	10.8	5.4	5.2	5.4	1.04	5.0	10.3
2H05	2	10.6	10.0	5.3	5.3	4.7	0.89	5.1	10.4
1H06	3	9.7	8.7	5.5	4.2	3.2	0.75	4.1	9.5
2H06	5	10.2	10.2	5.7	4.5	4.5	0.98	4.4	10.1
1H07	3	10.2	10.4	5.9	4.3	4.5	1.07	4.1	10.0
2H07	4	10.2	9.9	6.1	4.1	3.8	0.93	4.0	10.0
1H08	4	10.5	11.1	6.3	4.3	4.9	1.14	4.1	10.4
2H08	5	10.7	10.4	5.4	5.3	5.0	0.94	5.1	10.5
1H09	6	11.3	10.4	4.6	6.7	5.8	0.87	6.4	11.1
2H09	6	10.6	10.2	5.5	5.2	4.7	0.91	5.0	10.4
1H10	5	10.5	10.1	5.5	5.0	4.6	0.92	4.8	10.3
2H10	5	10.8	10.9	5.2	5.7	5.7	1.01	5.4	10.6
1H11	6	10.7	11.2	5.4	5.3	5.7	1.09	5.1	10.5
2H11	6	11.1	9.9	4.3	6.8	5.6	0.82	6.5	10.8
1H12	6	11.2	11.3	3.7	7.6	7.6	1.00	7.3	10.9
2H12	6	11.0	10.5	3.1	7.9	7.4	0.93	7.6	10.7
Average	4	10.6	10.5	5.3	5.3	5.2	0.99	5.1	10.4
2H02-1H08	3	10.3	10.4	5.6	4.7	4.8	1.02	4.5	10.1
2H08-2H12	6	10.9	10.5	4.7	6.2	5.8	0.94	5.9	10.6
All		Average risk premium ratio across all 85 network cases					0.96		

With respect to the concern over sample size, as mentioned above, this same concern can be levelled at cost of equity estimates determined with respect to the CAPM, populated with regression-based estimates of beta. One way to assess the potential impact of this problem is to estimate the variation in cost of equity estimates across firms from the two estimation techniques. In our original report, we presented this analysis in Sub-section 4.2.1. In the figure below we reproduce Figure 1 from our original report which illustrates the dispersion in cost of equity estimates across firms from the dividend growth model compared to what we would observe if regression-based beta estimates were incorporated into the CAPM. The standard deviation of beta estimates used in the figure is 0.6[25] and the assumed market risk premium is 6%.[26] The figure illustrates that the CAPM, if populated with regression-based estimates of beta, is likely to lead to individual firm cost of equity estimates that have more dispersion than dividend discount model estimates, computed using our technique.

[25] In the report *The Vasicek adjustment to beta estimates in the Capital Asset Pricing Model* by Gray, Hall, Brooks and Diamond (2013) we reported ordinary least squares regression estimates of beta had a standard deviation of 0.53 if estimated using at least ten years of four-weekly returns, and a standard deviation of 0.77 if estimated using at least 36 four-weekly returns (Section 4, Table 1, p.10).

[26] The basis for the market risk premium assumption of 6% is simply that it is the most recent assumption adopted by the AER (*Access arrangement final decision, Multinet Gas (DB No. 1) Pty Ltd and Multinet Gas (DB No. 2), 2013 – 2017, Part 1,* Sub-section 5.1, p.22)

Figure 1. Dispersion of cost of equity estimates across firms



The same conclusion holds if we consider the dispersion of estimates across industries. In our report *The Vasicek adjustment to beta estimates in the Capital Asset Pricing Model* we summarised beta estimates across ten industry groups.[27] The standard deviation of mean beta estimates across ten industry groups was 0.29. Applied to a market risk premium of 6% and a constant risk-free rate the standard deviation of cost of equity estimates would be 1.7% (that is, 0.29 × 0.06 = 1.7%). In our original report on the dividend discount model, we reported cost of equity estimates across 12 industry groups.[28] The standard deviation of cost of equity estimates across these 12 industry groups is 0.5%. So in compiling dividend discount model estimates of the cost of equity we observe less variation in cost of equity estimates across individual firms and across industries.

The point is that, while sample size is always a concern with empirical analysis, it is likely to be even more of a concern for the use of the current empirical approach of the AER, which is the use of regression-based estimates of beta in the CAPM. The preferred technique of the AER results in more dispersion of cost of equity estimates across firms than the dividend discount model analysis we presented. So it will be more important to use a larger sample of firms under the AER's preferred technique.

[27] Gray, Hall, Diamond, and Brooks (2013), Section 4, Table 2 (p.11).
[28] The industry groups in the dividend discount model analysis are defined by IBES so are not identical to those used in the analysis of beta.

Table 6. Cost of equity estimates for individual listed networks (%)

Firm	Number of half-year observations in SFG analysis	SFG (No imputation benefits)	AER (g = 4.6%) (Imputation benefits accounted by multiplying dividends by 1.225)	AER (g = 2.5%) (Imputation benefits accounted for by multiplying dividends by 1.225)
Gasnet	1	12.0	na	na
Alinta	8	9.5	na	na
Envestra	8	9.9	17.3	15.4
APA	17	9.5	15.8	13.9
AGL	9	11.0	na	na
HDUF	13	11.2	na	na
Spark	9	10.5	17.0	15.2
SPAusnet	9	10.7	16.3	14.4
DUET	11	11.1	18.1	16.3
Total	85			
Market		10.6	11.0	9.0
Mean:				
Equal weighted		10.6	16.9	15.0
Weighted by N		10.4	16.8	14.9
Common firms, equal weighted		10.3	16.9	15.0
Common firms, weighted by N		10.3	16.8	14.9
Standard deviation:				
Equal weighted		0.8	0.9	0.9
Weighted by N		0.7	0.9	0.9
Common firms, equal weighted		0.6	0.9	0.9
Common firms, weighted by N		0.6	0.9	0.9

The overall magnitude of the cost of equity across the SFG and AER estimates is **not comparable** because the AER estimates include the benefits of imputation credits associated with dividend payments, but the SFG estimates do not include any benefits of imputation credits.

The AER's second concern was that its estimates for the cost of equity for network businesses were implausibly high. The AER reported cost of equity estimates for the five comparable firms still listed (AER, 2013, Sub-section H.3, Table H.5, p.225). Across the five firms, the average cost of equity was 16.9% under an assumption that long-term growth is equal to 4.6%, and 15.0% under an assumption that long-term growth is equal to 2.5%. We reproduced the cost of equity estimates computed by the AER in Table 6, alongside our estimates for the same firms, plus the four firms that are no longer listed. It should be made clear that the magnitude of the cost of equity estimates between our estimates and the AER is not directly comparable because of the different consideration of imputation tax credits. As we made clear in our original report, our estimates do not account for any benefits of imputation, and we explained how these are accounted for in the AER's regulatory model (SFG, 2013, Appendix 2, pp.37–40). This issue is revisited in Section 9 of the current report.

The first point to note is that, while the individual firm cost of equity estimates computed by the AER are well above the AER's estimates for the market return, the estimates we computed are, on average, below the market return. Also recall that we drew our conclusions on individual firm estimates from an overall comparison of the estimated risk premium, which averaged 0.96 for listed energy networks. This suggests that the estimation techniques we adopted appropriately constrained the cost of equity estimates. The AER notes that, even assuming a growth rate of 2.5% for network business, compared to 4.6% for the market, the average cost of equity for the network businesses is still 15.0%, well above the estimate of 11.0% for the market. Even if the AER assumed zero growth for the network businesses it would likely reach the conclusion that the network businesses' cost of equity estimates were implausibly high.

The second point to note is that the AER's primary concern with the individual firm analysis is one of magnitude, and not variation in estimates across firms. The standard deviation of the AER's estimates across the five firms it analysed is 0.9%. If we consider the regression-based beta estimates for those same firms,[29] multiplied by a market risk premium of 6.0%, the standard deviation is 1.0%. So, according to the AER's preferred estimation technique for estimating the cost of equity and preferred sample of firms, there is just as much dispersion in the estimated cost of equity.

The third point to note is that, if the AER's dividend discount model analysis generates cost of equity estimates that are implausibly high for listed network businesses, but the market return is reasonable, it must also generate cost of equity estimates that are implausibly low for another sub-sample of the market. This suggests that the AER could revisit its estimation process by identifying in a more general sense the type of firms for which the cost of equity is either too high or too low. The likely outcome under the AER approach is that firms with a high dividend yield would be classified as having a cost of equity that is implausibly high, and firms with a low dividend yield would be classified as having a cost of equity that is implausibly low. If that is indeed the case, then it illustrates that the AER's dividend discount model approach could be modified to mitigate this problem, leading to more reliable cost of equity estimates.

The problem, however, is that the AER has not identified the fundamental reason that its cost of equity estimates for network businesses are considered implausibly high. Is the problem due to the growth rate assumption? Is the forecast period too short? Is there an inconsistency between the assumed growth rate and an implicit assumption about reinvestment? The AER simply formed the view that energy network businesses, as a "stylized fact," have a below-average cost of equity, and that empirical evidence that suggests otherwise should be disregarded.

7.3 Implication

As sample size decreases, cost of equity estimates are less reliable. This is true of cost of equity estimates using any estimation technique, including the dividend discount model and the CAPM, populated with regression based estimates of beta. The challenge in estimation is determining what use can be made of firm- and industry-specific information in small samples. Our analysis of nine listed firms previously used in cost of capital estimation by the AER implied that they have a cost of capital that is marginally below the required market return. In contrast, the analysis conducted by the AER suggested that those firms have a cost of equity that is well above the required market return. There are four implications of the different estimation techniques and assumptions from the dividend discount model analysis, applied to the sub-sample of listed networks.

1. **Anomalous results imply that estimation techniques and assumptions should be revisited.** This material difference in conclusions between the AER and ourselves results from the application of two different sets of methodological choices. The AER incorporated a constant growth assumption, from forecast year three onwards, with the growth rate estimated from data that was entirely independent of share price, earnings and dividends. In contrast, we elected to incorporate a constant growth assumption from year ten onwards, which was determined as a function of share price, earnings and dividends, and with a gradual transition to this terminal growth state. We recommend that the AER implement the process we adopted and re-visit the AER's estimates of the cost of equity for network businesses.

2. **Interpretation needs to consider sample size appropriately.** Aside from the estimation of the cost of equity for network businesses, there is a question of interpretation. We agree that performing a computation of the cost of equity for just a handful of firms at one point in time is

[29] SFG Consulting, 2013b, Appendix, Table 5 (p.18).

likely to involve estimation error. For this very reason we based our conclusions on the average risk premium for 85 estimates over the entire sample period. This is exactly the same rationale that underpins the use of a long time series of data in computing regression-based estimates of beta.

