THE DIVIDEND GROWTH MODEL

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EXECUTIVE SUMMARY

This paper has sought to assess Competition Economist Group's (CEG's) recent Market Risk Premium (MRP) estimates using the Dividend Growth Model (DGM) approach, and the conclusions are as follows.

Firstly, the conventional DGM approach used by CEG will overestimate the MRP when the risk free rate is low (and underestimate it when the risk free rate is high), because the DGM assumes that the market cost of equity never changes over time, and therefore that any changes in the MRP and the risk free rate are perfectly offsetting; such perfect offset is neither plausible nor do CEG offer any evidence in support of it. CEG do however test whether a model that allows different market costs of equity over different future time periods is compatible with the AER's estimated cost of equity capital over the next 10 years (8.98%) by determining what subsequent rate would be consistent with this, estimate this subsequent rate at 13.38%, and conclude that the latter is too high thereby implying that the former is too low. However, their calculations reflect particular choices of values for other parameters and plausible alternatives to these reverse their conclusions.

Secondly, 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 discount rate. CEG's observation that the Commonwealth Government Security (CGS) yield might also not be rational is not only irrelevant to this point but would in any case net out in the MRP estimate.

Thirdly, the DGM methodology is also prone to errors in the presence of short-term fluctuations in the market's earnings retention rate. CEG do not contest this point.

Fourthly, the DGM methodology is also prone to errors in the presence of long-term changes in the market's earnings retention rate. CEG do not contest this point.

Fifthly, and in relation to the claim that CEG's formula for the market cost of equity is mathematically wrong, CEG neither contest this point nor do they correct it in their latest paper.

Sixthly, CEG's argument that the long-run growth rate in the dividends per share of existing firms matches that for Gross Domestic Product (GDP), because new firms are funded from the dividends paid by existing firms, is not valid. However CEG's argument that the expected growth rate in dividends per share for existing companies might initially be larger than the expected GDP growth rate and then converge on a rate lower than that for GDP, so that the resulting MRP estimate approximates that provided by them, is valid in principle but CEG do not supply any analysis in support of this argument.

In view of these concerns about CEG's methodology, I therefore provide MRP estimates using the DGM approach. Leaving aside the first four concerns raised above, the resulting estimates are between 6.4% and 8.5% with the variation arising from the size of the deduction from the GDP growth rate to allow for new share issues and new companies and also from the period over which the short-run expected dividend growth rate converges towards the long-run rate. Amongst the first four concerns raised above, the principal concern is the assumption that the market cost of equity is the same for all future years. The more reasonable assumption is that the market cost of equity beyond year 10 corresponds to the analyst's belief about the long-run average value for this parameter, with the DGM approach then used to derive the market cost of equity capital for the next 10 years, from which the MRP estimate for the next 10 years then follows. Using CEG's belief that the long-run value for this market cost of equity capital is 11.86%, the resulting estimates for the MRP over the next 10 years range from 3.8% to 8.4%. This range is far too wide to be useful. My view is that a convergence period of at least 10 years is sensible, and this narrows the band of MRP estimates to between 5.9% and 8.4%. Thus the DGM approach supports an MRP estimate of at least the 6% favoured by the AER. However, this estimate is still subject to the potential concerns arising from rational pricing of equities and variations over time in the market-wide earnings retention rate.

1. Introduction

CEG (2012a) has proposed an estimate of the MRP for Australia using the DGM. This gave rise to a critique by Lally (2012), and in turn to subsequent papers by CEG (2012b, 2012c). Consequent upon this, the AER has sought a critical review of CEG's latest work and an assessment of whether their most recent MRP estimate using this DGM approach (CEG, 2012c) represents the best DGM based MRP estimate in the current market conditions.

In my earlier work (Lally, 2012), I raised a number of concerns about CEG's analysis and CEG have responded to some of those points. I therefore commence by reviewing CEG's response on these points, and then present my own MRP estimate using the DGM approach.

