REPORT TO THE AER

THE DIVIDEND GROWTH MODEL (DGM)

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December 14, 2013

Background

We have been asked to provide a critical review of the AER's draft guideline on the DGM.

Specifically, in the context of the AER's guidelines development, our advice was sought on the following matters:

1. Provide a critical review of the reasonableness of the AER's adoption of a two stage dividend growth model compared with a single stage model, three stage model, or other versions of dividend growth models.

   In providing this review, take into account the AER's rate of return criteria, focusing on:

   - where applicable, reflective of economic and finance principles and market information:
     - estimation methods and financial models are consistent with well accepted economic and finance principles and informed by sound empirical analysis and robust data
   - fit for purpose:
     - use of estimation methods, financial models, market data and other evidence should be consistent with the original purpose for which it was compiled and have regard to the limitations of that purpose
     - promote simple over complex approaches where appropriate
   - implemented in accordance with good practice:
     - supported by robust, transparent and replicable analysis that is derived from available credible datasets
   - where models of the return on equity and debt are used these are:
     - based on quantitative modelling that is sufficiently robust as to not be unduly sensitive to errors in inputs estimation
     - based on quantitative modelling which avoids arbitrary filtering or adjustment of data, which does not have a sound rationale
   - where market data and other information is used, this information is:
     - credible and verifiable
     - comparable and timely
     - clearly sourced

- sufficiently flexible as to allow changing market conditions and new information to be reflected in regulatory outcomes, as appropriate.

- In providing this review, assess the reasonableness of the methodology and input assumptions adopted by the AER with its two stage DGM. This review should include an assessment of or advice on:
    - estimating the long-term growth rate of dividends
    - the appropriate data source for obtaining forecasts of future dividends (possibly including comments on IBES as a potential data source)
    - estimating the adjustment factor for imputation credits

Executive Summary

The uncertainty that pervades the cost of capital debate means that we are strongly in favour of the triangulation of evidence from a range of sources. To this end, we are of the view that the dividend growth model (DGM) might be used as a reasonableness check in regulatory determinations. However, it is important to note that there are substantial limitations to the basic form of this model. To that end, an alternative specification of the DGM may prove useful, subject to the caveat that any extension of the model is going to require additional assumptions to be made and there will be considerable uncertainty around what the correct assumptions are. As such, any results must be interpreted carefully, keeping in mind the sensitivity of the results to the assumptions made.

We caution that current applications of the DGM, including the two stage model, are quite likely to result in upward biased estimates of the cost of equity. We explore the three main reasons for this upward bias.

The first is the common practice of modelling the growth path of dividends using analysts' forecasts. A well-established literature finds clear evidence that analysts' forecasts are overly optimistic with respect to target prices, earnings and dividends. Further, analyst forecasts are also not as forward looking as we might expect and react slowly to new information.

The second reason for this bias is linked to the growing importance of non-dividend forms of cash flows between the company and its shareholders. Specifically, it is share issues and the rise in prominence of share repurchases and dividend reinvestment plans that complicate matters and may lead to a biased result.

The third reason for upward bias is the common use of the GDP growth rate as a proxy for the expected long run growth rate for dividends. We note that empirically, there is a lack of evidence to support this assumed relationship and that negative correlations between GDP growth and stock returns are commonplace. Putting this aside and assuming that the GDP growth rate is used to proxy for the long run dividend growth rate it should be adjusted downwards. This adjustment is required to account for the additional capital that investors must supply to support the growth in GDP.

We also note that there is a tendency for dividend growth rate forecasts to be persistently positive and decidedly optimistic. This is possible in the short run for both individual firms and the market, but it is clearly not possible that *all* short-runs have above average growth rates.

We survey evidence on long run dividend growth rates for Australia and the average of the estimates that we consider is 3.73% (3.78% excluding the most extreme values). By way of contrast, the AER estimate is higher than these values at 4.6%.

In this report, we also consider a number of suggestions made by SFG (2013) with respect to the growth horizon, the use of share prices versus target prices, time matching analysts' forecasts with prices and jointly estimating the growth rate and the cost of equity. While interesting, it is not clear whether any real improvement is achieved in the accuracy of the cost of equity estimate. Indeed the use of an extended growth horizon is likely to inflate the estimated cost of equity.

We also consider the adjustment suggested by Pratt and Grabowski (2010) to account for the timing of dividends. We are of the view that in light of the other sources of inaccuracy in the DGM, explicitly making this type of adjustment would not lead to any meaningful refinement of the estimated cost of equity.

Finally, we consider SFGs concerns regarding the inconsistency between the AER's imputation adjustment for dividends for use in the DGM and the AER's accounting for imputation in its post tax revenue model. There are two issues, one arising from the use of a pre-tax cost of equity that only reliably applies in the case of perpetuities. The other issue is the implicit assumptions about the dividend payout ratio and the level of franking. The gamma factor used in computing the estimated corporate tax is a market-wide parameter that depends upon the market's dividend payout ratio and the level of franking, but it also is affected by companies that create imputation credits, but are not paying dividends. Whereas, at the level of the firm, the payout ratio is the firm's actual payout ratio, the level of franking is the firm's level of franking and the formula only applies to firms paying dividends. Thus, it is entirely possible and appropriate for adjustments for the effect of imputation on cash dividends at the level of individual firms to differ from the market wide adjustment that the AER uses to estimate the cost of corporate tax. While the adjustments should apparently be the same at the the market wide levelthe complicating factor is the firms that create imputation credits but don't pay dividends. As a result the dividend adjustment for franking gives a slightly higher benefit from franking than is assumed in the computation of the effective corporate tax.

1. Introduction

We have previously advised that a dividend growth model might be used as a reasonableness check in the regulatory determination of the cost of equity, but we have also pointed to the substantial limitations of the basic form of this model. Indeed, we are fond of quoting Hathaway (2005, p.3), who commented that:

> "It is a perpetuity model that has constant assumptions but it is applied in an ever changing world. The poor thing is not up to the task."

The key sensitivity of the model lies in the assumption about the dividend growth rate, but as Hathaway points out the model can readily go off the rails in the face of the relevant variables being expected to change through time. Lally (2013), for example, illustrates the problems that can arise if the cost of capital is expected to change or if the payout/retention ratio changes. Brick, Chen and Lee (2013) highlight the strong assumptions the DGM makes with regard to the financing mix of the firm.

