Cost of Equity Issues: A further report for the AER

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Final

Background

This report has been prepared for the Australian Energy Regulator, who asked for formal written advice on the cost of equity issues raised in the Envestra revised access arrangement proposal and attached consultant reports from Grundy, CEG and SFG.[1]

The AER requested that the report should specifically address the following major arguments put forward by Envestra and its consultants:

- Estimates of the cost of equity obtained by the Sharpe CAPM as applied by the AER are downward biased for equity betas that are less than one. In particular:
    - Evidence in published academic journals demonstrates that the Sharpe CAPM has this low beta bias.
- The Black CAPM (as implemented by Grundy and/or CEG) provides a better estimate of the cost of equity than the Sharpe CAPM (as implemented by the AER). In particular:
    - Evidence in published academic journals demonstrates that the Black CAPM is more accurate than the Sharpe CAPM in estimating the expected return on equity.
    - The Grundy and/or CEG estimates of the return on the zero-beta portfolio are appropriate for use in the current Australian context.

[1] Grundy, *Comment on the cost of capital: A report for Envestra*, 23 March 2011; CEG, *WACC estimation: A report for Envestra*, March 2011; and SFG, *The required return on equity commensurate with prevailing conditions in the market for funds: Response to Draft Decision: Report prepared for Envestra*, 23 March 2011.

- The dividend growth model can be reliably applied even though the 'dividends' are distributions comprising a combination of dividends, interest and return of capital.

- In assessing the overall rate of return on equity, the following analysis shows that the return on equity set by the AER is too low:
    - Comparison of the cost of debt and the cost of equity.
    - Analysis based on broker reports.

The AER asked that the report reference the theoretical and empirical evidence drawn from academic literature, including the set of academic papers already mentioned in my earlier report on this issue.[2] Additionally, the AER requested consideration of the recent papers mentioned in the first Grundy report but which were not specifically considered in my earlier report.

Summary

(1) It is my opinion that the recent empirical and theoretical evidence from academic research indicates that there is much uncertainty over which asset pricing model is best supported by the data. It is my opinion that this evidence does not imply that the Black CAPM is superior to the Sharpe CAPM.

(2) Tests of the CAPM are inherently tests of whether a mean variance efficient portfolio has been used as the market portfolio. Estimating a zero beta rate from the intercept of a fitted equation, such as done by Grundy (2010, 2011) requires an assumption that the market portfolio used is efficient, rather than subjecting the model to such a test. Several authors have noted that estimated zero beta rates are too high to be plausible, this being an indirect test of the Black model.

(3) The results from Grundy's approach to estimating the zero beta rate from prior studies are less conclusive than he suggests. The correct estimates based on Kothari, Shanken and Sloan (1995) arguably provide support for the hypotheses

[2] Davis, *Cost of equity issues: A report for the AER*, 16 January 2011.

that the zero beta rate equals the risk free rate. Results based on Fama and Macbeth (1973) and Black, Jensen and Scholes (1972) are subject to significant variation depending on the time period considered.

(4) A number of comparable companies in analyst research used by CEG and SFG pay distributions which are a variable mix of dividends and return of capital. For a number of these companies, the current level of earnings appears to be substantially less than the level of distributions, raising questions about the sustainability of the distribution rate and assumed security price growth.

(5) The argument advanced in CEG (2011) based on Grundy (2010) that debt costs cannot exceed the required return on equity is a red herring. The debt cost figure used in estimating the WACC is a yield to maturity. While the expected return on debt should not exceed the expected return on equity, the yield to maturity is the return calculated from the current debt price on the assumption that contractual interest and principal payments will be made. It is thus not an expected return.

Introduction: The CAPM and Financial Research

Early studies of the CAPM such as Black, Jensen and Scholes (1972) and Fama and Macbeth (1973) found that the Sharpe CAPM did not adequately explain returns on risky assets for the historical US data studied in those papers. In particular, the “flatter” slope of the estimated relationship than predicted by the Sharpe CAPM (with an intercept above the risk-free interest rate) led those authors to conjecture that the data was consistent with the “Black” CAPM, although other possible explanations were also mentioned. Black, Jensen and Scholes also found that their “beta factor”, and thus the implied zero beta rate, varied over time.

Subsequent research has focused primarily upon testing whether alternative asset pricing models can explain apparent anomalies not explained by the Sharpe CAPM (including the finding that the implied zero beta rate is above the observed risk free rate). Models with additional risk factors have been proposed (such as by Fama and French), while other papers have examined whether a “conditional” CAPM can explain returns which (as Jagannathan and Wang (1996) show) leads to additional factors being added to the usual Sharpe CAPM model. There is still substantial disagreement in the academic literature on which, if any, of these approaches (or the Sharpe CAPM) is superior.

It is perhaps worth noting, that there has been relatively little attention paid to estimating and testing the Black CAPM relative to these other approaches.

The Black CAPM and the Cost of Equity

The Grundy (2011) report and the CEG (2011) report argue that (a) the Sharpe CAPM used by the AER underestimates the required rate of return on equity for low beta stocks, and that (b) the Black CAPM is a justifiable alternative which does not exhibit such a bias.

The principal difference between the Sharpe and Black CAPM models is that the former assumes the existence of a risk free interest rate for borrowing and lending, while the latter assumes that a risk free interest rate does not exist (or that interest rates for borrowing and lending differ). The Black (1972) model implies an intercept for the security market line (SML, linking expected returns and betas) equal to the expected return on a zero-beta portfolio. While the original Black model does not imply whether the zero beta rate will be above or below the (non-existent!) risk free rate, Brennan (1971) develops a CAPM model with differential borrowing and lending interest rates and demonstrates that "the market equivalent risk-free rate [the zero beta rate] is constrained to lie between the borrowing rate *b* and the lending rate *l*". That is it could lie above or below the risk free rate. Black (1972, equation 39) shows that when riskless investment is possible, riskless borrowing is not possible, and unlimited short selling of risky assets is possible, the zero-beta rate will lie above the risk free rate but below the return on the market. Since a risk free investment does exist, in nominal terms and assuming no sovereign risk, this implies that this constraint on the zero-beta rate should, subject to two caveats, hold. The first caveat is that the theoretical model assumes unlimited short selling of risky assets is possible – a questionable assumption whose effects on the theoretical result, to my knowledge, have not been widely explored. The second caveat is that there may be no risk free asset in real (ie inflation adjusted) terms, making the Black model (with no riskless borrowing or lending) appropriate for the determination of real returns on risky assets. Again, however, inflation-adjusted government securities have in recent decades been available (to some degree) in major financial markets, such that risk free real lending is possible.