2. The Term Structure for the Market Cost of Equity

As used by CEG, the DGM estimates the cost of equity for the market consistent with the current dividend yield and assumptions about the future growth rate in dividends, and then deducts the current risk free rate to yield a current estimate of the MRP. In the first such step, at any given point in time, the market cost of equity is assumed to be the same for all future years.[1] 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[2], this DGM methodology implicitly assumes that the MRP over the next ten years will be unusually high relative to its long-term average by an exactly offsetting amount. This 'perfect-offset' hypothesis is implausible, even stronger than CEG's explicitly stated view that risk free rates and MRPs are merely negatively correlated, and it therefore gives rise to MRP estimates that will be too low when the risk free rate is unusually high and too high when the risk free rate is unusually low.

[1] This does not rule out the possibility that this uniform expectation 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.

[2] 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. Furthermore, even CEG (2012c, Table 4) implicitly accept that mean reversion operates by virtue of estimating the long-term average risk free rate at about 6% at a time when the current rate is only about half of this.

Lally (2012, section 3.2) illustrated this consequence of 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 cost of equity over 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 to its long-term average of (for example) 6%. In addition, we assume an expected growth rate in dividends of 5%. Letting *D* denote the dividends in the most recent year, it follows that the current value of equities is as follows:

$$S = \frac{D(1.05)}{1.10} + ... + \frac{D(1.05)^{10}}{(1.10)^{10}} + \frac{E(S_{10})}{(1.10)^{10}}$$

$$= \frac{D(1.05)}{.10-.05}\left[1-\left(\frac{1.05}{1.10}\right)^{10}\right] + \frac{\left[\frac{D(1.05)^{11}}{.12-.05}\right]}{(1.10)^{10}}$$

Per $1 of current dividends *D*, the current equity value is then $17.23. By contrast, if one assumed a constant value for the market cost of equity capital *k* (along with a constant growth rate *g*) then the estimate of *k* would satisfy the following equation:

$$S = \frac{D(1+g)}{1+k} + \frac{D(1+g)^2}{(1+k)^2} + ... = \frac{D(1+g)}{k-g} \qquad (1)$$

Solving this equation for *k* then yields

$$k = \frac{D}{S}(1+g) + g \qquad (2)$$

Substituting the equity value of $17.23 above (per $1 of current dividends) into the DGM equation (2) along with the expected growth rate of 5% yields an estimated cost of equity of 11.1%. Deduction of the current risk free rate of 3.8% then yields an estimated MRP of 7.3%. This is 1.1% above the actual MRP of 6.2% for the first ten years.

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 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, CEG (2012b, pp. 37-41) argues that the assumption of a constant cost of equity (i.e., the perfect-offset hypothesis) is unavoidable and is generally adopted by analysts. The latter point is definitely true but subtracts nothing from the problem that the MRP will be overestimated when the risk free rate is low. All methods for estimating the MRP have their disadvantages, these disadvantages must be recognised, and the disadvantage in question here is particularly significant when the risk free rate is unusually high or low. Furthermore, if the analyst holds a view about the long-term average value for the market cost of equity, this could be used in the DGM from year 10 onwards and therefore the DGM used to estimate the market cost of equity for the next 10 years.

CEG also claim that Lally (2012a) provides no evidence to support the claim that the negative relationship between the MRP and the risk free rate is less than 1:1. This is a strange inversion of the burden of proof; it is the proponent of a model with a questionable assumption (CEG) who has the obligation to supply evidence that the assumption holds rather than the sceptic (Lally). Furthermore this questionable assumption of the model (that the negative relationship between the risk free rate and the MRP is 1:1) is much stronger than the assumption that CEG explicitly make (that these two parameters are merely negatively related).