The basic form of the dividend growth model is often referred to as the DGM, but since there are many possible dividend growth models we will refer to the basic DGM as the Gordon model. In the Gordon model the cost of equity is taken to be the expected dividend yield for the next year plus a constant. This constant represents the expected rate of growth in dividends from next year until infinity. It is clear that the estimate of the cost of equity obtained from this model will be sensitive to the choice of the growth rate[1] and it is also clear that the assumption of a constant growth rate from next year to infinity is unrealistic. In some applications of the Gordon model, next year's expected dividend is estimated as the current dividend grown forward at the constant growth rate. In this case, the assumption then becomes an even more unrealistic assumption of a constant growth rate from now until infinity.

The AER proposes to use a two stage model rather than the Gordon model. The use of a two stage model, where dividends are allowed to vary, before settling down to a long term growth rate is a potential improvement on the Gordon model.[2] Whether this potential is realised will depend on the inputs to the model. Furthermore, the estimated cost of equity

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[1] The growth rate may be estimated using a firms fundamentals, historical data (as per Lally's analysis of estimating the long term growth rate of dividends) or financial analysts forecasts. On the latter, we note the use of Bloomberg data on expected earnings to condition the near term (ie. current and next two years) forecasts of dividends per share. To the best of our knowledge, the only comparable source of information currently available is from I/B/E/S. As these two databases are different, and given our stated preference for triangulation across various sources of information, we argue that it is appropriate to consider both sources of earnings information in constructing short term growth forecasts in the context of the DGM.

[2] While the two stage DGM may well be an improvement over the basic Gordon DGM, we note that Truong and Partington (2007) and Guay, Kothari and Shu (2011) find the finite growth DGM of Gordon and Gordon (1997) performed quite well relative to other models for estimating the implied cost of equity and we would recommend it as a useful model for consideration in the triangulation of evidence on this issue.

will continue to be sensitive to assumptions about the growth path and the long term growth rate.

To understand why, recall that the underlying logic of this model is that a firm should be able to grow at a high rate for a period in which it is able to reinvest funds in projects that earn a high rate of return. However, such opportunities become increasingly rare and eventually the firm will grow at a slower rate. Furthermore, in perpetuity that rate cannot exceed the growth rate of the economy. Clearly, the characterisation of the trajectory of expected dividends depends on how long the firm is in this high growth period, what above average rate of growth it generates and how the high growth transitions to the lower steady state growth. For each of these issues, an assumption is going to have to be made and each assumption is going to have a significant impact on the final estimate of the cost of equity.

Indeed, the sensitivity of the results of the DGM to growth assumptions is amply demonstrated by the debate between Lally (2012, 2013) and CEG (2012a,b,c) about the appropriate estimate of the market rate of return using the DGM. This sensitivity to assumptions is also illustrated in SFG's (2013) comparison of their application of a DGM and the AER's application of a DGM for individual regulated entities. The problem in resolving any debate about whose assumptions are better is that there is considerable uncertainty with respect to the key inputs, the growth path and long term growth rate. If there were objective and reliable measurements of these inputs, then there would be no need for assumptions about their value.

In this context, the AER's use of a two stage model is a reasonable approach to estimating the cost of equity using the DGM and meets most of the criteria as outlined in the Background section above. However, there are some issues that need to be considered and we discuss these issues below. We begin by considering the risk of a significant upward bias in the implied cost of capital estimates.

2. Sources of Upward Bias in the AER's DGM Estimate

We caution that current applications of the DGM, including the two stage model, are quite likely to result in upward biased estimates of the cost of equity. There are three reasons for this: bias in analyst's forecasts of dividends, failure to fully account for relevant cash flows in computing "dividends", and the questionable use of the expected growth rate in GDP as the long run growth rate for dividends. We will examine each in turn.

In understanding the effect of these biases it is helpful to know that when using an implied cost of equity method, such as a DGM, the principle is to equate the present value of forecast cash flows to the current share price. The discount rate that achieves this equality is the internal rate of return and this is the estimate of the cost of equity. If the cash flow is overstated then a higher discount rate is required to equate the present value of the cash flows with the price. Thus, there is an upward bias in the cost of equity. Conversely, the cost of equity will be downward biased if the cash flow is understated. Similarly, the cost of equity will be upward biased if the growth rate is overstated and the cost of equity will be downward biased if the growth rate is understated.

2.1 Overly Optimistic Analysts

In multistage growth models, the value for the dividends (their implicit growth path) before they settle down to steady state growth is often based on analyst's forecasts. This is the case with the AER's estimates.

It is well understood that analysts forecasts are overly optimistic with respect to target prices (see Bradshaw, Brown and Huang, 2012, and Parslow, 2012) and earnings (see *inter alia* Easton and Summers, 2007, Guay, Kothari and Shu, 2011, Hribar and McInnis, 2012, Brown, How and Verhoeven, 2013, and So, 2013). It is still an open issue however, as to exactly why these forecasts are so upwardly biased. For example, Hribar and McInnis (2012) find that analyst's forecasts for one-year ahead earnings and long-term earnings growth are relatively more optimistic when investor sentiment is high. So (2013) attributes this bias to the incentive misalignment between analysts and those of the end users of the earnings forecasts.

Given this bias, a literature has developed that focuses on explicitly correcting analysts forecasts for expected forecast errors (see *inter alia* Guay, Kothari and Shu, 2011, Hughes, Liu and Su, 2008, Mohanram and Gode, 2013 and So, 2013). In particular, Mohanram and Gode (2013) detail a comprehensive method for removing predictable forecast errors from analyst forecasts in the context of cost of equity estimates.

It is logical that if the forecasts of earnings are upward biased, then the estimates of dividends are also likely to be upward biased. The evidence suggests that while this is true, analysts' forecasts of future dividends are upward biased to a lesser extent that the bias in earnings (see Brown et al., 2002). This upward bias in the forecasts of dividends means that in order to equate the present value of the dividends to the current share price, a higher discount rate (cost of equity) has to be used. Thus, the estimated cost of equity is upward biased.

In addition to this upward bias, Guay, Kothari and Shu (2011) provide recent empirical evidence on the sluggishness of analysts to react to the information already captured in changes in share prices (for early evidence on this issue see Lys and Sohn, 1990, and Ali, Klein and Rosenfeld, 1992).[3] Damodoran (2006, Ch11) also observes that analysts' forecasts are not as forward looking as we would expect and:

> "… past growth rates play a significant role in determining analyst forecasts."

[3] This result may be driven by the use of consensus analysts forecasts. As SFG (2013) point out such forecasts contain a mixture of current and stale forecasts and this is likely to contribute to the problem of sluggish adjustment.