It is worth noting that in applying the Black CAPM, the conventional Market Risk Premium (MRP) defined as the return on the market portfolio less the risk free return has no explicit role. The required return on equity for stock *j* is a weighted average of the expected zero beta rate and the expected market return (with weights based on the beta of stock *j*).

In examining the relative merits of the Black and Sharpe CAPM it is known that the results of a number of studies have found that the SML appears to have a higher intercept (above the risk free rate) and lower slope than implied by the Sharpe CAPM. While this is consistent with the hypothesis that the Black CAPM is the correct model, it is not a test of that hypothesis. The results could be inconsistent with the Black CAPM if, for example, the implied zero-beta rate is implausible.

It is also worth quoting from the original Black (1972) article.

> "This [zero beta] model suggests that in periods when R_z is positive, the low β portfolios all do better than predicted by equation (1) [the Sharpe CAPM], and the high β portfolios all do worse than predicted by equation (1). In periods when R_z is negative, the reverse is true: low β portfolios do worse than expected, and high β portfolios do better than expected. In the postwar period, the estimates obtained by Black, Jensen, and Scholes for the mean of R_z were significantly greater than zero." (p446)

This raises the possibility that the results found by BJS and others are sample specific, both over time period studied, and for their applicability to other markets.

On the latter score, in the Australian study by Durack, Durand and Maller (2004) for example, one of their findings reported in their Table 7 is that "this test suggest[s] that the zero-beta and risk-free rates are similar, but that one is not statistically distinguishable from the other.… The marginal evidence of significance of a negative intercept suggests that the risk-free rate of return may be slightly higher than the zero beta return." This result should be interpreted with caution, being one amongst many results reported, and involving the use of additional factors in the estimating equation. Another Australian study by Gaunt (2004) presents estimates (his Table 3) of a CAPM equation for 25 portfolios, in which 8 of 25 intercept terms are negative and the remainder positive, with only 4 of the estimates (2 positive and 2 negative) being significantly different from zero (at a five per cent significance level). While Gaunt's paper provides evidence for a three factor model over the CAPM, the reported results for the CAPM estimation for Australia indicate the potential for error in taking CAPM results from a different time period and market and attempting to infer a zero beta rate for Australia from those results.

Grundy (2010, 2011) provides a calculation which aims to estimate the extent of the argued bias implied in a number of empirical studies. This calculation is essentially based upon the estimated parameters (λ_0, λ_1) from regressions such as:

$$r_i - r_f = \lambda_0 + \lambda_1\beta_i \qquad (1)$$

in which r_i is the return on asset (portfolio) i, r_f is the risk free rate, and β_i is the beta (systematic risk) of asset (portfolio) i. Further define r_m as the return on the entire market, β_m as the beta of the entire market, and r_z as the return on the zero-beta portfolio.[3] Since $r_m - r_f = \lambda_0 + \lambda_1$ (because $\beta_m = 1$), and assuming that $r_z - r_f = \lambda_0$ the ratio $((r_m - r_z)/(r_m - r_f))$ is then calculated, and found to be less than unity (an average of 0.511 for the four studies shown in Grundy (2010)).

There is a significant complication with this approach which renders that result unreliable and gives incorrect results for at least one of the papers considered by Grundy. Consider first the Kothari, Shanken and Sloan (1995) paper (KSS). In my previous report (Davis, 2011) I noted that Grundy had only presented estimates based on one of the results presented in Table 2 of KSS, and that this happened to give the lowest value for the ratio. I independently estimated that ratio for that KSS estimate using a different approach and derived a similar figure to Grundy. My approach was based on noting that in the KSS regression, $r_i = \gamma_0 + \gamma_1\beta_i + u_i$

3 An alternative notation for the return on the zero-beta portfolio, R0, was used in Grundy (2010).

the dependent variable is the return on portfolio i (not the return in excess of the risk free rate), such that the estimated coefficients γ_0 and γ_1 correspond to r_z and $r_m – r_z$ respectively. Given a value for r_f, $[(r_m – r_z)/(r_m – r_f)] = \gamma_1/(\gamma_1 + \gamma_0 – r_f)$

In fact, both Grundy's result and my result were incorrect. My error was in misinterpreting the scale of the variables used in the KSS regressions. Their return variables were measured in percentage form, such that the average risk free rate of return of 3.7 per cent per annum when converted to a monthly rate corresponds to a value of (approximately) 0.3. I instead used a figure of 0.003, and that generated a result very close to that derived by Grundy. Using the correct figure of 0.3, the results, as given below, are substantially higher. Indeed, using estimates from size ranked portfolios, the calculated ratio is, effectively, unity.

Portfolios	γ_0	γ_1	r_f	$\gamma_1/(\gamma_1+\gamma_0-r_f)$
20, beta ranked	0.76	0.54	0.3	0.54
20, size ranked	0.30	1.02	0.3	1
100, beta and size ranked independently	0.63	0.66	0.3	0.67
100, first beta, then size ranked	0.57	0.73	0.3	0.73
100, first size, then beta ranked	0.58	0.71	0.3	0.72

In his response to my report, Grundy (2011, paras 25 and 26) argues that the estimates obtained from the beta ranked portfolios (the first row in the table above) are the most efficient, because they generate the largest dispersion of portfolio betas. KSS however "note that the spread in post-ranking beta is greater when portfolios are formed on size (1.07 using beta-sorted portfolios as compared to 1.35 using size-sorted portfolios). Rankings that involve size appear to capture current information about firms that is missed by the "stale" (and noisy) historical betas used in forming beta ranked portfolios." On this basis, it seems to be a reasonable conclusion to conclude from the results in KSS that the best estimate of the calculated ratio is approximately unity, implying a zero beta rate approximately equal to the risk free rate.

