**REVIEW OF THE AER’S PROPOSED DIVIDEND GROWTH MODEL**

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**EXECUTIVE SUMMARY**

This paper has sought to critically review the Australian Energy Regulator’s (AER’s) proposed methodology for estimating the market risk premium (MRP) through a Dividend Growth Model (DGM) methodology, and the conclusions are as follows.

Firstly, in respect of the number of stages in the model, I estimate that the incremental benefits in moving from a two to a three-stage model are even greater than in moving from a one to a two-stage model. Consequently, given that the AER prefers a two-stage model over a one-stage model, the AER ought to adopt a three-stage model. In using a three-stage model, I favour a linear transition in the expected dividends per share (DPS) growth rate from the short-run values to the long-run value.

Secondly, it is very likely that the true term structure for the market cost of equity sometimes significantly departs from the standard assumption of a flat structure. Consequently, at such times, there will be significant benefits from using a DGM model in which non-flat term structures are recognised. This would involve setting the expected ten-year market cost of equity in ten years equal to the estimated long-run average value for this parameter and then using the DGM to find the current ten-year market cost of equity.

Thirdly, I concur with the AER’s formula for correcting expected cash dividends for imputation credits, and also with their estimate of the proportion of dividends that are fully franked, of 75%.

Fourthly, I concur with the AER’s estimate for the long-run expected real growth rate in DPS of 2% per year, and also with the AER’s estimate for the long-run expected inflation rate of 2.5% per year. Accordingly I concur with the AER’s estimate of the long-run expected growth rate in DPS of 4.6% per year.

Fifthly, in respect of the short-term expected growth rates in DPS, relative to the Bloomberg DPS forecasts, the IBES earnings per share (EPS) forecasts have the advantages of not being subject to short-term fluctuations in future earnings payout rates and have also been subject to extensive tests for bias. In addition, ‘stale’ analyst forecasts ought to be deleted from whichever data set is used to the extent this is feasible.

Sixthly, in respect of the mid-year correction proposed by the AER, the theoretical merits of this adjustment are clear. Failure to make the correction would lead to underestimating the market cost of equity, and therefore also the MRP, but only by about 0.25%. Thus, if this is considered sufficiently important to warrant correction, then a three-stage DGM should be preferred over a two-stage model and the assumption of a flat term structure in the market cost of equity should also be avoided.

Seventhly, and in respect of the partial-year correction proposed by the AER, failure to make this adjustment would lead to an underestimate in the market cost of equity, and therefore also the MRP, by about 0.1%. This is not significant. Furthermore, I understand that the Bloomberg DPS forecast are updated much more frequently than annually, and this undercuts the rationale for the adjustment. Accordingly, I recommend against the partial-year adjustment.

Finally, in addition to these issues, there are a number of limitations of the DGM that should be recognised. In particular, the DGM assumes that equity prices are equal to the present value of future dividends and therefore that the market’s expectation of the growth rate in dividends both exists and is rational. If this expected growth rate does not exist or is not rational, then an analyst could not hope to accurately estimate it and therefore could not hope to accurately estimate the market’s cost of equity. In addition the DGM is prone to errors in the presence of short-term fluctuations in the market’s earnings retention rate and also to long-term changes in the market’s earnings retention rate.

1. **Introduction**

The AER (2013, section H) has recently sought to develop a DGM methodology for estimating the MRP. This paper seeks to provide a critical review of the AER’s proposed methodology.

1. **The AER’s Proposal**

The AER’s proposal involves a two-stage version of the DGM with explicit expected dividends for the first three years followed by a constant expected growth rate. In addition, the term structure for the discount rate (the market cost of equity) is assumed to be flat. Letting *S0* denote the current value of the market index, *S3* the expected value in three years, *Dt* the DPS expected in year *t*, *g* the expected growth rate in DPS from the end of year 3, and *k* the market cost of equity, it follows that the current value of equities is as follows:

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 **** (1)

Solving (numerically) for *k*, and then deducting the prevailing risk free rate, yields the estimate of the MRP. The expected dividends in year *t* constitute the cash dividends subject to a correction for imputation credits. Letting *Dct* denote the expected cash dividends in year *t*, *U* the market utilisation rate for imputation credits, *P* the proportion of dividends that are fully franked, and *Tc* the corporate tax rate, then

 **** (2)

The expected cash dividends are drawn from Bloomberg and the estimate of *P* of 0.75 is drawn from Brailsford et al (2008, page 85). The estimate of *g* is 4.6%, comprising expected inflation of 2.5% (the midpoint of the Reserve Bank of Australia’s target range) and expected real growth in DPS of 2%, with the latter figure being the expected long-run real growth in GDP of 3% less a deduction of 1% for the net creation of new shares from new companies and new share issues (net of buybacks) from existing companies, i.e.,

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Equation (1) assumes that the dividends for year *t* are received at the end of year *t*. However, the dividends in year *t* would be received in a continuous stream throughout the year, with an average term till receipt of six months. Thus, following Pratt and Grabowski (2010, equation (4.14)), the AER reduces the term of discounting by six months in respect of each year. Accordingly, equation (1) becomes:

 **** (3)

Finally, the AER adjusts the model if the analysis is done part way through the financial year rather than at the beginning of the year. Following Pratt and Grabowski (2010, equation (4.18)), if the analysis done at a point such that proportion *y* of the year remains then equation (3) becomes:[[1]](#footnote-1)

 **** (4)

1. **The Use of a Two-Stage Model**

The AER’s use of a two-stage model implies a preference for this over a one-stage model or a three-stage model. A one-stage model involves the assumption that the long-run expected growth rate applies immediately and therefore explicit forecasts of dividends for the first few years are ignored. This involves ignoring a potentially valuable piece of information, and particularly so when the economy is booming or in recession (when forecast dividend growth rates for the next few years are likely to be unusual). By contrast a three-stage model utilises explicit forecasts of dividends for the first few years, a long-term growth rate, and assumes that there is a transitional period between the two in which the expected growth rate in dividends linearly converges from the last growth rate in the first stage to the long-run expected growth rate.