This sluggishness phenomenon has consequences for cost of equity estimation as analyst's earnings forecasts will be out of date relative to the share price at the date the forecast is formed. This creates a problem in correctly matching the forecasts to the appropriate price - if the forecast is matched to the price at the forecast date, an additional source of bias is created in the cost of equity estimates.

To understand this bias, note that when a share price has been rising (which implies increasing expected earnings), the analysts forecast tends to understate the expected earnings impounded into the price. Consequently, the implied cost of equity will be downward biased. When a share price has been falling however (which implies decreasing expected earnings), the analysts forecast tends to overstate the expected earnings impounded into the price. Consequently the implied cost of equity will be upward biased.

Thus, recently falling prices intensify the bias created by overly optimistic analyst's forecasts and recently rising prices mitigates this bias. Obviously, for firms without recent stock price run-ups or run-downs, sluggishness is unlikely to be a cause of substantive bias. To overcome the sluggish adjustment problem, Guay, Kothari and Shu (2011) suggest lagging the prices by five months relative to the date of the analysts forecast, although such an adjustment is neither perfect nor appropriate for every firm.

2.2 Accounting for Relevant Cash Flows

When Myron Gordon developed the Gordon growth model share repurchases and dividend reinvestment plans were not a significant feature of the corporate landscape. As a consequence, the dividend arguably represented a *reasonably good* measure of the net cash flow from the company to its shareholders.

Our description of dividends as a 'reasonably good measure' is quite deliberate as it is important to understand that it is not a perfect measure due to the fact that the forecast dividend may not account for shareholders putting cash back into the company. It is well recognised that it is the net dividend (the dividend adjusted for contributions of cash by, or returns of capital to, shareholders) that determines the value of the shareholders' equity.

It can be quite difficult to trace through the effect of share issues, share repurchases and dividend reinvestment on DPS. It is far easier to think in terms of what happens to the total dividend for the company. We recommend this approach as bringing greater clarity of thought to the analysis of these issues.

2.2.1 Share issues

If share issues are expected, then valuations need to be adjusted. For example, if we offer you a share with an expected $1 dividend forever and the cost of equity is 10%, then the share is worth $10.00 ($10 = $1/0.10). Now suppose that we tell you that in order to maintain the expected dividend of $1.00 forever, a capital contribution of $10 will be required in year ten. The share is now only worth \$6.14 (\$6.14 = $1/0.1 - 10/(1.1)^{10}$) and if we tell you that the \$10 contribution is required next year, then the share is only worth \$0.91 (0.91 = $1/0.1 - 10/(1.1)$). In all cases the correct implied cost of equity is 10%, but if we neglect the capital contribution, then the implied cost of equity in the second case is 16.29% (1/0.16287 = \$ 6.14) and in the third case it is over 100%! While the third case is too extreme, it does clearly illustrate that neglecting capital contributions can lead to an upward bias in implied cost of equity estimates.

Rather than being required to sustain the current expected dividend, the additional injections of capital may give rise to additional dividends. In this case, the questions are: have the analyst's forecasts allowed for both this future dividend growth and have they allowed for the capital injection? If the answer to both questions is yes, then the key issue *ceteris paribus* is the accuracy of the forecasts. If the answer to one or other of the questions is no, then the forecast is biased - upwards if the capital contributions are neglected and downwards if future growth arising from those capital contributions is neglected. If both the capital contribution and the resulting growth in dividends are neglected then the biases offset each other to some extent. If the capital investment is a zero NPV investment then the biases offset each other exactly.

2.2.2 Share Repurchases and Dividend Reinvestment Plans (DRPs)

In the period following the introduction of the Gordon model, share repurchases and DRPs have become increasingly common.

With respect to repurchases, Damodoran (2006, Figure 13.3) reports that over the period 1960 to 1998, approximately the same amount was paid out in the form of stock buybacks as was paid as dividends. Indeed in the United States, share repurchases have become so common that corporate finance texts now talk about payout policy (encompassing dividends and share repurchases) rather than just dividend policy. In Australia, share repurchases are much less important than in the United States and historically have been small relative to dividends, but their importance has grown. Neglect of repurchases will lead to downward bias in the forecast of net cash flow to shareholders and thus also lead to downward bias in the implied cost of equity.

With respect to DRPs, they have become popular in Australia and have been adopted by many dividend paying firms. An important feature of Australian DRPs is that investors receive newly issued shares, which increase the capital of the company. This is in direct contrast to the United States, where shares for the dividend reinvestment plans are commonly obtained by buying shares in the market on behalf of the shareholders participating in the DRP. As such, Australian DRPs involve investors contributing capital to the firm, while in the United States this is typically not the case. Australian shareholders participating in the DRP are therefore putting cash back into the business. The result is a smaller net dividend paid by the company, with less cash in total being distributed.

In Australia, DRPs have become quite an important source of equity capital for companies. For example, the ASX (2010, p32) notes that:

> "A total of 230 companies made use of DRPs during 2009, raising around \$11.4bn. This compared to 269 companies raising \$15.6bn in 2008 and 271 companies raising \$11.9bn in 2007."

These figures represent between around 0.75% and 1.25 % of the Australian market capitalisation for the years when the DRP funding was raised. This compares with an average dividend yield for each financial year over this period, varying from 3.81% to 5.00% (as reported by the Australian Tax Office).[4] We note that these numbers are intended to be illustrative rather than definitive, but they clearly suggest that DRPs result in a nontrivial reduction in the net dividend yield on the market. Indeed, for some Australian companies, DRPs have become such an important source of capital that they have their DRPs underwritten in order to guarantee the quantity of capital raised.

The effect of DRPs on the net dividend for individual stocks can be substantially higher or lower than the effect on the net yield on the market depending on the DRP participation rates for the individual firm. We note that with DRP participation rates running at between 15% to 45% percent, the DRP can represent a substantial reduction in the current dividend yield.

Failure to account for DRPs may significantly upwardly bias the implied cost of capital at the level of the individual firm and at the level of the market. For example, one procedure is to take the prospective dividend yield at say 4.0% and allow for growth at the forecast rate of nominal GDP, say 5%, giving an expected equity return of 9.0%. However, if 30 percent of the dividend is returned to the firm via the DRP, then the net dividend is 2.8%. This results in an expected equity return of 7.8%.

