Report prepared for the

Australian Energy Regulator

Further Comments on the Historical Equity Risk Premium

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1. INTRODUCTION

Pursuant to the National Electricity Rules, the Australian Energy Regulator (AER) is currently undertaking a review of the weighted average cost of capital (WACC) parameters to be adopted in determinations for electricity transmission and distribution network service providers. As part of the process, the AER released an Explanatory Statement[1] in December 2008 setting out its draft position, and in relation to which a number of interested parties have since made submissions. The AER has now sought further advice on the following matters in relation to the expected market risk premium:

- Update historical excess returns using full year data for 2008. Estimates should cover the 1883-2008, 1937-2008, 1958-2008, 1980-2008 and 1988-2008 periods, be relative to 10 year Commonwealth Government Securities, be grossed-up for a theta of 0, 0.28, 0.5, 0.65 and 1.0. Include standard errors and 95% confidence intervals

- Critique Officer and Bishop's (2008) assessment that the historical difference between 5 year and 10 year CGS is on average 18bp. Test the statistical significance of this difference. Advise on the meaning of this statistical significance when using historical excess returns relative to 10 year CGS yields as a measure of the MRP, in combination with a CAPM with a term matching the length of the regulatory period (in general, 5 years).

- Respond to comment by Officer and Bishop (2009) on whether an 'opening' or 'closing' CGS yield is appropriate, and note which approach was used by Brailsford, Handley and Maheswaran (2008).

- Provide a high-level critique of Officer and Bishop's alternative indicators of the MRP (changes in corporate bond spreads, changes in market volatility, JP Capital Partners ASX 200 index option approach, corporate bond spreads with assumed debt betas)

[1] Australian Energy Regulator (2008).

- In the explanatory statement, the AER noted that the historical returns pre-1958 were more likely to overstate, than understate, historical excess returns from this period due to Brailsford et al (2008)'s observation that the use of an unweighted dividend yield during this period is 'biased towards high yielding small stocks'. Respond to the JIA (p.86)'s comment that this observation is 'speculative and unproven'.

- Respond to Gray and Hall (2006, 2008)'s argument on the inconsistency between a MRP, gamma and tax rate of 6%, 0.5 and 30%, respectively. Comment on whether the arguments put forward by Lally (2008) or Truong and Partington (2008) resolve the alleged inconsistency, or whether there are alternative explanations.

2. ESTIMATION OF HISTORICAL EXCESS RETURNS OVER THE PERIOD 1883 - 2008

2.1 Data and Approach

In my earlier report,[2] I set out estimates of historical excess returns (or equivalently, estimates of the historical equity risk premium) over the period 1883 to 2007 and also preliminary estimates for the period 1883 to 2008 – the latter based on data up to 15 October 2008, being the latest available at that time. In this section, (some of) these estimates are updated for the full year data for 2008. The estimates are again based on the study by Brailsford, Handley and Maheswaran (2008) who present a set of estimates of the historical equity risk premium in Australia over a number of sample periods from January 1883 to December 2005.

Annual stock return and (10 year) bond return for each calendar year from 1883 to 2005 and imputation credit yield data for each calendar year from 1988 to 2005 is sourced from BHM (2008).[3] This is supplemented with three years of additional data for the calendar years 2006 to 2008, using sources and methodologies consistent with BHM (2008). In particular:

- Stock Returns: daily closing values of the All Ordinaries Accumulation Index during 2006 to 2008 are obtained from the Australian Stock Exchange (via IRESS). The annual Historical Stock Accumulation Index Series of BHM (2008) is then extended for three years by setting the 2006, 2007 and 2008 values of the series equal to the average value of the All Ordinaries Accumulation Index in December 2006, December 2007 and December 2008 respectively. This leads to an annual series of (discrete) stock returns – attributable to dividends and capital gains/losses – for the 126 calendar years from 1883 to 2008.

[2] Handley (2008).
[3] See BHM (2008) for details of data sources and return series construction.

- 10 Year Bond Returns: daily yields on 10 year Commonwealth Government treasury bonds during 2006 to 2008 are obtained from the Reserve Bank of Australia (RBA) website. The annual Historical Bond Return Series of BHM (2008) is then extended for three years by setting the 2006, 2007 and 2008 values of the series equal to the yield at the end of December 2006, December 2007 and December 2008 respectively.