Clearly a three-stage model is more likely to be closer to the truth than either a one or two-stage model, and a two-stage model is more likely to be closer to the truth than a one-stage model. So, to investigate the relative merits of this question, suppose that the true model is a three-stage model with dividends in the latest year of $1b, an expected growth rate of 7% for each of the next three years and linear convergence to the long-run expected growth rate of 4.6% over the following ten years.[[2]](#footnote-2) In addition the market cost of equity is 10%. We also assume that the analysis is done at the beginning of the financial year and we leave aside the mid-year correction. The expected dividend for year 13 is then

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and therefore the resulting current value of the market portfolio would be

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The user of a one-stage model will then solve the following equation for *k*, being equation (1) without the initial three year period of explicit dividend forecasts:

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and the solution to this equation is an estimate for *k* of .0927. Thus, *k* is underestimated by 0.73%. Table 1 presents results of this kind, for two possible true scenarios (a three-stage model with convergence over either 10 years or 20 years) and four possible models used for estimating *k* (the one stage model, the two stage model, the three stage model with convergence over 10 years, and the three-stage model with convergence over 20 years):

Table 1: Estimation Errors for the DGM

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True Situation Estimation Method

 1-Stage 2-Stage 3-Stage (10) 3-Stage (20)

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Three-Stage (10) 9.27% 9.59% 10.00% 10.34%

Three-Stage (20) 8.98% 9.27% 9.66% 10.00%

Average Absolute Error 0.88% 0.57% 0.17%

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Unsurprisingly, the table shows that the average absolute error from using the one-stage model is the highest, followed by the two stage model, and then the three-stage model (with the latter model errors arising from sometimes using the wrong convergence period in the model). More interestingly, the table shows that the error reduction in moving from a one-stage model to a two-stage model is less than in moving from a two-stage model to a three-stage model. Thus, whilst it is desirable to move from a one-stage model to a two-stage model, and it also desirable to move to a three-stage model, the incremental benefit in moving from a two to a three-stage model is even greater than in moving from a one to a two-stage model. Furthermore this conclusion would be even stronger if the initial and long-run expected growth rates diverged by even more than they do in this example.

SFG (2013, section 3) also favours a three-stage model but they adopt an eight year transition period. However the ‘correct’ transition period is neither known nor knowable, and is therefore a source of potential error in adopting the three-stage model. The analysis above takes account of this point by considering a range of possible values for the transition period.

SFG (2013, section 5) also argues that the long-term expected growth rate in dividends is the product of the earnings retention rate and the expected rate of return on new investment, and therefore that the transition path to these long-run values should be such that the retention rate and the expected rate of return on new investment move towards their long-run values in a smooth fashion. SFG also claims that this involves little variation from the AER’s existing assumptions, which include a long-term earnings retention rate of 30%. I have a number of reservations about this approach. Firstly, the formula that SFG invoke that links the expected growth rate, the earnings retention rate and the expected rate of return on new investment is that of Gordon and Shapiro (1956). However, as shown by Lally (1988), this holds only if inflation is zero and a variant is required in the presence of inflation. Thus all of SFG’s calculations are nullified. Secondly, SFG’s belief that the AER has adopted an earnings retention rate of 30%, and therefore an earnings payout rate of 70%, is incorrect. The figure of 70% that they refer to (AER, 2013, page 119) is the proportion of company taxes that are distributed as imputation credits rather than the earnings payout rate. Thirdly, and more fundamentally, both the Gordon-Shapiro and Lally formulas assume that all new investment yields payoffs in perpetuity and this is generally not realistic. Thus, the results from this approach may not provide a superior transition path to the long-run expected growth rate. Lastly, and also more fundamentally, the approach is considerably more complex than linear convergence and yet the only example given by SFG reveals that the resulting estimated market cost of equity is not materially different (12.02% in Table 3 v 11.87% in Table 2). In view of the latter two points, I do not favour this approach.[[3]](#footnote-3)

Notwithstanding this conclusion, I do sympathise with SFG on one point here: their observation that the market cost of equity should be linked to the expected growth rate. By contrast, no such linkage exists in conventional applications of the DGM, in which there is a single market cost of equity at any point in time, i.e., the term structure in the market cost of equity is flat. For example, suppose the short-term expected growth rates in DPS rise whilst the long-term rate remains unchanged. Under conventional applications of the DGM, the estimated market cost of equity (both long-term and short-term) must rise. Thus, in response to a purely short-term increase in the expected growth rate in DPS, the estimated long-term market cost of equity rises whilst the long-term expected growth rate in DPS is unchanged. Thus, whatever the linkage is between these latter two parameters, it would have been violated here. The fundamental problem here is that conventional applications of the DGM assume that there is a single market cost of equity at any point in time. If this assumption were relaxed, thereby allowing the long-term expected growth rate in DPS to remain fixed, SFG’s point could be addressed and this issue is dealt with in the next section.