In addition to using this DGM approach to estimate the MRP at the present time, CEG also provide a time-series of estimates, repeated in CEG (2012b, Figure 6). This time series shows an MRP of zero in 1994, leading Lally (2012, section 3.3) to observe that such an estimate is not only implausible but illustrates the problem that MRP estimates from the DGM approach will be too extreme (too low in this case) when risk free rates are extreme (high in this case). CEG (2012b, para 49) accept this criticism and have revised their time-series of expected dividend growth rates, leading to a new time-series of MRP estimates that is free of the implausible zero value (CEG, 2012b, Figure 7).[3] However, even with this revision, the MRP

[3] The acceptance of the criticism is implicit rather than explicit because CEG's wording in the relevant paragraph 49 suggests that it is their own observation of this problem that lead them to the revision rather than the critique in Lally (2012, section 3.3).

estimates are still subject to the problem that they will be too extreme when the risk free rate is extreme, as discussed above, unless the MRP and the risk free rate have a perfectly negative relationship (and CEG neither present evidence to support this assumption nor even claim it to be true).

CEG also test whether a model that allows different expected market costs of equity over different future time periods is compatible with the AER's estimated cost of equity capital over the next 10 years (8.98%) by rerunning the example shown above with the AER's market cost of equity for the next 10 years of 8.98% and use the DGM to estimate the market cost of equity capital in the subsequent years (CEG, 2012b, paras 152-160). In addition, CEG uses an expected nominal dividend growth rate of 5.6% (expected nominal GDP growth less 1%) and a current dividend yield of 5.45%. Using these values they deduce that the cost of equity from year 10 must be 13.38%, which is 50% larger than the AER's figure of 8.89% for the first ten years. Furthermore, if the MRP of 6% were maintained beyond year 10, the risk free rate beyond year 10 would have to be 7.38%. CEG considers such a jump to be implausible. However, the figure of 13.38% is based upon a deduction of only 1% from expected GDP growth and this deduction of 1% is presumably drawn from Lally (2012, page 20). However the only definitive statement offered by Lally was that the "correct adjustment is less than 2%" and the figure of 1% (along with a further figure of 1.5%) was merely an example. Suppose the correct deduction was instead 1.5%, and therefore the expected growth rate in dividends was 5.1%.[4] In addition, whilst CEG use a dividend yield of 5.45% in their analysis here, they use the figure of 5.34% in their updated calculations (CEG, 2012c, Table 4). Accordingly, I use a dividend yield of 5.34%. The result is an estimated cost of equity of 12.1% beyond year 10, which is close to the long-term average of 11.99% proposed by CEG (2012a), comprising an MRP of 6% and a risk free rate of 5.99%, and also to the long-term average of 11.86% proposed by CEG (2012c), comprising an MRP of 6% and a risk free rate of 5.86%. Thus, the AER's estimated cost of equity over the next 10 years of 8.98% is perfectly compatible with even CEG's view about the long-term situation.

In summary, the conventional DGM approach used by CEG will overestimate the MRP when the risk free rate is low (and underestimate it when the risk free rate is high), because the DGM assumes that the market cost of equity never changes over time, and therefore that any changes

[4] Section 7 provides further discussion of this issue including justification for the deduction being up to 2%.

in the MRP and the risk free rate are perfectly offsetting; such perfect offset is neither plausible nor do CEG offer any evidence in support of it. Also, in response to the observation that CEG's time series of MRP estimates includes an estimate of zero in 1994, CEG have offered a new set of estimates that is free of this implausible result. Finally, using a model that allows different expected market costs of equity over different future time periods, CEG also assesses the implications of the AER's estimated cost of equity capital over the next 10 years (8.98%) for the subsequent rate, estimate this subsequent rate at 13.38%, and conclude that the latter is too high thereby implying that the former is too low. However, their calculations reflect particular choices of values for other parameters and plausible alternatives to these reverse their conclusions.

