THE COST OF CAPITAL UNDER DIVIDEND IMPUTATION

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by

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EXECUTIVE SUMMARY

In Australia a consensus seems to have developed in recent years in favour of the "Officer" approach to valuation and cost of capital in the presence of Dividend Imputation. This treats imputation as a process that lowers the company tax rate and redefines dividends to include the attached imputation credits, to the extent that they can be used. Furthermore, a consensus has also developed in favour of a 50% reduction in the company tax rate, to reflect the benefits of imputation, and also in favour of an estimated market risk premium of 6%. In its recent regulatory decisions, in which output prices are prescribed for various firms, the ACCC has also favoured this approach and these parameter estimates. It has also assumed that investors in Australian companies are Australians rather than foreigners.

This paper has reviewed these conclusions, by addressing the following questions. First, to what extent if any should foreign investors be recognized. Second, what is an appropriate adjustment to the company tax rate to reflect the benefits of imputation. This adjustment reflects both the utilization rate for imputation credits and the ratio of credits assigned to company tax paid. Third, what is an appropriate estimate for the market risk premium in the "Officer" model. Finally, and in view of the simplifying assumption in the "Officer" approach that ordinary income and capital gains are equally taxed, should an allowance be made for differential taxation of ordinary income and capital gains.

The conclusions are as follows. First, regarding the issue of recognizing foreign investors, continued use of a version of the Capital Asset Pricing Model that assumes that national equity markets are segmented rather than integrated (such as the Officer model) is recommended. It follows that foreign investors must be completely disregarded. Consistent with the disregarding of foreign investors, most investors recognized by the model would then be able to fully utilize imputation credits.

Second, regarding the appropriate adjustment to the company tax rate to reflect the benefits of imputation, the utilization rate for imputation credits should be set at one, and this follows from the first point above. In addition the ratio of imputation credits assigned to company tax paid should be set at the relevant industry average, which appears to be at or close to one for most industries. These two recommendations imply an imputation-adjusted company tax rate of zero rather than the generally accepted figure of 50% of the statutory rate. Put another way, they imply that the product of the utilization rate and the ratio of imputation credits assigned to company tax paid (denoted gamma by the ACCC) should be at or close to 1 for most companies rather than the currently employed figure of 0.50. The effect of this change would be to reduce the allowed output prices of regulated firms.

Third, in respect of the market risk premium in the Officer model, the range of methodologies examined give rise to a wide range of possible estimates for the market risk premium and these estimates embrace the current value of 6%. Accordingly, continued use of the 6% estimate is recommended.

Finally, regarding the differential taxation of capital gains and ordinary income, the simplifying assumption in the "Officer" model that they are equally taxed at the personal level could lead to an error in the estimated cost of equity of up to 1.1%, depending upon the relevant industry average cash dividend yield and franking ratio. Prima facie this is a sufficiently large sum to justify use of a cost of equity formula that recognizes differential personal taxation of capital gains and ordinary income, and such a formula is presented in this paper. However a consensus has not yet developed amongst Australian academics and practitioners for making such an adjustment and it seems inappropriate for the ACCC to lead in this area. Consequently the continued use of the Officer model is recommended. If such an adjustment were made, it would raise the allowed output prices of some firms. However the argument for raising the utilisation rate on imputation credits is at least as strong, and the net effect of the two changes is unlikely to significantly benefit any firm.

1. Introduction

Since the introduction of Dividend Imputation in Australia in 1987 there has been considerable debate concerning its implications for valuation and the cost of capital. Two approaches have been employed. The first treats imputation as a process that lowers the personal tax rate on cash dividends (Ball and Bowers, 1986; Australian Department of Treasury, 1991; Monkhouse, 1993). Paralleling this was UK and New Zealand work (Ashton, 1989, 1991; Cliffe and Marsden, 1992; Lally, 1992). The second approach treats imputation as a process that lowers the company tax rate and redefines dividends to include the attached imputation credits (van Horne et al, 1990; Hathaway and Dodd, 1993; Officer, 1994). In recent years a consensus seems to have developed in Australia in favour of the second of these approaches. Consistent with this, the ACCC has favoured this approach (generally called the "Officer" model) in its recent regulatory decisions[1].

Nevertheless, a number of fundamental questions arise from the use of this approach. The first concerns foreign investors, and the extent to which they should be recognized, with the ACCC currently ignoring them. The second question concerns the appropriate value for "gamma" in the Officer model, and its implications for the market risk premium and the effective tax rate. The ACCC currently favours a value of .50, but there are arguments for both lower and higher values. The third question concerns the appropriate value for the market risk premium in the Officer model, with the ACCC favouring a value of .06 but with arguments for alternative values. The final question concerns the simplifying assumption within the Officer model that ordinary income and capital gains are equally taxed. Clearly some investors face lower tax on capital gains than on ordinary income, and this calls into question the Officer assumption.

This paper seeks to address these four issues. Recent changes to the Australian tax regime have implications for the usability of imputation credits and for the taxation of capital gains, and the discussion will reflect this. The paper commences with a review of the Officer model.

2. The Officer Model

Officer (1994) presents a model for the valuation of companies in the presence of dividend imputation. The model treats imputation as a process in which some company tax is a prepayment of shareholders' personal taxation on dividends. The level of company taxation that is treated in this way is the amount assigned as imputation credits, to the extent that investors can use them. The company tax rate is then reduced to reflect this, and dividends are defined to be the sum of cash paid and the imputation credits, to the extent they can be used. Officer formalizes the model in the context of a level perpetuity, and there is some ambiguity in definitions. However, Monkhouse (1993, 1996) develops a model that admits any cash flow profile and there is less ambiguity in definitions. Two versions are presented, corresponding to each of the two approaches to imputation that were discussed earlier (as a reduction in company tax rather than personal tax on dividends). In respect of the former, Officer, approach the value of the company is

$$V_0 = \sum \frac{E(Y_t) - T_e\left[E(Y_t) - E(Q_t)\right]}{\left\{1 + (1-L)\hat{k}_e + Lk_d(1-T_e)\right\}^t} \tag{1}$$

where Y_t is the firm's year t cash flow before deductions for interest and tax, Q_t are the year t deductions from Y_t to yield taxable income for an unlevered firm, L is the leverage ratio, k_d the cost of debt, and $\hat{k}_e$ the cost of equity with dividends defined to include utilized imputation credits. The company tax rate T_e is defined as

$$T_e = T_c\left[1 - U\frac{IC}{TAX}\right] \tag{2}$$

where T_c is the statutory company tax rate, U a weighted average over investor utilization rates for imputation credits (each investor's rate can range from zero to 1), IC are the imputation credits assigned by the company during a period and TAX is the company tax paid during that period. Clearly the ratio IC/TAX can vary from year to

[1] This is purely a matter of form rather than substance. Lally (2000b, p 10-11) demonstrates that the two approaches are equivalent.

year, and this is recognized by Monkhouse (1996). It may also be stochastic. In the interests of simplicity it is treated here as non-random and equal across time. The cost of equity, with returns defined to include imputation credits to the extent that they can be used, is

$$\hat{k}_e = R_f + \left[\hat{k}_m - R_f\right]\beta_e \tag{3}$$

where R_f is the riskfree rate, β_e the equity beta defined against the Australian market index, and $\hat{k}_m$ the expected rate of return on the Australian market portfolio inclusive of imputation credits to the extent they can be used. This is identical to the standard version of the CAPM (Sharpe, 1964; Lintner, 1965; Mossin, 1966) except that the returns in (3) include imputation credits. If the parameter $\hat{k}_m$ is expressed as the sum of the conventional expected return (cash dividends and capital gains), plus the imputation credits to the extent of being usable, then the last equation becomes

$$\hat{k}_e = R_f + \left[k_m + UD_m \frac{IC_m}{DIV_m} - R_f\right]\beta_e \tag{4}$$

where D_m is the cash dividend yield on the market portfolio, and IC_m/DIV_m is the franking ratio for the market portfolio (the ratio of credits attached to cash dividends paid). In equations (3) and (4), the equity beta is defined over returns inclusive of imputation credits. Nevertheless, estimates are generally obtained from returns that do not include the imputation credits. This inconsistency is innocuous because the inclusion or exclusion of dividends has no appreciable effect upon beta estimates (Brailsford et al, 1997, Table 4, reveals the similarity in beta results from use of the AOI price and accumulation). The same conclusion then extends to the issue of including or excluding imputation credits from the definition of dividends.