Depending on how the dividend growth model is applied, the effect of the DRP may also flow through into the forecast future growth path for dividends. For example, suppose that forecast dividends are reduced to allow for the cash returned to the company via the DRP. Thus, part of the company's future equity raising has been accounted for in the dividend net of DRP participation. DRPs seem unlikely to meet all of a company's future needs for equity capital, but reductions in the net dividend to allow for future equity raising only need to allow for the value of share issues in excess of the issues already allowed for under the DRP. Of course, if there was no allowance being made for future equity raising, then reducing forecast dividends to allow for DRP participation helps to partially correct that error.

2.3 The GDP growth rate

Use of the expected long run growth rate in GDP as a proxy for the expected long run growth rate for dividends has been a popular choice in implementing the DGM. The assumption is that in the long run dividends and stock prices will tend to grow in line with

[4] During this period the dividend yield on a monthly basis peaked at over 7% in January 2009 as reported by Datastream.

the growth rate of the general economy.[5] However, this assumption may not be as self-evidently appropriate as is often assumed. Barra (2010) points out that in order for real stock price increases to follow real GDP growth, the following conditions must hold:

- the share of company profits in the total economy remains constant
- investors have a claim on a constant proportion of those profits
- valuation ratios are constant
- the country's stock market only lists domestic companies
- the country's economy is closed,

The unrealistic nature of each of these assumptions, makes it less surprising to learn that the empirical literature has found *no* evidence of a positive relationship between GDP growth and stock returns (although an asymmetry exists insomuch as negative economic growth is clearly bad for the stock market). Indeed, the evidence suggests that the relationship between GDP growth and stock returns may be negative (see Siegel, 2002, Ritter, 2005, 2012, Barra, 2010, and Estrada, 2012).

Taken at face value, this evidence suggests that future economic growth is largely irrelevant to forecasting stock returns in the long run. As Ritter (2012, p. 16) puts it:

> "… whether the Chinese economy ends up growing by 7% per year, or by 3% per year, for the foreseeable future is unimportant for the future returns on Chinese stocks."

Barra (2010) describe and empirically examine the mechanism through which the assumed relationship exists and they find evidence in support of the hypothesis that *aggregate* corporate earnings grow at the same pace as GDP. The relationship between GDP growth and *individual* earnings per share (EPS), however, is weaker. For example, Table 1 below reproduces Exhibit 3 from Barra (2010) and the mean difference between GDP growth and EPS growth as 2.3% across all countries, and 2.7% for Australia.[6]

Note that earnings growth is relevant to dividend growth as in the Gordon model, prices, earnings and dividends are assumed to grow at the same rate.[7] The Appendix provides a detailed explanation of this point.

Thus, these Barra results highlight the important point that changes in GDP provide an upward biased estimate of the growth rate in dividends. Bernstein and Arnott (2003) estimate the upward bias across countries to be about 2%. One reason for this upward bias

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[5] In the applications of the DGM, both dividends and stock prices are assumed to grow at the same rate in the long run.

[6] Barra (2010) also discusses how these changes to EPS will translate into higher share prices if valuations (the P/E ratio) were fixed. Given this assumption is clearly unrealistic, it is no surprise that Barra (2010) finds no relationship between prices and the observed EPS growth – the real GDP growth rate for Australia is 3.1%, which is the same as the GDP growth minus the stock price returns (= 3.1%).

[7] We also note that in the long run, dividends clearly cannot grow faster than earnings.

is that part of GDP growth accrues to capital yet to be invested. As Ritter (2005, p. 490) puts it:

> "If an economy grows because personal savings are invested in new firms, or invested in existing firms through debt and equity infusions, the gains on this capital investment do not accrue to existing shareholders. Empirically, what matters for stock returns is how much of an economy's growth comes from reinvestment of earnings into positive NPV investments in existing publicly traded companies, versus how much of it comes from personal savings that are then invested in private companies or in new issues of equity from existing companies."

Ritter (2005) also points out that labour may increase its share of GDP growth at the expense of capital.

Table 1
The Relation Between GDP and Earnings from Barra (2010)

1969 - 2009	Real GDP growth rates	Real stock price return	Real EPS growth rates	PE change	GDP growth minus stock price return	GDP growth minus EPS growth
Australia	3.1%	0.0%	0.5%	-0.4%	3.1%	2.7%
Norway	3.0%	2.7%	0.9%	1.8%	0.3%	2.1%
Spain	3.0%	-1.4%	n. a.	n. a.	4.5%	n. a.
Canada	2.9%	2.5%	1.3%	1.1%	0.4%	1.6%
United States	2.8%	1.6%	0.0%	1.6%	1.2%	2.8%
Japan	2.8%	1.5%	not meaningful	not meaningful	1.3%	n. a.
Austria	2.6%	0.6%	-1.9%	2.6%	1.9%	4.6%
Netherlands	2.4%	1.9%	-2.6%	4.6%	0.5%	5.1%
France	2.3%	1.7%	n. a.	n. a.	0.6%	n. a.
Belgium	2.3%	0.6%	-2.8%	3.5%	1.7%	5.3%
United Kingdom	2.2%	1.1%	1.6%	-0.6%	1.1%	0.5%
Sweden	2.1%	5.8%	4.4%	1.3%	-3.5%	-2.3%
Italy	2.0%	-1.7%	n. a.	n. a.	3.8%	n. a.
Germany	1.8%	1.6%	-1.1%	2.7%	0.3%	2.9%
Denmark	1.7%	3.6%	1.2%	2.4%	-1.9%	0.5%
Switzerland	1.5%	2.6%	-0.5%	3.1%	-1.1%	2.0%
Average	2.4%	2.0%	0.1%	2.0%	0.3%	2.3%
MSCI ACWI[1]	2.7%	2.1%	0.6%	1.5%	0.6%	2.1%

Source: MSCI Barra, US Department of Agriculture, OECD. Average based on all countries excluding Spain, Japan, France, Italy.

The empirical evidence suggests that the long run growth rate of GDP may not be a good measure of dividend growth, it is clear however that the GDP growth rate provides an upper limit on the long run dividend growth rate. It is unreasonable to predict that a firm's long run stable dividend growth rate is higher than the GDP growth rate - because this implies that eventually the firm has a bigger cash flow than the economy. There is, however, nothing to stop the long run stable growth rate being less than the growth rate in GDP. For example, Bernstein and Arnott (2003) report that dividend growth in Australia was about 2.4% less than real GDP growth. Damodoran (2006, Ch 12) suggests that as a rule of thumb, the stable growth rate should not exceed the riskless rate used in the valuation.