- Imputation Credit Yields: average imputation credit yields on the All Ordinaries Index during 2006 to 2008 are sourced from the Australian Taxation Office (ATO) website. The annual imputation credit yield series of BHM (2008) is then extended for three years by setting the 2006, 2007 and 2008 values of the series equal to (weighted) average imputation credit yield for the 12 months ending December 2006, December 2007 and December 2008 respectively.

2.2 Results

Table 1 sets out various statistics of the historical equity risk premium in Australia over a number of sample periods from January 1883 to December 2008. The differing start dates of 1883, 1937, 1958 and 1980 correspond to periods of increasing data quality but decreasing sample size. The start date of 1988 reflects the introduction of the dividend imputation tax system in Australia. AM is the arithmetic mean, SE is the standard error, Low and High define the 95% confidence interval for the "true" but unobservable value of the mean, p-value is the (2-tail) significance level of AM and GM is the geometric mean. The equity premium is defined as the (simple) difference between the stock return and the relevant proxy for the risk free rate – in this case the yield on 10 year Commonwealth Government bonds. Calculations are based on nominal, discrete returns and the stock return takes into account cash dividends and capital gains/losses only.

Relative to 10 year bonds, the equity risk premium has averaged 5.9% p.a. over 1883–2008.

BHM (2008) document concerns about data quality the further back into the past one looks and in particular suggest there are sufficient question marks over the quality of data prior to 1958 to warrant any estimates based thereon to be treated with caution.

Relative to 10 year bonds, the equity risk premium has averaged 5.7% p.a. over 1958–2008, which is a period of relatively good data quality. It is noted that the statistical significance of this estimate (p-value of 0.07) is slightly lower than the standard 5% level using a two-tailed test. The estimates of 5.9% p.a. and 5.7% p.a. agree with those contained in Officer and Bishop (2009).[4]

TABLE 1

Historical Equity Risk Premium 1883 - 2008

Assumed Value of Imputation Credits 0.00

Relative to 10 year Bonds

				95% Confidence Interval			
Period	Years	AM	SE	Low	High	p-value	GM
1883 - 2008	126	**0.059**	0.015	0.031	0.088	0.00	0.046
1937 - 2008	72	**0.054**	0.023	0.008	0.099	0.02	0.034
1958 - 2008	51	0.057	0.032	-0.006	0.119	0.07	0.031
1980 - 2008	29	0.050	0.043	-0.038	0.137	0.26	0.023
1988 - 2008	21	0.038	0.040	-0.046	0.122	0.36	0.019

Note: Refer to report for data sources and variable definitions
Estimates in Bold are significant at the 5% level using a 2-tailed test.

The impact of the global economic crisis on these historical estimates is evident from a comparison with those contained in BHM (2008) and in my earlier report. BHM (2008) report the equity risk premium, relative to 10 year bonds, has averaged 6.2% p.a. over 1883–2005 and 6.3% p.a. over 1958–2005. Handley (2008) reports the equity risk premium, relative to 10 year bonds, has averaged 6.4% p.a. over 1883–2007 and 6.7% p.a. over 1958–2007. Due to the smaller sample size, the impact is more noticeable over the more recent estimation period. BHM (2008) report the historical stock return (from cash dividends and capital gains/losses) averaged 11.8% p.a. (standard deviation of 16.0%) over 1883–2005 and 14.5% p.a. (standard deviation of 22%) over 1958–2005.[5] In comparison, the stock return in the 2006, 2007 and 2008 calendar years was +25%, +22% and –43% respectively.[6] The stock market performance during the 2008

[4] See Table 1 in Officer and Bishop (2009).
[5] BHM (2008 p.87).
[6] From 1958, the annual index value is equal to the arithmetic average of the daily closing index values during the corresponding December.

calendar year is the worst on record by a clear margin – the second worst result is –30% recorded in the 1930 calendar year – and had the effect of wiping out all of the strong gains (and more) that had been generated in the previous two years.

Tables 2 to 5 sets out similar statistics of the historical equity risk premium in Australia assuming (distributed) imputation credits are valued at 28 cents, 50 cents, 65 cents and 100 cents in the dollar respectively.[7]

Over the period 1883–2008 and relative to 10 year bonds, the grossed-up equity risk premium has averaged 6.0% p.a., 6.1% p.a., 6.1% p.a. and 6.2% p.a. assuming (distributed) imputation credits are valued at 28 cents, 50 cents, 65 cents and 100 cents in the dollar respectively.