Turning now to Officer's (1994) presentation, he introduces the symbol γ ("gamma"), and defines it (ibid, p. 8) such that it must correspond to the following product in (2)

$$U\frac{IC}{TAX} \tag{5}$$

However, he later (ibid, p. 9) uses it in such a way that it must correspond to the utilization rate *U*. Clearly, if the ratio *IC*/*TAX* is equal to 1, then the two uses of "gamma" coincide, and this is consistent with Officer's consideration of a level perpetuity scenario. However, outside of a level perpetuity scenario, the ratio *IC*/*TAX* may be less than 1, and some estimates of "gamma" clearly reflect this possibility. Consequently the use of the term "gamma" to describe two phenomena is a recipe for confusion. The ACCC clearly uses the term to refer to the product in equation (5) rather than the utilization rate. However, at various points, various writers have defined it in a way that corresponds to the utilization rate. Accordingly, to avoid any confusion, this paper desists from use of the term "gamma". Instead it refers to the utilization rate and the ratio of imputation credits assigned to company tax paid.

We now consider the valuation formula used by the ACCC (ACCC, 2000). This matches equation (1), except that it values the cash flows to equityholders rather than to equityholders and debtholders, i.e.,

$$S_0 = \sum \frac{E(Y_t) - E(B_t) - T_e\left[E(Y_t) - E(Q_t) - E(INT_t)\right]}{(1+\hat{k}_e)^t}$$

where S_0 is the value of the cash flows to equityholders, B_t is the year t payment to debtholders (principal and interest) and INT_t is the year t interest payment. The allowed output price is then chosen (more precisely, an escalation rate applicable to a base level of pricing is chosen) so that the present value of the cash flows to equityholders equals the level of equity funding required (being proportion 1-*L* of the investment required), i.e., the escalation rate in the output price is chosen so that

$$A(1-L) = \sum_t \frac{E(Y_t) - E(B_t) - T_e\left[E(Y_t) - E(Q_t) - E(INT_t)\right]}{(1+\hat{k}_e)^t} \tag{6}$$

where *A* is the investment required.

3. The Relevance of Foreign Investors

Foreign investors are clearly significant in the Australian equity market, with around 30% of foreign shares so held (J.B. Were, 1996). Furthermore there is virtually free flow of equity capital between Australia and the world's principal equity markets. Prima facie it then seems that models for valuation and the cost of capital should take account of this. However modeling all features of the real world is impossible, and certain abstractions are unavoidable. Inter alia, the Officer version of the CAPM (like the standard version) assumes that national equity markets are completely segregated. As a consequence the "market" portfolio is an Australian one, and betas are defined against it. Versions of the CAPM have been developed that recognize that international investment opportunities are open to investors, starting with Solnik (1974). We will examine this model because, dividend imputation aside, it closely parallels the Officer model. As with most international versions of the CAPM, international capital flows are assumed to be unrestricted and investors exhibit no irrational home country biases, i.e., there is no preference for local assets for non-financial reasons. Like the standard version of the CAPM, it assumes that interest, dividends and capital gains are equally taxed. The resulting cost of equity for an Australian company is[2]

$$k_e = R_f + MRP_w \beta_{ew} \tag{7}$$

where R_f is (as before) the Australian riskfree rate, MRP_w is the risk premium on the world market portfolio and β_{ew} is the beta of the company's equity against the world market portfolio. By contrast with the Officer CAPM in equation (4), there is no recognition of dividend imputation. However, since most investors in Australia's equity market would be foreigners in this full internationalization scenario, and foreigners gain only slight benefits (at most) from imputation credits under any imputation regime, this feature of the model is not significant. The remaining, and significant, distinction between the models lies in the definition of the market

[2] This cost of equity is defined in respect of returns that do not include imputation credits, and is therefore denoted as k_e without the "hat".

portfolio, i.e., the "market" is Australian in the Officer model and the world in the Solnik model. Thus the market risk premiums may differ across the two models and the beta of an asset is defined against a different portfolio.

These distinctions in the market risk premium and beta have significant numerical implications. In respect of the market risk premium, under the Officer model, an estimate of the Australian market risk premium is about .06 (this is discussed in section 6). By contrast, under the Solnik model in which markets are assumed to be integrated, investors will now be holding a world rather than a national portfolio of equities, and the latter will have a considerably lower variance due to the diversification effect. Since the market risk premium is a reward for bearing risk, then the world market risk premium under integration should be less than that for Australia under segmentation. Stulz (1995) argues that, if the ratio of the market risk premium to variance is the same across countries under segmentation, the same ratio will hold at the world level under integration and this fact should be invoked in estimating the world market risk premium[3]. Merton (1980) estimates the ratio at 1.9 for the US for the period 1926-78. Harvey (1991, Table VIII) offers estimates for 17 countries over the period 1970-90, which average 2.3. All of this suggests a figure of about 2. If we use this figure then this suggests a market risk premium for the Solnik CAPM of

$$MRP_w = 2\sigma_w^2 \tag{8}$$

Cavaglia et al (2000) estimates the world market variance over the period 1985-2000 as $.135^2$. Substitution into equation (8) then implies an estimate for the world market risk premium of about .04.

Turning now to the question of betas, the average Australian stock has a beta against the Australian market portfolio of 1, by construction. Similarly, the average asset world-wide has a beta against the world market portfolio of 1, but this does not imply that the average Australian stock has a beta of 1 against the world market portfolio. Ragunathan et al (2001, Table 1) provide beta estimates for a variety of Australian

[3] It would not be sensible to attempt to estimate the world market risk premium by historical averaging over a long time-series of returns, because even if markets were currently fully integrated this would not have been true for very long.

portfolios for the period 1984-1992, against both Australian and world market indexes. The average of the latter to the former is about .40. In addition Gray (2000) regresses the Australian index against a world index, for the period 1995-2000, and obtains a beta of .72. The fact that these estimates are less than 1 is unsurprising in view of Australia's small weight in the world market index and the large weights for some markets. To illustrate this point, suppose the world comprised four equity markets with weights of .01, .245, .245 and .50. Also, the correlation between all markets is .30 (Odier and Solnik, 1993) and they have the same variance. It follows that the small market (market 1) has a beta against the world portfolio of

$$\beta_{1w} = \frac{Cov(R_1, .01R_1 + .245R_2 + .245R_3 + .50R_4)}{Var(.01R_1 + .245R_2 + .245R_3 + .50R_4)} = .55$$

regardless of the value for the common variance. The other three markets have betas of .84, .84 and 1.16 (the weighted average of the four betas is of course 1). Lally (1996, Appendix 2) presents a more realistic example utilizing actual country weights but the outcome is similar: ceteris paribus, very small markets have betas against a world market portfolio that are much less than 1. For illustrative purposes we will assume a beta for a typical Australian stock against the world market portfolio of .70.

We now combine this information about betas and market risk premiums. Employing the Officer CAPM in equation (4), a riskfree rate of .06, and the estimated market risk premium of .06 referred to above, the cost of equity for an average Australian stock would be

$$k_e = .06 + .06(1) = .12$$

By contrast, under the Solnik CAPM in equation (7), with the Australian riskfree rate of .06, and estimates for the world market risk premium and the beta of an average Australian stock against the world market portfolio as indicated above, the cost of equity for an average Australian stock would be

$$k_e = .06 + .04(.70) = .088$$

The difference in costs of equity under the two models is quite substantial, and is essentially due to the difference in the market portfolio. Since the difference is so large, and the Officer model rests upon an assumption about segregation of national equity markets that is clearly false, then the Solnik model (or some other international CAPM) would appear to be more appealing. However the real test is which is the better description of how the expected returns on equities are determined. All direct tests of this question suffer from the Roll (1977) problem, in which the use of mere proxies for the true market portfolio may induce significant test biases. However less direct tests can be performed. One of these is to examine investors' portfolios. The Solnik model implies that all investors will hold risky assets (both foreign and local) in proportion to their market values. Clearly this is not the case, with investors exhibiting pronounced home country bias, i.e., investors in most major markets hold at least 90% of their risky asset holdings in home country assets (Cooper and Kaplanis, 1994; Tesar and Werner, 1995). Not all international versions of the CAPM have the same implications for investor portfolio holdings, but none can be readily reconciled with this overwhelming home country bias (Huberman, 2001).

In view of this significant difficulty, it is understandable that analysts in Australia and elsewhere have not (yet) invoked international CAPMs in estimating the cost of equity capital. Furthermore, until home country bias is significantly ameliorated, such caution is likely to persist. A similar caution is warranted in setting the costs of capital for regulated industries. Thus the continued use of a version of the CAPM that assumes capital markets are completely segregated (such as the Officer model) is recommended. Consistency then requires that foreign investors be completely disregarded.

4. Estimation of the Utilisation Rate

The utilisation rate is a weighted average across the imputation utilisation rates of investors. This is unclear in Officer (1994) but is clear from Monkhouse (1993). Furthermore, and this is not clear in even Monkhouse, it is a weighted average over all investors in the market rather than those holding the equity in a particular company[4]. Consistent with this, the same utilisation rate arises inside the company's effective tax rate in equation (2) and in the market risk premium in equation (4). The fact that this utilization rate is a weighted average across investors implies that it is not the rate for the "marginal" investor.