3. **Boundaries on plausible results must be justified.** Most importantly, if the magnitude of the cost of equity estimates for a sample of firms is to be interpreted as plausible or implausible, there must be an objective basis for these boundaries. In the interpretation put forward by the AER, there is an assumption that the upper bound of the cost of equity for a listed energy network is the market return. The AER has simply assumed that the high leverage of a listed energy network is not sufficiently high to offset low cash flow risk. This is an assumption but is referred to as a "stylized fact." On what basis do we know this stylized fact to be true?

4. **Relevance cannot be based upon magnitude.** If results are implausible because they breach a boundary that is justified, there needs to be analysis on why the breach occurred, rather than simply dismissing the results as unreliable. The reason this is important is because, if results are included or excluded on the basis of magnitude, the consideration to those results is high if they support a pre-determined view, and low if they reject a pre-determined view. Put another way, suppose that the network business results computed by the AER implied a cost of equity slightly below the market return, what would the AER do with these estimates? *All else being equal,* as the cost of equity estimate from individual firm analysis increases from the risk-free rate to the market return, this would nudge the AER's final cost of equity estimate upwards. But once the cost of equity estimate from individual firm analysis exceeds the market return, the information is discounted and the final cost of equity would fall again. *Even if* the market return represented an appropriate upper bound on cost of equity estimates, the appropriate interpretation of the AER's dividend discount model analysis for individual firms is that the AER is unable to distinguish between the cost of equity for network businesses and the cost of equity for the market. This lack of any measurable difference in required returns is relevant for the final cost of equity estimate.

8. Comparison of the market cost of equity over time

8.1 Introduction

In this section we discuss the variation in the market cost of equity estimates over time from our estimation technique and that adopted by the AER. There are two questions to be addressed. First, how variable is each set of estimates over time? Second, what estimation techniques and assumptions cause the variation in the cost of equity estimates over time?

8.2 How variable are the estimates over time?

In Figure 2 we illustrate the variation in our cost of equity estimates over time and the estimates of the AER. This figure presents the cost of equity estimates we compiled over each six month period from the second half of 2002 (2H02) to the second half of 2012 (2H12) (red),[30] dividend yield from 2H02 to 2H12 (blue),[31] the market cost of equity estimates reported by the AER (black)[32] and the Bloomberg estimates for the cost of equity (green).[33] We do not have access to the actual data points reported by the AER, so have superimposed the time series chart reported in the Explanatory Statement. We reiterate that the figures are not directly comparable because the AER estimates have been computed after making an assumption about the value of imputation credits, which is not included in either the estimates we compiled or those reported by Bloomberg. Imputation credits are discussed separately in Section 9.

The figure illustrates that the AER estimates of the cost of equity are more variable over time than our estimates. Note that the AER chart gives the appearance of greater volatility over time because the estimates we report are six-monthly averages, whereas the AER estimate are computed on a more frequent basis. We are unsure whether the AER figure shows daily values or average values over a longer estimation period. However, this is merely a reporting issue. Leaving aside the appearance of volatility because of more frequent computations the AER's estimates span a considerably wider range than our estimates. There is a directional consistency between our estimates and those of the AER. The increase in the cost of equity estimates during 2008 and 2009 is expected, as this is the period known as the global financial crisis. The estimates from Bloomberg also follow this same pattern, albeit with even more volatility.

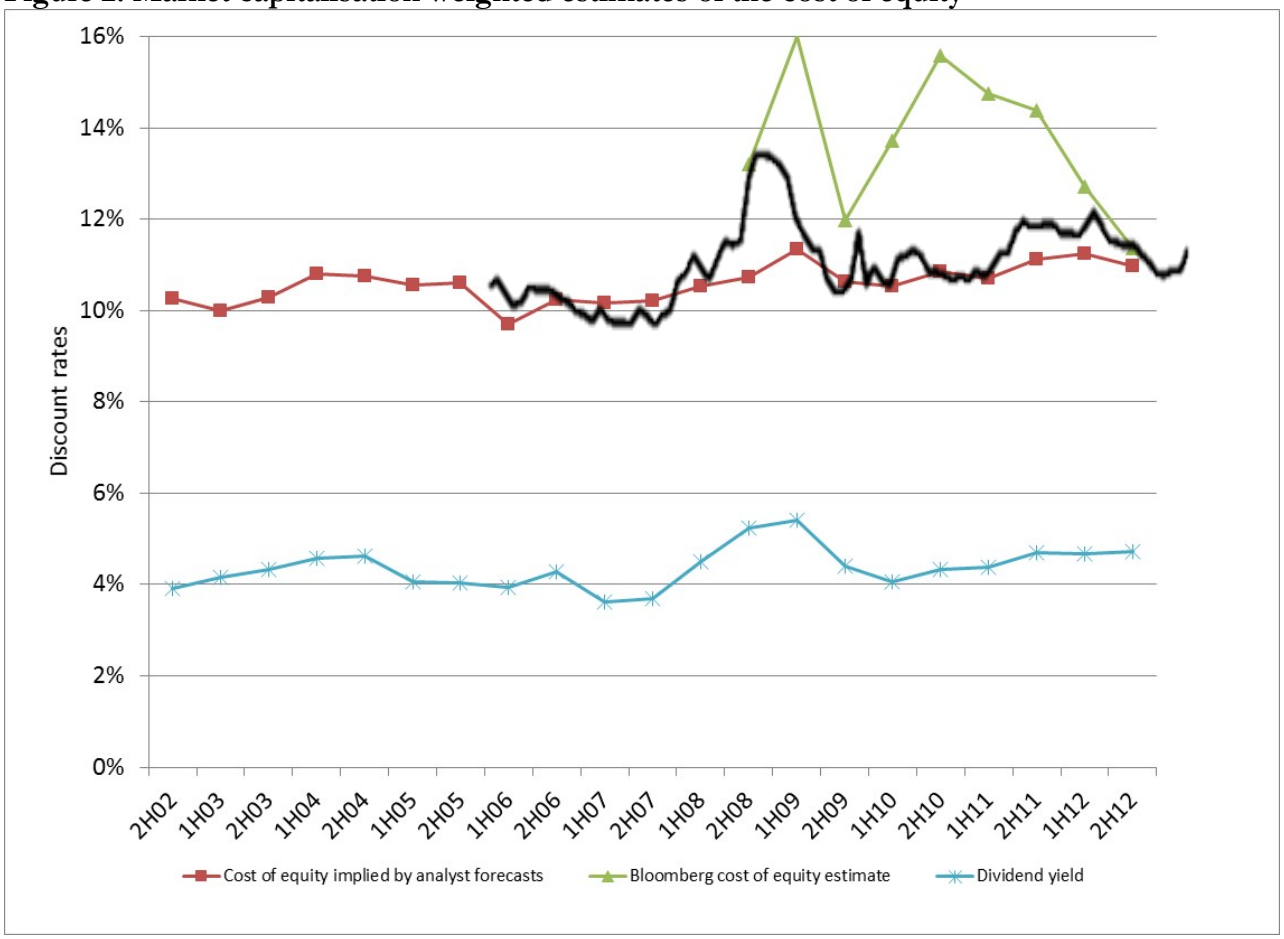
8.3 What causes the difference in volatility?

The reason the AER cost of equity estimates are more volatile over time than our estimates is likely to be a direct result of the AER's selection of estimation techniques and assumptions.

1. **Period of mean-reversion.** Reverting to long-term growth after two years of explicit dividend forecasts, rather than transitioning to long-term growth over ten years, will result in the cost of equity estimates being more sensitive to changes in dividend yields over the first two forecast years.

[30] SFG Consulting (2013a), Sub-section 4.2.2, Figure 2 (p.23) and Table 4 (p.22).
[31] SFG Consulting (2013a), Sub-section 4.2.2, Table 4 (p.22).
[32] AER Explanatory Statement, Sub-section H.2, Figure H.8 (p.222).
[33] SFG Consulting (2013a), Sub-section 4.2.2, Figure 2 (p.23) and Table 4 (p.22).

Figure 2. Market capitalisation weighted estimates of the cost of equity



2. **Share prices, price targets and timing issues.** The combination of share prices and consensus earnings and dividend forecasts means that there is a mis-match between expectations embedded in the share price and expectations embedded in the earnings and dividend forecasts. Share prices react immediately to information which affects earnings expectations. But analyst earnings expectations and price targets are not revised immediately. So when share prices rise or fall sharply, the cost of equity derived from the consensus earnings forecast attributes most of this variation to changes in the cost of equity, rather than changes in expectations for earnings and dividends. This can be alleviated by:

    a. Compiling a dataset in which the price and earnings and dividend forecasts are compiled on approximately the same date. This can be done regardless of whether the share price or price target is used in the analysis, and the dataset can still be aggregated into a consensus database.

    b. Using price targets rather than share prices, which can be done simply by selecting one price input instead of another.

3. **Simultaneous estimation of long-term growth and the cost of equity.** If the growth rate assumption is held constant, changes in share prices will be attributed almost entirely to changes in estimates of the cost of equity. Adopting a technique in which long-term growth and the cost of equity are estimated simultaneously means that a portion of share price fluctuations will be reflected in changes in long-term growth assumptions.

9. Imputation tax credits

9.1 Allowed revenue under the AER's post-tax revenue model

In Appendix 2 of our original report we discussed the issue of regulated returns under imputation. The purpose of this appendix was to reconcile the cost of equity estimates we compiled (which do not include any allowance for imputation) with the derivation of the regulated return adopted by the AER (which does include the benefits of imputation). According to the AER's post-tax revenue model, investors are assumed to receive their total return from two components – the revenue stream and an assumed value for imputation tax credits. We referred to the return the investors receive from the revenue stream as the "return excluding imputation benefits" and the total return (the return from the revenue stream plus the return from assumed imputation tax benefits) as the "cost of equity for regulation."

According to the AER's post-tax revenue model, the relationship between these two types of return is given by the following equation, where γ (gamma) is the estimated value of imputation tax credits:

$$Cost\ of\ equity\ for\ regulation = Return\ excl\ imp\ benefits \div \left[\frac{1 - tax\ rate}{1 - tax\ rate\ \times (1 - \gamma)}\right]$$

This issue is discussed at length in our original report. The equation presented above is derived exclusively from the AER's post-tax revenue model.