Over the period 1958–2008, which is a period of relatively good data quality, and relative to 10 year bonds, the grossed-up equity risk premium has averaged 5.9% p.a., 6.1% p.a., 6.2% p.a. and 6.4% p.a. assuming (distributed) imputation credits are valued at 28 cents, 50 cents, 65 cents and 100 cents in the dollar respectively. It is noted that the statistical significance of the first two estimates (p-value of 0.06) is slightly lower than the standard 5% level using a two-tailed test.

[7] In this case, the stock return takes into account cash dividends, the value of imputation credits attached to those dividends and capital gains/losses.

TABLE 2

Historical Equity Risk Premium 1883 - 2008

Assumed Value of Imputation Credits 0.28

Relative to 10 year Bonds

				95% Confidence Interval			
Period	Years	AM	SE	Low	High	p-value	GM
1883 - 2008	126	**0.060**	0.015	0.031	0.089	0.00	0.046
1937 - 2008	72	**0.055**	0.023	0.009	0.101	0.02	0.035
1958 - 2008	51	0.059	0.032	-0.004	0.121	0.06	0.033
1980 - 2008	29	0.053	0.043	-0.035	0.141	0.22	0.027
1988 - 2008	21	0.043	0.040	-0.042	0.127	0.30	0.024

Note: Refer to report for data sources and variable definitions

Estimates in Bold are significant at the 5% level using a 2-tailed test.

TABLE 3

Historical Equity Risk Premium 1883 - 2008

Assumed Value of Imputation Credits 0.50

Relative to 10 year Bonds

				95% Confidence Interval			
Period	Years	AM	SE	Low	High	p-value	GM
1883 - 2008	126	**0.061**	0.015	0.032	0.090	0.00	0.047
1937 - 2008	72	**0.056**	0.023	0.010	0.102	0.02	0.037
1958 - 2008	51	0.061	0.032	-0.002	0.123	0.06	0.035
1980 - 2008	29	0.056	0.043	-0.032	0.144	0.20	0.030
1988 - 2008	21	0.047	0.041	-0.038	0.131	0.26	0.028

Note: Refer to report for data sources and variable definitions

Estimates in Bold are significant at the 5% level using a 2-tailed test.

TABLE 4

Historical Equity Risk Premium 1883 - 2008

Assumed Value of Imputation Credits 0.65

Relative to 10 year Bonds

				95% Confidence Interval			
Period	Years	AM	SE	Low	High	p-value	GM
1883 - 2008	126	**0.061**	0.015	0.032	0.090	0.00	0.048
1937 - 2008	72	**0.057**	0.023	0.011	0.103	0.01	0.037
1958 - 2008	51	**0.062**	0.032	-0.001	0.124	0.05	0.036
1980 - 2008	29	0.058	0.043	-0.030	0.146	0.19	0.031
1988 - 2008	21	0.050	0.041	-0.035	0.134	0.24	0.031

Note: Refer to report for data sources and variable definitions
Estimates in Bold are significant at the 5% level using a 2-tailed test.

TABLE 5

Historical Equity Risk Premium 1883 - 2008

Assumed Value of Imputation Credits 1.00

Relative to 10 year Bonds

				95% Confidence Interval			
Period	Years	AM	SE	Low	High	p-value	GM
1883 - 2008	126	**0.062**	0.015	0.034	0.091	0.00	0.049
1937 - 2008	72	**0.059**	0.023	0.013	0.105	0.01	0.039
1958 - 2008	51	**0.064**	0.032	0.002	0.127	0.04	0.038
1980 - 2008	29	0.063	0.043	-0.025	0.151	0.16	0.036
1988 - 2008	21	0.056	0.041	-0.029	0.141	0.19	0.037

Note: Refer to report for data sources and variable definitions
Estimates in Bold are significant at the 5% level using a 2-tailed test.

The negative impact of the global economic crisis on the historical estimates which allow for a positive value of imputation credits is again evident.

2.3 Are Historical Returns pre-1958 Overstated ?

In the Explanatory Statement, the AER states:

> *"The AER notes that of the two significant biases identified by Brailsford et al in the pre-1958 data series commonly adopted in Australian studies, the authors only attempt to correct for one of the biases. Additionally, of the bias that is corrected for, the correction factor applied is on the boundary of what the authors consider a defensible range, meaning a conservatively small downwards correction is made. Therefore, in using the approach from Brailsford et al, returns from pre-1958 are still highly likely to overstate the market return from this period."*[8]