In summary, given that the AER prefers a two-stage model over a one-stage model and that the incremental benefits from moving to a three-stage model are even greater than in moving to a two-stage model, I recommend that the AER adopt a three-stage model. In doing so, I favour a linear transition in the expected DPS growth rate from the short-run values to the long-run value.

1. **The Term Structure for the Discount Rate**

The AER assumes that the term structure for the market cost of equity is flat, i.e., at any given point in time, the market cost of equity is assumed to be the same for all future periods.[[4]](#footnote-4) This implies that the ‘forward’ rates are all the same. For example, since the term structure is assumed to be flat then the market cost of equity per year over the next ten years is equal to the rate per year over the next 20 years:

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The ‘forward’ rate for years 10 to 20 is the solution to the following equation:

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So, it follows from the last two equations that the current rate for the next ten years is equal to the forward rate for the following ten years:

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In addition, the market cost of equity is the sum of the risk free rate and the MRP, for both the current and forward rates. Therefore

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Forward rates are predictors of future rates. Under the expectations hypothesis, they are unbiased predictors. Invoking this hypothesis the last equation becomes:[[5]](#footnote-5)

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This says that the sum of the current ten year risk free rate and the MRP equals the sum of the current expectations of their values in ten years’ time. Thus, if the current ten year risk free rate were unusually low relative to its long-term average, and therefore could be expected to be higher in ten years’ time[[6]](#footnote-6), then the current ten-year MRP would have to be unusually high relative to its long-term average by an exactly offsetting amount. This ‘perfect-offset’ hypothesis is implausible. Furthermore, it implies that the market cost of equity is much more stable over time than the MRP and therefore that the Ibbotson method for estimating the MRP from historical data would be inferior to estimating the market cost of equity directly from historical data and then deducting the current risk free rate (as argued by Wright, 2012). However this is contrary to the AER’s strong emphasis on Ibbotson estimates of the MRP.

Lally (2012, section 3.2) illustrated this consequence of (wrongly) assuming that the term structure for the market cost of equity is flat (i.e., the ‘perfect-offset’ hypothesis) with the following example. Suppose that the current ten year risk free rate is 3.8%, the MRP over the next ten years is 6.2% and therefore the current market cost of equity for the next ten years is 10%. Since the risk free rate is so low, the rate expected in ten years should be higher and we assume it equals the long-term average of (for example) 6%. In addition, since the risk free rate is expected to rise, the MRP might be expected to fall, and we therefore assume it is expected to fall over the same period to its long-term average of (for example) 6%. So, the expectation now of the ten-year market cost of equity in ten years time is 12%. In addition, we assume an expected growth rate in dividends of 5% for each future year. Letting *D* denote the dividends in the most recent year, it follows that the current value of equities is as follows:

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Per $1 of current dividends *D*, the current equity value is then $17.23. By contrast, if one assumed a flat term structure for *k*, along with a constant growth rate, then the estimate of *k* would satisfy the following equation:

 **** (5)

Substituting the equity value of $17.23 above (per $1 of current dividends) into the DGM equation (5) along with the expected growth rate of 5% yields an estimated market cost of equity of 11.1%. Deduction of the current risk free rate of 3.8% would then yield an estimated MRP of 7.3%. This is 1.1% above the actual MRP of 6.2% for the first ten years. To put this error in perspective, it is almost four times the average error reduction in adopting a two-stage DGM rather than a one-stage DGM. Thus, if a two-stage DGM is considered important, the issue of the term structure for the market cost of equity should be judged to be considerably more important.

This example demonstrates that, when the MRP and the risk free rate are negatively correlated but the changes are less than perfectly offsetting, the DGM with an assumed constant market cost of equity will overestimate the MRP when the risk free rate is unusually low (as is presently the case) and the overestimation may be very significant. In response to this analysis, CEG (2012, pp. 37-41) argues that the assumption of a flat term structure for the market cost of equity is both unavoidable and is generally adopted by analysts. The latter point is definitely true but the former point is not, i.e., the assumption need not be adopted. Furthermore, if the market cost of equity that is being estimated is the current rate for the next ten years, then the other rate required in the DGM is the expected ten year rate in ten years and it is both plausible to treat this as the long-run average and easier to estimate this than the rate for the next ten years. In setting this long-run average value for the ten-year cost of equity, one should be guided by the fact that it must be related to the long-run expected growth rate in DPS, as argued by SFG (2013, section 5), although the mechanics of this are far from clear.

In summary, it is very likely that the true term structure for the market cost of equity is not flat at some points in time and there may be significant benefits from using a DGM model in which non-flat term structures are recognised. This would involve setting the expected ten-year market cost of equity in ten years equal to the estimated long-run average value for this parameter and then using the DGM to find the current ten-year market cost of equity.

1. **The Correction for Imputation Credits**

The AER’s proposed model seeks to estimate the discount rate in the Officer (1994) CAPM. Consequently the dividends in the numerator (*Dt* for year *t*) must be defined to be gross dividends, and these are equal to the cash dividends augmented by the imputation credits to the extent that they can be used. Letting *Dct* denote the expected cash dividends in year *t*, *ICt* the expected imputation credits for year *t*, and *U* the market utilisation rate for imputation credits, the expected gross dividends for year *t* are as follows:

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The imputation credits arise solely from the fully franked cash dividends (*DFt*), because dividends are either fully franked or unfranked. Also, by virtue of being fully franked the relationship between *ICt* and *DFt* is as follows:

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where *Tc* is the corporate tax rate. Substitution of the last equation into its predecessor, and letting *P* denote the proportion of dividends that are fully franked, yields:

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This is the formula used by the AER, as shown in equation (2), and I therefore concur with it. I also concur with the AER’s estimate of *P*, of 0.75, which is drawn from Brailsford et al (2008, page 85).