In the Explanatory Statement the AER announced that its estimate for the value of imputation tax credits had been revised to 0.50. This is the product of an assumed payout ratio of 0.70 and an assumed utilisation rate of 0.70[34] If the corporate tax rate is assumed to be 0.30, this implies that the cost of equity for regulation (that is, the return investors receive from the allowed revenue stream) will be 82% of the total allowed return. The remaining 18% of investors' return is assumed to be derived from the value of imputation credits. This can be seen by populating the equation above.

$$\begin{aligned} Cost\ of\ equity\ for\ regulation &= Return\ excl\ imp\ benefits \div \left[\frac{1 - 0.30}{1 - 0.30 \times (1 - 0.50)}\right] \\ &= Return\ excl\ imp\ benefits \div \left[\frac{0.70}{0.85}\right] \\ &= \frac{Return\ excl\ imp\ benefits}{0.82} \end{aligned}$$

To illustrate, suppose the estimated return excluding imputation benefits was 10.6%, which is the time-series average of the estimated market cost of equity in our original report. In order for the investors to receive this return, which does not include any imputation benefits, we need to divide by 0.82 to compute the cost of equity for regulation. The implication is that the cost of equity which needs to be incorporated into the AER's post-tax revenue model is 12.9%, computed as 0.106 ÷ 0.82 = 12.9%. This means that investors are assumed to receive 10.6% of their returns from the allowed revenue stream, and a further 2.3% of their returns from the assumed value of imputation credits.

[34] AER Explanatory Statement, Sub-section 8.2 (pp.118–119). Note that the rules require an estimate of the value of imputation credits (NER 6.5.3) but this issue is not within the scope of the current report. The distinction between utilisation rate and value has no impact on the discussion presented here.

9.2 How does the AER account for imputation in its dividend discount model estimates?

In estimating the cost of equity using the dividend discount model, the AER incorporates the benefits of imputation into the expected dividend stream. The AER multiplies each dividend by a factor of 1.225, according to the following equation, where θ (theta) is the same figure referred to by the AER as the utilisation rate:[35]

$$Dividends\ incl\ imp\ benefit = Cash\ dividends \times \left[1 + \theta \times \%Franked \times \left(\frac{tax\ rate}{1 - tax\ rate}\right)\right]$$

$$= Cash\ dividends \times \left[1 + 0.70 \times 0.75 \times \left(\frac{0.30}{1 - 0.30}\right)\right]$$

$$= Cash\ dividends\ \times [1 + 0.70 \times 0.75 \times 0.43]$$

$$= Cash\ dividends \times 1.225$$

So for example, if the projected dividend was $1.00 the AER makes an assumption that this dividend is valued by the market at $1.225. The AER projects all future dividends using the adjustment factor of 1.225 and then estimates the cost of equity which sets the present value of dividends equal to the share price.

As a completed example suppose that the share price is $1.00, next year's dividend is projected to be $0.0500 and the following dividend is projected to be $0.0548. This is the same example presented in Sub-Section 3.2. Incorporating the AER's long-term growth assumption of 4.60%, this implies a cost of equity of 11.0% as illustrated below.

$$P = \frac{D_1}{(1 + r_e)^1} + \frac{D_2}{(1 + r_e)^2} + \frac{D_2 \times (1 + g)}{(r_e - g) \times (1 + r_e)^{20}}$$

$$P = \frac{\$0.0500 \times 1.225}{(1.1100)^1} + \frac{\$0.0548 \times 1.225}{(1.1100)^2} + \frac{\$0.0548 \times 1.225 \times (1.046)}{(0.1100 - 0.046) \times (1.1100)^2}$$

$$P = \frac{\$0.0613}{1.1100} + \frac{\$0.0671}{1.2321} + \frac{\$0.0702}{0.0789}$$

$$P = \$0.0522 + \$0.0545 + \$0.8903$$

$$P = \$1.0000$$

The figure of 11.0% is an estimate of the cost of equity including imputation benefits. This total return can be disaggregated into three components – capital gains, cash dividend yield and imputation benefits. The capital gain is the percentage change in the price of the share from one year to the next. The cash dividend yield in the cash dividend relative to the share price at the start of the year. The imputation benefit is the assumed benefit from imputation credits relative to the share price at the start of the year.

To illustrate this disaggregation of total returns we computed the expected share price over three years as the present value of expected dividends including imputation. The figures are presented in Table 7.

[35] AER Explanatory Statement, Sub-section H.2 (p.221).

Table 7. Accounting for imputation benefits in the AER's dividend discount model

Year	0	1	2	3
Cash dividend		$0.0500	$0.0548	$0.0573
Imputation benefit		$0.0113	$0.0123	$0.0129
Dividend including imputation benefit		$0.0613	$0.0671	$0.0702
Share price	$1.0000	$1.0487	$1.0969	$1.1474
Capital gains		4.87%	4.60%	4.60%
Cash dividend yield		5.00%	5.22%	5.22%
Return excluding imputation benefits		9.87%	9.82%	9.82%
Return from imputation benefits		1.13%	1.18%	1.18%
Total return		11.00%	11.00%	11.00%

In the first forecast year, the total expected return is comprised of capital gains of 4.87%, cash dividend yield of 5.00% and return from imputation benefits of 1.13%. Every year thereafter, the total expected return is comprised of capital gains of 4.60%, cash dividend yield of 5.22% and return from imputation benefits of 1.18%. This means that the total expected return excluding any benefits of imputation is 9.87% in the first year and 9.82% in every year thereafter.

9.3 How does the AER account for dividend imputation in the post-tax revenue model?

Suppose that the expected market return is 11.00% as in the example presented above, and also suppose that the AER determined that a regulated firm has the same cost of equity as the market. Under the post-tax revenue model adopted by the AER, the allowed revenue would be set such that the firm only receives a return of 9.06% excluding imputation benefits. Specifically, under the AER's post-tax revenue model, the allowed revenue stream is set such that the return generated from the firm's revenue stream would be $11.00\% \times 0.82 = 9.06\%$. This means that in this step the AER is assuming that the firm receives a return benefit from imputation of 1.94%.

This represents a fundamental inconsistency in the way in which the AER accounts for the benefit of imputation credits. In the dividend discount model analysis the AER assumes that the imputation tax benefits are about 1% of returns for the average firm, with returns from cash dividends and capital gains of about 10%. But if the AER were to regulate that same firm it would adopt an assumption that the imputation tax benefits are around 2%, with returns from dividends and capital gains of about 9%.

9.4 Implication

The way in which the AER accounts for imputation benefits in its dividend discount model analysis is inconsistent with the way in which the AER accounts for imputation benefits in its post-tax revenue model. This leads to a material understatement of allowed revenues. There are two ways to resolve this inconsistency.

1. The AER could make an estimate of returns excluding imputation benefits from the dividend discount model analysis, use the equation presented in Sub-section 9.1 to estimate the cost of equity for regulation and input this value into the post-tax revenue model. Note that this could be done even if the AER incorporates the imputation benefits into the dividend forecasts as it already does. The AER just needs to strip out the benefits of imputation at the end of the process, as illustrated in Table 7.

   For example, suppose the AER determined that its best estimate of the return excluding imputation benefits was 9.82%, as illustrated above. In order to set the allowed revenue stream so that the regulated firm is expected to earn this same return excluding imputation benefits, the input into the AER's post-tax revenue model would be $0.0982 \div 0.82 = 11.93\%$

Alternatively, the AER could first compute the cost of equity without incorporating imputation benefits. In the example presented above, the implied return excluding imputation benefits is 9.83%. This is the discount rate which sets the present value of cash dividends equal to the share price. In order to compute the input into the AER's post-tax revenue model, again, this needs to be divided by 0.82.

2. The AER could adjust the post-tax revenue model so that the assumed benefits from imputation as computed by the model are the same as the assumed benefits of imputation from the dividend discount model analysis.

10. Conclusion

10.1 Introduction

We have structured out conclusions to directly address the six specific issues raised in the terms of reference. These conclusions appear below.

10.2 Comparison of the AER and SFG dividend discount models

> 1. Compare the AER's proposed two-stage version of the DGM to that proposed by SFG as part of the ENA's submission on the AER rate of return consultation paper; and
>
> 2. Critically review the reliability and robustness of the AER's version of the two stage DGM and how it would perform over time

The dividend discount model analysis compiled by the AER, in comparison to the analysis we submitted, leads to cost of equity estimates that are likely to be more variable over time and more variable across firms, as discussed in Sections 7 and 8. Given the AER's preference for stability in estimating the cost of equity, the estimation techniques and assumptions we put forward lead to a material increase in stability. The AER's own analysis of listed network businesses suggests that its methodological choices lead to an overstatement of the cost of equity for high yield firms, which implies that the cost of equity estimate for low yield firms is likely to be understated.

The relatively high variation over time for the cost of equity estimates compiled by the AER, in comparison to the estimates we submitted, is a direct result of a series of estimation techniques and assumptions adopted by the AER. We outlined four material differences in methodological choices adopted by the AER that are likely to have directly contributed to the higher level of instability in the estimates compiled by the AER, namely (1) that growth is constant from year three onwards, rather than allowing for a gradual transition to long-term growth (Section 3), (2) the use of share prices rather than price targets (Section 4), (3) the use of a long-term growth estimate that is independent of share price, earnings forecasts and dividend forecasts (Section 5), and (4) and the mis-match in the timing at which prices are compiled (regardless of whether share prices or price targets are used) and the timing at which earnings and dividend forecasts are compiled (Section 6).

10.3 Potential changes to the AER's version of the dividend discount model

> 3. Identify potential changes to the AER's version of the DGM that retain its simplicity and transparency, but improve its reliability and robustness.

In this report we document the specific methodological choices that the AER is able to adopt which will likely lead to improvements in the reliability of the cost of equity estimates. We document that each estimation technique or assumption can be adopted in a manner that is independent of all the other methodological choices. Specifically, with reference to the four estimation techniques and assumptions listed above, each of these four changes could be implemented separately, and each change is likely to increase the reliability of the cost of equity estimates.

Further, the complexity associated with each methodological choice is small, in comparison to the material improvements in reliability that are likely to result. With respect to the transition to long-term growth, the use of target prices and the matching of price dates with earnings forecast dates, the complexity associated with these changes is minimal. With respect to the simultaneous estimation of long-term growth, return on equity and the cost of equity, this exercise is data-intensive. But each computation itself is not challenging. There is merely a large number of computations to be performed. The problem is that, in the absence of some technique to estimate growth rates as a function of prices,

earnings and dividends, dividend discount model analysis eventually collapses into debate over what growth rate the market *should* assume.

The problem of incorporating a fixed long-term growth rate, independent of prices, earnings forecasts and dividend forecasts, is exacerbated when a very short explicit forecast period is incorporated. Even if the AER were to continue to assume a constant growth rate (estimated with respect to historical growth in GDP, earnings per share or something else) the impact of this assumption will be mitigated if there is simply a more gradual transition to long-term growth.

10.4 Achieving the rate of return objective

> 4. Assess how well different versions of the DGM contribute to achieving the rate of return objective outlined at clause 6.5.2(c) of the NER as well as other requirements in the NER.

According to clause 6.5.2 of the NER, "[t]he *allowed rate of return objective* is that the rate of return for a *Distribution Network Service Provider* is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the *Distribution Network Service Provider* in respect of the provision of *standard control services* (the *allowed rate of return objective*)."