As noted in BHM (2008 p.76), the equity series used in Officer (1989) and Dimson, Marsh and Staunton (2002, 2003) includes stock price index data constructed retrospectively by Lamberton for the period January 1875 to December 1957. BHM (2008) document a number of concerns with this pre-1958 data (including an important issue identified by Lamberton himself) – the potential for some (upward) residual survivorship bias, by definition. BHM (2008) make no attempt to adjust for this – to do so would require reconstructing the entire historical series. They do however conclude:

> *"Although it is difficult to draw a conclusion on the extent to which the above issues impact on the observed rates of return on the equity index relative to the unobserved 'true' rates of return, a consequent bias leading to an overstatement of equity performance up to the mid-1950s is probable."*[9]

And so, it is partly for this reason that BHM (2008) further suggest:

> *"there are sufficient question marks over the quality of data prior to 1958 to warrant any estimates based thereon to be treated with caution."*[10]

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8 Australian Energy Regulator (2008 p.149-150).
9 BHM (2008 p.77).
10 BHM (2008 p.73).

In other words, BHM (2008) express a view on the direction of the bias but not on its magnitude and hence the suggestion for caution.

Regarding the "dividend yield adjustment", BHM (2008) also suggest:

> *"Accordingly, the difference between our results and those of Officer (1989) and Dimson et al. (2002), which is largely explained by our estimate of lower stock returns, appears in turn to be largely explained by differences in the dividend yield series used in the retrospective construction of the underlying stock accumulation index for the period prior to 1958."*[11]

For clarity, the stock return data underlying the BHM (2008) study incorporates an adjustment made to the original Lamberton data, by the Sydney Stock Exchange in the mid 1980's, when it (the SSE) retrospectively constructed the stock accumulation index for the period 1882-1979.[12] The data was not adjusted further by BHM although they did examine the reasonableness of the adjustment and on the contrary, conclude:

> *"We cannot be more specific, but note that there is no strong evidence to suggest that we should diverge from the currently used adjustment factor"*[13]

11 BHM (2008 p.92).
12 BHM (2008 p.79-80).
13 BHM (2008 p.81).

3. SOME COMMENTS ON OFFICER AND BISHOP

3.1 Relevance of Historical Estimates

On the matter of the role of historical estimates (of the market risk premium) in estimating the forward looking or expected market risk premium, it is noted that Officer and Bishop suggest:

> *"a long term view of the historical MRP is the best guidance for forming a view about the forward looking MRP".*[14]

Officer and Bishop also suggest that:

> *"The prevailing market conditions suggest that the current short – medium term MRP is well above 6.0%. ... The current economic circumstances are most unusual. As already noted, 2008 stands out as the year realising the lowest market return in the 126 year history available to us. Equity risk is also at the high end of experience. As a consequence, we see a need to add more weight to the prevailing market conditions and forward evidence than we might otherwise consider. However, in the face of this evidence, we do not change our prior recommendation that there is support for an MRP of 7.0% if the chosen theta is greater than 0.3."*[15]

Officer and Bishop then discuss a series of alternative approaches that may be used to estimate the forward looking market risk premium including using data sourced from options on SPI futures, credit spreads on corporate bonds and theoretical considerations concerning the CAPM. It is noted that Officer and Bishop discuss a number of caveats[16] in using these approaches and hence rely on them not as the principal method of estimation but rather as a "cross check" on their historical estimates.

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14 Officer and Bishop (2009 p.2).

15 Officer and Bishop (2009 p.6-7).

16 For example, in relation to the use of options data, Officer and Bishop (2009) suggest *"Such estimates are only valid for the time period implied by the option or the forward period. We might expect that, although variable, such an estimate of the rate might approach (from above or below) an equilibrium value over time such as that implied by the 'long term average' estimate of MRP." (p.7)*. In relation to the use of credit spreads on corporate bonds, they suggest *"Corporate debt is a risky asset and*

Notwithstanding the CAPM is a single period model, an important question concerns whether the expected MRP is stationary over time. Certainly, ex-post studies indicate that the historic MRP is not constant over time and in fact has exhibited substantial volatility in the past.[17] On the matter of a time varying expected market risk premium, Officer and Bishop suggest:

> *"As noted earlier, and in our previous review paper, the MRP will change over time. However there is as yet no 'accepted' theory to guide how to change the MRP for current conditions which is why we adhere to using an MRP informed by the long term historical MRP to minimise regulatory risk."*[18]

In my opinion, Officer and Bishop's continued reliance on long term historical estimates as the principal basis for estimating the expected market risk premium is appropriate.