One approach to estimating this parameter derives from the fact that the Officer model (like the standard CAPM) assumes that national equity markets are segmented. Consistency then suggests that U be estimated on the basis that all investors in Australian equities are Australians. In respect of such investors, most of those who are taxed can fully utilise the credits, whilst tax-exempt investors cannot[5]. Wood (1997, footnote 10) estimates that the proportion of shares held by Australians who are tax exempt is 3-4%. Thus the estimate of U should be very close to 1. Even this estimate presumes that tax-exempt investors cannot sell the credits to those who can use them. In so far as they can, the estimate of U should be even closer to 1.

An alternative, and more popular, approach to estimating U is to do so from examination of ex-dividend day returns. Bruckner et al (1994), using data from 1990-93, estimated U as 0.68. The mechanism was as follows: per \$1 of cash dividend the maximum imputation credit attachable with a corporate tax rate (T_c) of .39 was

$$\frac{T_c}{1-T_c} = \frac{.39}{1-.39} = .64$$

In addition the average ex-dividend day price drop per \$1 of cash dividends was \$1.06 for fully franked dividends and 62c for unfranked ones, a difference of 44c. The value U then satisfied the following equation:

$$U(\$0.64) = \$0.44 \tag{9}$$

[4] In the work of Cliffe and Marden (1992), and Lally (1992), it is clear that the averaging is over all investors in the market place. This averaging is a consequence of aggregating over investors in order to obtain market equilibrium. In intuitive terms the explanation is that market prices are determined by investors in aggregate.
[5] Recent tax changes allow investors a tax rebate instead of a tax credit for the imputation credits, and this should allow most taxed investors to fully benefit from the imputation credits.

This implies that U = 0.68. Other studies yield a range of values: Hathaway and Officer (1995) obtain U = 0.44 using 1986-95 data, Brown and Clarke (1993) obtain 0.80 using 1989-91 data[6], and Walker and Partington (1999) obtain 0.88 using contemporaneous cum and ex trades in 1995-97. Taking account of these studies, an estimate for U of around .60 is generally employed[7].

This approach to estimating U is subject to a number of problems. Firstly, the 95% confidence intervals on the estimates are large (for example, Bruckner et al's is from .44 to .92). Secondly, ex-dividend day returns are known to exhibit perverse behaviour, which contaminates the estimate (see, for example, Frank and Jagannathan, 1998, in respect of Hong Kong and Brown and Walter, 1986, in respect of Australia). Thirdly, these studies assume that capital gains and ordinary income are equally taxed in Australia. This is clearly not the case, and this issue will be examined in more detail in section 7. If capital gains are taxed at 10%, and ordinary income at 30%, then equation (9) becomes

$$U(\$0.64)(1-.30) = \$0.44(1-.10)$$

and this implies U equals 0.88 rather than 0.68.

Finally, these estimates of U may and presumably do reflect the presence of foreign investors in the Australian market, who cannot use or fully use the credits and this exerts a downward effect on the estimates[8]. However, as noted earlier, the Officer CAPM (like the standard CAPM) assumes that national equity markets are segmented. Consequently the use of an estimate for U that is potentially significantly influenced by the presence of foreign investors introduces an inconsistency into the model. One possible response to this might be to argue that the shortcoming from use of a model that fails to reflect the reality of international capital flows should not be compounded by using an estimate of U that also fails to reflect international investors. However

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[6] Brown and Clarke use slightly different methodology enabling them to include partly franked dividends in the data set.

[7] Interestingly McDonald (2001) obtains a similar figure in a study of the German market.

[8] J.B. Were (1996) estimate that 30% of Australian equities were foreign owned. This fact alone would point to an estimate for U of .70, which is almost identical to the Bruckner et al (1994) estimate.

the effect of recognising foreign investors only in this one respect would be to lower the perceived value of a firm (and hence raise the output price allowed by the ACCC). By contrast, the overall effect of internationalization is likely to involve raising the value of a firm (and hence lower the output price that should be allowed by the ACCC), because the adverse effect upon the usability of imputation credits is likely to be more than offset by the positive effects from a lower risk premium. Thus recognition of foreigners only in the estimate of U would push the calculated value of a firm further away rather than closer to the "correct" answer, i.e., it leads to a raising in the output price allowed by the ACCC when the appropriate direction is a lowering.

To illustrate this point, consider a regulated firm that has just been set up, with no debt, and with assets costing \$100*m* and of indefinite life. The expected output is 1*m* units per year and there are no operating costs. Letting the allowed output price be denoted P, then the expected cash flow in year 1 before company tax is \$*Pm*. Taxable income is likewise and both are expected to grow at 3% pa indefinitely. Consistent with the discussion in the next section, the ratio IC/TAX is assumed to be 1. If equity markets are fully segmented then a utilization rate U of close to 1 will prevail, and we assume 1. In addition the Officer version of the CAPM is employed. Consistent with the example in the previous section, we use a riskfree rate of .06, a market risk premium of .06, and an equity beta of 1, leading to a cost of equity of .12. Following equation (2), the effective tax rate is

$$T_e = .30[1 - 1(1)] = 0 \tag{10}$$

Following equation (6), the output price P should be chosen so that the present value of the cash flows to equityholders, discounted at the cost of equity of .12, equals the asset cost of \$100*m*, i.e.,

$$\$100m = \frac{\$Pm(1-0)}{1.12} + \frac{\$Pm(1-0)(1.03)}{(1.12)^2} + ... = \frac{\$Pm(1-0)}{.12-.03} \tag{11}$$

Solving this yields an output price of \$9. By contrast, if national equity markets are completely integrated, then the Officer CAPM should be replaced by an international version. Following the discussion in the previous section, we invoke the Solnik model and the estimate there for the cost of equity of this firm of .088. In addition a value for U of zero is invoked. Recomputing the effective tax rate in (10) and then the output price in (11), the results are

$$T_e = .30\left[1 - 1(0)\right] = .30$$

$$\$100m = \frac{\$Pm(1-.30)}{1.088} + \frac{\$Pm(1-.30)(1.03)}{(1.088)^2} + ... = \frac{\$Pm(1-.30)}{.088-.03}$$

Solving the last equation yields an output price of \$8.28. Thus the full effect of internationalization is to reduce the appropriate output price. By contrast, if one continues to use the Officer model but recognizes the effect of internationalization upon the value of U, by reducing the estimate from 1 to the generally employed figure of .60, then the last two equations become

$$T_e = .30\left[1 - 1(.60)\right] = .12$$

$$\$100m = \frac{\$Pm(1-.12)}{1.12} + \frac{\$Pm(1-.12)(1.03)}{(1.12)^2} + ... = \frac{\$Pm(1-.12)}{.12-.03}$$

Solving the last equation then yields an output price of \$10.23. Thus the full effect of internationalization would be to *reduce* the allowed output price by 10%, whereas recognizing only a reduction in U leads to the allowed output price *rising* by 14%. Thus the common practice of recognizing the effect of foreign investors in the estimate of U, but not also in the choice of CAPM, has a totally perverse effect. Accordingly it is not recommended.

In summary then, the estimate for U of around .60 that has been deduced from ex-dividend studies is not recommended. Lonergan (2001) goes even further and argues that an appropriate estimate of U is close to zero, primarily because Australia "..is a price-taker in the world's capital market". He goes on to note that use of a higher value for U by regulatory authorities leads to the result that "..some investors are being deprived of part of the return to which they properly should be entitled". However, if it is true that Australia is a price-taker in the world's capital market, then it follows not only that the value of *U* is close to zero but also that the appropriate CAPM to employ is an international version. In the above example, the allowed output price should then fall from \$9 to \$8.28. However, if a value for *U* of zero was adopted, but the Officer model was still used, then equations (10) and (11) would become

$$T_e = .30[1 - 1(0)] = .30$$

$$\$100m = \frac{\$Pm(1-.30)}{1.12} + \frac{\$Pm(1-.30)(1.03)}{(1.12)^2} + ... = \frac{\$Pm(1-.30)}{.12-.03}$$

Solving the last equation yields an output price of \$12.86. However the correct figure is somewhere between \$8.28 and \$9. By lowering the utilization rate *U*, but not also modifying the form of the CAPM, a form of "cherry picking" is being practiced, whose effect is to *raise* the allowed output price when it should be *lowered*.

An alternative means of illustrating the same point is to examine a recent ACCC Decision in which a WACC is presented that includes within it the imputation effect on company tax. Considering the Moomba Final Decision (ACCC, 2001), Table 2.14 presents a pre-tax nominal WACC of this form and the figure given is .094[9]. Inter alia this calculation embodies a market risk premium of .06, an equity beta of 1.16 and a "gamma" value of .50 (this is the product of *U* and the *IC*/*TAX* ratio). If gamma is reduced to zero, as suggested by Lonergan, then the WACC will rise from .094 to .097, i.e., in the direction recommended by Lonergan. However, consistency requires that an international CAPM is also invoked. Using the Solnik model, with a market risk premium of .04 and an equity beta reduced by 30% (as discussed earlier in section 4), the resulting WACC falls to .081, i.e., in the opposite direction to that recommended by Lonergan[10].