1. **The Long-Run Expected Growth Rate in DPS**

The AER favours an estimate for the long-run expected growth rate in DPS of 4.6%, comprising expected inflation of 2.5% (the midpoint of the RBA target range) and expected real growth in DPS of 2%, with the latter figure being expected real growth in GDP of 3% less a deduction of 1% for the net creation of new shares from new companies and net new share issues (net of buybacks) from existing companies, i.e.,

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In respect of the long-run expected GDP growth rate, the historical average over the period 1900-2000 is 3.3% (Bernstein and Arnott, 2003, Table 1), and the average over the 11 years since 2000 is 3.1% (The Treasury, 2012, Chart 2.2), yielding an average over the period 1900-2011 of 3.3%. Furthermore, Bernstein and Arnott provide average real GDP growth rates over 16 developed countries, and the average over this set of 16 countries is 2.8%, suggesting that even the figure of 3.3% is too high. Furthermore, the Australian Federal Treasury (The Treasury, 2012, Chart 2.2) has forecasted the Australian real GDP growth rate at 3% over the next four years. Taking account of all of this, an estimate for long-run expected real GDP for Australia should be about 3%.

In respect of the deduction from this long-run expected GDP growth rate, the long-term expected growth rate for dividends in the DGM model is that for dividends on the current shares of existing companies, and therefore is the expected growth rate in the DPS of companies, because the current value of the market portfolio represents a claim on only the dividends for the current shares of existing companies. However, the aggregate dividends paid in the economy in future year *t* are allocated to the existing (time 0) shares in existing companies, the shares in existing companies that are issued between now and time *t*, and shares issued by new companies formed between now and time *t*. So, the growth rate in the dividends of the first group must be less than the growth rate in aggregate dividends, and the latter growth rate must match that for GDP (otherwise the share of dividends in GDP will eventually reach zero or exceed 1). Consequently the expected long-term growth rate in the DPS for existing companies will be less than that for GDP, to reflect the impact of new share issues (net of buybacks) and the formation of new companies.

Bernstein and Arnott (2003) argue for subtracting 2% to deal with both of these points, based upon two comparisons. The first comparison is of real growth in DPS with real GDP growth over the last century, for a range of countries; the latter grew about 2% per annum faster than the former (ibid, Table 1). However this comparison will exaggerate the relevant adjustment in the presence of a declining dividend payout rate, which has characterised at least the US market (Grinold et al, 2011, Figure 1). Their second comparison is of the growth in market capitalisation with the growth in a capitalisation-weighted price index, using US data since 1925; the former grew about 2% per annum faster than the latter. However, this comparison will exaggerate the relevant adjustment when market capitalisation grows simply due to listings from foreign firms and from previously unlisted domestic firms. Both points suggest that the correct adjustment is less than 2%.

To illustrate this point, suppose that a market currently contains a set of firms with aggregate dividends paid in the last year of $1b and the dividends on the existing shares in these firms are expected to grow at 5% per annum. Suppose further that 30% of these dividends in the latest year are invested to create new firms, or to fund new share issues in the existing firms, and these new equity investments are expected to deliver a first dividend equal to 4.76% of the funds invested, and their subsequent dividends are expected to grow at 5% per year.[[7]](#footnote-7) Suppose further that this process repeats itself every year, i.e., 30% of dividends paid in every year are invested to create new firms, or finance new share issues, with a first dividend expected to be 4.76% of the funds invested, and these new dividends are expected to grow at 5% per year. Suppose further that these new firms are the only new firms in the economy. Finally suppose that the market cost of equity is 10% and the risk free rate is 4% so that the MRP is 6%. Using equation (1), the existing firms would then be worth $21b as follows:

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Substitution of this value for *S*, along with the current dividend level of $1b and the expected growth rate in dividends of 5% into the DGM equation (1) would then accurately estimate the market cost of equity at 10%, and deduction of the risk free rate of 4% would then yield an accurate estimate of the MRP of 6%. Although dividends for this set of firms are expected to grow at 5% per year, the expected growth rate in dividends paid to all firms is 6.43% per year as follows:

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For example, the dividends expected in one year are $1050m paid to shareholders in existing firms and $14.28m paid to shareholders of the newly created firms or new share issues (4.76% of the $300m invested in them), for a total of $1064.3m which is 6.43% larger than the dividends of $1b paid in the most recent year. In the long-run, GDP growth must match that of all dividends, which is expected to be 6.43% per year. Thus, if one attempts to estimate the MRP using the DGM, the relevant long-run expected growth rate is that for the DPS in existing firms (5%) rather than the long-run expected growth rate in GDP (6.43%). So, if one starts with the long-run expected growth rate in GDP, one would have to deduct 1.43%.