It should also be noted that the correctly calculated value of the ratio in the Table above for the beta ranked portfolio estimates of 0.54 is substantially higher than the value calculated by Grundy of 0.415. The reason for that can be found from the explanation in Grundy (2011) of how he calculated the ratio for the Da, Guo and Jagannathan (2009) results. Specifically as explained above, the formula used is appropriate for use when the regression equations involve a dependent variable measured as a return in excess of the risk free return. In that case the intercept term λ_0 can be used as an estimate of $r_z - r_f$ under the hypothesis that the Black CAPM is correct. However, when the dependent variable is actual returns the intercept term λ_0 is an estimate of r_z. Because the KSS regressions use actual returns, the estimate calculated by Grundy is incorrect.

In Grundy (2010) an estimate for the ratio $(r_m - r_z)/(r_m - r_f)$ of 0.639 for the Fama and Macbeth (1973) results for 1935-1968 US data is given. This can be derived using the formula $\gamma_1/(\gamma_1 + \gamma_0 - r_f)$ and figures from the first row of Table 4 of the Fama-Macbeth paper. Fama and Macbeth also provide estimates for subperiods of 10 and 5 years in their Table 4. The table below provides those estimates and the calculation of the ratio for the five year subperiods. It is apparent that there is substantial variability over time, with the estimate of the ratio $(r_m - r_z)/(r_m - r_f)$ for the last subperiod (1961-68) exceeding unity. Moreover, the finding of a negative ratio for the period 1956-60 implies that the estimated zero beta rate exceeded the return on the market, which is incompatible with the Black model.

period	γ_0	γ_1	r_f	$(r_m - r_z)/(r_m - r_f)$
35-68	0.0061	0.0085	0.0013	0.639098
35-40	0.0024	0.0109	0.0001	0.825758
41-45	0.0056	0.0229	0.0002	0.809187
46-50	0.005	0.0029	0.0007	0.402778
51-55	0.0123	0.0024	0.0012	0.177778
56-60	0.0148	-0.0059	0.002	-0.85507
61-68	0.0001	0.0143	0.003	1.254386

Similar evidence of time instability in the estimated zero beta rates can be found in the Black, Jensen, and Scholes (1972) study. The table below takes the data from their Table 4 for estimates over different time periods. The figure for the entire period (1931-65) is the same as that provided in Grundy (2010), but it is apparent that there significant time variation and a downward trend, and a negative ratio for the latest sub period implying a zero beta rate, implausibly in excess of the return on the market.

	γ_0	γ_1	$\gamma_0 + \gamma_1$	
	$r_z - r_f$	$r_m - r_z$	$r_m - r_f$	$(r_m - r_z)/(r_m - r_f)$
31-65	0.00359	0.0108	0.0142	0.761
31-39	-0.00801	0.0304	0.022	1.382
39-48	0.00439	0.0107	0.0149	0.718
48-57	0.00777	0.0033	0.0112	0.295
57-65	0.0102	-0.0012	0.0088	-0.136

It is not clear from Da, Guo and Jagannathan (2009) whether the dependent variable for their results presented in Panel D of Table 2 is actual returns or returns in excess of the risk free rate. If the latter, the Grundy calculation is correct in that case.

These calculations are premised on the hypothesis that the static Black CAPM is the correct model of asset pricing, such that the intercept term is a good estimate of r_z - r_f. That may be the case, however there are a number of complications suggesting that caution is warranted. First, while the data used in estimating equation (1) may reject the static Sharpe CAPM, this does not imply that the alternative of the static Black CAPM would not also be rejected. Both may be inconsistent with the data, because some third model is appropriate, or due to specific assumptions adopted in estimating the relationship. On that latter score, for example Ang and Chen (2007) find that once the possibility of time variation in betas is allowed for, they are unable to reject the Sharpe CAPM. One of their conclusions is that "we cannot find evidence to reject the time-varying beta model over the period from 1963:07 to 2001:12" (p 13).

Recognition that time variation in beta exists implies that a purely "static" CAPM, in which parameters such as beta are assumed never to change, is rejected. It does not, however, follow that implementation of a single period CAPM at different points in time, for each of which beta is freshly estimated is necessarily inappropriate. The AER approach could, I suggest, be viewed as an "implicit conditional CAPM" approach in which there is regular review of beta, the risk free rate and the MRP. While that does not explicitly capture the effect of the conditioning factor(s), there is little agreement on what those factors are in practice.

A second complication with this approach is an inherent inconsistency in (a) assuming that the correct asset pricing model is the Black model in which a risk free rate is assumed not to exist, and (b) estimating parameters for that model from studies which have involved use of an observed risk free rate. The approach thus is only consistent with the variant of the Black model in which risk-free borrowing is not possible, and which imposes particular constraints on the zero beta rate.

A number of scholars have made the observation that estimates of the zero-beta rate are too high to be plausible, suggesting that the hypothesis that the Black CAPM is the correct model should be rejected. As noted above, when investors can borrow and lend, but at differential rates (as is empirically the case) the zero beta rate should lie within the range of those rates. Hence, knowledge of relevant borrowing and lending rates is relevant for assessing the plausibility of estimated or calculated zero beta rates.

Grundy (2011) makes reference to my argument that institutional investors are able to access borrowings at rates very close to the risk free rate by using various forms of collateralized borrowings such as repurchase agreements (or securities lending). In these arrangements, the investor obtains cash by selling and simultaneously agreeing to repurchase a particular security with a third party. This is equivalent to a secured borrowing which is generally short term and typically at a small margin above risk free interest rates.[4] While such transactions may be used to effectively finance the investment in the asset used as collateral, they can also be used to leverage up a portfolio with the cash received being used for the purchase of other risky assets. (This was common practice amongst the US investment banks prior to the GFC for example). Thus, while the collateral may be government securities, the cash generated may be used for investment in equities.