Indeed there is nothing to stop the growth rate in dividends being negative for individual firms (in both the short run and the long run).[8] This is an important point as it should not automatically be assumed that dividend growth rates will always be positive. Companies and markets can and do fall into hard times and dividends decline. Companies can temporarily inflate their dividends above their free cash flow by raising finance externally and, if this finance is raised through debt, the net dividend will also rise. The cost however, is of lower dividends in the future. Indeed, the financing of dividends seems to be exactly the course of action that regulated water companies in the UK have been following, Armitage (2012).

In most cases however, forecasts of dividend growth rates remain positive. Indeed, in our view we would argue that there is a tendency for dividend growth rates to be persistently positive and decidedly optimistic. In many analyses, for example the current DGM analyses for regulated businesses, the short-run growth rate is typically assumed to be above the assumed long run GDP growth rate. This is possible in the short run for both individual firms and the market, but it is clearly not possible that *all* short-runs have above average growth rates.

In the light of the foregoing discussion, it would appear that there are several ways to proceed. On the one hand, the empirical evidence suggests that the GDP growth rate may be a poor choice in setting the long run growth rate of dividends. On the other hand, we could take evidence from the long sweep of history. For example, we note that both Bernstein and Arnott (2003) and Ritter (2005) report the Dimson, Marsh and Staunton (2002) estimate that real dividend growth was 0.9% in Australia from 1900 until the start of the new century. Thus, it might be argued that the nominal dividend growth rate should be the long run average of 0.9% real growth adjusted for inflation. Alternatively, we could follow Bernstein and Arnott (2003) and argue that it should be the expected real GDP minus 2.4%.[9] Alternatively, taking the more recent data from Barra (2010), it might be argued that the growth rate should be the real EPS growth of 0.5% adjusted for inflation, or the expected real GDP rate minus 2.7%.

Additionally there are the estimates from Lally (2013) and CEG (2013) to consider. Lally (2013) focuses on the headline Bernstein and Arnott (2003) adjustment to GDP of 2.0% but argues for the adjustment to be reduced. Lally takes the long run GDP growth to be 3.0% and adjusts this down by 0.5%, 1.0% and 1.5%. While CEG (2013) takes the real growth rate to be 3.9% and also computes the run real dividend growth from 1884 to 2010 as 2.76%.[10]

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[8] Of course if the growth rate is negative in the long run then the company will have a finite life and its value will converge to zero over time.

[9] The resulting difference should not be adjusted for inflation. A slightly more accurate calculation is to convert the real values to nominal values and then take the difference.

[10] This seems quite a large value for the real growth rate in Australian dividends relative the estimates of Bernstien and Arnott (2003) and Barra (2010). With an inflation rate at 2.5%, a real dividend growth rate of 2.76% implies that the dividends on the market would double about every thirteen years and four months. To

Both Lally and CEG use the same rate for expected inflation at 2.5%.

In Table 2, we present alternative estimates of the long term dividend growth rate based on the information presented above. The range is quite wide, from 0.31% to 6.5%, with CEG data consistently providing the highest estimates both overall and across similar estimation methods. This variability in estimated growth rates highlights our earlier observation about the sensitivity of the model to the choice of the growth rate. Rather than making the judgment of Solomon about who has the best growth forecast we treat them all equally. Taking a simple average across all the growth estimates the value is 3.73%. Clearly the Lally/Barra growth estimate of 0.31% seems rather low. We would argue that the CEG estimate of 6.5% is too high as it allows no adjustment for the additional investment by shareholders that is required to support the growth. Deleting these two observations the mean of the remaining estimates is 3.78%. By way of contrast, the AER estimate at 4.6% is higher than either of mean values above. On the basis of this comparison the AER estimate may be viewed as somewhat on the generous side.

Our concluding comment with respect to the long term growth rate in dividends is that methods of determining this long term growth rate that neglect the effect of the additional capital that shareholders have to contribute (via shares issues and DRPs) to support growth, will overstate the growth rate and this in turn will lead to overstatement of the cost of equity. We view this as an important and, with respect to DRPs, an underappreciated issue.

3. Suggestions from SFG

SFG (2013) make several suggestions for modifications that could be applied to the AER's dividend growth modelling approach. These suggestions relate to the horizon over which growth reverts to the long run value, the use of analyst's target prices rather than market prices in estimating the implied cost of capital, the joint estimation of growth rates and the cost of equity and matching the timing of analysts' forecasts with the date the price is observed. We will discuss each of these suggestions in turn.

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put it another way dividends at the end of the century would be forecast to be about 92 times their value today.

Table 2
Alternative Estimates of the Long Term Dividend Growth Rate

Main Source	Average Real Dividend	Inflation	Real GDP	Real GDP adjustment	Lally GDP Adjustment	Long run growth
Barra	0.50%	2.50%				3.01%
Bernstein/Ritter	0.90%	2.50%				3.42%
CEG	2.76%	2.50%				5.33%
Lally/Bernstein		2.50%	3.00%	2.40%		0.62%
CEG/Bernstein		2.50%	3.90%	2.40%		1.54%
Lally/Barra		2.50%	3.00%	2.70%		0.31%
CEG/Barra		2.50%	3.90%	2.70%		1.23%
CEG		2.50%	3.90%			6.50%
CEG		2.50%	3.90%		0.50%	6.00%
CEG		2.50%	3.90%		1.00%	5.50%
CEG		2.50%	3.90%		1.50%	5.00%
Lally		2.50%	3.00%		0.50%	5.08%
Lally		2.50%	3.00%		1.00%	4.58%
Lally		2.50%	3.00%		1.50%	4.08%

3.1 Growth Horizon

In section 2.3, we noted the tendency for analysts to be eternally optimistic in assuming that the current dividend growth rate will be above the long term growth rate. Clearly this cannot be true for all possible sub-periods, as this would imply the impossible outcome that the dividend growth rate was always above its long term rate. If it is always assumed that the current dividend growth rate will be above the long term growth rate across regulatory periods, then the likely outcome is an upward biased estimate of the cost of equity in at least some of those regulatory periods.

It is clear that if it is assumed that the current growth rate is above the long term rate, then the longer it takes to transition to the to the long term rate, the higher will be the forecast stream of dividends. In turn, the higher the forecast stream of dividends, the higher the implied cost of equity. The question therefore, becomes one of what is the appropriate transitional period?

The AER have selected a two year period for above normal growth, while SFG (2013) have selected a ten year period. To our minds, it does not seem particularly likely that firms or markets will often sustain ten years of above average growth. This may happen occasionally, but we doubt that it is the normal state of affairs for the market or for the majority of firms.