Other requirements in the NER include that regard must be had to relevant estimation methods, financial models, market data and other evidence [NER 6.5.2 (e)], and that in estimating the return on equity regard must be had to the prevailing conditions in the market for funds [NER 6.5.2 (f)].

In this report we directly compare two approaches for using the dividend discount model to estimate the cost of equity capital – the approach adopted by the AER and the approach we undertook in compiling our original report. The words "different versions of the DGM" in the terms of reference should not be interpreted narrowly as referring to an *equation*. We understand that this refers to the entire set of estimation techniques and assumptions used in implementing the dividend discount model analysis. In this report, we outlined what are the four key differences in estimation techniques and assumptions that lead to the different estimates compiled by ourselves and the AER.

The set of estimation techniques and assumptions that we adopted are likely to lead to a material increase in reliability of the cost of equity estimates, and will therefore better contribute to achieving the rate of return objective. The only reason identified by the AER for adopting an alternative set of methodological choices was its concern over complexity. We believe we have addressed this concern in the current report. Our intention is to demonstrate that the methodological choices we adopted can be implemented and explained with a minimal increase in complexity. Further, the AER could perform its own analysis using these same techniques, applied to the data it already uses in performing dividend discount model analysis.

With respect to other requirements of the NER, there is the issue of whether the AER has had regard to relevant estimation methods, financial models, market data and other evidence. It does not appear that the AER has had regard to the information submitted in our earlier report. The only reference to this work in the Explanatory Statement is a footnote stating that our analysis was "excessively complex." Even if the techniques and assumptions themselves were considered unreasonably complex, with which we disagree, the AER does not appear to have had any regard to the conceptual issues raised in the report that require no computations whatsoever. For example, the AER has not considered:

- whether it is reasonable to assume the same long-term growth rate, regardless of the share price, dividend forecasts and earnings forecasts, despite our commentary that the share price at each point in time is likely to incorporate expectations for both long-term growth and the cost of equity capital;

- the potential implications of mean-reversion in parameter inputs versus a constant growth assumption, despite our commentary on the potential anomalous results that occur with respect to a constant growth version of the dividend discount model;

- the potential impact of matching the timing of release of analyst earnings and dividend forecasts with the timing of the share price used in the analysis, despite our commentary that this is likely to be one of the reasons that the Bloomberg cost of equity series is more volatile over time than the cost of equity series we reported; and

- the clear inconsistency between the AER's treatment of the value of imputation credits in its dividend discount model analysis and its treatment of the value of imputation credits in setting the regulated rate of return.

These are conceptual issues that need to be addressed in reaching conclusions about the appropriate estimation techniques and assumptions to be adopted. It is not an exhaustive list. The methodological choices we incorporated were the direct result of considering these relevant issues. Another researcher may well decide to address these concerns by making different methodological choices. But the AER does not appear to have constructed its analysis with any of these issues in mind. In that regard it does not appear that the AER has incorporated relevant information in its analysis.

In short, the AER does not appear to have incorporated estimation techniques and assumptions which will best achieve the rate of return objective. Even if the AER does not adopt the particular set of estimation techniques and assumptions we adopted, the AER is required to have regard to relevant information. That information includes the potential adverse results which could result from its implementation of the dividend discount model, and which we highlighted in the text. Our objective in this report is to assist the AER to incorporate a set of methodological choices which lead to more reliable estimates of the cost of equity, and which therefore contribute to achieving the rate of return objective.

10.5 Use of historical data

> 5. Consider whether using purely historical data to estimate parameters within the DGM is consistent with the theory underlying the model.

The use of the dividend discount model to estimate the cost of equity is analogous to estimating the cost of debt as the yield to maturity on corporate bonds. The only difference is that estimating the market's expectations for dividends involves more uncertainty than estimating the market's expectations for bond payments. The AER incorporates an assumption that, after the first two forecast years, dividends will grow at a constant rate. The growth rate assumption is the AER's estimate of nominal GDP growth less 1%. In turn, the real growth rate which underpins this assumption is a long-term historical average of real GDP growth.

The assumption made by the AER will only be consistent with the model if the historical average real growth rate, less 1%, represents the most reliable estimate of the market's long-term growth expectations at each point in time. We consider that a more reliable estimate of the long-term growth rate can be made using the simultaneous estimation technique that we incorporated.

The problem with using historical data in estimation lies in the mis-match between one parameter based upon historical information (growth) and another parameter based upon contemporaneous information (cost of equity). The AER believes that an historical growth rate, less 1%, represents an unbiased estimate of the market's estimate of future growth rates, and this can be used to derive an estimate of the cost of equity at each point in time. In reality, the market is assessing expectations of the entire dividend stream at each point in time, along with the estimate of the cost of equity. So when

share prices fall, this suggests that dividend expectations have fallen or the cost of capital has risen, or both; when share prices rise, this suggests that dividend expectations have risen, or the cost of capital has fallen, or both. By imposing a constant estimate of growth, based upon an historical average, the AER attributes all of the share price change to dividend expectations over two years and the cost of equity. Dividends are reasonably sticky, so the real impact is that the AER will over-estimate the variation in the cost of equity over time.

Put another way, suppose we wanted to use share prices to make an inference about the market's expectations for earnings growth. According to the AER's rationale, we could incorporate an estimate of the cost of equity based upon long-term average returns, and then estimate the market's expectation for long-term growth.

The AER's approach will lead to cost of equity estimates that are materially mis-stated if there is a material change in the reinvestment policy of listed firms. If there was a large change in reinvestment rates, long-term growth expectations would be materially different from historical average growth rates. This is an important reason to consider growth rates as a function of reinvestment rates and expected returns on investment.

It should also be noted that the AER also makes two important assumptions about long-term growth that need to be justified – first, that GDP growth is a reasonable proxy for earnings and dividend growth and second, that the listed firms in the data at each point in time are expected to have below-average long-term growth rates. We have already stated that it is not within the scope of this report to discuss what the "correct" long-term growth assumption is. However, we need to make mention of these assumptions here to clarify that the two assumptions made by the AER are crucial in their application of a long-term historical average to estimate the cost of equity at each point in time.

10.6 Relevance of alternative estimation techniques and assumptions

> 6. Consider whether different versions of the DGM can each provide relevant information for the expected return on the market.

The AER's estimates of the market cost of equity, using the dividend discount model, are likely to be positively correlated with the true market cost of equity. This occurs because dividend yield is likely to be high when the market cost of equity is high, and dividend yield is likely to be low when the market cost of equity is low. From inspection of the time series of cost of equity estimates from the AER, in comparison to the time series of our estimates, the two series appear to be positively correlated.

However, there are two concerns with the AER's analysis which lower the reliability of its cost of equity estimates. The first concern is whether the cost of equity estimates compiled by the AER have an upward or downward bias. The second concern is whether the AER's cost of equity estimates are more volatile than the prevailing cost of equity.

With respect to potential bias in the AER's estimates, if a long-term growth estimate is compiled on the basis of historical growth rates (whether that be GDP growth or earnings per share growth or something else), and there is information to suggest that expectations should differ from historical average growth rates (such as a change in reinvestment rates) the AER's cost of equity estimates will be biased. Furthermore, if the AER's assumption that listed firms are expected to have lower growth than the broader economy is not true, then the AER's cost of equity estimates will be biased. The potential for bias can only be measured with a detailed assessment of whether the AER's long-term average growth rate assumption is, on average, reasonable. This problem is mitigated if long-term growth expectations are estimated simultaneously with other parameter inputs.

With respect to the time series variation in cost of equity estimates, the AER's cost of equity estimates are likely to be more volatile than the prevailing cost of equity in the market. If the AER's growth expectations were, on average, unbiased, we would likely observe the AER's cost of equity estimates as too high during periods of high dividend yields, and too low during periods of low dividend yields. This is likely to occur because the share price will incorporate both expectations for growth in dividends and the cost of equity. By holding growth expectations constant, and if dividend expectations in the dataset change slowly, almost all movement in share prices will be attributed to fluctuations in the cost of equity.

In short, the AER's dividend discount model analysis provides relevant information about the market cost of equity, because it is likely to have the same directional relationship between the market cost of equity and dividend yield. As highlighted in our two reports, we consider that a set of estimation techniques and assumptions can be made that lead to substantial increases in the reliability of the market cost of equity estimates. So even if the AER continues to rely upon the dividend discount model analysis it has compiled, the analysis submitted in our earlier report and in the current report contains relevant information for estimating the market return.

11. References

Australian Energy Regulator, 2013. "Access arrangement final decision, Multinet Gas (DB No. 1) Pty Ltd and Multinet Gas (DB No. 2), 2013 – 2017, Part 1," March.

Australian Energy Regulator, 2013. "Better regulation. Explanatory statement: Draft rate of return guideline," August.

Gray, S., J. Hall, N. Diamond, and R. Brooks, 2013. "The Vasicek adjustment to beta estimates in the Capital Asset Pricing Model," June.

SFG Consulting, 2013a. "Dividend discount model estimates of the cost of equity," June.

SFG Consulting, 2013b. "Regression-based estimates of risk parameters for the benchmark firm," June.

12. Appendix: Miscellaneous technical adjustments

12.1 Introduction

In compiling our original analysis we made a series of detailed methodological choices in addition to the four key estimation techniques and assumptions documented above. These technical adjustments are made to maximise the reliability of the results. Each of these adjustments is useful in mitigating estimation error, and can be incorporated incrementally into the analysis once a dataset is compiled.

12.2 Accounting for growth from new share issuance

Earnings growth results from the reinvestment of earnings and new share issuance. For this reason, it is possible for a firm to experience growth in earnings per share, even if the firm distributes 100% of its earnings as dividends. However, in this 100% payout situation, there will only be positive earnings per share growth if the firm earns a return on investment that exceeds the cost of equity capital.

Our analysis incorporates a gradual transition from the firm's current reinvestment rate to a long-term reinvestment rate. For firms that have issued new shares, if we estimate the firm's reinvestment rate simply with reference to the dividend payout ratio, the total reinvestment rate will be understated. So, in order to have the most reliable estimate of the current reinvestment rate, we performed a computation to estimate what the reinvestment rate would be had the firm issued no new shares but instead funded investments with retained earnings.[36]

In our original report we provide an example of a case in which the firm reinvested 20% of earnings ($RR = 0.20$) and made investments that earned a return on equity of 18% ($ROE = 0.18$). In the absence of new share issuance, the estimated growth rate for the firm would be 3.6%, computed as $g = RR \times ROE = 0.20 \times 0.18 = 3.6\%$. If that same firm issued 1% new shares ($C = 0.01$) at a price-earnings ratio of 16 times ($P/E_1 = 16$), this will lead to further earnings per share growth. In the Appendix to our original report we provided the derivation of the equation which shows how growth is computed in this situation. According to the inputs in this example, the estimated growth rate is 5.58% as shown below.

$$
\begin{aligned}
g &= \frac{(1 + RR \times ROE)/(1 + C)}{1 - \frac{C}{1+C} \times \frac{P}{E_1} \times ROE} - 1 \\
&= \frac{(1 + 0.20 \times 0.18)/(1.01)}{1 - \frac{0.01}{1.01} \times 16 \times 0.18} - 1 \\
&= \frac{1.0257}{0.9715} - 1 \\
&= 5.58\%
\end{aligned}
$$

When incorporating mean-reversion in parameter inputs we decided it simplified the analysis if we did not project that firms issue new shares each year. Instead, for firms that issued new shares we adjusted the initial reinvestment rate. With respect to the example above, we worked out what input for RR would result in the same growth rate of 5.58% if C was equal to zero. This computation is straightforward. We simply compute:

[36] SFG Consulting (2013a), Sub-section 3.3 (p.12).

$$RR = \frac{g}{ROE} = \frac{0.0558}{0.1800} = 31.03\%$$

This means that the initial reinvestment rate for the mean-reversion process is 31.03%.