In my previous report, the illustrative repo rate information provided was that on such transactions with the Reserve Bank – because that is the only publicly available data on repo rates in Australia. While repo rates on over the counter transactions within the private sector may differ from those, the haircut and margining arrangements which aim to make the collateralized loan near to risk free for the lender suggest that the rates should not be significantly different.

[4] "Haircuts" and margin calls to ensure that the collateral value exceeds the cash repayment required operate to ensure the loan is "virtually" risk free.

While, as Grundy notes, such borrowing facilities are only available to large institutional investors, it is presumably these investors who are the marginal price setting investors in security markets, such that these borrowing rates are particularly relevant (a major contributor) in setting limits on the reasonable values for the zero beta rate.

Grundy also notes that these borrowing facilities are generally quite short term and notes that they are thus not relevant when considering applying the CAPM (as in the regulatory framework) over a period of five years. It is well known that the period over which the CAPM is thought to apply is not given by theory. However, stock prices and expected returns are determined continuously through the operations of traders in stock markets, generating turnover rates on many large stocks in excess of 100 per cent per annum. More generally, empirical tests of the CAPM generally use holding periods of a month or less (and one month risk free interest rates). Consequently, it can be expected that it is the cost of access to relatively short term borrowings which is the appropriate borrowing cost to consider in asking whether zero beta estimates (derived using investment horizons of a month or less) are consistent with the limits implied by borrowing costs. (It is perhaps also worth noting that the Black CAPM assumes unlimited ability to short sell risky assets – and institutional practices in that regard (which perhaps challenge that assumption) also suggests a short time frame for which short positions can be held).

In my previous report for the AER (Davis, 2011) I reviewed the findings of a number of recent academic papers on the CAPM. In the Appendix to this report, I provide further comments on some of those and other academic papers referenced there and by Grundy (2010, 2011) and CEG (2010, 2011). My conclusions from my earlier review and this subsequent review are unchanged and are that (a) there is no consensus on which asset pricing model best explains returns on risky assets, and that (b) there is some support for a "conditional" CAPM in which forward looking expected returns depend on some stochastic factor(s) additional to the expected Market Risk Premium (which itself may be variable), but that there is little agreement on the best set of additional factors.

I do not believe that there is substantive evidence in any of the papers surveyed, and on the basis of the discussion earlier in this section, which would provide grounds for a conclusion that the Black CAPM is superior to the Sharpe CAPM.

Dividends, Distributions and Valuation

The SFG report and the CEG report both address the issue of whether projected distributions to investors from comparable companies can be used for the purpose of estimating the cost of equity. SFG argue that the expected rate of return to an investor in a comparable firm would substantially exceed the AER's proposed regulatory return on equity "if the firm simply maintained its current dividend (no growth at all) and maintained the real value of its shares (no real growth)". (para 36)

CEG (section 4) use the Dividend Growth Model to derive implied costs of equity using such projected distributions under different assumed growth rates for such distributions. Using a risk free interest rate of 5.6 per cent, an "equity risk premium" is calculated for the average of comparable firms (table 3) and then transformed into an implied beta value which is consistent with various assumed growth rates and an assumed MRP of 6 per cent. It is argued, based on these calculations, that only a significantly negative growth rate is consistent with the AER's assumptions regarding the MRP and beta.

A fundamental issue with these approaches lies in the interpretation of forecast distributions by the comparable firms and the reliability of those forecasts. The comparable companies used are listed in Table 1 below and are characterized by often having stapled securities on issue. The "dividends" or more correctly "distributions" which analyst forecasts refer to, reflect projected payments on the various components of those stapled securities, some part of which may be a return <u>of</u> capital (often referred to as tax deferred income) rather than a return <u>on</u> capital. While it is true that these are both cash flows receive by the holder of the stapled security, the form they take may have implications for the future capital value of the security, and thus its rate of return. Including return of capital can lead to an overstatement of the rate of return or yield.

To see this, consider a simple example involving a single project with a life of 10 years which has straight line accounting (and economic) depreciation and generates exactly the required rate of return of 15 per cent per annum on the depreciated asset value (such that it is a zero NPV project and has a market value equal to its depreciated asset base at all times. The cash flows generated by the project (initial outlay of $100) are shown for the initial years in the table below, where earnings are 15 per cent of the start of year depreciated asset value.

End of Year	Cash Flow	Return on capital (earnings)	Return of capital (depreciation)	Depreciated asset value
1	$25	$15	$10	$90
2	$23.5	$13.5	$10	$80
3	$22	$12	$10	$70

Assume the company pays out the cash flow of the project each year as a distribution. Calculating, for example, the $25 distribution paid out in year 1 as a rate of return of 25 per cent on the initial value of $100 clearly overstates the true rate of return of 15 per cent, because it ignores the decline in the value of the asset from $100 to $90.

In practice, the comparable companies have much more complicated activities and financial arrangements (including reinvestment schemes for distributions as one method of rebuilding the capital base) than this simple example involves. Nevertheless, the point remains that the rate of return needs to take into account the expected change in the price of the underlying security as well as the distribution.

As Table 1 illustrates, distributions of some of the comparable companies over the past year did not involve a return of capital (APA being the major exception). Nevertheless the sustainability of a pure dividend (return on capital) at the current level (as opposed to maintaining a constant distribution rate via a return of capital) is called into question by the "dividend times covered" ratios shown in the final column. For most of the companies, this ratio is in the region of 0.5 – 0.6, indicating that earnings were inadequate to cover distributions. In these circumstances, the assumptions that dividends could be maintained at the same level with a constant or growing share price (the SFG analysis) or growing at a constant rate (the CEG analysis) are questionable.

A full analysis of the expected rate of return on the comparable companies, involving expected cash flow distributions (from earnings and return of capital) in conjunction with the implications for future security prices of these distributions exceeding current earnings is beyond the scope of this report. Nevertheless, reliance upon distribution yields as a measure of the current rate of return accompanied by arbitrary assumptions about the growth rate of those distributions would appear unreliable as a way of estimating expected rates of return.