3. The Relationship Between Equity Prices and Present Values

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 current value of equities is 25% below the present value of future dividends. In addition, consistent with CEG (2012a), suppose that the expected growth rate in dividends is 6.60%, the current dividend yield is 5.68%, and the current ten year risk free rate is 3.77%. These parameters in conjunction with equation (2) imply that the MRP is estimated at 8.89%. However, if the current value of equities matched the present value of future dividends rather than being 25% below it, the estimate of the MRP would have been 7.37%, and therefore it would have been overestimated by 1.52% as a result of the market valuation error.

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 discount rate *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 discount rate to an acceptable degree of approximation.

To illustrate these points, suppose the current level of dividends is \$1b, *g* is (irrationally) zero, *k* is 10%, the current risk free rate is 4%, and therefore the MRP is 6%. Using the first three of these parameter values along with equation (1), the market value of equities would then be \$10b as follows:

$$S = \frac{\$1b}{1.10} + \frac{\$1b}{(1.10)^2} + ... = \frac{\$1b}{.10} = \$10b$$

and therefore the dividend yield would be 10%. However, in using equation (2) to estimate *k*, the analyst would presumably use a positive value for *g* and therefore would overestimate *k*. For example, if the analyst estimated *g* at 5%, they would estimate *k* at 15.5% as follows

$$k = \frac{\$1b}{\$10b}(1.05) + .05 = .155$$

Given that the current risk free rate is 4%, the MRP would then be estimated at 11.5% rather than the correct value of 6%. 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 discount rate. 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.

4. The Impact of Short-Run Fluctuations in the Earnings 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 (matching the expected long-run expected GDP growth rate), 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:

$$S = \frac{\$1b(1.05)}{1.10} + \frac{\$1b(1.05)^2}{(1.10)^2} + ... = \frac{\$1b(1.05)}{.10 - .05} = \$21b$$

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 (2) would then accurately estimate the market cost of equity at 10% as follows:

$$k = \frac{\$1b}{\$21b}(1.05) + .05 = .10$$

Deduction of the risk free rate of 4% would then yield an accurate estimate of the MRP of 6%. 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 current dividend level 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, application of the DGM in equation (2) with g still estimated from the expected long-run growth rate in GDP (at 5%) would yield the following estimate of the market cost of equity:

$$k = \frac{\$1.3b}{\$20.7b}(1.05) + .05 = .116$$

Deduction of the risk free rate of 4% would then yield an estimate of the MRP of 7.6%. Since the true MRP is 6%, the DGM has overestimated it by 1.6%. The source of the problem is the fact that CEG's DGM approach applies a constant expected growth rate 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.

CEG (2012b, 2012c) do not respond to this concern or even allude to it.

5. 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 dividends per share 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.

CEG (2012b, 2012c) do not respond to this concern or even allude to it.

6. Correctly Deducing the Cost of Equity Using the DGM

In using the DGM approach, CEG (2012a) adopted a particular variant that they term the AMP Method. This involves adding the dividend yield of 5.68% to the expected long-run growth

rate in dividends of 6.6% to yield an estimated market cost of equity capital of 12.28%, and the expected long-run growth rate in dividends is set equal to the expected long-run growth rate in GDP (CEG, 2012a, Table 4 and section 4.3). The prevailing ten-year risk free rate of 3.77% is then deducted from this cost of equity to yield the estimated MRP of 8.52%. In a subsequent paper (CEG, 2012c, paras 45-53, Table 4), the dividend yield is reduced to 5.34% and the risk free rate to 3.05%, leading to a revised estimate for the MRP of 8.89%.

CEG clearly intend that the expected growth rate in dividends of 6.60% applies immediately and therefore the value of equities (S) can be represented as shown in equation (1) above. The market cost of equity is then as shown in equation (2) above. Substituting CEG's (2012c, Table 4) parameter values into equation (2) then yields a value for k of 12.29%, and deduction of the risk free rate of 3.05% then yields an estimate for the market risk premium of 9.24% rather than the figure of 8.89% claimed by CEG. CEG's error was to ignore the $(1+g)$ term in equation (3).