CEG (2013, pp. 77-80) argue that the average growth rate in real DPS for Australia is 2.67% over the period 1884-2011. By contrast, the AER favour an estimate of 2.0%. Letting *dt* denote the dividend yield for year *t*, *Pt* the price of the market portfolio at the beginning of year *t*, and *it* the inflation rate over year *t*, CEG’s formula for the real growth rate in DPS from year t-1 to year *t* is

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However this formula does not provide the real growth rate in DPS; it provides the real growth rate in aggregate dividends from year *t*-1 to year *t*, which will exceed the growth rate in DPS to the extent that existing firms issue new shares or new firms are created. To illustrate this point, suppose that *dt-1* = *dt* = .05, *Pt-1* = $100b, *Pt* = $110b, and *it* = .02. The aggregate dividends will then be $5b in year *t*-1 and $5.5b in year *t*, yielding a nominal growth rate in aggregate dividends of 10% and therefore a real growth rate of 7.84%. Suppose that, over year *t*-1, new shares were issued in new and existing companies of $6b, which constitutes 5.45% of *Pt*. Thus, of the aggregate dividends of $5.5b paid in year *t*, only 94.55% flowed to the shares that existed at the beginning of year *t*, being $5.2b. Thus the real growth rate in DPS from year *t*-1 to year *t* would be 1.96% as follows:

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CEG’s data source was Brailsford et al (2012), who do not provide data on new share issues. Thus, CEG could never have obtained a correct estimate of the real growth rate in DPS from this source. An appropriate source is Bernstein and Arnott (2003, Table 1), who give a real growth rate in the DPS for Australia of 0.9% for the period 1900-2000.

An alternative approach to estimate the long-run expected real growth rate in DPS arises from the fact that the long-run expected real growth rate in DPS should match that for EPS, and the latter can be estimated from the historical average without the bias arising from a change n the payout rate over time. Grinold et al (2011, Table 1) give a figure of 1.91% for the US for the period 1926-2010. This is similar to the AER’s proposed figure of 2%.

SFG (2013, page 12 and page 35) assert that the deduction of 1% presumes that current listed firms will have lower expected growth than other businesses that comprise the overall economy. This claim is not correct; the deduction arises instead from the existence of new share issues by existing firms and the formation of new companies. Even if all three sets of assets had the same expected growth rate in their dividends, as in the example presented above, the deduction (of 1% or some other figure) would still be warranted.

In summary, all of this evidence suggests that an appropriate estimate for the long-run expected real growth rate in DPS is 2% per year, which accords with the AER’s view. In respect of expected inflation, the midpoint of the RBA’s target range is 2.5% and the average rate since inflation targeting at 2-3% was formalised in August 1996 has been 2.6%.[[8]](#footnote-8) All of this suggests that an appropriate estimate of long-run expected inflation is 2.5%, which also accords with the AER’s position. Consequently, I concur with the AER’s estimate of the long-run expected growth rate in DPS, of 4.6%.

1. **The Short-Run Expected Growth Rate in DPS**

The AER uses Bloomberg’s expected growth rates in DPS for the first three years, and this raises the question of whether this is the best source of expected short-term growth rates. The obvious alternative is the IBES forecasts of EPS, and these have a number of advantages.

Firstly, they are not sensitive to short-term forecasts of dividends that reflect a change in the payout rate. For example, suppose the EPS forecast growth rate is 5% per year for the next three years and the DPS forecast growth rate is 7% because the payout rate is expected to rise. This change in the payout rate cannot be sustained indefinitely, and must come at the expense of subsequent dividends (those beyond three years into the future), and therefore must adversely affect the DPS growth rate beyond three years into the future. However the latter growth rate is estimated from the GDP growth rate, and therefore does not reflect the adverse consequence of a short-term increase in the earnings payout rate. So, using short-term DPS growth rates with a long-term growth rate based upon the expected GDP growth rate will reflect the favourable consequences of a short-term increase in the earnings payout rate but not the subsequent unfavourable effects. By contrast, using short-term IBES forecast growth rates rather than DPS forecast growth rates is free of this problem.

Secondly, the IBES forecasts have been subject to extensive tests for bias. For example, Claus and Thomas (2001, Table VI) report average errors (upward) for one to five year ahead forecasts, and also for each year from 1985 to 1997. Since these forecast errors have clearly declined over this period the most recent ones are of most interest, and they involve errors ranging from zero for one-year ahead forecasts up to 0.74% for five years ahead (relative to stock price). Since the price-earnings (PE) ratios at the corresponding times are about 15 (ibid, Table V), these forecast errors therefore range from zero to 11% of the EPS, and therefore would overestimate the growth rate per year by about 2%, i.e., two percentage points. This is not a trivial error. However, Gu and Wu (2003, Table 1) find that the median forecast error is zero despite the mean forecast error being positive and statistically significant, and attribute this to the fact the EPS distribution is skewed rightwards and analysts target the median rather than the mean of the distribution. By contrast with this evidence on EPS forecasts, I am not aware of bias tests on the Bloomberg forecasts, and therefore they warrant less confidence.

A further point relates to the potential deletions from the Bloomberg set of forecasts. SFG (2013, section 6) argues that share prices on a particular day should be combined with contemporaneous analyst forecasts rather than stale analyst forecasts, and therefore that stale forecasts should be deleted. I agree with this in principle, but without offering a view on the definition of stale.

In summary, relative to the Bloomberg DPS forecasts, the IBES EPS forecasts have the advantages of not being subject to short-term fluctuations in future earnings payout rates and have also been subject to extensive tests for bias. In addition, ‘stale’ analyst forecasts ought to be deleted from whichever data set is used to the extent this is feasible.

1. **The Mid-Year Correction**

The AER favours the mid-year correction as shown in equation (3). The conceptual merits of this are clear. However the effect is not large. For example, suppose that the dividends in the most recent year were $1b, the expected growth rate in dividends is 4.6% for each year, and the market cost of equity is 10%. Using equation (3), the current value of the market portfolio would be $20.32b as follows:

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Using this result in conjunction with equation (1), which does not have the mid-year correction, the resulting estimate of *k* is 9.75%. So, failure to make the mid-year correction would lead to underestimating the market cost of equity and therefore also the MRP by about 0.25%. However, if this is considered sufficiently important to warrant correction, then a three-stage DGM should be preferred over a two stage model (with an average error reduction of 0.40%) and the assumption of a flat term structure in the market cost of equity should be avoided (with an error reduction of 1.1%).