In addition to these difficulties in using the available data for comparable companies, it should be noted that the Dividend Growth Model (as used by CEG) is well known to be particularly sensitive to the assumptions used.

Code	Div Amount	Ex Div Date	% Franked	Type	Further Information	Dividend Times Covered. Source: AFR 28/4/11
APA	17c	24/06/2010	0%	Final	5.6421C UNFRANKED 11.3579C TAX DEF DRP	
APA	16.5c	23/12/2010	0%	Interim	13.2527C UNFRANKED 3.2473C TAX DEF; DRP	0.59
DUE	10c	24/06/2010	1%	Final	0.12C FRANKED @ 30% D.R.P.	
DUE	10c	23/12/2010	5%	Interim	0.5102C FRANKED @30% D.R.P.	0.56
ENV	2.75c	13/09/2010	0%	Final	UNFRANKED NIL CFI D.R.P.	
ENV	2.75c	15/03/2011	0%	Interim	UNFRANKED NIL CFI D.R.P.	0.53
HDF	3c	24/06/2010	0%	Interim	D.R.P.	
HDF	3c	24/09/2010	0%	Interim	D.R.P.	
HDF	3c	23/12/2010	0%	Final	D.R.P. 100% TAX DEFERRED	
HDF	2.5c	25/03/2011	0%	Interim	D.R.P. SUSPENDED	<0 (negative earnings)
SKI	6.72c	26/08/2010	0%	Interim	6.72C INTEREST PER LOAN NOTE DRP SUSP	
SKI	6.82c	2/03/2011	0%	Final	6.82C INTEREST PER LOAN NOTE DRP SUSP	0.55
SPN	4c	22/11/2010	40%	Interim	1.591C FRANKED @ 30% 0.18C TAX DEF. DRP	1.09

Cost of Equity and Cost of Debt Consistency

It has been asserted that there is an inconsistency in the AER approach to the cost of capital in that the cost of equity (r_e) can never be below the cost of debt (r_d) for a firm. Because the cost of (required return on) equity r_e is derived from application of an asset pricing model such as the CAPM and the cost of debt r_d is derived from available market comparables data, the possibility arises that $r_d > r_e$. Indeed, this result is observed and criticized in the initial CEG and Grundy reports, and reiterated in the second CEG report (section 4.2) and the SFG report (section 3). In these reports a number of explanations for this outcome are reviewed and disputed.

As explained in my previous report, this is a "red herring" and the argument is irrelevant, being based on different interpretations of the terms r_e and r_d. It is true that if both are interpreted as expected returns, then the inequality $r_e > r_d$ must hold. This was shown by, for example, Merton (1974) and Figure 9 reproduced from that article, in which α_e is the expected return on equity, α_y is the expected return on debt, and d is the market debt/equity ratio, illustrates. As the capital structure approach 100 per cent debt, the expected return on debt increases from the risk free rate (r) and approaches the expected return on the firm (α).

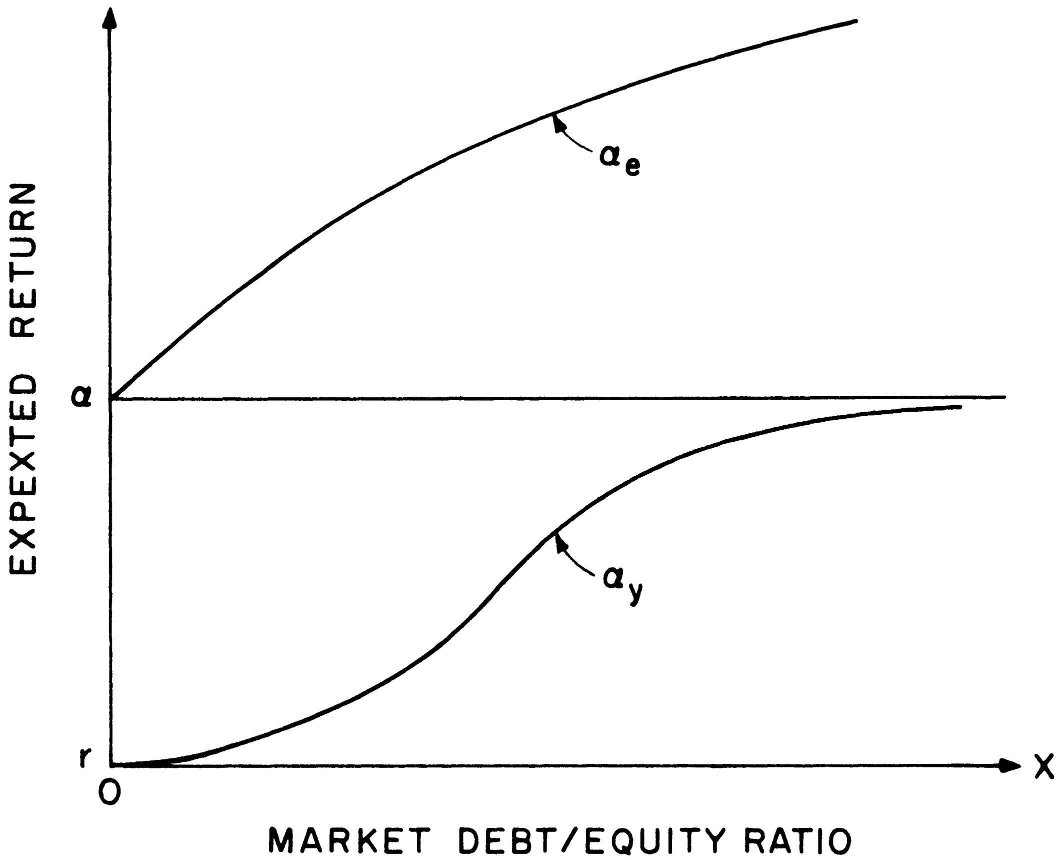

FIGURE 9

However, Merton also makes it clear that α_y is not the same as the yield to maturity which is the cost of debt figure used by market participants and the AER. Merton notes that (using continuous time notation) if $F(V, \tau)$ is the current market value of a bond issued by a company with market value V, which promises to pay B in τ year's hence, and Exp is the exponential operator then defining $R(\tau)$ by:

$$\mathrm{Exp}\{-R(\tau)\tau\} \equiv F(V,\tau)/B$$

"$R(\tau)$ is the yield-to-maturity on the risky debt provided that the firm does not default. It seems reasonable to call $R(\tau) - r$ a *risk premium….*". (Merton, 1974, p 451) While the equation above is for a zero coupon bond and expressed in continuous time, the concept is the same as the yield to maturity calculated in financial markets. Expressed slightly differently as: $F = e^{-rT}B$, it states that the yield to maturity (r) is that rate of return (discount rate) which equates the present value of promised future cash flows to the current market price. This is the same approach as outlined in the recent report on debt costs to the AER by Oakvale Capital (2011) which noted that the price of a fixed coupon bond promising a coupon of \$c p.a. for N years and principal repayment of M at the end of N years is given by the formula:

$$P = c[\frac{1-(1+i)^{-N}}{i}] + M(1+i)^{-N}$$

In this formula (and in more complicated cases) the yield to maturity (i, in this formula) is that rate of return which equates the present value of promised future cash flows (an coupon annuity of c over N years and final principal payment of M in this case) to the bond price. It is not an expected return, and there is no reason in principle why the yield to maturity on a corporate debt could not exceed the expected return on that firm's equity which in turn is above the expected return on that debt security.

It is also worth noting that Merton demonstrates that the pricing of corporate debt (in the simple, single, zero coupon debt case analyzed) and thus the risk premium depend (for a given maturity) only upon the volatility of the firm's asset value and the market debt to equity ratio.[5] An increase in perceived volatility and decline in equity values (such as

[5] This is a "quasi-leverage" ratio in that it measures the market value of debt by discounting promised payments at the risk free interest rate.

occurred in the GFC) would thus increase the cost of debt (measured as yield to maturity) but the effect on the cost of equity (measured as expected, or required, return) is driven at least in part by different factors (such as changes in the market risk premium or systematic risk (β), if the CAPM is applied). While the factors causing an increase in the cost of debt could also cause an increase in the cost of equity, the relationship is not a simple one.

REFERENCES

CEG (2011) "WACC Estimation" A Report for Envestra March 2011

Davis (2011) "Cost of Equity Issues: A Report for the AER" 16 January 2011

Grundy B (2010) "The Calculation of the Cost of Capital" A Report for Envestra 30 September 2010

Grundy B (2011) "Comment on the Cost of Capital" A Report for Envestra 23 March 2011

Oakvale Capital (2011) "Report on the cost of debt during the averaging period: The impact of callable bonds" Report for the AER February 2011

SFG Consulting (2011) "The required return on equity commensurate with prevailing conditions in the market for funds: Response to Draft Decision" Report Prepared for Envestra, 23 March 2011

APPENDIX: Comments on academic papers referenced in earlier studies

In this appendix I provide, where appropriate, some brief comments on issues raised about results and inferences from academic papers in previous consultant reports.

Roll (1977). Grundy (2011, para 29-30) disputes the conclusion of Handley (2011) that Roll (1977) questioned low beta bias of the Sharpe CAPM, and states that "Roll (1977) establishes that whenever the expected return on assets with zero beta with respect to the mean-variance efficient market proxy exceeds the risk-free rate….the Sharpe CAPM *must* as a mathematical consequence exhibit low beta bias". That conditional statement is true, but it is not a correct implication to infer, as CEG (2010) and Grundy (2011) appear to do, that an empirical result of an estimated intercept in excess of the risk free rate implies that a mean variance efficient market proxy has been used and that the zero beta rate is thus above the risk free rate. Roll (1977, p130) notes that one of his conclusions is that "All other so-called implications of the model, the best known being the linearity relation between expected return and 'beta', follow from the market portfolio's efficiency and are not independently testable." Another of his conclusions (p131) relates to "the papers by Fama and MacBeth (1973), Black, Jensen, and Scholes (1972) and Blume and Friend (1973), in the context of their rejection of the Sharpe-Lintner model. It is shown that their tests results are fully compatible with the Sharpe-Lintner model and a specification error in the measured 'market' portfolio."

Roll and Levy (2010). Levy and Roll demonstrate that with small adjustments to the market portfolio, the CAPM cannot be rejected. They do not provide evidence in favor of either the Sharpe or Black versions, and suggest that the CAPM can provide a suitable method for finding the cost of capital. Grundy (2011, para 13-14) argues that they "are clear that expected returns should be determined from the Black CAPM". Their comments do not, however, substantiate a conclusion that a zero beta estimate should be found from an empirical estimate of the intercept of the security market line using an inefficient proxy for the market portfolio. Rather, they argue that a theoretically correct approach is to "calculate the adjusted mean return for the market index proxy and for its corresponding zero-beta portfolio". They make no comment on whether the appropriately calculated zero beta rate will differ from the risk free rate.

Campello, Chen and Zhang (2008). This paper focuses on whether using an estimated measure of expected returns generates different results to using realized returns in asset pricing models. I do not agree with Grundy (2011 para 7) that their results support a low beta bias of the Sharpe CAPM, which Grundy argues can be found in Table 7, Panel A. My reading of the figures in that Table are that they are for their estimated expected return on the market in excess of the risk free rate (not the zero beta rate as Grundy states) which they estimate at 3.39% p.a. as compared to the average realized excess return on the market of 7.54% p.a. (not the expected return as Grundy states).
It is perhaps worth noting that, to the extent that the expected MRP is actually this low (which is also consistent with the survey findings of Graham and Harvey (2010) for the USA), using the Sharpe CAPM with a higher MRP and the risk free rate to calculate the cost of capital would provide an upward bias to required returns to both low and high beta stocks.

Llewelyn, Nagel and Shanken (2010). As noted in Davis (2011) and Grundy (2011) these authors note that the estimated implied zero beta rates are too high to be attributed to differences in borrowing and lending rates. Llewelyn et al note that "(riskless) borrowing and lending rates are not sufficiently different, perhaps 1-2% annually, to justify the extremely high zero-beta estimates in many papers". Their Table 1 results (p187), to which Grundy refers, find estimated zero beta rates implausibly high for a wide range of asset pricing models. To say, as Grundy does, that "average returns are better described by the Black model" ignores the violation of a reasonableness test on the estimated zero beta rate.