For example, Table 3 gives the length of expansions in the US economy as determined by the National Bureau of Economic Research (NEBR) for the period from 1854 to 2009. During this period there was only one expansion that lasted 10 years. Most expansions lie in the range eighteen months to five years and the mean over the full period is 38.7 months. Post World War II, we note that expansions tend to have been longer with a mean of 58.4 months.

For Australia, Cotis and Coppel (2005) report an average expansion phase of 18.7 quarters (54 months) over the period from 1970 to 2003.

Given our comments in section 2.3 about the lack of a relationship between economic growth and stock market growth, it is possible that this business cycle information is not an ideal basis to assess the length of stock market cycles. However in contrast to the business cycle literature, the objective measurement of stock market cycles is less well developed. Pagan (1998, p. 3) observes that:

> "When one turns to the ups and downs of asset markets there doesn't seem to be the equivalent literature or even a standard body of facts."

Pagan (1998, p. 1) observes that the lack of evidence is easily explained, as it quite simply:

> "… is not an easy task to do this. As Le Rochefoucauld once observed "The greatest of all gifts is the power to estimate things at their true worth".

Using Australian data from 1875 to 1997, Pagan (1998) reports that the average duration of the stock market cycle was 47 months, which was composed of an average expansion duration of 33 months and contraction duration of 14 months (the results are reproduced in Table 4 below). It is interesting to note that the equivalent metrics for the US and UK were comparatively lower. It is also worth noting that while the average length of stock market cycles may be similar, Pagan (1998) reports that the timing of these stock market cycles are very different and there is little evidence of a global stock market cycle.

Thus, the evidence of Pagan provides an average expansionary phase of approximately 3 years for the Australian stock market, which is much closer to the AER estimate of 2 years than the SFG 10 year horizon. Pagan (1998) also refers to a study by Bennett (1998), who finds that the Australian stock market has an average bull market cycle of 3 - 3.5 years, while bear markets typically last around 18 months. Thus, depending on whether we take the business cycle or the stock market cycle as the indicator of the likely length of a period of abnormal dividend growth, a period somewhere between three to five years would seem appropriate.

Table 3
Length of Business Cycles in the USA

BUSINESS CYCLE REFERENCE DATES		DURATION IN MONTHS			
Peak	**Trough**	**Contraction**	**Expansion**	**Cycle**	
Quarterly dates are in parentheses		*Peak to Trough*	*Previous trough to this peak*	*Trough from Previous Trough*	*Peak from Previous Peak*
	December 1854 (IV)	--	--	--	--
June 1857 (II)	December 1858 (IV)	18	30	48	--
October 1860 (III)	June 1861 (III)	8	22	30	40
April 1865 (I)	December 1867 (I)	32	46	78	54
June 1869 (II)	December 1870 (IV)	18	18	36	50
October 1873 (III)	March 1879 (I)	65	34	99	52
March 1882 (I)	May 1885 (II)	38	36	74	101
March 1887 (II)	April 1888 (I)	13	22	35	60
July 1890 (III)	May 1891 (II)	10	27	37	40
January 1893 (I)	June 1894 (II)	17	20	37	30
December 1895 (IV)	June 1897 (II)	18	18	36	35
June 1899 (III)	December 1900 (IV)	18	24	42	42
September 1902 (IV)	August 1904 (III)	23	21	44	39
May 1907 (II)	June 1908 (II)	13	33	46	56
January 1910 (I)	January 1912 (IV)	24	19	43	32
January 1913 (I)	December 1914 (IV)	23	12	35	36
August 1918 (III)	March 1919 (I)	7	44	51	67
January 1920 (I)	July 1921 (III)	18	10	28	17
May 1923 (II)	July 1924 (III)	14	22	36	40
October 1926 (III)	November 1927 (IV)	13	27	40	41
August 1929 (III)	March 1933 (I)	43	21	64	34
May 1937 (II)	June 1938 (II)	13	50	63	93
February 1945 (I)	October 1945 (IV)	8	80	88	93
November 1948 (IV)	October 1949 (IV)	11	37	48	45
July 1953 (II)	May 1954 (II)	10	45	55	56
August 1957 (III)	April 1958 (II)	8	39	47	49
April 1960 (II)	February 1961 (I)	10	24	34	32
December 1969 (IV)	November 1970 (IV)	11	106	117	116
November 1973 (IV)	March 1975 (I)	16	36	52	47
January 1980 (I)	July 1980 (III)	6	58	64	74
July 1981 (III)	November 1982 (IV)	16	12	28	18
July 1990 (III)	March 1991 (I)	8	92	100	108
March 2001 (I)	November 2001 (IV)	8	120	128	128
December 2007 (IV)	June 2009 (II)	18	73	91	81

Average, all cycles:					
1854-2009 (33 cycles)		17.5	38.7	56.2	56.4
1854-1919 (16 cycles)		21.6	26.6	48.2	48.9
1919-1945 (6 cycles)		18.2	35.0	53.2	53.0
1945-2009 (11 cycles)		11.1	58.4	69.5	68.5

Source: NBER

Table 4
Duration of Expansions and Contractions in Three Stock Markets(in months)

	US	UK	Aust.
Contraction	15	18	14
Expansion	25	26	33

Source: Reproduced from Table 3 in Pagan (1998)

3.2 Share Price or Target Price

SFG (2013) suggest using analyst's target prices in place of market prices when estimating the implied cost of capital. To understand this implications of this choice, the relevant question that needs to be answered is 'what is the objective of the analysis?'.

The usual objective is to obtain the market's implied cost of equity, in which case we want to combine the market's forecast of expected earnings and dividends with the market price. In computing the implied cost of equity, the usual proxy for the market's earnings/dividend forecast is the forecast of the analysts, although we would argue that this proxy may not be a particularly good one.[11] We do note however, that improved accuracy in this process may be obtained if analysts forecasts are combined with time series forecasts when estimating earnings, see for example Conroy and Harris (1987) and Lobo (1992).

If, however, the objective is to discover the implicit discount rate of the analysts, then the use of target prices is appropriate. This might be used as a source of additional triangulating information on discount rates. The use of analysts' forecasts, however, does bring with it some problems. As earlier explained analysts forecasts of earnings and dividends tend to be upward biased. If analyst's earnings and dividend estimates are upward biased, then it is a reasonable bet that their target prices are upward biased too and indeed research suggests that this is the case (see Bradshaw, Brown and Huang, 2012). To quote from Bradshaw, Huang and Tan (2012, p.2):

> "In recent years, analysts have increasingly issued target prices alongside earnings forecasts and stock recommendations in their equity research reports. Yet, the credibility and usefulness of target prices has long been dubious. In spite of target price "hits" from time to time, media and investment managers frequently accuse target prices as merely sales hype.