[9] The formula here is Officer's (1994) formula (7) converted to pre-tax terms by dividing through WACC by (1-*T*).

[10] Lally (1998) considers this issue in the context of a CAPM that impounds the imputation tax effect into the discount rate rather than the cash flows. The overall effect of a shift from a domestic to an international CAPM is to reduce the discount rate, and this implies a reduction in the allowed output price. This is consistent with the result obtained here.

In summary then, within the context of the Officer model, it is not appropriate to recognize foreign investors. Consequently an estimate for the utilisation rate of close to 1 is recommended.

5. Estimation of the Ratio of Imputation Credits to Company Tax Paid

Within the context of the Officer model, the ratio *IC*/*TAX* is firm specific. Variation across firms will arise from variation in the ratio of Australian company tax paid to Australian sourced "profits", and variation in the ratio of cash dividends to "profits"[11]. For example, a firm might generate "profits" of $4m, pay Australian company tax of $1m and pay a dividend of $3m. There is no rationale for withholding imputation credits, and hence this firm would be expected to attach the entire $1m as imputation credits. The value of *IC*/*TAX* would then be 1, as would the payout rate. However, the two rates can diverge. If the dividend (*DIV*) was less than $2.33m, the attached imputation credits would have to be less than $1m, in accordance with the restriction that

$$IC \leq DIV\left[\frac{T_c}{1-T_c}\right] = DIV\left[\frac{.30}{1-.30}\right] = .43DIV$$

Thus, if the dividend was $2m, then *IC* could not exceed $.86m. Assuming it was set at this upper limit, then *IC*/*TAX* would be .86, and the payout rate would be .67. If the dividend was $2.5m then *IC*/*TAX* would be 1 but the payout rate would be .83. These examples demonstrate that the ratio *IC*/*TAX* may diverge from the payout rate, and therefore the latter should not be treated as an estimate of the former. This caveat appears warranted in the light of frequent suggestions that appear to involve using the payout rate in this way.

[11] Profit is used here to mean some performance measure on which dividends are based rather than to mean taxable income. The obvious performance measure is accounting profit. Also, as indicated earlier, the Officer formula presumes that the operation being valued is Australian, and therefore any company taxes paid are Australian, which give rise to imputation credits.

Within the present context, in which the ACCC prescribes an output price, there are some difficulties in utilizing the firm's actual ratio *IC*/*TAX*. First, it raises the computational burden to the ACCC. Secondly, it generates a further area of controversy in estimation. Finally, if the firm's ratio is less than 1, then the firm will be encouraged to raise its payout rate, and such behaviour may be value damaging because the valuation model employed does not capture all aspects relevant to dividend policy[12]. However these concerns can be mitigated by using the relevant industry average. This compromise is then recommended.

Notwithstanding this recommendation, the market average is still of interest, as an indicator of a typical outcome at the industry level. Accordingly the ratios for the eight largest listed firms in Australia were examined, i.e., Telstra, News Corporation, NAB, BHP, Rio Tinto, Westpac, Commonwealth Bank and ANZ. Collectively they constitute almost 50% of listed equity in Australia. In all cases their most recent financial statements reveal that the ratio *IC*/*TAX* was equal to one. In respect of Telstra, News Corp and BHP, it is evident that the ratio is one from the fact that some recent dividends have not been fully franked. In respect of the remaining companies, recent dividends have all been fully franked. Nevertheless there are currently no surplus imputation credits. Accordingly, all company taxes that have been paid have been passed on as imputation credits. This selective sample suggests that the ratio *IC*/*TAX* is close to one for most industries.

In summary then, it is recommended that the ratio *IC*/*TAX* for the firm of interest be set at the industry average. In most cases this should be at or close to one. In conjunction with the recommended estimate for the utilization rate of 1, this implies that the product of these two parameters (called gamma by the ACCC) should be at or close to 1 for most firms. Thus the imputation-adjusted company tax rate should be zero for most firms rather than the currently employed estimate of 50% of the statutory tax rate. The effect of this change would be to lower the allowed output prices of regulated firms.

[12] For example, one factor relevant to dividend policy is the extent to which capital gains are taxed less onerously than ordinary income. However, to simplify, the Officer model assumes that they are equally taxed.

6. Estimating the Market Risk Premium

6.1 Estimation by Historical Averaging

As indicated in equation (4) the market risk premium in the Officer CAPM is defined as

$$k_m + UD_m \frac{IC_m}{DIV_m} - R_f \tag{12}$$

A number of approaches are available for estimating this parameter. The first employs historical data, and averages over the ex post annual outcomes for a long time series. The ex-post outcome for (12) in any year is

$$R_m + UD_m \frac{IC_m}{DIV_m} - R_f \tag{13}$$

where R_m is the actual rate of return on the market portfolio over a period, comprising only cash dividends and capital gains. For years prior to 1987, when dividend imputation did not operate, the central term in (13) disappears and the ex-post value is simply $R_m - R_f$. This process of averaging over ex-post outcomes follows Ibbotson and Sinquefield (1976), who applied it to US market returns from 1926.

In applying the process there are four significant controversies. The first concerns how much historical data is used. Use of older data risks sampling from periods in which the market risk premium was different. Disregarding all but the most recent data guarantees an impossibly large standard error on the estimate. Theory offers no guidance as to the optimal trade-off.

The second controversy involves whether the time-series averaging should be arithmetic or geometric. Proponents of the latter (minority) view include Copeland et al. (1994, pp. 260-263) and Damodaran (1997, pp. 126-127), and the effect of using such a process is to reduce the estimate of the Australian market risk premium by almost .02 (Dimson et al, 2000, Table 5). Theoretical support for the geometric mean is offered by Blume (1974), who argues that one should seek an estimator $\hat{m}$ of the expected return m which has the property that, over n future years, the estimator $\hat{m}^n$ is unbiased with respect to m^n. For n = 1, the arithmetic mean is an unbiased estimator of m. However, for $n > 1$, Blume shows that the arithmetic mean is biased up and the geometric mean biased down. Accordingly he proposes a weighted average of the two.

Cooper (1996) extends this approach to argue that, for discounted cash flow purposes, one should seek an estimator $\hat{m}$ such that $1/(\hat{m})^n$ is unbiased with respect to $1/m^n$. Because of both the power and inverse transformations just described, an estimator $\hat{m}$ that is unbiased with respect to m will not meet this test. Thus the arithmetic mean is inappropriate. However Cooper offers no support for the geometric mean. The appropriate estimator lies above the arithmetic mean, and hence even further from the geometric mean (which is always below the arithmetic mean). Furthermore, for $n <$ 20 years, the preferred estimator is close to the arithmetic mean. For $n >$ 20 years, the preferred estimator departs significantly from the arithmetic mean but the effect on present value is small.

A third level of sophistication is to allow for the well-documented evidence of negative autocorrelation in long-horizon returns (see Fama and French, 1988a; Poterba and Summers, 1988). Indro and Lee (1997) show by simulation that negative autocorrelation affects the biases in both arithmetic and geometric means. Nevertheless, for $n <$ 20 years, the effect is very small so that Cooper's conclusion is preserved, i.e. the arithmetic mean is a good approximation[13].

The third significant controversy in this area concerns the choice of term for the riskfree rate. In principle it should correspond to the investor horizon implicit within the CAPM. However the model gives no guidance in determining this. Booth (1999) examines the errors that can arise. For example, suppose that the Ibbotson averaging is done over market return net of the yield on long-term government bonds, but the investor horizon is short term. The short-term investor horizon implies that the expected market return (k_m) is the sum of the short-term government stock rate (R_{fS})

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[13] Indro and Lee examine the effect of negative autocorrelation on estimates of m^n rather than $1/m^n$. Clearly the latter is more appropriate for DCF purposes.

plus the market risk premium (u). In addition the short-term investor horizon implies that the long-term government bond rate (R_{fL}) is the sum of the short rate plus a risk allowance (p). It follows that the market risk premium relative to long bonds is

$$k_m - R_{fL} = \lfloor R_{fS} + u \rfloor - \lfloor R_{fS} + p \rfloor = u - p$$

Thus, if the current value of p exceeds the historical average then the current value of the market risk premium relative to long bonds will be low. However the Ibbotson averaging process engaged in will embody the historical average for p rather than the current value, and will therefore be biased up. Booth (1999) shows that the systematic risk of long-term bonds is particularly high at the present time, suggesting that p is currently high. Consequently, if the investor horizon is short-term, and the Ibbotson averaging process uses yields on long-term bonds, it will be biased up. In addition, even if the current value for p equals the historical average, error will still arise for stocks whose beta differs from 1. It might seem that the solution here is to define the market risk premium relative to short bonds. However, the investor horizon may be long term, and therefore we just swap one source of bias for another.