Ang and Chen (2007). These authors examine whether the higher returns observed on portfolios with higher book to market ratios, which partially motivates the Fama-French three factor model, is inconsistent with the CAPM. They use a long time period (1926-2001) because of concerns that the observed "anomaly" may be specific to a shorter time period commonly studied, and adopt a conditional CAPM in which stock betas evolve through time in a relatively smooth and mean reverting fashion. By using stock returns in excess of the 30 day T-Bill rate they are implicitly adopting a (conditional) Sharpe CAPM, for which the estimated intercept should be zero. They find that, while there remain some anomalies in returns (such as a momentum effect) the difference in returns between high and low B/M stocks is consistent with the CAPM. One of their conclusions is that "we cannot find evidence to reject the time-varying beta model over the period from 1963:07 to 2001:12" (p 13).

Morana (2009) compares a number of approaches to explaining asset returns, focusing upon how a conditional CAPM approach performs relative to a range of alternative models with additional factors. He also compares results from different modeling/estimation strategies including Black Jensen and Scholes and Fama McBeth approaches for different asset pricing models. He finds that (smoothed) realized betas estimated from a time-varying beta approach have substantial explanatory power regarding the returns on the twenty five Fama-French portfolios (sorted on market to book ratio and size). The conditional CAPM used involves returns in excess of the 3 month risk free rate. He finds that: additional factors add relatively little to the market beta factor explanation in the conditional CAPM when "smoothed" realized betas are used. However, his estimates consistently imply a negative coefficient for the market beta across all models considered, a result at variance with both the Sharpe and Black CAPM.

Gregory and Michou (2009) perform a horse-race on different asset pricing models using industry level data for the UK, noting the importance of cost of capital estimation for regulated industries. None of the models perform particularly well, leading them to conclude that "Cost of capital is estimated with large errors, as are the slope coefficients in either the CAPM or three-factor models. Whether the latter is better than the traditional CAPM is difficult to judge." They consider conditional models as well as static models, and find that there is relatively little to choose between CAPM, FF etc in terms of predictive ability. They also find that, from rolling regressions, the predictability of beta (and other risk premia) 60 months ahead is relatively low (although the mean errors are relatively small, the mean absolute error for beta, for example, is 0.27).

They also note that "One clear message that does emerge from this research, for the CAPM and the alternative factor models investigated, is that despite the noisiness of the estimates, all outperform the simple alternative of assuming that beta is equal to one for all firms. Furthermore, beta estimates for the main regulated utility industry groupings used in this paper are reliably less than one…"

Schrimpf, Schroder, and Stehle (2007) examine the performance of static and conditional asset pricing models using size and book/market portfolios constructed from German stocks. They find that using the term spread as the conditioning variable in the CAPM generates results which support a conditional CAPM and that the performance of that model is as good as other multifactor models (such as the FF model).

Grauer and Janmaat (2010) is referred to in Panel B of Table 1 in Grundy (2010) where he states that "[f]or 7 of the 14 methods for grouping stocks to form portfolios that are examined in the paper, the likelihood of the Sharpe CAPM being true is < 5%". That brief summary provides a distorted view of the Grauer and Janmaat paper and its results. First, a key message of their paper is that the method of forming portfolios of stocks for use in testing asset pricing models can significantly (and inappropriately) affect the results. That argument (which they demonstrate with simulation studies) raises questions about the validity of results from prior studies using particular portfolio formation methods. Second, they present a range of results based on "repackaging" the existing portfolios used in much of the empirical research to form "zero-weight" portfolios.

In contrast to the impression given by Grundy's comment, for their cross-section tests, they conclude that "GLS cross-sectional tests, in particular, strongly support the CAPM". Based on 42 repackaged datasets their CAPM tests show that "with GLS (OLS) regressions, the slope is statistically significant and the intercept is not in 28 (16) repackaged datasets". Their "zero-weight portfolio" approach does not appear to allow for discrimination between the Black and Sharpe CAPM (because the portfolio formation nets out either the zero beta or the risk free rate to generate an implied zero intercept for the test portfolios), Hence, Grundy's comment about the "truth" of the Sharpe CAPM would appear to be equally applicable to the Black CAPM. However, as noted earlier, it is my opinion that this comment gives a distorted view of the results from the Grauer and Janmaat paper which is at variance to what the authors themselves conclude.

Cohen, Polk, and Vuolteenaho (2009) is discussed in Grundy (2011, para 6) where it is argued that: (a) the method of beta estimation (based on cash flow covariances) is different to that used by the AER (based on return covariances, as is more commonly the case); and (b) that "the superiority of the Black CAPM is suggested by the results in Table V of Cohen *et al*". Point (a) is correct, but the implications which follow from that regarding the relative superiority of the Black or Sharpe CAPM model are unclear. What is pertinent for assessing evidence from prior studies of asset pricing models, however, is the argument of Polk *et al* that a long-horizon test using prices rather than short run returns (as used in many of the prior studies) is preferable. This, in my opinion, highlights the unsettled state of empirical testing of asset pricing theories.

In point (b) Grundy focuses upon the results in Table V of Cohen *et al* to argue that the estimated intercepts exceed the sample period average risk free rate. However, Table IV of Cohen *et al* provides explicit tests of the Sharpe-Lintner CAPM where all estimated intercepts for the six different assumed periods are negative (with only one significantly different from zero and thus inconsistent with that model). Also, Table VI provides explicit p-values for the null hypothesis that the Sharpe-Lintner CAPM is true for different portfolio construction methods (panel A v panel B) for different assumed holding periods. In panel A (col 2) p-values all less than 0.05 are reported whereas in panel B (col2) the p-value all exceed 0.09. I interpret this result as indicative of the sensitivity of results to methods of portfolio formation used in asset pricing tests, as suggested by Grauer and Janmaat (2010). I am currently unable to reconcile the results of Tables IV and VI of Cohen *et al* to those in their Table V referred to by Grundy. I do note, however, that the dependent variable for those results is the N-period price level.