[11] An increasing number of problems with the use of these forecasts has been documented. Over optimistic forecasts and sluggish adjustment have already been discussed, but there are other problems as well. For example, managers managing analysts expectations to manipulate share prices, deliberate manipulation of forecasts by analysts to facilitate a good relationships with corporate clients of the institution that the analysts work for and retrospective adjustment by analysts of the forecasts in the I/B/E/S forecast database.

In a work that contributed to a Pulitzer Prize in 2002, the New York Times journalist Gretchen Morgenson criticized target prices as being based more on fantasy than reality and concluded that 'Price Targets are Hazardous to Investors' Wealth.'

Prior research demonstrates significant optimistic bias in target prices relative to current trading prices. Asquith, Mikhail and Au (2005) and Brav and Lehavy (2005) both document an average return implied by analyst target prices of 32.9% for the period of 1997 to 1999, while Bradshaw, Brown and Huang (2012) document an implied return of 24.0% from analyst target prices for the period of 2000 to 2009. In contrast, Mehra (2003) finds that from 1802 to 1998, the real annual U.S. equity return is only 7.0%, and that the equity returns in other developed countries are even lower. Data provided by CRSP shows that the nominal NYSE/Nasdaq/Amex market return over the period of 1997 to 2009 is 8.1%."

The higher the price, other things equal, the lower will be the implied cost of equity. Thus the upward bias in target prices will tend to offset the upward bias in earnings and dividend forecasts when computing the implied cost of equity, but to what extent is unknown. Combining analysts forecast of dividends with their target prices and estimating their implied discount rates is almost akin to conducting a survey of analysts' views on discount rates. We ask analysts what they think dividends and prices are going to be and then infer what they think discount rates are. An alternative would be to ask then about discount rates directly.

3.3 Joint Estimation of Growth and the Cost of Equity

SFG (2013) suggested the joint estimation of the long run dividend growth rate and the cost of equity. While on a first glance this may sound appealing, our past experience of joint estimation of growth rates and the cost of equity using simultaneous equations was not encouraging. Growth rates tended to be overestimated and as a consequence, given the nature of the simultaneous equation system, the cost of equity tended to be underestimated.

SFG are not proposing a simultaneous estimation procedure, but an iterative procedure based on the relation $g = b \times ROE$, where g is the growth rate, b is the plough back ratio (the fraction of earnings reinvested rather than paid out as a dividend) and ROE is the return on equity. SFG (2013, p. 13) describe their approach as "relatively straightforward" and describe it as follows:

"We input different possible values for *re, 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."

Based on this description, we are doubtful that we could exactly reproduce SFG's results given the same data set. To that extent, we wonder how straightforward and transparent this approach is. We also note that in the first stage of this approach very large numbers of possible combinations of *re, g* and *ROE* could be generated. The particular combination selected is likely to be sensitive to the filtering procedure applied. In SFGs approach, the filter is the smooth transition to the long term growth rate and growth at year ten close to the long term growth rate. Thus, assumptions about the growth rate have been replaced by assumptions about the filtering procedure and the term over which growth transitions to an equilibrium growth rate.

Importantly, this method does not escape the need to assume a long term growth rate, it merely provides a means to form growth rates over the assumed transition period. Our conclusion is that the method involves significant extra computation for no very clear advantage. If we want to have a smooth transition to the long term growth rate then this can be achieved very simply using the dividend growth model known as the H model, Fuller and Hsia (1984).

We also note that the *ROE* of 18.4 % with the AER's 4.6% growth rate and a plough back ratio of 25% suggested in SFG's example seems rather too high. Even the 15.3% they report as the AER's implicit *ROE* with a 30% payout ratio seems on the high side. By way of contrast, Kim (2011) provides data on the return on assets (net income to total assets) for firms listed on the ASX over the period 1995 to 2006, covering 1,703 firms (excluding financial institutions) and 11,573 firm year observations. The mean return on assets was minus 21% and the median was minus 2%. Much of this result can be attributed to the effect of small firms. However, restricting the sample to the top quartile of firms by market capitalisation the mean return on assets only rises to 3.4% and the median to 5%. It would take a very high level of leverage to increase these asset returns to an 18.4% *ROE.* Possibly the assumed long term growth rate of 4.6% is too high, or the assumed 30% plough back ratio too low. Our earlier discussion of DRPs, suggests that 30% is too low since DRPs increase the effective plough back ratio.

3.4 Time Matching Analysts' Forecasts and Prices

Finally, SFG (2013) suggest matching the timing of analyst forecasts with time matched prices. If analysts' forecasts were updated in a timely fashion, then we agree that it would desirable to match the time of the forecast to the time the price was observed.

As previously discussed, the research of Guay, Kothari and Shu (2011) finds that earnings adjustments by analysts are sluggish. This raises the question as to whether sluggish adjustment is a feature of individual analysts, or just a feature of consensus earnings forecasts.

As SFG (2013) suggest, one problem with consensus forecasts is that they contain a mixture of current and stale earnings forecasts. This would naturally tend to create a sluggish adjustment problem. Thus, if the only cause of sluggish adjustments is stale forecasts, rather than slow adjustment by analysts to new information, then there is merit in using individual forecasts time matched to prices.

On the other hand, if the cause of the problem is true sluggishness in the way in which analysts update their forecasts, then special care is required. One solution is to follow Guay Kothari and Shu (2011) and use the consensus earnings forecast but with a lagged price that is matched to the forecast by approximately five months. Guay Kothari and Shu (2011) suggest this as one way to mitigate the problem of sluggish adjustment for some firms.[12]

The length of the lag period that Guay Kothari and Shu (2011) use suggests that the problem is more than just stale forecasts by the individual analysts who are included in the consensus forecast. In our view, it seems unlikely that forecasts five months out of date will be of a sufficient number to have a substantive effect on the consensus forecasts. Thus, it seems likely that the problem is a mixture of both stale forecasts in the consensus and sluggish adjustment to information by individual analysts when they do make a forecast. In this case, time matching of forecasts and prices for individual analysts will not solve the sluggish adjustment problem.[13]

The convenient solution to the problem is to lag the price that is matched to the consensus forecast. The question then becomes one of what lag should be used? Guay Kothari and Shu's (2011) adjustment may or may not best suit the Australian consensus forecast. However, the sensitivity of the implied cost of capital to the lag can be easily be investigated by trying a number of different lags, say from one to six months.