1. **The Partial-Year Correction**

The AER favours the partial year correction as shown in equation (4). To investigate the effect of this adjustment, suppose that the analysis is performed mid-way through the first year, the dividends in the year just before the first year were $1b, the expected growth rate in dividends is 7% for the first three years and 4.6% thereafter, and the market cost of equity is 10%. Invoking equation (4), the current value of the market portfolio would be $22.74b as follows:

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Using this result in conjunction with equation (3), which does not have the mid-year correction, the resulting estimate of the market cost of equity would be 9.88%. So, failure to make this adjustment would lead to an underestimate in the market discount rate, and therefore also the MRP, by about 0.1%. This is trivial. In addition, I understand that the Bloomberg DPS forecast are updated much more frequently than annually, and this undercuts the rationale for the adjustment.

In view of these points, I recommend against the partial-year adjustment.

1. **Limitations in the DGM**

Having either concurred or disagreed with various features of the AER’s proposed DGM approach to estimating the MRP, it remains to detail some adverse features of the DGM. An appreciation of these shortcomings, along with those of other MRP estimation methods, is critical to an appreciation of the relative merits of these estimation methods.

*10.1 The Assumption of Rational Pricing*

The DGM methodology assumes that the current value of equities matches the present value of future dividends. Consequently, if the current value of equities exceeds the present value of future dividends, then the estimate for the market cost of equity (and hence the MRP) that arises from this methodology will be too low. Similarly, if the current value of equities is below the present value of future dividends, then the estimate for the market cost of equity (and hence the MRP) that arises from this methodology will be too high. To illustrate the possible extent of the errors, suppose that the market dividends in the most recent year were $1b, the expected growth rate is 5%, and the market cost of equity is 10%. If the current value of equities is equal to the present value of future dividends then, following equation (1), this value will be $21b. Thus, application of the DGM approach would correctly estimate the market cost of equity at 10%. However, if the current market value of equities was 25% below this level, at $15.75b, application of the DGM would yield an estimate of *k* of 11.7%. Thus, the market cost of equity would be overestimated by 1.7% as a result of this undervaluation of equities.

CEG (2012b, paras 163-166) seems to accept that this is a potential problem but claims that the same problem afflicts the prevailing CGS yield, i.e., it too is deduced from the prevailing market price of an asset and therefore *may* embody perceptions that are unjustified and even “irrational”. However, whilst these claims about the CGS yield may be true, they presumably equally affect the market cost of equity capital and therefore net out in the MRP estimate. Furthermore, the primary source of concern over mis-pricing of equities lies in the market’s expected dividend growth rate *g* rather than the market cost of equity *k*, and this has no counterpart in the pricing of CGS. If the market price of equities is the present value of future dividends, then investors must have ‘rational’ perceptions about *g* and therefore an analyst using the DGM approach could hope to reasonably accurately estimate it. Upon doing so, they could then deduce *k* and therefore the MRP. Thus an analyst using the DGM could hope to accurately estimate *k* only in so far as they could accurately estimate *g*. However, if the market price of equities is disconnected from a ‘rational’ valuation of future dividends to the extent that investors have no value for *g*, the process breaks down. Furthermore, even if investors do have a value for *g* but it is irrational, the analyst could not hope to accurately estimate it and therefore could not hope to accurately estimate *k*. So, in summary, whilst the CGS price and hence yield may be irrational in some sense as might the discount rate on equities, the fundamental problem with equities lies in the expected growth rate for dividends and therefore in the ability to estimate the market cost of equity to an acceptable degree of approximation.

To illustrate these points, suppose the current level of dividends is $1b, *g* is (irrationally) zero, and *k* is 10%. Following equation (1), the market value of equities would then be $10b as follows:

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However, if the analyst estimates *g* at (say) 5% in conjunction with the DGM, their estimate of *k* would satisfy equation (1) as follows:

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Accordingly *k* would be overestimated at 15.5%. Even worse, if the market price of equities is disconnected from a ‘rational’ valuation of future dividends to the extent that investors have no value for *g*, then no estimate of *g* by an analyst could hope to accurately estimate the market’s (non-existent) estimate.

In summary, the use of the DGM implies that equity prices are equal to the present value of future dividends and therefore that the market’s expectation of the growth rate in dividends both exists and is rational. If this is not true, then an analyst could not hope to accurately estimate this expected growth rate and therefore could not hope to accurately estimate the market’s cost of equity. CEG’s observation that the CGS yield might also not be rational is not only irrelevant to this but would in any case net out in the MRP estimate.

*10.2 The Impact of Short-Run Fluctuations in the Retention Rate*

The DGM methodology is also prone to errors in the presence of short-term fluctuations in the market’s earnings retention rate (the proportion of earnings retained rather than paid as dividends). Lally (2012, section 3.2) illustrated this problem with the following example. Suppose the market cost of equity is 10% per year in perpetuity, the expected growth rate in dividends per share is 5% per year in perpetuity, and the dividends in the most recent year were $1b. Suppose also that the risk free rate is 4% in perpetuity, and therefore the MRP is 6%. Using the first three of these parameters, in conjunction with equation (1), the current value of equities would then be as follows:

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Substitution of this value for *S*, along with the current dividend level *D* and the expected growth rate in dividends *g*, into the DGM equation (1) would then accurately estimate the market cost of equity at 10%.