While there is an explicit comment on p 2766 that they are discussing an "annualized beta premium estimate", there is no information available on the units of measurement for the intercept, but I would assume (as Grundy has done) that it is annualized. However, it is important to note that Table V relates to robustness checks and involves comparison of how adding additional portfolio sorts affects results. Thus the first (benchmark) column of results for λ_0 has no estimate (for different assumed holding periods) which appears to be significantly different from zero at a 5 per cent level (based on the standard errors reported there). The other columns of results for λ_0, where additional portfolio sorts have been used (and where there are significantly positive results) could reflect the problems created by different portfolio formation methods as discussed by Grauer and Janmaat (2010).

APPENDIX 1 Academic Papers referred to in this and prior reports

Adrian, Tobias, and Joshua Rosenberg **“**Stock Returns And Volatility: Pricing The Short-Run And Long-Run Components Of Market Risk**”** *The Journal Of Finance*,. LXIII, 6, December 2008, 2997-3030.

Black, F., “Capital market equilibrium with restricted borrowing”, *Journal of Business*, 45, 1972, 444–455.

Black, F., Jensen, M.C., and M.Scholes “The Capital Asset Pricing Model: Some Empirical Tests” Studies in the Theory of Capital Markets, Michael C. Jensen, ed., Praeger Publishers Inc., 1972.
Brennan, M.,.”Capital market equilibrium with divergent borrowing and lending rates”,*Journal of Financial and Quantitative Analysis*, 6, 1971, 1197–1205.

Campbell, John Y., Christopher Polk, and Tuomo Vuolteenaho “Growth or Glamour? Fundamentals and Systematic Risk in Stock Returns” *The Review of Financial Studies*, 23, 1, 2010, 305-344.

Campello, Murillo, Long Chen, and Lu Zhang Expected Returns, Yield Spreads, and Asset Pricing Tests *The Review of Financial Studies*, 21, 3 2008, 1298-1338

Cohen, Randolph, Christopher Polk, and Tuomo Vuolteenaho “The Price is (Almost) Right” *The Journal of Finance*, LXIV, 6, December 2009, 2739–2782.

Da, Zhi, Re-Jin Guo and Ravi Jagannathan, “CAPM for Estimating the Cost of Equity Capital: Interpreting the Empirical Evidence” May 2010, Available at SSRN: http://ssrn.com.abstract=1571299

Durack, Nick, Robert B. Durand, and Ross A. Maller “A best choice among asset pricing models? The Conditional Capital Asset Pricing Model in Australia” *Accounting and Finance*, 44, 2004, 139–162

Elton Edwin J. “Expected Return, Realized Return, and Asset Pricing Tests” *The Journal Of Finance*, LIV, 4, August 1999, 1199-1220

Fama, E. and French, K.R., ‘Common risk factors in the returns on stocks and bonds’, *Journal of Financial Economics*, Vol. 33, 1993, pp. 3–56.

Fama, E., and J.Macbeth, “Risk, return, and equilibrium: Empirical tests” *Journal of Political Economy*, 81 (3), 1973, pp. 607-636.

Gaunt, Clive, “Size and book to market effects and the Fama French three factor asset pricing model: evidence from the Australian stockmarket” *Accounting and Finance*, 44 (2004) 27–44

Graham, John and Campbell Harvey "The Equity Risk Premium amid a Global Financial Crisis" (May 14, 2009). Available at SSRN: http://ssrn.com/abstract=1405459

Graham, John R. and Harvey, Campbell R., The Equity Risk Premium in 2010 (August 9, 2010). Available at SSRN: http://ssrn.com/abstract=1654026

Grauer, Robert R. and Johannus A. Janmaat, "Cross-sectional tests of the CAPM and Fama–French three-factor model", *Journal of Banking & Finance* 34 (2010) 457–470.

Kothari, S., J. Shanken and R. Sloan, "Another look at the cross-section of expected stock returns", *The Journal of Finance*, Vol. L(1), 1995, 185–224.

Jagannathan, Ravi and Zhengyu Wang "The Conditional CAPM and the Cross-Section of Expected Returns" *The Journal of Finance*, LI, 1, March 1996, pp. 3-53.

Levy, H., The CAPM is Alive and Well: A Review and Synthesis. *European Financial Management*, 16, 2010, 43–71

Levy, Moshe and Richard Roll, "The Market Portfolio May Be Mean/Variance Efficient After All" *The Review of Financial Studies,* 23, 6 2010, 2464-2491

Lewellen, Jonathan, Stefan Nagel and Jay Shanken, "A skeptical appraisal of asset pricing tests" *Journal of Financial Economics*, 96, 2010, 175–194

Merton, R., "An intertemporal capital asset pricing model", *Econometrica* 41, 1973, 867–887.

Pastor, Lubos, Meenakshi Sinha, and Bhaskaran Swaminathan, "Estimating The Intertemporal Risk–Return Tradeoff Using The Implied Cost Of Capital", *The Journal of Finance,* LXIII, 6, December 2008, 2859-2897.

Petkova, R., 'Do the Fama–French factors proxy for innovations in predictive variables?' *Journal of Finance*, Vol. 61, 2006, pp. 581–612.

Ray Surajit D., N. Eugene Savin , Ashish Tiwari "Testing the CAPM Revisited", *Journal of Empirical Finance*, Vol. 16, No. 5, 2009

Roll, R. "A Critique of the Asset Pricing Theory's Tests; Part I: On Past and Potential Testability of the Theory", *Journal of Financial Economics* 4, 1977, 129–76.

Sharpe, W., 'Capital asset prices: a theory of market equilibrium under conditions of risk', *Journal of Finance*, Vol. 19, 1964, pp. 425–42.

Subrahmanyam, A. , "The Cross-Section of Expected Stock Returns: What Have We Learnt from the Past Twenty-Five Years of Research?" *European Financial Management*, 16, 2010, 27–42.

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