3.2 Historical Difference Between 5 year and 10 year CGS

In their earlier report, Officer and Bishop state:

> *"Indicative data on Government bond yields from January 1972 to July 2008 does show an average yield difference between ten year and five year bonds of 18 basis points with there being more positive than negative differences. This suggests that the MRP relative to a five year bond will be slightly higher than for a ten year bond."*[19]

To check this assertion, I sourced data on yields on 5 year and 10 year Commonwealth Government treasury bonds (CGS) from the RBA website – the data is expressed on an end of month basis. Over the period Dec 1971 to Dec 2008, the average yield on 5 year CGS is 9.05% p.a. and the average yield on 10 year CGS is 9.23% p.a. which leads to

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can be priced according to the CAPM. In this context, the rise in the spread can be explained by either an increase in the MRP, an increase in beta or some combination."(p.8).

17 For example, see Figure 1 in Officer and Bishop (2009).

18 Officer and Bishop (2009 p.9). It is noted that the lack of adequate theory underlying the variability of MRPs is a view also shared by Stephen Gray.

19 Officer and Bishop (2008 p.11).

an average spread between 10 year CGS and 5 year CGS of 0.18% p.a. or 18 basis points p.a. – which is statistically significant at the 5% level using a two-tailed test. If instead an annual series of bond yields (as at December of each year) is used then the average spread between 10 year CGS and 5 year CGS is 0.15% p.a. or 15 basis points p.a. – again statistically significant at the 5% level using a two-tailed test. This implies that there will be a statistically significant difference in the mean historical excess returns based on 5 year CGS and 10 year CGS over the 1971-2008 period.

3.3 Use of Opening or Closing CGS Yields

Officer and Bishop state:

> *"Our calculation of the historical MRP is assessed by examining the excess realised rate of return over a year for an investor who invests in the market portfolio and the proxy for the risk free rate at the beginning of the year. Thus the MRP is calculated as the realised market rate of return less the opening yield on a proxy for the risk free rate. We suspect the AER (and possibly Brailsford et al) estimates have been calculated using the closing yield for the proxy for the risk free rate. This can affect shorter term averages in particular."*[20]

The issue here concerns a difference in methodology in estimating the return on the risk free rate when the proxy for the risk free security is a 10 year bond. Officer and Bishop have taken the yield on 10 year bonds at the beginning of each year. BHM (2008) have taken the yield on 10 year bonds at the end of each year.[21] Whilst Officer and Bishop are correct in identifying that there is a difference (and also in suggesting that this can affect shorter term averages more than longer term averages), it is noted that: (i) the observed yield on a bond, whether observed at the start of the year or at the end of the year, serves only as an estimate of the actual return on the bond over the year;[22] and (ii) the average difference between the opening and closing yields is considered immaterial

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20 Officer and Bishop (2009 p.3).

21 See BHM (2008 p.82).

22 As BHM (2008 p.82) state *"We note that at any given time the (nominal) yield on a bond is a measure of its ex ante or promised (nominal) return. This yield will be realized ex post only if the bond is held to maturity and if all interim cash flows are immediately reinvested on receipt at an interest rate equal to the promised yield".*

for the purposes of estimating historical equity risk premia.[23] For example, over the period 1958 – 2008, the average yield on 10 year bonds is 8.00% per annum using closing yields and 8.02% per annum using opening yields – a difference of 2 basis points per annum.

4. SOME COMMENTS ON GRAY AND HALL

The Key Issue

Gray and Hall (2006) derive an explicit relationship between the value of franking credits (gamma), the market risk premium (MRP) and the corporate tax rate and conclude:

(i) *"the parameter values that have been adopted as standard in Australian regulatory determinations violate this relationship ... [and] are collectively inconsistent with each other and with external data on dividend yields. Therefore, one or more parameter estimates must be changed in order to restore internal consistency" (p.426).*

(ii) *"gamma cannot be set to 0.5 or above ... [and] if the MRP is set to 6% (consistent with practice), the maximum value of gamma that can reasonably be considered (in the light of observed dividend yields) is 0.3" (p.420-421).*

(iii) *"setting the value of franking credits to zero is the most straightforward and most complete way to restore consistency" (p.417).*

In a critique of Gray and Hall (2006), Truong and Partington (2008) suggest the apparent inconsistency can be resolved by recognizing that retained franking credits might have a positive value, whilst Lally (2008) suggests it may be resolved by

[23] As BHM (2008 p.89) note: *"In comparison to Officer (1989) who reports that the nominal return on stocks and bonds averaged 13.1 and 5.2 per cent p.a., respectively, over 1883–1987, we find that the respective averages are 11.7 and 5.3 per cent p.a."*

abandoning certain parts of the Officer (1994) framework. In their reply paper, Gray and Hall (2008) state:

> *"Gray and Hall (2006) demonstrate the inconsistency by (1) computing the return from franking credits that is implied by setting T = 30 per cent and γ = 0.5; then (2) solving for the amount of dividends that would have to be paid in order to distribute sufficient franking credits to warrant the implied return in (1). The required dividend yield is then shown to be more than twice the actual dividend yield in the market, and this is the inconsistency."*[24]

and

> *"Truong and Partington (2008) and Lally (2008) recognize this same inconsistency and propose alternate ways of resolving it. In this paper, we demonstrate that these proposals are outside the Officer framework. The standard set of regulatory parameters cannot be resolved with observed dividend yields within the Officer framework."*[25]

In contrast to the above claims (and as will be explained below) there is no inconsistency in the Officer framework which necessitates any adjustment to be made to any parameters, including any adjustment to gamma.

Analysis and Discussion

Gray and Hall present their argument within the influential cost of capital framework developed by Officer (1994). Officer (1994) derives a number of alternative definitions (formulae) of a company's weighted average cost of capital (WACC) appropriate to the Australian imputation tax system.[26] The starting point of his analysis is to assume the firm's operating income (free cash flow) is ultimately distributed amongst three classes

[24] Gray and Hall (2008 p.136).
[25] Gray and Hall (2008 p.133).
[26] One before company tax and four after company tax cases are presented. The after tax cases differ with respect to whether the interest tax shield and the value of imputation credits are included in or excluded from the corresponding (consistent) definition of after tax cash flow.

of claimants: X_D to debt investors, X_E to equity investors, and X_G to the government in the form of company tax, such that:

$$X_O = X_D + X_G + X_E \tag{1}$$

Officer (1994) suggests that under the imputation system, an amount of tax paid at the company level can be viewed as a form of personal withholding tax, paid by the company on behalf of its underlying shareholders, and he introduces the now widely adopted notation γ (gamma) to represent the value of (a dollar of) franking credits. Consequently, the equity investors' share of the firm's free cash flow is:

$$X_E = X'_E + \gamma T(X_O - X_D) \tag{2}$$

where $X'_E = (X_O - X_D)(1-T)$ is the cash dividend distributed to the equity investors, T is the corporate tax rate, $T(X_O - X_D)$ is the amount of franking credits distributed to equity investors and $\gamma T(X_O - X_D)$ is the value of those franking credits. Note in this context, since X_E is "grossed-up" to include the value of franking credits then it is expressed on an after company before personal tax basis whereas X'_E is expressed on an after company after some personal tax basis.[27]

A key assumption underlying the Officer (1994) framework is that all cash flow streams, including associated imputation credits, are perpetuities which means that 100% of the free cash flow and 100% of the associated imputation credits generated in each period are fully distributed at the end of that period.

Officer (1994) also posits the following capital asset pricing model for the Australian imputation tax system:

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[27] The conventional approach to describing a return as "after company tax" is potentially ambiguous in an imputation setting since company tax paid $T(X_O - X_D)$ consists of a mixture of personal tax $\gamma T(X_O - X_D)$ being that part rebated against personal taxes and "true" company tax $T(X_O - X_D)(1-\gamma)$ being that part not rebated against personal taxes.

$$k_E = r_f + \beta_e \left(k_m - r_f \right) \tag{3}$$

where k_E is the expected grossed-up rate of return on equity for the firm, k_m is the expected grossed-up rate of return on the market portfolio, r_f is the risk free rate and β_e is the equity beta of the firm. In other words, Officer assumes the CAPM holds when returns are expressed on an after company before personal tax basis. By definition, the grossed up rates of return reflect the value of franking credits in equilibrium, however, Officer does not address this issue.

Gray and Hall focus on the following two mathematical relationships, derived direct from Officer (1994):

(i) the proportion of total cash flow to equity due to franking credits (Gray and Hall (2006) eqn 8):

$$\frac{\gamma T}{1 - T\left(1 - \gamma\right)} \tag{4}$$

(ii) the relationship between the value of franking credits, the MRP and the assumed tax rate (Gray and Hall (2006) eqn 17):

$$MRP_{fc} = \frac{r_f + MRP_{dc}}{\left(1 - T\right) / 1 - T\left(1 - \gamma\right)} - r_f \tag{5}$$

where MRP_{fc} is the market risk premium grossed up for the value of franking credits, and MRP_{dc} is the market risk premium from dividends and capital gains only.