12.3 Constraints on initial values

12.3.1 Earnings per share and dividends per share

In our original report we were required to contrast the situation in which growth was assumed to be constant from the first forecast year with the case in which there was mean-reversion in growth. We drew all our conclusions from the mean-reversion case because assuming constant growth from the first forecast year introduces considerable estimation error. Further, in the constant growth case there are two situations in which computations simply cannot be mathematically performed. These situations are (1) when earnings per share are less than or equal to zero; and (2) dividends per share are less than or equal to zero.

In 2% of cases earnings per share was less than or equal to zero and in 2% of cases dividends per share was less than or equal to zero. We want to retain these firms in the dataset, because the market is likely pricing these shares on the expectation of positive earnings and dividends at some future point. But if the initial inputs for earnings per share and dividends per share are negative the computations cannot be performed. So the solution is to winsorize the data for these items at the 2nd percentile. This means replacing the earnings yield (earnings per share divided by price) with the value that appears at the 2nd percentile, and replacing the dividend yield (dividend per share divided by price) with the value that appears at the 2nd percentile. We also applied the corresponding winsorization at the upper end of the distribution, replacing the highest values with those at the 98th percentile. The reason this winsorization is conducted at the lower and upper ends is to ensure that the median values in the dataset are not shifted upwards.

In the mean-reversion case these cases of earnings per share and dividends per share being less than zero could be retained, because there is a projection towards a case of positive earnings per share and positive dividends per share. But we retained the winsorized dataset to ensure that all our results were compiled using exactly the same data.

It is standard procedure in finance research to mitigate the impact of extreme observations by winsorizing data. The AER has stated that models are to be based upon "quantitative modelling which avoids arbitrary filtering or adjusting of data, which does not have a sound rationale."[37] The adjustments used in our analysis are in no way arbitrary and do have a sound rationale. The lower bound constraint is required in order for the observation to be retained, at all, for a constant growth case, and the upper bound constraint is imposed to ensure that the imposition of the lower bound constraint does not bias the earnings yield and the dividend yield upwards.

12.3.2 Initial growth from new share issuance and reinvestment rate

In some instances there are large changes in the number of new shares issued in the period prior to the forecast of earnings per share and dividends per share. With respect to the above equation, the input *C* would be very high, leading to high initial estimates of growth, and consequently, very high initial estimates for the reinvestment rate. There are also instances in which there is a negative change in shares on issue, which can occur in cases of share buybacks, and which could lead to very low or

[37] AER Explanatory Statement, Sub-section 2.5 (p.28), Sub-section 2.6.4 (p.30),

negative initial values for the reinvestment rate. Further, these initial cases of high or low changes in shares on issue can also result from errors in the original database.

In 10% of cases the growth in new shares was negative, so we winsorized the variable on new share issuance (C) at the 10^{th} and 90^{th} percentiles. We also imposed the constraint that the growth in new share issuance cannot be so large that the implied reinvestment rate is more than 100%, which means that the minimum possible initial reinvestment rate is zero and the maximum possible initial reinvestment rate is 100%.

The constraints on initial growth from new share issuance and reinvestment rate are not arbitrary and do have a sound rationale. The rationale is to mitigate against the potential extreme instances of very low or high initial reinvestment rates that, if projected over the period of mean-reversion, are likely to lead to extremely low or high projections for earnings and dividends per share. In short, in the absence of constraints on initial new share issuance, there will be an increase in noise in the data without any improvement in the reliability of the cost of equity estimates. The magnitude of the constraints is also not arbitrary as it essentially constrains the reinvestment rate to boundaries in which all or none of earnings is reinvested in new projects. This remains a very wide range for which to begin a process of reverting to a long-term reinvestment rate.

13. Terms of reference and qualifications

This report was prepared by Professor Stephen Gray and Dr Jason Hall. Professor Gray and Dr Hall have made all they enquiries that they believe are desirable and appropriate and that no matters of significance that they regard as relevant have, to their knowledge, been withheld.

Professor Gray and Dr Hall have been provided with a copy of the Federal Court of Australia's "Guidelines for Expert Witnesses in Proceeding in the Federal Court of Australia." The Report has been prepared in accordance with those Guidelines, which appear in the terms of reference.

TERMS OF REFERENCE – RESPONSE TO AER DRAFT RATE OF RETURN GUIDELINE ON DIVIDEND GROWTH MODEL

Background

The Australian Energy Regulator (AER) is currently developing a rate of return guideline that will form the basis of the regulated rate of return applied in energy network decisions under the recently revised National Electricity Rules (NER). The NER sets out the considerations the AER must have regard to when setting the rate of return. The NER requires that the AER publish a rate of return guidelines, which set out the following:[1]

> *(1) the methodologies that the AER proposes to use in estimating the allowed rate of return, including how those methodologies are proposed to result in the determination of a return on equity and a return on debt in a way that is consistent the allowed rate of return objective; and*
>
> *(2) the estimation methods, financial models, market data and other evidence the AER proposes to take into account in estimating the return on equity, the return on debt and the value of imputation credits referred to in clause 6.5.3.*

In accordance with the NER, the AER published a draft rate of return guideline accompanied by an explanatory statement on 30 August 2013. Submissions on the draft guideline are due by 11 October 2013.

In its draft guideline the AER stated that it intends to use the dividend growth model (DGM) to inform its estimate of the market risk premium parameter, but not to directly inform estimates of the cost of equity for a benchmark efficient regulated energy network firm.

Scope of work

The consultant is required to prepare an internal memorandum for the ENA cost of capital sub-group which addresses the AER's consideration of the DGM in estimating the cost of equity for a benchmark efficient regulated energy network business. The memorandum may need to be converted into an expert report for submission to the AER.

In response to the AER's consideration of the DGM in its draft rate of return guideline:

1. compare the AER's proposed two-stage version of the DGM to that proposed by SFG as part of the ENA's submission on the AER rate of return consultation paper.[2]
2. critically review the reliability and robustness of the AER's version of the two stage DGM and how it would perform over time

[1] NER, Clause 6.5.2(n).

[2] SFG, *Dividend discount model estimates of the cost of equity*, 19 June 2013.

3. identify potential changes to the AER's version of the DGM that retain its simplicity and transparency, but improve its reliability and robustness.

4. assess how well different versions of the DGM contribute to achieving the rate of return objective outlined at clause 6.5.2(c) of the NER as well as other requirements in the NER.

5. consider whether using purely historical data to estimate parameters within the DGM is consistent with the theory underlying the model.

6. consider whether different versions of the DGM can each provide relevant information for the estimation of the expected return on the market

The consultant is required to consider the issues above in the context of the allowed rate of return objective outlined at clause 6.5.2(c) of the NER:

> *"The allowed rate of return objective is that the rate of return for a Distribution Network Service Provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the Distribution Network Service Provider in respect of the provision of standard control services (the allowed rate of return objective)."*

The consultant is required to provide a report that only relies on information or data that is fully referenced and could be made reasonably available to the AER or others. If the internal memorandum is to be converted into an expert report, the consultant will be required to:

- Document the methods, data, adjustments, equations, statistical package specifications/printouts and assumptions used in preparing your opinion3

- Include specified wording at the beginning of the report stating that "[the person(s)] acknowledge(s) that [the person(s)] has read, understood and complied with the Federal Court of Australia's Practice Note CM 7, Expert Witnesses in Proceedings in the Federal Court of Australia" as if your brief was in the context of litigation

- Include specified wording at the end of the report to declare that "[the person(s)] has made all the inquiries that [the person(s)] believes are desirable and appropriate and that no matters of significance that [the person(s)] regards as relevant have, to [the person(s)] knowledge, been withheld"

- State that the person(s) have been provided with a copy of the Federal Court of Australia's "Guidelines for Expert Witnesses in Proceeding in the Federal Court of Australia" and that the Report has been prepared in accordance with those Guidelines, refer to Appendix 1 to these Terms of Reference or alternatively online at <http://www.federalcourt.gov.au/law-and-practice/practice-documents/practice-notes/cm7>.

Timeframe

The consultant is to provide a draft an internal memorandum for the ENA considering the issues raised above by 30 September 2013. If the memorandum is to be converted into an expert report supporting the ENA's submission on the AER's draft rate of return guideline, this report is to be finalised by 8 October 2013.

Reporting

Iftekhar Omar, Eli Grace Webb and Blair Alexander will provide the primary interface to the ENA for the duration of the engagement. The consultant will report on work progress on a regular basis. The consultant will make periodic presentations on analysis and advice when appropriate.

The consultant may be called on to present analysis and advice to the ENA cost of capital sub-group.

Conflicts

The consultant is to identify any current or future potential conflicts.

Fees

The consultant is requested to propose:

- a fixed total cost for the memorandum
- a fixed total cost for converting the memorandum into an expert report
- hourly rates for the proposed project team should additional work be required.
- the staff who will provide the strategic analysis and advice;
- declare the absence of any relevant conflict of interest in undertaking the project; and
- indicate preparedness to enter into a confidentiality agreement regarding research and findings.

Any changes to the scope of the consultancy must be agreed with the ENA before the quotation is submitted. Miscellaneous costs such as travel and accommodation will be reimbursed, provided that they are agreed with the ENA beforehand.

Contacts

Any questions regarding this terms of reference should be directed to:

Iftekhar Omar, IOmar@ausgrid.com.au, (02) 9269 2695

Eli Grace-Webb, Eli.Grace-Webb@jemena.com.au, 03 8544 9164.

Blair Alexander, blair.alexander@actewagl.com.au, 02 6248 2522

Appendix 1

FEDERAL COURT OF AUSTRALIA
Practice Note CM 7
EXPERT WITNESSES IN PROCEEDINGS IN THE FEDERAL COURT OF AUSTRALIA

1. Rule 23.12 of the Federal Court Rules 2011 requires a party to give a copy of the following guidelines to any witness they propose to retain for the purpose of preparing a report or giving evidence in a proceeding as to an opinion held by the witness that is wholly or substantially based on the specialised knowledge of the witness (see **Part 3.3 - Opinion** of the *Evidence Act 1995* (Cth)).