Applying the Ibbotson methodology, with arithmetic averaging and long-term bond yields (10 yr), Dimson et al (2000, Table 2) estimates the Australian market risk premium at .07, using data from 1900-2000[14]. This data omits inclusion of the central term in (12). However, since this term applies only since 1987, the omission exerts only a minor effect on the average across the full 100 years of data. To see this, the current value for the central term in (12) involves a value for U of 1, a market dividend yield of .032 (data courtesy of JP Morgan), and a franking rate of .19 (data also courtesy of JP Morgan). The product is .006. If it is attributed to each of the 13 years since the introduction of imputation, the effect upon the estimate of (12) is to raise it by less than .001[15]. In addition to this data issue, the introduction of

[14] The data are largely drawn from Officer (1989), who had earlier estimated the premium using data from 1882-1987. However it should be noted that Officer uses bond yields in his calculation whereas Dimson et al use bond returns. The use of bond yields seems more in accord with the model and the effect of using them would be to slightly raise the estimate for the market risk premium.

[15] The average cash dividend yield of the "market" over the 13 year period was in fact slightly more than the current figure of .032 (data courtesy of JP Morgan). However the average franking rate is likely to have been less than the current value because franking credits can only be obtained from

imputation in 1987 would have introduced a regime shift (downwards) in k_m. However, as noted by Officer (1994, p. 10) this should be equal to the central term in (12) so that (12) would have been invariant to the regime shift.

A variant on the Ibbotson approach arises from Siegel (1992), who observes that the expected real return on equity appears to be stable over time. This suggests that k_m should be estimated from the long-run average real return on equity and the current forecast for inflation. The market risk premium then follows by deducting the current value for the riskfree rate, and Siegel generates significantly different results for the US from this approach relative to the Ibbotson approach. This approach is free of the problem identified by Booth (1991), and described above. However it ignores the presence of dividend imputation. Notwithstanding this point, modifications can be made.

Applying this approach, the average real value of R_m is .091 (Dimson et al, 2000, Table 2), and forecast medium term inflation is .025 (Australian Department of Treasury, 2001)[16]. Invoking the Fisher relationship, the current estimate for k_m is then .118. Deducting the current long-term bond yield of .062 (using 10 yr bonds to be consistent with the Dimson data[17]) generates an estimate for the market risk premium over long-term bonds of

$$k_m - R_f = .118 - .062 = .056$$

However, as noted, k_m will have experienced a regime shift downwards with the introduction of imputation, equal to the central term in (12), i.e., $UD_m IC_m / DIV_m$. This regime shift will have had little effect upon the historical average but a more pronounced effect upon the current value. Thus, to estimate the current value of k_m, one should deduct the current value of the central term from the above estimate of .118. This estimate for k_m should then be inserted into equation (12) to yield an estimate for (12) of

company tax paid after the introduction of imputation; this has no appreciable effect today but would have had a downward effect in the first few years following 1987. Thus even the figure of .001 may be too high.

[16] The forecast is from October 2001 but is not expected to change when it is updated shortly.

[17] The figure represents an average of the daily rates over April and May reported on the Reserve Bank's website.

$$\left[.118 - UD_m \frac{IC_m}{DIV_m}\right] + UD_m \frac{IC_m}{DIV_m} - R_f$$

Clearly the central terms here disappear and we are left with the same estimate of .056 appearing in the preceding equation. This estimate is close to the .06 figure currently used by the ACCC.

Whichever period, definition of the riskfree rate and form of averaging is used, there are a number of concerns with this historical averaging methodology. First, the true market portfolio is a value weighting of all risky capital assets (those held for investment purposes). The proxy used in the historical averaging approach is listed equity at most. This represents only a small proportion of the actual market portfolio, and the rest is not obviously similar in its risk characteristics[18]. The resulting potential for bias is well recognised in empirical tests of the CAPM – see Roll (1977), Kandel and Stambaugh (1987), Shanken (1987), and Roll and Ross (1994). In respect of the cost of equity capital, Lally (1995) indicates the potential for serious bias, through non-compensating biases in estimating both beta and the market risk premium.

The second concern is that the 95% confidence intervals on these estimates are large enough to admit substantial estimation error, even if the true value has not changed over the estimation period. With a standard deviation of .20 per year (see Dimson et al, 2000, Table 5), and 100 years of data, the resulting 95% confidence interval is ± .04. Since the point estimate arising from the Dimson data is .07, the 95% confidence interval ranges from .03 to .11. Relative to the debate over the correct value, these intervals are huge.

The third concern is that the estimates may be biased in a number of ways even if the true value has not changed over time. One of these is survivorship bias, in that estimation is based on data drawn from markets that survived, and this implies a sample average return in excess of the population parameter. The theoretical work of

[18] Stambaugh (1982) estimates that equities represent only about 25% of the US market portfolio.

Brown et al. (1995) suggests that substantial bias may thereby arise. In addition Jorion and Goetzmann (1999) survey a large set of markets, many of which have failed at some point, and find that the results from Anglo-Saxon markets are unusually high by about .03. However Dimson et al. (2000) identify a number of deficiencies in this study and, upon correcting for this, find that the results for Anglo-Saxon markets are not unusual. In particular the Australian result is close to the average. Another possible source of bias, suggested by Siegel (1992), is that unexpected inflation over the post WWII period has led to real returns on bonds (but not stocks) being significantly less than expected, and this has led to MRP estimates being biased upwards.

The fourth concern is bias arising from changes over time in the true value. Siegel (1999) suggests that the costs of acquiring a well-diversified portfolio (via a mutual fund) have fallen considerably in the past 20 years, and offers an estimate for the resulting reduction in the US market risk premium of .015. Other factors affecting the market risk premium, and which may have changed, are the "term premium", risk aversion, personal taxation, market risk and internationalisation. The "term premium" is the issue raised by Booth (1999), as discussed earlier, and it afflicts only the Ibbotson approach to historical averaging. In respect of risk aversion, a number of papers (Keim and Stambaugh, 1986; Campbell, 1987; Fama and French, 1988a, 1989; Schwert, 1990) indicate that a set of time-varying variables that could be regarded as proxies for risk aversion have some power to explain changes in the market risk premium[19]. However the statistical reliability of these relationships is weak.

In respect of personal taxation Gordon and Gould (1984) examine Canadian data for 1956-82, and found that the market risk premium net of personal tax averaged 4.9% over that period. They then construct a time-series for the pre-tax counterpart (i.e. the standard market risk premium) that would preserve the 4.9%. They find that it would have to vary enormously, from .5% to 5%! Such variation has two sources: changes in personal tax rates and changes in the riskfree rate. In respect of the latter, an increase in the riskfree rate implies a less than equal increase is needed in the pre-tax expected return on equities so as to preserve the market risk premium net of personal tax, because equities are taxed less onerously. Thus the pre-tax market risk premium falls in response to this rise in the riskfree rate.

In respect of market risk, changes can be measured with a high degree of accuracy, and they have been substantial. Merton (1980, Table 4) presents US estimates over successive four year periods from 1926 to 1978, and finds that the annualised standard deviation ranges from .45 during the Great Depression to .11 during the 1960s. Finally, in respect of internationalization, clearly there have been considerable developments since 1970. As indicated in section 3, this should lower the Australian market risk premium.

The fact that the market risk premium changes is aggravated by the fact that, as it changes, it drives equity prices and hence historical average returns in the *opposite* direction. Thus the bias is aggravated. For example, the apparent decline in market volatility over the sample period implies that the current market risk premium is below the historical average. Thus there is upward bias in the historical average return even if the decline in volatility did not raise market prices. The fact that it did raise prices implies that the historical average return is even more biased as an estimator of the current market risk premium. To illustrate this point, suppose that the market risk premium recently fell by .02, inducing a decline in k_m from .13 to .11 and raising market prices such that the average market return over the estimation period was raised by .01. Most past market returns would then be drawn from a distribution with mean .13 rather than the current value of .11. Consequently there will be an upward bias of almost .02 in estimating the current market risk premium from past data. In addition, the very event in question here raises average market returns by .01, and thereby imparts a further bias of .01. Thus the aggregate upward bias in estimating the current market risk premium from historical data is .03.

In recognition of this problem some authors (Fama and French, 2002; Jagannathan et al, 2000) have sought to estimate the standard market risk premium by historical averaging methods that avoid averaging actual market returns. The standard market risk premium is

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[19] These include business conditions, dividend yields and returns on low grade versus high-grade

$$k_m - R_f$$

and k_m is the sum of the expected dividend yield and the expected capital gain. The expected dividend yield can be estimated by the historical average dividend yield. The expected capital gain comes from expected growth in dividends, which in turn comes from expected growth in profits, and this in turn from expected growth in GDP. Fama and French (2002) estimate the expected capital gain from the average growth rate in dividends and also from the average growth rate in profits. Coupling these estimates of expected capital gain with the average dividend yield yields an estimate of k_m. Subtracting the average value of R_f then yields an estimate of the market risk premium. Jagannathan et al (2000) undertake a similar analysis except that they estimate the expected capital gain from the average growth rate in GDP. Applying these approaches to the US market yields estimates of the standard market risk premium of .026 - .043, considerably lower results than those obtained by historical averaging of the Ibbotson type. Results from the application of this methodology to Australian data are not yet available.