Equation (4) is definitional being the ratio of the value of franking credits distributed to equity investors, $\gamma T\left(X_O - X_D\right)$ to the total return to equity, (2). Equation (5) also has a simple interpretation, which becomes clearer after rearranging:

$$\frac{r_f + MRP_{fc}}{1 - T(1-\gamma)} = \frac{r_f + MRP_{dc}}{1 - T} \qquad (6)$$

i.e. equation (5) is just a rearrangement of two ways of expressing the same thing – the before corporate before personal tax return on the market portfolio.

Using equations (4) and (5), Gray and Hall (p.415) state:

(i) *"we demonstrate that the [standard] set of parameter values that is commonly used in Australian corporate practice*[28] *is inconsistent with [equation (5)]. That is, the parameters collectively are inconsistent with the framework to which they apply !"*

(ii) *"we examine various alternatives for restoring consistency".*

The inconsistencies suggested by Gray and Hall depend on whether the MRP is assumed to include or exclude the value of franking credits. If the (standard) MRP estimate of 6% is assumed to include the value of franking credits then (4) and (5) imply: (i) the MRP from dividends and capital gains is 3.9% which Gray and Hall suggest is *"unreasonable, considering the historical evidence" (p.14)*; (ii) an average firm in the market portfolio must generate a dividend yield of 8.2% which Gray and Hall suggest is *"demonstrably inconsistent with observed dividend yields" (p.14)*; and (iii) foreign investors will provide capital in return for a 3.9% risk premium which Gray and Hall suggests *"fails the test of economic reasonableness" (p.15)*. If instead, the MRP estimate of 6% is assumed to exclude the value of franking credits then (4) and (5) imply the required dividend yield is 10% which Gray and Hall suggests is *"also dramatically inconsistent with observed data on dividend yields" (p.16)*. Gray and Hall attribute the problem to shortcomings in the assumed set of parameters: $MRP = 6\%$, $T = 30\%$ and $\gamma = 0.5$. In other words, the key problem that Gray and Hall have with the Officer framework is that:

[28] $MRP = 6\%$, $T = 30\%$ and $\gamma = 0.5$ and for illustrative purposes, Gray and Hall assume a risk free rate equal to 6%.

"Gray and Hall (2006) is centrally about the amount of return that shareholders are assumed to receive from franking credits."[29]

Gray and Hall then explore various ways to restore (the suggested) consistency both between the set of parameters values and with observed dividend yields, ultimately arriving at the conclusion that the simplest way to correct the perceived shortcomings in the standard set of parameter values is to set gamma equal to zero.

In my view, Gray and Hall have made an oversight in reaching their conclusions. In particular, Gray and Hall have failed to take account of three important and related implications of the perpetuity assumption that underlies Officer's model. First, all free cash flow and all franking credits are assumed to be distributed each period to equity investors in the form of franked dividends. Second, this means there is no capital gain on the underlying shares.[30] Third, this means that no franking credits are retained i.e. credits created and credits distributed are one and the same.[31] In other words, Officer's model assumes the return to equity investors consists of only two, rather than three, components – i.e. dividends and franking credits – and therefore, for a given total return, it is assumed that firms will pay high dividend yields. In other words, the Gray and Hall conclusion that, for a given after company before personal tax return, the dividend and franking credit yields are (unrealistically) high is tautological to the extent that the Officer model makes this assumption at the outset i.e. there is no problem with the Officer model – rather the Officer model is the imputation tax system equivalent of the standard Miller and Modigiliani (1961) valuation framework that is applicable to a classical tax framework.

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[29] Gray and Hall (2008, p.140).

[30] Strictly, whilst the underlying stock price is expected to grow at the cost of capital between ex-dividend dates, there is no expected stock price growth from one ex-dividend date to the next. Note that the "McKelly Corporation" example in the Appendix to Officer (1994) is actually inconsistent with the Officer model in assuming $5 million of free cash flow is transferred to general reserves rather than being paid out. Also see Troung and Partington (2008 p.155).

[31] It is therefore inconsistent within the Officer model to draw a distinction between credits retained and credits distributed and adjust the value of (distributed) franking credits by a distribution factor in order to arrive at an estimate of gamma. Such an adjustment underlies the statement by Gray and Hall (footnote 3) that: *"It is common to assume that about 80% of created franking credits are distributed and that, once distributed, franking credits are worth about 60% of face value to the relevant investor"*. In this case it is inconsistent to then conclude that $\gamma = 0.5$ i.e. 0.8×0.6.