This problem was noted in Lally (2012, section 3.3). However CEG (2012b, 2012c) do not respond to this concern or even allude to it.

7. The Long-Run Expected Growth Rate in Dividends

The AMP Method invoked by CEG (2012a, 2012b, 2012c) sets the expected growth rate for dividends equal to the long-term expected GDP growth rate, which CEG estimate at 6.6%. However, the long-term expected growth rate for dividends in the DGM model is that for dividends per share in existing companies, and this must be less than that for GDP. If these two growth rates matched then, since the expected long-term growth rate in all dividends from all companies would exceed that for dividends per share in existing companies (due to new share issues net of buybacks and also to the formation of new companies), the expected long-term growth rate in all dividends from all companies would exceed that for GDP, and therefore dividends in absolute terms would eventually exceed GDP in absolute terms. This is impossible. So, it is necessary to assume that the long-term growth rate in all dividends for all companies will match that for GDP (to ensure that the ratio of dividends to GDP does not eventually reach zero or exceed 1). It follows that the expected long-term growth rate in dividends per share 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 dividends per share 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. 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 US firms. Both points suggest that the correct adjustment is less than 2%. If we deduct 1% from the expected long-term growth rate in GDP, the estimate for the expected long-term growth rate in dividends would then be 5.6%, and substitution of this into equation (2) followed by deduction of the risk free rate would yield an estimated MRP of 7.82% rather than 8.89%. If the deduction is instead 1.5%, to yield an expected long-run growth rate in dividends of 5.1%, then the estimated MRP would fall further to 7.3%.

This concern was raised in Lally (2012, section 3.3) and CEG (2012b, section 3.3.1) responds to it in two ways. Firstly, CEG argue that the equity capital for new firms comes from the dividends paid by existing firms.[5] However this claim is not true (some firms receive their equity funding by other means) nor would it matter even if it were true. To illustrate the latter point, suppose that a market currently contains a set of firms with aggregate dividends paid in the last year of $1b and which 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, these firms 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. Suppose further that this process repeats itself every year, i.e., 30% of dividends paid in every year are invested to create new firms, 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

[5] 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.

that the MRP is 6%. Using equation (1), the existing firms would then be worth $21b as follows:

$$S = \frac{\$1b(1.05)}{1.10} + \frac{\$1b(1.05)^2}{(1.10)^2} + ... = \frac{\$1b(1.05)}{.10 - .05} = \$21b$$

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 (2) 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:

$$g_a = \frac{E(DIV_{t+1})}{E(DIV_t)} - 1 = \frac{E(DIV_t)(1.05) + E(DIV_t)(.30)(.0476)}{E(DIV_t)} - 1 = .0643$$

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 (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 dividends 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%. Furthermore nothing would be changed in these results even if new firms were financed in some way other than from the dividends paid by the firms existing at the time the new firms were established. Thus, CEG's claim that funding of new firms from the dividends of existing firms obviates the need to subtract something from the long-run expected growth rate in GDP in order to estimate the MRP is not correct.

Secondly, CEG (2012b, section 3.3.1) argues that the expected growth rate towards which the dividends per share of existing firms must converge is irrelevant because only dividends expected over the next 30-40 years are material to the result. Thus CEG appear to be suggesting that the expected growth rate in dividends of existing firms over the next (say) 40 years might

be larger than the expected GDP growth rate and to an extent that would compensate for the subsequent lower growth rate. Furthermore, they do provide limited evidence to this effect, in the form of Bloomberg's forecast for dividend growth in Australian equities of 7.4% and 7.5% for the next two years (ibid, section 3.3.1) and also a forecast of 7% from Capital Research (2012, pp. 13-14). However, CEG provide no analysis with multiple dividend growth rates that supports their MRP estimate, the only analysis supplied being that described in the previous section and involving a constant expected growth rate rather than multiple dividend growth rates.