6.2 Other Estimates From Historical Data

The possibility that the market risk premium has changed over time has given rise to estimation processes that attempt to model this. The seminal paper in this area is Merton (1980), who suggests that the (standard) market risk premium is proportional to volatility and attempts to model this relationship. Scruggs (1998) clarifies the earlier controversy about the sign of the relationship (French et al., 1987, and Glosten et al., 1993, reach opposite conclusions) and concludes that it is positive. However the functional form of the relationship is not apparent. Friend and Blume (1975) conclude that aggregate relative risk aversion is constant, and this implies that the standard market risk premium is proportional to variance (see Chan et al., 1992). Merton estimates this ratio of the standard market risk premium to market variance at 1.9, using US data over the period 1926-78. Harvey (1991, Table VIII) offers estimates for 17 countries over the period 1970-1990, with a mean of 2.3 and a

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corporate bonds.

standard error of .30[20]. All of this suggests a figure of around 2. If we use this figure, and couple it with an estimate for the Australian market variance of $.183^2$ (Cavaglio et al, 2000, Table 1, using data from 1985-2000), the resulting estimate of the Australian market risk premium is

$$2\left(.183^2\right) = .067$$

This is an estimate of the standard market risk premium, i.e., $k_m - R_f$. If the data used to estimate the reward to risk ratio (estimated at 2) were drawn from the Australian market in the period since imputation was introduced, the estimate of .067 would require addition of the central term in (12). This would raise the .067 figure by about .013, as discussed in the previous section. If the data were drawn from the Australian market prior to the introduction of imputation, no adjustment would be required because the standard premium in the pre-imputation period should be equal to the Officer premium in the post imputation period. However the data are drawn from a variety of markets, some with imputation and some without. Even in markets with imputation (such as Australia) the data is drawn largely from the pre-imputation period. Thus the figure of .067 requires some adjustment, but by much less than .013. This suggests an estimate for the market risk premium of about .07.

As a form of cross-check, application of this methodology to the US market, along with the above reward to risk ratio of 2 and an estimate of the US market variance over the same 1985-2000 period (of $.153^2$: see Cavaglia et al, 2000, Table 1), yields an estimate for the US market risk premium of

$$2(.153^2) = .047$$

This is remarkably consistent with Cornell's (1999, Chapter 4) estimate of .045 by the forward-looking approach or Welch's (2001) result of .045 from survey evidence (using long-term bond yields in both cases).

[20] Harvey also gives an estimate for Australia of 1.1, but the standard error of .90 is so large that the estimate is quite unreliable.

This approach to estimating the market risk premium avoids most of the problems associated with historical averaging. However both the estimated reward to risk ratio and the estimated variance are subject to statistical uncertainty, particularly the former. There is also doubt surrounding the choice of variance rather than standard deviation as a measure of volatility. Merton (1980) estimates the ratio for each of these approaches, and they can generate dramatically different estimates of the market risk premium.

In addition, even if the market volatility estimate is accurate, the resulting estimate of the market risk premium is only good for a future period matching that for which current volatility will remain unchanged. Clearly the fact that it has changed in the past implies that it will do so in the future. If it follows a random walk without drift, this will not be a concern because today's value will then be the best estimate for all future years. However, as one might expect, the market risk premium appears to exhibit mean reversion over time (see Bookstaber and Pomerantz, 1989). Consequently one would have to estimate market risk over a sufficiently long period in the past as to act as a good estimate for the future period of interest. If this past period is equal to that used in Ibbotson type analysis, the resulting MRP estimate will be much like that from the Ibbotson approach. For the ACCC's purpose, in which output prices are set for five years, the estimate for the market risk premium need only hold for five years. Thus an estimate of market volatility should be good for the same period. Just which historical period should be used for this purpose is unclear.

The Merton study is only one of a number of papers that have attempted to generate time-varying estimates of the market risk premium by estimating a functional relationship from historical data. Other examples are Fama and French (1988b, 1989), Schwert (1990) and Pastor and Stambaugh (2001). All appear to face estimation difficulties even more severe than those of the Merton methodology.

6.3 Forward-Looking Estimates

Forward-looking estimates are determined by first finding a value for k_m that reconciles the current market value of the "market" portfolio with forecasts of future dividends. This is then inserted into equation (12) along with the current values of the other parameters to yield a current estimate of the market risk premium. Thus there is no reliance upon historical data, only current information and forecasts. The mechanics of estimating k_m are as follows. Let P denote the current value of the "market" portfolio, DIV_m the current level of cash dividends and g_1, g_2…..the forecast growth rates in cash dividends to existing shareholders. It follows that

$$P = \frac{DIV_m(1+g_1)}{1+k_m} + \frac{DIV_m(1+g_1)(1+g_2)}{(1+k_m)^2} + ...$$

The focus upon dividends to existing shareholders implies that future share issues can be ignored, and it implies that the expected growth rates g_1, g_2…are equal to those for dividends per share. From some point (call it year N) the expected growth rate must be assumed to be constant, and is denoted g. Following the constant growth model (Gordon and Shapiro, 1956), and letting P_N denote the value of the market portfolio in N years, the preceding equation can then be expressed as

$$P = \sum_{t=1}^{N} \frac{DIV_m(1+g_1)....(1+g_t)}{(1+k_m)^t} + \frac{E(P_N)}{(1+k_m)^N}$$

$$= \sum_{t=1}^{N} \frac{DIV_m(1+g_1)....(1+g_t)}{(1+k_m)^t} + \frac{\left[\dfrac{DIV_m(1+g_1)....(1+g_N)(1+g)}{k_m - g}\right]}{(1+k_m)^N}$$

Dividing through by P yields

$$1 = \sum_{t=1}^{N} \frac{D_m(1+g_1)....(1+g_t)}{(1+k_m)^t} + \frac{\left[\dfrac{D_m(1+g_1)....(1+g_N)(1+g)}{k_m - g}\right]}{(1+k_m)^N} \tag{14}$$

where D_m is the current dividend yield on the "market" portfolio. This current dividend yield is observable. However the expected growth rates must be estimated.

A particularly simple case of equation (14) is to assume that the expected growth rates in dividends per share for all future years are equal, i.e., the growth rate g applies immediately and hence $N = 0$. Equation (14) then collapses to

$$1 = \frac{D_m(1+g)}{k_m - g}$$

Solving for k_m yields

$$k_m = D_m(1+g) + g$$

This is the well known "Discounted Dividends Model" but applied to the entire market rather than a single company. One commonly used approach to the estimation of the expected growth rate in dividends per share (g) is to employ analysts' forecasts for earnings per share over the next few years (see Harris and Marston, 1992, 2001)[21]. However Cornell (1999, Ch. 4) observes that these short-term forecasts are typically in excess of reasonable estimates of the long-run growth rate in GDP. Since dividends are part of GDP, the indefinite extrapolation implies that dividends will eventually exceed GDP, and this is logically impossible. Accordingly Cornell suggests that short-run forecasts of the growth rate in earnings per share should converge upon the forecast long-run GDP growth rate, and he suggests a convergence period of 20 years. Since the long-run growth rate in dividends per share cannot exceed the long-run growth rate in aggregate dividends, and the latter cannot exceed the long-run growth rate in GDP, then the resulting estimate of the market risk premium is an upper bound on the true value.

This process is now applied to the Australian market. Recent estimates for the weighted average growth in earnings per share of Australian companies are .129 for 2002 and .115 for 2003 (data courtesy of JP Morgan)[22]. In addition the current cash

[21] Dividends per share may grow at a rate differing from that of earnings per share, but this can only be temporary and must have a future offsetting effect. For example, faster initial growth in dividends per share relative to earnings per share must be followed by slower growth. In the interests of simplification, it is assumed that dividends per share always grow at the same rate as earnings per share.

[22] There is evidence of upward bias in these estimates but the degree appears to be small for forecasts out to two years ahead. Claus and Thomas (1999, Table V) report upward biases of less than 1% for this forecast period. Biases of this order would have little effect upon the results in this paper.

dividend yield on the Australian market is .032 (data courtesy of JP Morgan). Furthermore, an estimate for the long-run growth in Australia's GDP is .061, comprising inflation of .025 and real growth of .035 (Australian Department of Treasury, 2001)[23]. This inflation rate is consistent with use of the current riskfree rate. However the estimate for the real growth rate is more problematic, and alternative values will be considered.