Now suppose instead that firms in aggregate lowered their earnings retention rate in the most recent year and that the effect of this was to raise the dividend level in the most recent year from $1b to $1.3b, at the expense of future dividends (relative to the above path). Suppose also that the effect of this change was NPV neutral, so that the current value of equities would be lower by $0.3b. So, applying the DGM in equation (1) with *g* still estimated at 5%, the estimate of *k* would satisfy the following equation:

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The result would be an estimate of *k* of 11.6%, compared to the true value of 10%, i.e., an overestimate of 1.6%, and therefore the same for the MRP. The source of the problem is the fact that the DGM approach applies a set of expected growth rates to existing dividends, and therefore implicitly assumes that current dividends have not been subject to a temporary fluctuation. If they have been subject to a temporary upward (downward) fluctuation, the entire future stream of expected dividends will be overestimated (underestimated) and so too then will the MRP.

*10.3 The Impact of Long-Run Changes in the Earnings Retention Rate*

The DGM combines the current dividend level of firms (which reflects the current earnings retention rate) with an expected long-run growth rate in DPS for existing companies that is based upon an estimate of the expected long-run growth rate in GDP, and the latter estimate is based upon historical averaging and therefore upon the historical average earnings retention rate (assuming plausibly that the growth rate in GDP is affected by the level of corporate investment). Thus, if the earnings retention rate has fallen over time, so that the current level is below its historical average, then estimating the expected long-run growth rate in GDP from its historical average will over estimate this parameter and therefore overestimate the MRP. SFG (2013, page 35) make the same point.

1. **Conclusions**

This paper has sought to critically assess the AER’s proposed DGM methodology for estimating the MRP, and the conclusions are as follows.

Firstly, in respect of the number of stages in the model, I estimate that the incremental benefits in moving from a two to a three-stage model are even greater than in moving from a one to a two-stage model. Consequently, given that the AER prefers a two-stage model over a one-stage model, the AER ought to adopt a three-stage model. In using a three-stage model, I favour a linear transition in the expected DPS growth rate from the short-run values to the long-run value.

Secondly, it is very likely that the true term structure for the market cost of equity sometimes significantly departs from the standard assumption of a flat structure. Consequently, at such times, there will be significant benefits from using a DGM model in which non-flat term structures are recognised. This would involve setting the expected ten-year market cost of equity in ten years equal to the estimated long-run average value for this parameter and then using the DGM to find the current ten-year market cost of equity.

Thirdly, I concur with the AER’s formula for correcting expected cash dividends for imputation credits, and also with their estimate of the proportion of dividends that are fully franked, of 75%.

Fourthly, I concur with the AER’s estimate for the long-run expected real growth rate in DPS of 2% per year, and also with the AER’s estimate for the long-run expected inflation rate of 2.5% per year. Accordingly I concur with the AER’s estimate of the long-run expected growth rate in DPS of 4.6% per year.

Fifthly, in respect of the short-term expected growth rates in DPS, relative to the Bloomberg DPS forecasts, the IBES EPS forecasts have the advantages of not being subject to short-term fluctuations in future earnings payout rates and have also been subject to extensive tests for bias. In addition, ‘stale’ analyst forecasts ought to be deleted from whichever data set is used to the extent this is feasible.

Sixthly, in respect of the mid-year correction proposed by the AER, the theoretical merits of this adjustment are clear. Failure to make the correction would lead to underestimating the market cost of equity, and therefore also the MRP, but only by about 0.25%. Thus, if this is considered sufficiently important to warrant correction, then a three-stage DGM should be preferred over a two stage model and the assumption of a flat term structure in the market cost of equity should also be avoided.

Seventhly, and in respect of the partial-year correction proposed by the AER, failure to make this adjustment would lead to an underestimate in the market cost of equity, and therefore also the MRP, by about 0.1%. This is not significant. Furthermore, I understand that the Bloomberg DPS forecast are updated much more frequently than annually, and this undercuts the rationale for the adjustment. Accordingly, I recommend against the partial-year adjustment.

Finally, in addition to these issues, there are a number of limitations of the DGM that should be recognised. In particular, the DGM assumes that equity prices are equal to the present value of future dividends and therefore that the market’s expectation of the growth rate in dividends both exists and is rational. If this expected growth rate does not exist or is not rational, then an analyst could not hope to accurately estimate it and therefore could not hope to accurately estimate the market’s cost of equity. In addition the DGM is prone to errors in the presence of short-term fluctuations in the market’s earnings retention rate and also to long-term changes in the market’s earnings retention rate.

**REFERENCES**

AER, 2013, *Better Regulation*: *Explanatory Statement Draft Rate of Return Guideline* ([www.aer.gov.au](http://www.aer.gov.au)).

Bernstein, P. and Arnott, R. 2003, ‘Earnings Growth: The Two Percent Dilution’, *Financial Analysts Journal*, Sept/October, pp. 47-55.

Brailsford, T., Handley, J., and Maheswaren, K., 2008, ‘Re-examination of the Historical Equity Risk Premium in Australia’, *Accounting and Finance*, vol. 48, pp. 73-97.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2012. ‘The Historical Equity Risk Premium in Australia: Post-GFC and 128 Years of Data, *Accounting and Finance*, 52, pp. 237-247.