In summary, CEG's argument that no deduction is required from the expected long-run GDP growth rate, to estimate the expected long-run growth rate in the dividends per share of existing firms, is not valid. In addition, CEG's argument that the expected growth rate in dividends per share for existing companies *might* initially be larger than the expected GDP growth rate and then converge on a rate lower than that for GDP, so that the resulting MRP estimate approximates that provided by them, is valid in principle. However they do not supply any analysis in support of this argument.

8. A Proposed MRP Estimate Using the DGM

Having critiqued CEG's proposed MRP estimate using the DGM approach, I now offer an estimate using the DGM approach. I concur with CEG's current cash dividend yield of 4.8%, the 11.25% increment to it arising from the allowance for imputation credits (yielding an imputation-adjusted dividend yield of 5.34%), and the long-run expected inflation rate of 2.5%.[6] However the risk free rate of 3.05%, being the average for September 2012, requires updating to the latest monthly average (Dec 2012) of 3.26%.[7] Furthermore I disagree over the long-run expected growth rate in GDP, and the lack of a deduction from it to allow for new share issues and new firms. There are also reasonable grounds to challenge the assumption that the expected growth rate in dividends should match its expected long-run rate immediately rather than converging on it over some period, as suggested by CEG.

[6] CEG's imputation adjustment of 11.25% embodies a utilisation rate on distributed credits of 35% (CEG, 2012c, footnote 9), and this latter value matches that invoked by the AER.

[7] This comprises the average figure of 3.23% reported for December 2012 on the RBA's website, subject to correction for the fact that it converts a semi-annual rate to an annual rate using simple rather than compound interest.

In respect of the long-run expected GDP growth rate, CEG (2012b, Appendix) favours an estimate of 3.9% based upon the average outcome over the period 1958-2010. However, the result over the considerably longer period from 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%. This figure of 3.3% suggests that CEG's figure of 3.9% is too high. Furthermore, Bernstein and Arnott provide average real GDP growth rates over 16 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%. Coupled with expected long-run inflation of 2.5%, this implies an expected nominal long-run GDP growth rate of 5.6%.

In respect of the deduction from the expected GDP growth rate to account for new share issues and new companies, as discussed previously, I consider that this should be less than 2%. So, I consider deductions of 0.5%, 1% and 1.5%. In respect of the initial expected growth rates, I invoke the expected dividend growth rates of 7.4% and 7.5% for the first two years drawn from Bloomberg and referred to by CEG (2012b, section 3.3.1). Finally, in respect of the period over which this latter growth rate (linearly) converges on the long-run expected growth rate (the expected GDP growth rate less the deduction referred to), I consider convergence periods of 0, 10, and 20 years.

To illustrate the mechanics of deducing the MRP with this information, suppose that the deduction from the expected GDP growth rate is 1% (yielding an expected long-run dividend growth rate of 4.6%) and the convergence period is 20 years. In this case the current value of equities would be as follows:

$$S = \frac{D(1.074)}{1+k} + \frac{D(1.074)(1.075)}{(1+k)^2} + ... + \frac{D(1.074)(1.075)...(1.046)}{(1+k)^{20}} + \frac{E(S_{20})}{(1+k)^{20}}$$

$$= \frac{D(1.074)}{1+k} + ... + \frac{D(1.074)(1.075)...(1.046)}{(1+k)^{20}} + \frac{\left[\frac{D(1.074)...(1.046)(1.046)}{k-.046}\right]}{(1+k)^{20}}$$

With D/S = .0543, the value of k solving this equation is 11.46% and deduction of the risk free rate of 3.26% then yields an MRP estimate of 8.20%. Table 1 shows the results for a range of deductions from the expected GDP growth rate (d) and the convergence period from the short-run to the long-run expected dividend growth rate (N). The results range from 6.40% to 8.51%, and are therefore all in excess of the 6.0% estimate favoured by the AER.