If it takes 20 years for the growth rate in dividends per share to converge upon this long-run growth rate in GDP, and convergence is linear from the year 2 forecast, then the expected growth rates in dividends per share over each of the next 20 years are as follows:

.129, .115, .112, .109, .106, .103, .100, .097, .094, .091
.088, .085, .082, .079, .076, .073, .070, .067, .064, .061

Insertion of these expected growth rates into equation (14) then yields an estimate for k_m of .113. This is then substituted into equation (12), along with current values for R_f, U, D_m and IC_m/DIV_m. As indicated earlier in section 6.1, the current values are .062, 1, .032 and .19 respectively. This yields an estimate for the market risk premium of

$$.113 + (1)(.032)(.19) - .062 = .057$$

This estimate is sensitive to the estimates of the expected growth rates in dividends per share, and these in turn to the long-run real growth rate in GDP (g_r) and to the period required before the growth rate in dividends per share converges upon this (N). In respect of N, some analysts assume convergence to long-run growth rates immediately after their explicit forecasts for future years EPS terminate, which would imply $N = 2$ in this case. Others (for example, Davis, 1998) employ only the long-run data, i.e., $N = 0$. The latter are computationally simple but involve disregarding apparently relevant information (forecasts of earnings per share). Table 1 below shows estimates of the market risk premium as a function of g_r and N. In addition to the estimate mentioned above for g_r of .035, a lower figure of .030 is also considered,

[23] The figures are from October 2001 but are not expected to change when they are next updated. In respect of GDP forecast, Cornell (1999, Ch. 4) assumes a long-run real growth rate in GDP for the US of .025.

in recognition of the fact that the long run real growth rate in the cash dividends of existing shares in existing Australian companies must be below the long run growth rate in GDP[24]. Plausible values of *N* are 5-20 years, and this implies an estimate for the market risk premium from .040 to .057.

TABLE 1

Estimated Market Risk Premium

	N (yrs)			
g_r	0	2	10	20
.030	.032	.038	.045	.054
.035	.036	.043	.049	.057

A variant on the approach just presented is to transform equation (14) to express market value as the sum of book value and the present value of expected excess earnings. The latter are then forecast rather than dividends. Claus and Thomas (2001) apply this methodology to various countries and generate estimates of the standard market risk premium of around .03. Results from applying the methodology to Australia are not yet available.

These forward-looking approaches have a number of limitations. First, as already noted, estimates of the long-run growth rate in GDP and the period before the growth rate in dividends per share converges upon this are problematic. Second, since the current market value of the "market portfolio" is a parameter in this approach, it must be assumed that this is rationally determined. Finally, forward-looking estimates reflect the actual pricing model invoked by the market. If this differs from the model into which the estimate of the market risk premium is inserted, then there will be an inconsistency. In particular, if prices reflect some degree of internationalization (leading to higher equity prices and therefore a lower estimate for the market risk

[24] It is the cash dividends of all shares in all Australian companies (some of them yet to be established) that cannot grow in the long-run in real terms by more than .035.

premium using this method), then this estimate will be too low for insertion into the Officer version of the CAPM.

6.4 Summary

To summarise this review of evidence on the market risk premium in the Officer CAPM, the estimates are .07 from historical averaging of the Ibbotson type, .056 from historical averaging of the Siegel type, .07 from the Merton methodology, and .040-.057 from the forward-looking approach. If a point estimate for the last approach is .048, then the average across these four approaches is .061. In addition various other methodologies have been alluded to, for which Australian results are not available but which have generated low values in the markets to which they have been employed. All of this suggests that the ACCC's currently employed estimate of .06 is reasonable, and no change is recommended.

7. Differential Taxation of Ordinary Income and Capital Gains

7.1 Modeling Differential Taxation

As previously discussed the Officer model assumes that ordinary income and capital gains are equally taxed in Australia. The extent to which this assumption is false depends upon the set of investors examined. The principal holders of Australian equities are foreigners, companies, superannuation funds and individuals. As discussed previously in section 4, on account of assuming that national capital markets are segregated, recognition of foreign investors is both inconsistent and leads to perverse results. Accordingly they are omitted from consideration. In respect of corporate holdings of shares in other companies, inclusion of them would lead to double-counting because the values of shares held by companies is already reflected in the values of shares held by the other three classes of shareholders. Consequently corporate owners of shares are ignored. Nevertheless, if companies were subject to taxation on the dividends received from other companies, then the personal tax rates faced by the ultimate recipients of dividends (individuals and superannuation funds) would need to be increased to reflect this. However, companies are not taxed on dividend income, and therefore this potential complication is absent. Thus, having excluded both foreign investors and corporate shareholders, only individuals and superannuation funds need to be considered.

In respect of individuals and superannuation funds there are three factors that suggest that their taxes on capital gains will be considerably less than on ordinary income. Firstly, it is probable that most of their equities are held for more than one year, and therefore most of the resulting capital gains will be taxed at the concessionary "long-term" rates. This is true despite an average turnover rate for Australian stocks in recent years of around 50% (Australian Stock Exchange, 2001), because of wide variation across investors in their holding periods[25]. To illustrate this point, suppose 10% of stock is traded four times a year and the rest is traded every ten years; the turnover rate is then 50% but 90% of stocks are subject to long-term capital gains tax. Secondly, in respect of these long-term gains, individuals are now subject to tax on only 50% of the assessable gains, and superannuation funds on only 67% of them[26]. Finally, capital gains are taxed only on realisation and the resulting opportunity to defer payment of the tax is equivalent to a reduction in the statutory rate of tax. Protopapadakis (1983) estimates that the opportunity to defer reduces the effective tax rate on capital gains by about 50%.[27] Collectively these features of investor behaviour and the Australian taxation regime for capital gains suggest that, on average, individual investors and superannuation funds will pay capital gains tax at only 25% and 33% respectively of the rates applicable to ordinary income[28].

These results suggest that a significant error in estimating the cost of capital may arise from use of a model that assumes equal tax treatment of capital gains and ordinary income. Furthermore the principle that capital gains are taxed less onerously than ordinary income, because of exemptions and/or the deferral option, is well recognised,

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[25] Froot et. al (1992, Table 1) report variations across investor classes in the US ranging from one to seven years, the latter for passive pension funds. The variation across individual investors will be even more pronounced.

[26] Under the previous tax regime, only the real return was subject to tax.

[27] The result reflects the US tax regime in a period in which long-term capital gains (greater than one year) were subject to concessionary treatment similar to the current situation in Australia. Thus, prima facie, the result is suggestive about the Australian situation. It should also be noted that the opportunity to defer lowers the effective tax rate not only because of the time value of money but also, as Hamson and Ziegler (1990, p. 49) note, because gains can be realised when the investor's tax rate is lower, such as in retirement.

not only for Australia (see Howard and Brown, 1992) but other countries including the US (see Constantinides, 1984) and the UK (see Ashton, 1991). Within New Zealand this point is sufficiently acknowledged, and has been for several years, to the extent that standard practice in estimating the cost of capital is to invoke a model recognizing less onerous tax treatment of capital gains relative to ordinary income (see, for example, New Zealand Treasury, 1997).

To determine whether recognition of this issue would materially alter the results from the Officer model, it is necessary to construct a model of the cost of equity that allows for differential tax treatment of capital gains and ordinary income. Various authors have done so, including Ashton (1989, 1991), Lally (1992), Cliffe and Marsden (1992), Dempsey (1996) and Brailsford and Davis (1995). However all of these models treat dividend imputation as a process that lowers the tax rate on dividends rather than the corporate tax rate. Consequently their cost of equity is defined over returns exclusive of imputation credits. Consistency with the Officer model would require that returns be defined to include imputation credits. Lally and van Zijl (2001) have done this and the result is

$$\hat{k}_e = R_f(1-T) + D\left(1+U\frac{IC}{DIV}\right)T + \left[\hat{k}_m - R_f(1-T) - D_m\left(1+U\frac{IC_m}{DIV_m}\right)T\right]\beta_e \qquad (15)$$

where D is the cash dividend yield for the company in question. In addition the parameter T is a weighted average (across investors) of the following tax ratio

$$\frac{t_i - t_{gi}}{1-t_{gi}}$$

where t_i is the ordinary tax rate of investor i and t_{gi} is their tax rate on capital gains (this rate impounds the effect of the deferral option). Thus the parameter T is a measure of the extent to which ordinary income is taxed more heavily than capital gains[29].

[28] The 25% figure for individuals reflects all gains being taxed at the long-term rate, with a 50% exemption and a further 50% reduction to reflect the deferral effect. The 33% figure for institutions is calculated in a parallel fashion.

Clearly the formula (15) is more complex than the Officer model (3), and the intuition for the additional terms is as follows. The additional terms are of two types: firstly, a dividend term for the firm in question, inclusive of imputation credits to the extent they are usable (and its market counterpart inside the market risk premium term); secondly, the riskfree rate R_f is replaced by $R_f(1-T)$. In respect of the gross dividend term, as this rises, the firm substitutes gross dividend for capital gain. The former is taxed at the ordinary rate and the latter at the capital gains tax rate. If the ordinary tax rate is higher than the rate on capital gains then the increase in gross dividend at the expense of capital gain is disadvantageous in tax terms and therefore must be compensated for by higher expected return. This is the effect of the dividend term. In respect of the riskfree rate, to see the effect of this, assume that the dividend is zero. Now consider the effect as beta goes to zero. Equation (15) says that the expected return on equity goes to $R_f(1-T)$, which is less than the riskfree rate. This occurs because the firm's equity resembles a riskless asset except that it is taxed as capital gain rather than at the ordinary tax rate applicable to interest. If the tax rate on capital gains is less than the ordinary tax rate (i.e., T is positive) then the expected return of zero beta equity before personal tax does not need to be as high as R_f.