CEG. 2012, *Response to AER Vic Gas Draft Decision*: *Internal Consistency of MRP and Risk Free Rate*, report prepared for Envestra, SP AusNet, Multinet and APA ([www.aer.gov.au](http://www.aer.gov.au)).

\_\_\_\_ 2013, *Estimating E(Rm) in the Context of Recent Regulatory Debate* ([www.aer.gov.au](http://www.aer.gov.au)).

Claus, J. and Thomas, J., 2001, ‘Equity Premia as Low as Three Percent?: Evidence from Analysts’ Earnings Forecasts for Domestic and International Stocks’, *The Journal of Finance*, vol. 56, pp. 1629-1666.

Cox, J., Ingersoll, J., and Ross, S. 1985, ‘A Theory of the Term Structure of Interest Rates’, *Econometrica*, vol. 53, pp. 385-407.

Fama, E. (1984), ‘The Information in the Term Structure’, *Journal of Financial Economics*, vol. 13 (4), pp. 509-528.

Gordon, M. and Shapiro, E. 1956, ‘Capital Equipment Analysis: The Required Rate of Profit’, *Management Science*, vol. 3, pp. 102-10.

Grinold, R., Kroner, K., and Siegel, L., 2011, ‘A Supply Model of the Equity Premium’, *The Research Foundation of CFA Institute* (<http://www.cfainstitute.org>).

Gu, Z., and Wu, J., 2003, ‘Earnings Skewness and Analyst Forecast Bias’, *Journal of Accounting and Economics*, vol. 35, pp. 5-29.

Hull, J., and White, A. 1990, ‘Pricing Interest Rate Derivative Securities’, *Review of Financial Studies*, vol. 3, pp. 573-592.

Lally, M., 1988, ‘The Gordon-Shapiro Dividend Growth Formula and Inflation’, *Accounting and Finance*, Vol. 28, pp. 45-51.

\_\_\_\_\_\_\_ 2012, *The Cost of Equity and the Market Risk Premium*, report prepared for the AER ([www.aer.gov.au](http://www.aer.gov.au)).

McCulloch, J. (1975), ‘An Estimate of the Liquidity Premium’, *Journal of Political Economy*, vol. 83, pp. 95-119.

Officer, R., 1994, ‘The Cost of Capital of a Company under an Imputation Tax System’, *Accounting and Finance*, vol. 34, pp. 1-17.

Pratt, S., and Grabowski, R., 2010, *Cost of Capital*: *Applications and Examples*, 4th edition, John Wiley and Sons, Hoboken.

SFG, 2013, *Reconciliation of Dividend Discount Model Estimates with those Compiled by the AER* ([www.aer.gov.au](http://www.aer.gov.au)).

The Treasury, *Mid-Year Economic and Fiscal Outlook 2012-2013* (<http://www.budget.gov.au/2012-13/content/myefo/download/2012-13_MYEFO.pdf> ).

Vasicek, O. 1977, ‘An Equilibrium Characterisation of the Term Structure’, *Journal of Financial Economics*, vol. 5, pp. 177-188.

Wright, S., 2012, *Review of Risk Free Rate and Cost of Equity Estimates*: *A Comparison of UK Approaches with the AER*, report prepared for Envestra, SP AusNet, Multinet and APA ([www.aer.gov.au](http://www.aer.gov.au)).

1. The AER invokes Pratt and Grabowski (2010, equation (4.18)) but this equation contains the term *n* instead of *n*-1. The test is thus: if *y* = 1, equation (3) must collapse to equation (2), which it does. However, Pratt and Grabowski’s equation (4.18) does not then collapse to their equation (4.14). [↑](#footnote-ref-1)
2. The figure of 7% is chosen because it represents the most extreme annual average expected growth rate across the three-year forecast period in the Bloomberg monthly figures covering the period 2006-2013 (relative to the AER’s long-term expected growth rate of 4.6%). Choosing such a number will give rise to the greatest discrepancy between the three-stage model and its simpler alternatives. [↑](#footnote-ref-2)
3. There is also considerable confusion in SFG’s presentation of this approach. SFG (2013, section 5) asserts that the approach merely varies the transition path to the long-run DPS growth rate (of 4.6%), with the example having this feature, but SFG (2013, page 27 and page 34) claims that the approach also estimates the long-term growth rate. These are quite different claims. [↑](#footnote-ref-3)
4. This does not rule out the possibility that this uniform expectation at any point in time for all future years changes as one moves through time, due to changes in the market dividend yield or the expected growth rate in GDP. [↑](#footnote-ref-4)
5. I assume that the “expectations hypothesis” is valid merely to simplify the analysis here. The empirical evidence strongly indicates that interest rates also impound liquidity premiums (McCulloch, 1975; Fama, 1984). [↑](#footnote-ref-5)
6. This property of interest rates is called “mean reversion” and is considered to be sufficiently uncontroversial in the academic literature that it underlies all modern theoretical modelling of interest rate movements (Vasicek, 1977; Cox et al, 1985; Hull and White, 1990). The intuition is thus: high (real) rates curtail demand for and increase supply of funds, thereby pulling rates down, whilst low rates incite demand for and reduce supply of funds, thereby pulling rates up. [↑](#footnote-ref-6)
7. Debt capital might also be used by firms but the assumption that, at any point in time, the subsequently expected cost of equity is the same for all future years implies that the leverage ratio remains fixed over time. [↑](#footnote-ref-7)
8. This is based on RBA data (Table G2) from September 1996 to September 2013 ([www.rba.gov.au](http://www.rba.gov.au)). [↑](#footnote-ref-8)