Table 1: Estimated Ten-Year MRP with Constant Cost of Equity

	$N = 0$	$N = 10$	$N = 20$
$d = 0.5\%$	7.45%	8.09%	8.51%
$d = 1.0\%$	6.93%	7.70%	8.21%
$d = 1.5\%$	6.40%	7.31%	7.92%

However, these estimates are still all subject to the concerns raised in sections 2 to 5 above. Amongst these concerns, the term structure issue discussed in section 2 is of particular concern at the present time because the risk free rate is so low. Consequently, MRP estimates are derived for the next ten years assuming a market cost of equity from year 10 that corresponds to the long-run average value for this parameter and then using the DGM to estimate the market cost of equity (and hence the MRP) for the next 10 years. In respect of the long-run average value for the market cost of equity, I adopt CEG's estimate of 11.86% comprising a long-run average risk free rate of 5.86% and a long-run average MRP of 6% (CEG, 2012c, Table 4).[8]

To illustrate this process, and how it differs from that underlying the results in Table 1, consider the central MRP estimate in Table 1 of 7.70% arising from convergence of the short-run expected dividend growth rate to the long-run rate over a period of 10 years and an expected long-term growth rate in dividends equal to 4.6% (the expected GDP growth rate of 5.6% less a deduction of 1.0%). This MRP estimate of 7.70% arises from an estimated market cost of equity of 10.96% less the risk free rate of 3.26%, and assumes that this market cost of equity

[8] This approach assumes (reasonably) that interest rates are mean reverting, as discussed in footnote 2. Of course, the focus in a regulatory situation is on the risk free rate and the MRP over some finite future period (such as ten years). However, if the DGM is used to estimate the MRP over that ten year period and risk free rates are believed to exhibit mean reversion, it is desirable to posit some view about the long-term average risk free rate in order to generate a *better* estimate of the MRP for the next ten years.

of 10.96% applies to all future years. By contrast, if one adopts an estimate of 11.86% for the market cost of equity from year 10, and uses the DGM to estimate the market cost of equity for the next 10 years, the DGM would be as follows:

$$S = \frac{D(1.074)}{1+k} + ... + \frac{D(1.074)...(1.046)}{(1+k)^{10}} + \frac{E(S_{10})}{(1+k)^{10}}$$

$$= \frac{D(1.074)}{1+k} + ... \frac{D(1.074)...(1.046)}{(1+k)^{10}} + \frac{\left[\frac{D(1.074)...(1.046)(1.046)}{.1186-.046}\right]}{(1+k)^{10}}$$

The resulting estimate for the market cost of equity for the next 10 years (k) is 9.92%, and therefore an MRP estimate for the next 10 years of 6.66%. Thus an MRP estimate of 7.70% based upon a constant future market cost of equity falls to 6.66% with an assumed long-run average market cost of equity of 11.86%.

Table 2 shows the results for all combinations of parameter values used in Table 1. All of the MRP estimates in Table 2 are lower, with the difference being most pronounced for the low MRP estimates in Table 1 and tailing off to zero as the MRP estimate in Table 1 approaches 8.60% (and therefore the market cost of equity for all future years approaches 11.86%). In particular, the lowest MRP estimate in Table 1 of 6.40% 1 falls to 3.81% and the highest figure in Table 1 of 8.51% is not materially affected.

Table 2: Estimated Ten-Year MRP with Time-Varying Costs of Equity

	N = 0	N = 10	N = 20
d = 0.5%	5.96%	7.45%	8.39%
d = 1.0%	4.86%	6.66%	7.77%
d = 1.5%	3.81%	5.90%	7.20%