2. The guidelines are not intended to address all aspects of an expert witness's duties, but are intended to facilitate the admission of opinion evidence[3], and to assist experts to understand in general terms what the Court expects of them. Additionally, it is hoped that the guidelines will assist individual expert witnesses to avoid the criticism that is sometimes made (whether rightly or wrongly) that expert witnesses lack objectivity, or have coloured their evidence in favour of the party calling them.

Guidelines

1. General Duty to the Court[4]

1.1 An expert witness has an overriding duty to assist the Court on matters relevant to the expert's area of expertise.

1.2 An expert witness is not an advocate for a party even when giving testimony that is necessarily evaluative rather than inferential.

1.3 An expert witness's paramount duty is to the Court and not to the person retaining the expert.

2. The Form of the Expert's Report[5]

2.1 An expert's written report must comply with Rule 23.13 and therefore must

(a) be signed by the expert who prepared the report; and

(b) contain an acknowledgement at the beginning of the report that the expert has read, understood and complied with the Practice Note; and

(c) contain particulars of the training, study or experience by which the expert has acquired specialised knowledge; and

(d) identify the questions that the expert was asked to address; and

(e) set out separately each of the factual findings or assumptions on which the expert's opinion is based; and

---

[3] As to the distinction between expert opinion evidence and expert assistance see *Evans Deakin Pty Ltd v Sebel Furniture Ltd* [2003] FCA 171 per Allsop J at [676].

[4] The "*Ikarian Reefer*" (1993) 20 FSR 563 at 565-566.

[5] Rule 23.13.

(f) set out separately from the factual findings or assumptions each of the expert's opinions; and

(g) set out the reasons for each of the expert's opinions; and

(h) comply with the Practice Note.

2.2 The expert must also state that each of the expert's opinions is wholly or substantially based upon the expert's specialised knowledge[6].

2.3 At the end of the report the expert should declare that "[the expert] has *made all the inquiries that* [the expert] *believes are desirable and appropriate and that no matters of significance that* [the expert] *regards as relevant have, to* [the expert's] *knowledge, been withheld from the Court*."

2.4 There should be included in or attached to the report the documents and other materials that the expert has been instructed to consider.

2.5 If, after exchange of reports or at any other stage, an expert witness changes the expert's opinion, having read another expert's report or for any other reason, the change should be communicated as soon as practicable (through the party's lawyers) to each party to whom the expert witness's report has been provided and, when appropriate, to the Court[7].

2.6 If an expert's opinion is not fully researched because the expert considers that insufficient data are available, or for any other reason, this must be stated with an indication that the opinion is no more than a provisional one. Where an expert witness who has prepared a report believes that it may be incomplete or inaccurate without some qualification, that qualification must be stated in the report.

2.7 The expert should make it clear if a particular question or issue falls outside the relevant field of expertise.

2.8 Where an expert's report refers to photographs, plans, calculations, analyses, measurements, survey reports or other extrinsic matter, these must be provided to the opposite party at the same time as the exchange of reports[8].

3. Experts' Conference

3.1 If experts retained by the parties meet at the direction of the Court, it would be improper for an expert to be given, or to accept, instructions not to reach agreement. If, at a meeting directed by the Court, the experts cannot reach agreement about matters of expert opinion, they should specify their reasons for being unable to do so.

PA KEANE
Chief Justice
1 August 2011

---

[6] *Dasreef Pty Limited v Nawaf Hawchar* [2011] HCA 21.

[7] The *"Ikarian Reefer"* [1993] 20 FSR 563 at 565

[8] The *"Ikarian Reefer"* [1993] 20 FSR 563 at 565-566. See also Ormrod *"Scientific Evidence in Court"* [1968] Crim LR 240

Stephen F. Gray

University of Queensland
Business School
Brisbane 4072
AUSTRALIA
Office: +61-7-3346 8032
Email: s.gray@business.uq.edu.au

Academic Qualifications

1995 Ph.D. (Finance), Graduate School of Business, Stanford University.
Dissertation Title: Essays in Empirical Finance
Committee Chairman: Ken Singleton
1989 LL.B. (Hons), Bachelor of Laws with Honours, University of Queensland.
1986 B.Com. (Hons), Bachelor of Commerce with Honours, University of Queensland.

Employment History

2000-Present Professor of Finance, UQ Business School, University of Queensland.
1997-2000 Associate Professor of Finance, Department of Commerce, University of Queensland and Research Associate Professor of Finance, Fuqua School of Business, Duke University.
1994-1997 Assistant Professor of Finance, Fuqua School of Business, Duke University.
1990-1993 Research Assistant, Graduate School of Business, Stanford University.
1988-1990 Assistant Professor of Finance, Department of Commerce, University of Queensland.
1987 Specialist Tutor in Finance, Queensland University of Technology.
1986 Teaching Assistant in Finance, Department of Commerce, University of Queensland.

Academic Awards

2006 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.
2002 Journal of Financial Economics, All-Star Paper Award, for Modeling the Conditional Distribution of Interest Rates as a Regime-Switching Process, JFE, 1996, 42, 27-62.
2002 Australian University Teaching Award – Business (a national award for all university instructors in all disciplines).
2000 University of Queensland Award for Excellence in Teaching (a University-wide award).
1999 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.
1999 KPMG Teaching Prize, Department of Commerce, University of Queensland.
1998 Faculty Teaching Prize (Business, Economics, and Law), University of Queensland.
1991 Jaedicke Fellow in Finance, Doctoral Program, Graduate School of Business, Stanford University.
1989 Touche Ross Teaching Prize, Department of Commerce, University of Queensland.
1986 University Medal in Commerce, University of Queensland.

Large Grants (over $100, 000)

- Australian Research Council Linkage Grant, 2008—2010, Managing Asymmetry Risk ($320,000), with T. Brailsford, J.Alcock, and Tactical Global Management.
- Intelligent Grid Cluster, Distributed Energy – CSIRO Energy Transformed Flagship Collaboration Cluster Grant, 2008-2010 ($552,000)
- Australian Research Council Research Infrastructure Block Grant, 2007—2008, Australian Financial Information Database ($279,754).
- Australian Research Council Discovery Grant, 2006—2008, Capital Management in a Stochastic Earnings Environment ($270,000).
- Australian Research Council Discovery Grant, 2005—2007, Australian Cost of Equity.
- Australian Research Council Discovery Grant, 2002—2004, Quantification Issues in Corporate Valuation, the Cost of Capital, and Optimal Capital Structure.

- Australian Research Council Strategic Partnership Grant, 1997—2000, Electricity Contracts and Securities in a Deregulated Market: Valuation and Risk Management for Market Participants.

Current Research Interests

Benchmark returns and the cost of capital. Corporate Finance. Capital structure. Real and strategic options and corporate valuation. Financial and credit risk management. Empirical finance and asset pricing.

Publications

Chan, K-F., R. Brooks, S. Treepongkaruna and S. Gray, (2011), "Do Trading Hours Affect Volatility Links in the Foreign Exchange Market?" *Australian Journal of Management*, forthcoming.

Chan, K-F., R. Brooks, S. Treepongkaruna and S. Gray, (2010), "Asset market linkages: Evidence from financial, commodity and real estate assets," *Journal of Banking and Finance*, forthcoming.

Parmenter, B, A. Breckenridge, and S. Gray, (2010), 'Economic Analysis of the Government's Recent Mining Tax Proposals', *Economic Papers*: *A Journal of Economics and Policy*, 29(3), September, 279-91.

Gray, S., C. Gaunt and Y. Wu, (2010), "A comparison of alternative bankruptcy prediction models," *Journal of Contemporary Accounting and Economics*, 6, 1, 34-45.

Feuerherdt, C., S. Gray and J. Hall, (2010), "The Value of Imputation Tax Credits on Australian Hybrid Securities," *International Review of Finance*, 10, 3, 365-401.

Gray, S., J. Hall, D. Klease and A. McCrystal, (2009), "Bias, stability and predictive ability in the measurement of systematic risk," *Accounting Research Journal*, 22, 3, 220-236.

Treepongkaruna, S. and S. Gray, (2009), "Information volatility links in the foreign exchange market," *Accounting and Finance*, 49, 2, 385-405.

Costello, D., S. Gray, and A. McCrystal, (2008), "The diversification benefits of Australian equities," *JASSA*, 2008, 4, 31-35.

Gray, S. and J. Hall, (2008), "The Relationship Between Franking Credits and the Market Risk Premium: A Reply," *Accounting and Finance*, 48, 1, 133-142.

Gray, S., A. Mirkovic and V. Ragunathan, (2006), "The Determinants of Credit Ratings: Australian Evidence," *Australian Journal of Management*, 31(2), 333-354.

Choy, E., S. Gray and V. Ragunathan, (2006), "The Effect of Credit Rating Changes on Australian Stock Returns," *Accounting and Finance*, 46(5), 755-769.

Gray, S. and J. Hall, (2006), "The Relationship Between Franking Credits and the Market Risk Premium," *Accounting and Finance*, 46(3), 405-428.

Gray, S. and S. Treepongkaruna, (2006), "Are there non-linearities in short-term interest rates?" *Accounting and Finance*, 46(1), 149-167.

Gray, P., S. Gray and T. Roche, (2005), "A Note on the Efficiency in Football Betting Markets: The Economic Significance of Trading Strategies," *Accounting and Finance*, 45(2) 269-281.

Duffie, D., S. Gray and P. Hoang, (2004), "Volatility in Energy Prices. In V. Kaminski," (Ed.), *Managing Energy Price Risk: The New Challenges and Solutions* (3rd ed.). London: Risk Books.

Cannavan, D., F. Finn and S. Gray, (2004), "The Value of Dividend Imputation Tax Credits in Australia," *Journal of Financial Economics*, 73, 167-197.

Gray, S. and S. Treepongkaruna, (2003), "Valuing Interest Rate Derivatives Using a Monte-Carlo Approach," *Accounting and Finance*, 43(2), 231-259.

Gray, S., T. Smith and R. Whaley, (2003), "Stock Splits: Implications for Investor Trading Costs," *Journal of Empirical Finance*, 10, 271-303.

Gray, S. and S. Treepongkaruna, (2003), "On the Robustness of Short-term Interest Rate Models," *Accounting and Finance*, 43(1), 87-121.

Gray, S. and S. Treepongkaruna, (2002), "How to Value Interest Rate Derivatives in a No-Arbitrage Setting," *Accounting Research Journal* (15), 1.

Gray, P. and S. Gray, (2001), "A Framework for Valuing Derivative Securities," *Financial Markets Institutions & Instruments*, 10(5), 253-276.

Gray, P. and S. Gray, (2001), "Option Pricing: A Synthesis of Alternate Approaches," *Accounting Research Journal*, 14(1), 75-83.