4. Adjusting for semi-annual dividends

The AER (2013, p. 220) notes that:

> In implementing the two-stage DGM, we have made two adjustments to the equation above. First, a 'partial first year' adjustment must be made for the case in which the date at which the model is estimated is not at the

[12] Guay, Kothari and Shu (2011) suggest other more effective methods of adjustment but they are more complex.

[13] The forecast target prices could help here as they are likely to be better time-matched to the dividend forecast. However, as explained earlier the target prices are upward biased.

beginning of the financial year. Second, a midyear convention is adopted, to adjust for the fact that dividends are distributed not only at the end of the financial year but also during the year. Pratt and Grabowski's method is used for adjusting for partial first year and the midyear convention."

Having reviewed the Pratt and Grabowski (2010) material, we are of the view that in light of the other sources of inaccuracy in the DGM, explicitly making this type of adjustment would not lead to any meaningful refinement of the estimate of the cost of equity. While there is nothing wrong with the adjustment per se, we would view this adjustment as a form of spurious precision.

5. Imputation Adjustment

We have reviewed the analysis contained in SFG (2013) and SFG (2013a) concerning the inconsistency between the AER's imputation adjustment for dividends for use in the DGM, and the AER's accounting for imputation in its post tax revenue model. The key aspect of SFG analysis arises from the following description that SFG (2013a) gives for the AER's method of accounting for corporate tax. SFG (2013a, p. 38) observes that imputation credits are accounted for as a cash flow item according to the following equation:

$$\textit{Estimated cost of corporate tax} = (\textit{Estimated taxable income} \times \textit{Expected statutory tax rate}) \times (1 - \gamma)$$

In making an estimate of taxable income, the AER implements the following equation:
$\textit{Estimated taxable income} = (\textit{Regulated asset base}\ (RAB) \times \textit{Allowed rate of return} + \textit{Regulatory depn} - \textit{Tax depn} - \textit{Interest})\ /\ 1-\tau \times (1-\gamma)$"

While with respect to the AER's imputation adjustment SFG (2013, p29) state:

"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:

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

If the foregoing is accepted as an accurate description of the AER's proposed practice, then SFG is correct in concluding that there is an inconsistency in the approach that the AER applies in computing the estimated cost of corporate tax and that applied in their DGM imputation adjustment.

One problem lies in the grossing up of the allowed after tax return to a pre-tax return when computing the estimated taxable income. As Dempsey, McKenzie and Partington (2010) explain, grossing up a post-tax return to get a pre-tax return is problematic. In particular the Adjustment, $Allowed\ rate\ of\ return$ / $1-\tau \times (1-\gamma)$, can only be relied on for perpetual cash flows.

The other potential source of difference in the adjustment lies in the implicit assumptions about the dividend payout ratio and the level of franking. The gamma factor used in computing the estimated corporate tax is a market-wide parameter that depends upon the market's payout ratio of imputation credits distributed to imputation credits created. Implicitly, the market's payout ratio for imputation credits depends upon the dividend payout ratio for the market and the level of franking for those dividends, but it is also affected by the companies that are not distributing the imputation credits they create because they are not currently paying a dividend. Whereas, in converting cash dividends to imputation adjusted dividends at the level of the firm, the payout ratio is the firm's actual payout ratio, the level of franking is the firm's level of franking and firms not paying dividends are ignored. Thus, it is entirely possible and appropriate for adjustments for the effect of imputation on cash dividends at the level of individual firms to differ from the market wide adjustment that the AER uses to estimate the cost of corporate tax.

While the adjustments should apparently be the same at the level of the market the formula

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

neglects the impact of firms that pay no dividends but that do generate franking credits. Because of this, the *%Franked* is an overstatement of the percentage of franking credits created that are distributed. In adjusting cash dividends to allow for imputation the AER has assumed a level of franking of 75% for the market compared to a 70% distribution rate for franking credits when computing the gamma factor. Thus the dividend adjustment for franking gives a slightly higher benefit from franking than is assumed in the computation of the effective corporate tax.

6. Conclusion

Any implementation of the dividend discount model in estimating the implied cost of equity is open to criticism and debate over the assumptions employed. However, in our opinion the AERs implementation of a two stage model is a reasonable, transparent and easily reproducible implementation. Some extension of the period for transition to normal growth might be warranted, but we recommend that this transition period be no more than five years and more likely closer to three. For the reasons we discuss in our report, the risk with the AER's implementation of the dividend discount model is that the estimate of the implied cost of equity will be too high rather than too low.

Appendix

Following Brick, Chen and Lee (2013), the basic dividend growth model can be expressed as :

$$P_0 = \frac{d_1}{(r - g)}$$

Defining *b* as the fraction of earnings retained withing the firm, and *r* as the rate or return the firm will earn on all new investments, then $g = br$. Let I_t denote the level of new investment at time *t*. Because growth in earnings arises from the return on new investments, earnings can be written as $E_t = E_{t-1} + rI_{t-1}$, where *E* is the earnings in period *t*. If the firms retention rate is constant and used in new investment, then the earnings at time *t* is $E_t = E_{t-1}(1+ rb)$.

The growth rate in earnings is he percentage change in earnings and can be expressed as

$$\begin{aligned} g_E &= \frac{E_t - E_{t-1}}{E_{t-1}} \\ &= \frac{E_{t-1}(1 + rb) - E_{t-1}}{E_{t-1}} \\ &= rb \end{aligned}$$

If a constant proportion of earnings is assumed to be paid out each year, the growth in earnings equals the growth in dividends, implying $g = br$.

If we define the growth in stock prices as:

$$g_P = \frac{P_{t+1} - P_t}{P_t}$$

and recognising that *Pt* and *Pt+1* are defined by the basic dividend growth model, while $d_{t+2} = d_{t+1}(1 + br)$ then

$$\begin{aligned} g_P &= \frac{\frac{d_{t+2}}{k - rb} - \frac{d_{t+1}}{k - rb}}{\frac{d_{t+1}}{k - rb}} \\ &= \frac{d_{t+2} - d_{t+1}}{d_{t+1}} \\ &= \frac{d_{t+1}(1 + br) - d_{t+1}}{d_{t+1}} \\ &= br \end{aligned}$$

Thus, under the assumption of a constant retention rate, dividends, earnings and prices are all expected to grow at the same rate for a one period model.

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