To illustrate using the example from Gray and Hall, assume the MRP estimate of 6% includes the value of franking credits, $T = 30\%$, $\gamma = 0.5$ and $r_f = 6\%$. Following Officer (1994), the total return to equity is assumed to take the form of a franked dividend:

$$D + \gamma D \frac{T}{1-T} = 12\% \tag{7}$$

where D is the (cash) dividend and $\gamma D \frac{T}{1-T}$ is the value of franking credits. Rearranging (7), the grossed up dividend return is:

$$D \frac{1-T(1-\gamma)}{1-T} = 12\% \tag{8}$$

which implies a cash return of 9.9% and a franking credit return of 2.1% i.e. by assumption, the required dividend yield is 9.9% and the required franking credit yield, assuming $\gamma = 0.5$, is $2.1/0.5 = 4.2\%$.[32] Clearly these yields are larger than is observed in practice. But Gray and Hall conclude that this is indicates a problem with the standard set of parameters. In fact it has nothing to do with the assumed parameters – rather the source of the difference between the larger implied and smaller observed yields is the perpetuity assumption which holds in Officer's model, but which we know does not hold in practice. In short, Officer's model assumes returns are in the form of franked dividends only, there are no capital gains and therefore dividend yields are naturally high whereas we know that observed returns reflect dividends, the value of franking credits and capital gains.[33] The Gray and Hall "inconsistency" is not an inconsistency that requires adjustment. This conclusion is independent of the particular values assumed for gamma, the market risk premium and the corporate rate.

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[32] Note the proportion of total equity return due to franking credits is $2.1/12.0 = 18\%$ and the proportion due to dividends is $9.9/12.0 = 82\%$ which is in accordance with both equation (4) above and Table 1 in Gray and Hall (2006). These values are even higher than the required dividend yield of 8.2% and required franking credit yield of 3.5% suggested by Gray and Hall (2006 (p.416). The difference is due to Gray and Hall assuming $\gamma = 0.5$ but then inconsistently using 0.6 to calculate the required franking yield – this gives a total return of only $8.2 + 0.6 \times 3.5 = 10.3\%$ – with the remaining 1.7% supposedly due to capital gains.

[33] Further, Gray and Hall's statements regarding the reasonableness or otherwise of the MRP due to dividends and capital gains and the reasonableness of the return required by foreign investors can only be answered within a formal equilibrium framework.

Conclusion

In my opinion, and for reasons set out above, I do not agree with Gray and Hall that (i) there is any internal inconsistency in the standard set of parameter estimates and (ii) data on observed dividend yields and effective tax rates impose bounds on the value of franking credits and (iii) there a need to set gamma to zero (as a way to deal with the suggested inconsistency).

5. CONCLUSION

In the Explanatory Statement, the AER suggests that an appropriate estimate of the expected market risk premium, having regard to a positive value of gamma, is 6% per annum:

> *"The AER accepts the legitimacy of the value of imputation credits forming part of the MRP. However, after examining regulatory determinations from the time 6 per cent was adopted in regulatory practice, the AER considers it is clear that the previously adopted MRP of 6 per cent does not need to be 'corrected' to incorporate the value of imputation credits. Regard was had by Australian regulators to the value of imputation credits in establishing the previously and consistently adopted MRP of 6 per cent. Accordingly, the issue is not whether a 6 per cent MRP needs to be 'corrected' for imputation credits, but rather, after 'grossing-up' historical excess returns for the value of imputation credits, among other measures and matters considered, whether or not 6 per cent remains a reasonable estimate of the MRP having had regard to the relevant factors".*[34]

As discussed in section 3.1 above, Officer and Bishop suggest the appropriate value is 7% per annum, assuming a theta greater than 0.3.

[34] Australian Energy Regulator (2008 p.178).

BHM (2008) report the equity risk premium, relative to 10 year bonds, has averaged 6.3% p.a. over 1883–2005 and 6.7% p.a. over 1958–2005 assuming credits are valued at 50 cents in the dollar.[35]

Taking into account the last three years of data, it is shown in Table 3 above that the equity risk premium, relative to 10 year bonds, has averaged 6.1% p.a. over 1883–2008 and 6.1% p.a. over 1958–2008, again assuming credits are valued at 50 cents in the dollar.

Finally, it is noted that the use of historical data as a basis for estimating the expected market risk premium should be considered in the light of the additional uncertainty concerning the impact of the global economic crisis.

[35] See Table 6 in BHM (2008).

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