Dahlquist, M. and S. Gray, (2000), "Regime-Switching and Interest Rates in the European Monetary System," *Journal of International Economics*, 50(2), 399-419.

Bollen, N., S. Gray and R. Whaley, (2000), "Regime-Switching in Foreign Exchange Rates: Evidence from Currency Options," *Journal of Econometrics*, 94, 239-276.

Duffie, D., S. Gray and P. Hoang, (1999), "Volatility in Energy Prices. In R. Jameson," (Ed.), *Managing Energy Price Risk* (2nd ed.). London: Risk Publications.

Gray, S. and R. Whaley, (1999), "Reset Put Options: Valuation, Risk Characteristics, and an Example," *Australian Journal of Management*, 24(1), 1-21.

Bekaert, G. and S. Gray, (1998), "Target Zones and Exchange Rates: An Empirical Investigation," *Journal of International Economics*, 45(1), 1-35.

Gray, S. and R. Whaley, (1997), "Valuing S&P 500 Bear Market Warrants with a Periodic Reset," *Journal of Derivatives*, 5(1), 99-106.

Gray, S. and P. Gray, (1997), "Testing Market Efficiency: Evidence from the NFL Sports Betting Market," *The Journal of Finance*, 52(4), 1725-1737.

Gray, S. (1996), "Modeling the Conditional Distribution of Interest Rates as a Regime- Switching Process," *Journal of Financial Economics*, 42, 27-62.

Gray, S. (1996), "Regime-Switching in Australian Interest Rates," *Accounting and Finance*, 36(1), 65-88.

Brailsford, T., S. Easton, P.Gray and S. Gray, (1995), "The Efficiency of Australian Football Betting Markets," *Australian Journal of Management*, 20(2), 167-196.

Duffie, D. and S. Gray, (1995), "Volatility in Energy Prices," In R. Jameson (Ed.), *Managing Energy Price Risk*, London: Risk Publications.

Gray, S. and A. Lynch, (1990), "An Alternative Explanation of the January Anomaly," *Accounting Research Journal*, 3(1), 19-27.

Gray, S. (1989), "Put Call Parity: An Extension of Boundary Conditions," *Australian Journal of Management*, 14(2), 151-170.

Gray, S. (1988), "The Straddle and the Efficiency of the Australian Exchange Traded Options Market," *Accounting Research Journal*, 1(2), 15-27.

Teaching

Fuqua School of Business, Duke University, Student Evaluations (0-7 scale):

- Financial Management (MBA Core): Average 6.5 over 7 years.
- Advanced Derivatives: Average 6.6 over 4 years.
- Empirical Issues in Asset Pricing: Ph.D. Class

1999, 2006 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.

UQ Business School, University of Queensland, Student Evaluations (0-7 scale):

- Finance (MBA Core): Average 6.6 over 10 years.
- Corporate Finance Honours: Average 6.9 over 10 years.

2002 Australian University Teaching Award – Business (a national award for all university instructors in all disciplines).

2000 University of Queensland Award for Excellence in Teaching.
1999 Department of Commerce KPMG Teaching Prize, University of Queensland.
1998 Faculty Teaching Prize, Faculty of Business Economics and Law, University of Queensland.
1998 Commendation for Excellence in Teaching, University-wide Teaching Awards, University of Queensland.
1989 Touche Ross Teaching Prize, Department of Commerce, University of Queensland.

Board Positions

2002 - Present: Director, Financial Management Association of Australia Ltd.
2003 - Present: Director, Moreton Bay Boys College Ltd. (Chairman since 2007).
2002 - 2007: External Risk Advisor to Board of Enertrade (Queensland Power Trading Corporation Ltd.)

Consulting

Managing Director, Strategic Finance Group: www.sfgconsulting.com.au.

Consulting interests and specialties, with recent examples, include:

- **Corporate finance**
  - ⇒ **Listed multi-business corporation:** Detailed financial modeling of each business unit, analysis of corporate strategy, estimation of effects of alternate strategies, development of capital allocation framework.

- **Capital management and optimal capital structure**
  - ⇒ **State-owned electricity generator:** Built detailed financial model to analyze effects of increased leverage on cost of capital, entity value, credit rating, and stability of dividends. Debt of $500 million issued.

- **Cost of capital**
  - ⇒ **Cost of Capital in the Public Sector:** Provided advice to a government enterprise on how to estimate an appropriate cost of capital and benchmark return for Government-owned enterprises. Appearance as **expert witness** in legal proceedings that followed a regulatory determination.
  - ⇒ **Expert Witness:** Produced a written report and provided court testimony on issues relating to the cost of capital of a cable TV business.
  - ⇒ **Regulatory Cost of Capital:** Extensive work for regulators and regulated entities on all matters relating to estimation of weighted-average cost of capital.

- **Valuation**
  - ⇒ **Expert Witness:** Produced a written report and provided court testimony. The issue was whether, during a takeover offer, the shares of the bidding firm were affected by a liquidity premium due to its incorporation in the major stock market index.
  - ⇒ **Expert Witness:** Produced a written report and provided court testimony in relation to valuation issues involving an integrated mine and refinery.

- **Capital Raising**
  - ⇒ Produced comprehensive valuation models in the context of capital raisings for a range of businesses in a range of industries including manufacturing, film production, and biotechnology.

- **Asset pricing and empirical finance**
  - ⇒ **Expert Witness:** Produced a written report on whether the client's arbitrage-driven trading strategy caused undue movements in the prices of certain shares.

- **Application of econometric techniques to applied problems in finance**
  - ⇒ **Debt Structure Review:** Provided advice to a large City Council on restructuring their debt portfolio. The issues involved optimisation of a range of performance measures for each business unit in the Council while simultaneously minimizing the volatility of the Council's equity in each business unit.

⇒ **Superannuation Fund Performance Benchmarking:** Conducted an analysis of the techniques used by a large superannuation fund to benchmark its performance against competing funds.

- **Valuation of derivative securities**
  - ⇒ **Stochastic Volatility Models in Interest Rate Futures Markets:** Estimated and implemented a number of models designed to predict volatility in interest rate futures markets.

- **Application of option-pricing techniques to real project evaluation**
  - ⇒ **Real Option Valuation:** Developed a framework for valuing an option on a large office building. Acted as arbitrator between the various parties involved and reached a consensus valuation.
  - ⇒ **Real Option Valuation:** Used real options framework in the valuation of a bio-tech company in the context of an M&A transaction.

Jason Hall, PhD BCom(Hons) CFA

Director
SFG Consulting
Level 1, South Bank House, Stanley Street Plaza
South Bank, Queensland, Australia 4101
Phone: 61-7-3844 0684
Australia mobile: +61 419 120 348
j.hall@sfgconsulting.com.au

Experience

2000-12 University of Queensland Business School, The University of Queensland (Senior Lecturer)
2008 Ross School of Business, The University of Michigan (Visiting Assistant Professor in Finance)
1997-99 Credit Suisse First Boston (Equities analyst)

Education

2005 PhD in finance from The University of Queensland
2003 Chartered Financial Analyst designation by the CFA Institute
1996 Bachelor of Commerce with First Class Honours from The University of Queensland

Research

Journal articles

Impact of sector versus security choice on equity portfolios, with Ben McVicar, *Applied Financial Economics*, 2013, 23 (12), 991 – 1004.

Unconstrained estimates of the equity risk premium, with Stephen Gray, Tristan Fitzgerald and Ravi Jeyaraj, *Review of Accounting Studies*, 2013, 18 (2), 560 – 639.

Market risk exposure of merger arbitrage in Australia, with Matthew Pinnuck and Matthew Thorne, *Accounting and Finance*, 2013, 53 (1), 185 – 215.

The value of imputation credits on hybrid securities, with Clinton Feuerherdt and Stephen Gray, *International Review of Finance*, 2010, 10 (3), 365 – 401.

Forecast accuracy and stock recommendations, with Paul Tacon, *Journal of Contemporary Accounting and Economics*, 2010, 6 (1), 18 – 33.

Speculation and e-commerce: The long and the short of IT, with Colin Ferguson, Matthew Pinnuck and Frank Finn, *International Journal of Accounting Information Systems*, 2010, 11 (2), 79 – 104.

Bias, stability and predictive ability in the measurement of systematic risk, with Stephen Gray, Drew Klease and Alan McCrystal, *Accounting Research Journal*, 2009, 22 (3), 220 – 236.

Leveraged superannuation, with Peter Dunn and Scott Francis, *Accounting and Finance*, 2009, 49 (3), 505 – 529.

Persistence in growth versus market expectations, with Matthew Tochterman, *Australian Journal of Management*, 2008, 33 (1), 169 – 199.

Relationship between franking credits and the market risk premium: A reply, with Stephen Gray, *Accounting and Finance*, 2008, 48 (1), 133 – 142.

Comment on 'Regulation and the term of the risk free rate: Implications of corporate debt', *Accounting Research Journal*, 2007, 20 (2), 81 – 86.

Valuation of mining projects using option pricing techniques, with Shannon Nicholls, *JASSA*, 2007, Issue 4 (Summer), 22 – 29.

Relationship between franking credits and the market risk premium, with Stephen Gray, *Accounting and Finance*, 2006, 46 (3), 405 – 428.

Electronic commerce investments, the resource-based view of the firm, and firm market value, with Colin Ferguson and Frank Finn, *International Journal of Accounting Information Systems*, 2005, 6 (1), 5 – 29.

Auditor conservatism and voluntary disclosure: Evidence from the Year 2000 systems issue, with Peter Clarkson and Colin Ferguson, *Accounting and Finance*, 2003, 43 (1), 21 – 40.

Working papers

The impact of security analyst recommendations on the trading of mutual funds, with David Costello, AFAANZ Conference 2010 (Winner Best Paper in Finance), Australasian Finance and Banking Conference 2010, undergoing revisions for re-submission to *Journal of Contemporary Accounting and Economics.*

Portfolio rebalancing and mutual fund tournament behavior, with Paul Tacon, Finance and Corporate Governance Conference 2011, FIRN Frontiers in Finance Conference 2011, Financial Management Association Annual Meeting 2012, undergoing revisions for re-submission to *Financial Management.*

Forecasting stock returns using investor flows under short-sales constraints, with Paul Tacon, Australasian Finance and Banking Conference 2011, Finance and Corporate Governance Conference 2012, AFAANZ Conference 2012, Financial Management Association Annual Meeting 2012, Southern Finance Association Annual Meeting 2012.