In summary, using the DGM approach and leaving aside the potential problems discussed in sections 2 to 5, I estimate the MRP at between 6.4% and 8.5% with the variation arising from the size of the deduction from the GDP growth rate to allow for new share issues and new companies and also from the period over which the short-run expected dividend growth rate

converges over the long-run rate. Amongst the potential problems in sections 2 to 5, the principal concern is the assumption that the market cost of equity is the same for all future years. The more reasonable assumption is that the market cost of equity beyond year 10 corresponds to the analyst's belief about the long-run average value for this parameter, with the DGM approach then used to derive the market cost of equity capital for the next 10 years, from which the MRP estimate for the next 10 years then follows. Using CEG's belief that the long-run value for this market cost of equity capital is 11.86%, the resulting estimates for the MRP over the next 10 years range from 3.81% to 8.39%. This range is far too wide to be useful. My view is that a convergence period of at least 10 years is sensible, and this narrows the band of MRP estimates from 5.90% to 8.39%. Thus the DGM approach supports an MRP estimate of at least the 6% favoured by the AER. However, this estimate is still subject to the potential concerns discussed in sections 3 to 5 as well as possible errors in the parameters used above.

9. Conclusions

This paper has sought to assess CEG's recent MRP estimates using the DGM approach, and the conclusions are as follows.

Firstly, the conventional DGM approach used by CEG will overestimate the MRP when the risk free rate is low (and underestimate it when the risk free rate is high), because the DGM assumes that the market cost of equity never changes over time, and therefore that any changes in the MRP and the risk free rate are perfectly offsetting; such perfect offset is neither plausible nor do CEG offer any evidence in support of it. CEG do however test whether a model that allows different market costs of equity over different future time periods is compatible with the AER's estimated cost of equity capital over the next 10 years (8.98%) by determining what subsequent rate would be consistent with this, estimate this subsequent rate at 13.38%, and conclude that the latter is too high thereby implying that the former is too low. However, their calculations reflect particular choices of values for other parameters and plausible alternatives to these reverse their conclusions.

Secondly, 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 discount rate. CEG's observation that the CGS yield might also not be rational is not only irrelevant to this point but would in any case net out in the MRP estimate.

Thirdly, the DGM methodology is also prone to errors in the presence of short-term fluctuations in the market's earnings retention rate. CEG do not contest this point.

Fourthly, the DGM methodology is also prone to errors in the presence of long-term changes in the market's earnings retention rate. CEG do not contest this point.

Fifthly, and in relation to the claim that CEG's formula for the market cost of equity is mathematically wrong, CEG neither contest this point nor do they correct it in their latest paper.

Sixthly, CEG's argument that the long-run growth rate in the dividends per share of existing firms matches that for GDP, because new firms are funded from the dividends paid by existing firms, is not valid. However CEG's argument that the expected growth rate in dividends per share for existing companies might initially be larger than the expected GDP growth rate and then converge on a rate lower than that for GDP, so that the resulting MRP estimate approximates that provided by them, is valid in principle but CEG do not supply any analysis in support of this argument.

In view of these concerns about CEG's methodology, I therefore provide MRP estimates using the DGM approach. Leaving aside the first four concerns raised above, the resulting estimates are between 6.4% and 8.5% with the variation arising from the size of the deduction from the GDP growth rate to allow for new share issues and new companies and also from the period over which the short-run expected dividend growth rate converges towards the long-run rate. Amongst the first four concerns raised above, the principal concern is the assumption that the market cost of equity is the same for all future years. The more reasonable assumption is that the market cost of equity beyond year 10 corresponds to the analyst's belief about the long-run average value for this parameter, with the DGM approach then used to derive the market cost of equity capital for the next 10 years, from which the MRP estimate for the next 10 years then follows. Using CEG's belief that the long-run value for this market cost of equity capital is 11.86%, the resulting estimates for the MRP over the next 10 years range from 3.8% to 8.4%. This range is far too wide to be useful. My view is that a convergence period of at least 10

years is sensible, and this narrows the band of MRP estimates to between 5.9% and 8.4%. Thus the DGM approach supports an MRP estimate of at least the 6% favoured by the AER. However, this estimate is still subject to the potential concerns arising from rational pricing of equities and variations over time in the market-wide earnings retention rate.

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