Presentations

Accounting and Finance Association of Australia and New Zealand Conference (5) 2005, 2007, 2009-10, 2012
Asian Finance Association Conference 2009
Australasian Finance and Banking Conference (2) 2008, 2010
Australian National University Seminar Series 2012
Coal Trade, hosted by AIC Worldwide 1999
Coaltrans Asia, hosted by Coaltrans Conference Limited 1999
Contemporary Accounting Research/Journal of Contemporary Accounting and Economics Joint Symposium 2009
CPA Mining and Energy Conference 2006
Financial Management Association 2012
First Annual Private Equity Conference, hosted by Television Education Network 2007
JBWere Family Business Conference 2010
Melbourne Centre for Consumer Finance Investment & Regulatory Symposium 2008
PhD Conference in Economics and Business, hosted by University of Western Australia 2003
Southern Finance Association 2012
University of Melbourne Seminar Series (2) 2005, 2010
University of Queensland Seminar Series 2008

Referee activity

Accounting and Finance (8 reviews) 2003, 2005, 2009-13
Accounting Research Journal (3 reviews) 2002, 2006, 2010
Applied Financial Economics (3 reviews) 2012-13
Australian Journal of Management 2012
Contemporary Economic Policy 2011
Financial Review 2013
International Journal of Emerging Markets 2013
International Review of Finance 2012
MIS Quarterly 2003
Quarterly Journal of Finance and Accounting 2010
Quarterly Review of Economics and Finance 2012

Research grants

PricewaterhouseCoopers/Accounting and Finance Association of Australia and New Zealand 2006: Returns, tax and volatility – Superannuation choice with a complete information set ($8,500)
Australian Research Council Discovery Grant 2002-4: Quantification issues in corporate valuation, the cost of capital and optimal capital structure ($126,000)
UQ New Staff Research Start-up Fund: The competitive advantage of investments in electronic commerce ($10,000)

Research students

PhD (1 student)

2012 – Paul Tacon

Honours (20 students)

2012 – Edward Parslow (Carnegie Wylie)
2011 – James Lamb (Port Jackson Partners)
2010 – Jeremy Evans (JP Morgan), Sarah Thorne (JP Morgan), Alexandra Dwyer (Reserve Bank of Australia)
2009 – Tristan Fitzgerald (UNSW), David Costello (National Australia Bank), William Toe (Ernst & Young)
2008 – Ben McVicar (Credit Suisse), Matthew Thorne (Credit Suisse)
2007 – Sam Turner (ABN Amro Morgans)
2006 – Paul Tacon (PhD, UQ), Ravi Jeyaraj (Navis Capital), Thomas Green (Crescent Capital), Alexander Pascal-Bossy (Macquarie)
2005 – Angela Gill (Wilson HTM), Andrew Wagner (Macquarie)
2004 – Matthew Tochterman (M. Fin. Eng., UC Berkeley), Justyna Lewandowska (JP Morgan), An Pham (UBS)

Masters (2 students)

2003 – Scott Francis (A Clear Direction Financial Planning), Hernando Barrero (PricewaterhouseCoopers)

PhD reader

Damien Cannavan 2012

Teaching

UQ Business School, The University of Queensland (Mean teacher ratings out of a possible 5.0)

Awarded undergraduate teaching prize 2009
Empirical Finance Honours (2009-12; PhD and Honours students; avg. rating 4.1)
Corporate Finance Honours (2005 & 2011; PhD and Honours students; avg. rating 4.7)
Investments & Portfolio Management (2002-7, 2009-10 & 2012; B.Com, MBA & M.Com students; avg. rating 3.8)
Corporate Finance (2002-4, 2006-10 & 2012; B.Com, MBA and M.Com students; avg. rating 3.8)
Finance (2005-6; M.Com students; avg. rating 3.7)
Corporate Finance and Investments (Mt Eliza Business School, Beijing 2003; MBA students)
Technology Valuation and Project Evaluation (Singapore 2004; Masters of Technology Management students)
Auditing (Summer 2000/1-2001/2; B.Com, MBA and M.Com students; avg. rating 3.8)

Ross School of Business, The University of Michigan

Corporate Financial Policy (2008; MBA students; avg. rating 4.3)

Executive education

Risk Management and Financial Analysis (Rabobank 2000-10)
Financial Analysis of Innovative Investments (UQ Business School 2007)
Credit Analysis (Queensland Treasury Corporation 2005)
Capital Management (UQ Business School 2004)
Making Critical Financial Decisions (UQ Business School 2003)
Business Valuation and Analysis (UQ Business School 2003)
Cost of Capital Estimation (UQ Business School 2003)
Analysis of Real Options (Queensland Treasury 2003)

Student competitions

Rotman International Trading Competition

Manager of the UQ Business School trading team (2007 & 2009-12) which competes annually at the University of Toronto amongst 50 teams. UQ is the 9th most successful entrant from 66 schools which have competed in any of the same years, finishing 3rd in 2010, 6th in 2007, 11th in 2009, 14th in 2011 and 18th in 2012.

UBS Investment Banking Competition

Judge for the UQ section 2006-7 & 2009-12. Faculty representative at the national section 2008.

JP Morgan Deal Competition

Judge for the UQ section 2007-8.

Wilson HTM Research Report Competition

Delivered two workshops as part of the 2006 competition and was one of three judges.

Industry engagement

From 2000-12, I have provided consulting services as part of SFG Consulting and UQBS Commercial. Services have been provided in conjunction with Frontier Economics, ARENA Consulting, Parsons Brinckerhoff and Uniquest.

Retail electricity and gas margins in NSW (Independent Pricing and Regulatory Tribunal 2012)

In 2006-7 and 2009-10 I acted as part of a team which was engaged to estimate electricity costs and margins for electricity and gas retailers in NSW. We have been reappointed for 2012-13. My role related to the estimation of a profit margin which would allow the retailer to earn a return commensurate its systematic risk. The approach developed was novel in that the margin was derived without reference to any pre-defined estimate of the asset base. Rather, the margin was a function of the potential increases or decreases in cash flows which would result from changes in economic conditions. Reports are available from IPART.

Advice on rules to determine regulated rates of return (Australian Energy Markets Commission 2012)

The AEMC is considering changes to the rules relating to regulation of electricity and gas networks. Independent rule change proposals have been put forward by the Australian Energy Regulator and the Energy Users Association of Australia. Both groups argue that application of the existing rules by the regulator generate upwardly-biased estimates of the regulated rate of return. As part of a team I am currently providing advice to the commission on whether the rule change proposals provide evidence on an upward bias, and if so, whether the proposed amendments are likely to reduce the extent of any bias.

Expert evidence relating to regulated rates of return (Electricity network businesses 2011)

In April 2011 the Australian Competition Tribunal heard an appeal by electricity networks on the regulated rate of return set by the Australian Energy Regulator. The issue was the value of dividend imputation tax credits. The Tribunal directed us to perform a dividend drop-off study to estimate the value of a distributed credit. Largely on the basis of our evidence the Tribunal determined that an appropriate value for a distributed credit was 35 per cent of face value. The Tribunal determination is available on its website and our expert report is available on request.

Estimation of risks associated with long-term generation contracts (New South Wales Treasury 2010)
In 2010 the NSW Government privatised a segment of its electricity industry, by selling three electricity retailers and entering into two generation agreements termed GenTrader contracts. The state-owned generators agreed to provide generation capacity in exchange for a charge. The generators also agreed to pay penalties in the event that their availability was less than agreed. As part of a team, I provided advice to NSW Treasury on the risks associated with the contracts. The estimated penalties resulting from this analysis are used by NSW Treasury in their budgeting role and in providing forward-looking analysis to the Government.

Litigation support relating to asset valuation (Alcan 2006-7)
In 2006-7 I acted as part of a team which provided litigation support to Alcan in a dispute with the taxation authority in the Northern Territory. The dispute related to whether Alcan was required to pay stamp duty as a result of its acquisition of an additional 30 per cent interest in Gove Alumina Limited. One issue was whether the acquisition was land-rich, meaning that the proportion of the asset considered to be land exceeded a threshold triggering stamp duty.

Methodology for evaluating public-private partnerships (Queensland Treasury Corporation 2005)
In 2005 I acted as part of a team which advised QTC on evaluating public-private partnerships, which typically require subsidies to appeal to the private sector. We rebutted the conventional wisdom, adopted in NSW and Victoria, that the standard valuation approach is flawed for negative-NPV projects. Furthermore, we developed a technique to incorporate systematic risk directly into expected cash flows, which are then discounted at the risk-free rate.

Litigation support
Insolvency proceedings relating to the collapse of Octaviar (Public Trustee of Queensland 2008-9)
Valuation of resource assets (Compass Resources 2007-8, Westpac Banking Corporation 2007)
Appeals against regulatory determinations (Envestra 2007-8, Telstra 2008)
Advice on whether loan repayments correspond to contract terms (Qld Dept. of Fair Trading 2005)
Advice on whether port and channel assets were contributed and hence not part of regulated assets (Comalco 2004-5)

Valuation
Management performance securities (Collins Foods Group 2006-11, GroundProbe 2008-9)
Ordinary shares in the context of an equity raising (Auscript 2007-8)
Intangible assets (Inbartec 2007)
Resources assets (Senex Energy 2012, Chalco 2007, Bank of Queensland 2007)

Cost of capital estimation, advice and regulatory submissions
Transport (Qantas 2008, QR National 2005 & 2012)
Water (Essential Services Commission of South Australia 2012, ActewAGL 2012, IPART 2011, Metropolitan utilities in Victoria 2004 & 2006-7, QCA 2002-3)
Energy networks (Economic Regulation Authority in Western Australia 2009, Hong Kong Electric 2007, Envestra 2006-7 & 2012, Powercor 2005, AGL 2004, Energex 2003-4, Ergon Energy 2003-4)
Local government networks (Queensland Competition Authority 2009)
Electricity generation (National Generators Forum 2008)
Environmental consulting (Ecowise 2007)
Listed vs unlisted infrastructure funds across alternative European equity markets (ABN AMRO Rothschild 2007)
Forestry assets (Queensland Department of Natural Resources 2004)

Portfolio performance measurement
Performance evaluation and benchmark derivation (Friday Investments 2010-12, Zupp Property Group 2011-12)

Corporate finance
Economic impact assessment of a proposed development of a retail shopping complex (Lend Lease 2006)
Impact of an acquisition on dividend growth, earnings per share and share price (AGL 2003-4)
Estimation of the optimal capital structure for electricity generation and distribution (NSW Treasury 2001-2)
Review of the debt valuation model used by the Snowy Hydroelectric Authority (NSW Treasury 2002)
Estimation of the optimal contract terms for coal sales to an electricity generator (NSW Treasury 2001-2)

Econometrics
Scoping study into the determinants of changes in tax debt in Australia (Australian Taxation Office 2007)

Interests

I am interested in sport as a participant and spectator. I finished 3rd on three occasions in the Brisbane Half Marathon (2005 & 2009-10), 8th in the Toronto Half Marathon (2002) and 3rd in the Australian Universities Marathon Championships (2003). I have finished 17 marathons, recording a best time of 2:47:54 in the Chicago Marathon 2011. From 1994-96 I was a member of The University of Queensland tennis team, which placed 1st at the Australian University Games in 1994.