7.2 Comparison of Models

Whether equation (15) yields a materially different result to that of the Officer model (3) depends on a number of factors. One of them is how the market risk premium is estimated. One possibility is that the current value of k_m is estimated by the Siegel (1992) or forward-looking methods, and then translated into an estimate of the market risk premium using current values of the remaining parameters. In this event, models (3) and (15) will involve the same estimate for k_m, and hence $\hat{k}_m$. The excess of the estimated cost of equity in (15) over that of the Officer model in (3), and denoted Δ, will then be

$$\Delta = T\left\{D\left(1+U\frac{IC}{DIV}\right)-R_f+\beta_e\left[R_f-D_m\left(1+U\frac{IC_m}{D_m}\right)\right]\right\} \qquad (16)$$

[29] Equation (15) can also be obtained from Lally (1992, 2000b) by adding the imputation credits (to the extent they can be used) to his formula for the cost of equity.

Clearly the difference here is zero if T is zero, and a sufficient condition for this is that all investors are equally taxed on ordinary income and capital gains. Less apparent, but more significant, is the fact that the difference will also be zero if the individual company in question matches the market in its beta, dividend yield and franking ratio, i.e.,

$$\beta_e = 1, \quad D = D_m, \quad \frac{IC}{DIV} = \frac{IC_m}{DIV_m} \tag{17}$$

In respect of the industries that are being regulated by the ACCC, the asset betas are in general low, although the choice of leverage may reverse this. For example, in the AGL Final Decision (ACCC, 2000), an asset beta of .60 and leverage of .60 were specified, leading to an equity beta of 1.50. This is considerably in excess of that for the market, and equation (16) reveals that this would cause the cost of equity in (15) to exceed that from the Officer model, i.e., the Officer model would understate the cost of equity. In respect of the cash dividend yield and the franking ratio in (17), the values for the firm in question may differ from those of the market. If they do not differ then the difference in equation (16) reduces to

$$\Delta = T(\beta_e - 1)\left[R_f - D_m\left(1 + U\frac{IC_m}{DIV_m}\right)\right]$$

The values indicated earlier for R_f, D_m, U and IC_m/DIV_m were .062, .032, 1 and .19 respectively. In respect of the tax parameter T, Lally and van Zijl (2001) estimate the value at .23. Across the plausible range of equity betas, from .50 to 1.50, the resulting variation in Δ is only $\pm$.003, i.e., $\pm$.3%. This is not significant.

By contrast, if the cash dividend yield and the franking ratio for the firm of interest do diverge from the market averages, then Δ may be substantial. Using the values for R_f, U, D_m, IC_m/DIV_m, and T indicated above, equation (16) becomes

$$\Delta = .23\left[D\left(1 + \frac{IC}{DIV}\right) - .062 + .024\beta_e\right]$$

The bounds on a firm's dividend yield D are zero to .08 (the latter is the outer limit of observed yields on Australian companies when averaged over the last three years and when averages that are significantly influenced by one year's result are excluded). The bounds on the franking rate IC/DIV are zero to .43 (the latter is the largest value possible with a corporate tax rate of .30). Finally, plausible bounds on β_e are .50 to 1.50. Using these bounds, the most extreme values for Δ in the last equation are -.011 and .020.

We now consider the implications of estimating the market risk premium by historical averaging of the Ibbotson type. In this case, one should determine the ex-post value for the market risk premium for each year in a long time-series, and then average over these. As we have indicated earlier, using data for the last 100 years, the result for the Officer model is an estimate of about .07. For the model in (15) the estimate would be

$$AV\left[\hat{R}_m - R_f(1-T) - D_m\left(1+U\frac{IC_m}{DIV_m}\right)T\right]$$

where AV[.] denotes the sample average over [.]. This is equal to

$$AV\left[\hat{R}_m - R_f\right] + AV\left[\left(R_f - D_m\right)T\right] - AV\left[D_m U\frac{IC_m}{DIV_m}T\right] \tag{18}$$

The first of these terms is the historical averaging estimate for the market risk premium in the Officer model, i.e., .07. The last term is zero until 1987, because imputation did not commence until then. This represents only 13 of the 100 years in the data used for the historical averaging. Thus an estimate of it is 13% of the average value since 1987. This will be close to zero, as follows. The market cash dividend yield averaged .035 over this period (data courtesy of JP Morgan). Thus, even if the franking ratio was as much as .50 and T was as much as .30, then with U = 1, the post 1987 average for the last term in (18) would only be .005. Multiplication by .13 then yields less than .001, i.e., less than .1%. This can be ignored. The average in (18) is then

$$.07 + AV\left[\left(R_f - D_m\right)T\right] \qquad (19)$$

The last term in (19) is also close to zero because the estimate of T is well below one and, over the last 100 years, the difference between the riskfree rate and the market cash dividend yield has not been large. The average value for R_f over this period was .064 (Dimson, 2000, Table 2). Also, the average for D_m was about .04[30]. If the current estimate for T of .23 is attributed to the last 100 years, then the last term in (19) becomes .005 and the average in (19) becomes .075[31]. The excess of the estimated cost of equity in equation (15) over that of the Officer model in (3) is then

$$\Delta = T\left[D\left(1 + U\frac{IC}{DIV}\right) - R_f\right] + .005\beta_e \qquad (20)$$

If the dividend yield and the franking ratio for the firm of interest are similar to the market averages (of .032 and .19) then, with U =1, T = .23 and the current value of R_f of .062, the difference in (20) reduces to

$$\Delta = -.006 + .005\beta_e$$

Across the plausible range of values for the equity beta, from .50 to 1.50, the value of Δ departs from zero by only .004 at most. So, as with the situation in which the market risk premium is estimated by the Siegel or forward-looking methods, the difference between the estimated costs of equity from models (15) and (3) is slight. However, if the firm's values for D, IC/DIV or β_e depart from the market averages, then the excess in the estimated cost of equity from equation (15) over (3), as shown in equation (20), could be substantial. To demonstrate this we use the values above for R_f, U and T of .062, 1 and .23 respectively. In addition, we use the same bounds

[30] Data on D_m over the entire period is not available but Datastream gives an average of .043 over the period since 1973.

[31] Clearly the Australian tax regime changes as one moves back through time over the last century. In particular, capital gains tax did not apply to individuals prior to 1986, and this would induce an increase in *T*. However, it is also true that superannuation funds were not taxed on anything prior to 1986, and this would induce a reduction in *T*. It is also true that, as one moves back in time, the rates of tax on ordinary income tend to decline, and this also exerts a downward effect upon *T*. Taking account of all this, the current estimate for *T* of .23 seems reasonable as an upper bound estimate of the average value over the last 100 years.

used earlier for D, IC/DIV and β_e of 0 to .08, 0 to .43 and .50 to 1.50. Accordingly the difference in (20) could range from -.012 to .020.

7.3 Summary

In summary then, regardless of whether the market risk premium is estimated through the Ibbotson, Siegel or forward-looking methods, the difference in the estimated cost of equity from equations (3) and (15) is not significant if the cash dividend yield and franking ratio for the firm of concern are similar to their market counterparts. If they are not constrained to be similar, then the estimated cost of equity from (15) could diverge from the Officer model by as much as -.011 to .020 if the market risk premium is estimated through the Siegel or forward-looking methods, and by as much as -.012 to .020 under the Ibbotson method. The results from these two estimation approaches are pleasingly consistent. Clearly an increase in the cost of equity of .020 is significant. Nevertheless, even if it is true that the firm's cash dividend yield and franking ratio are unusual, there still remains the question of whether these parameter values should be acknowledged. As indicated in section 5, when discussing the ratio IC/TAX, it may not be desirable to use the firm's actual values. The compromise suggested there was to use the averages for the relevant industry. Applying the same practice here involves using the relevant industry averages for D and IC/DIV, and this will generate less extreme values for them. For example, if the maximum industry average D (dividend yield) fell from .08 to .053, then the most extreme difference in the costs from equity from models (3) and (15) would fall from .020 to .011.[32]

Whether effects up to this level justify a change in the model used is a matter for debate. Clearly no consensus has yet developed amongst Australian academics and practitioners for making such an adjustment, and it seems inappropriate for the ACCC to lead in this area. Consequently the continued use of the Officer model is recommended. Nevertheless, the suggestion that the cost of equity could be increased by up to .011 may lead to some enthusiasm for the adjustment on the part of regulated firms. However the argument for raising the utilization rate on imputation credits from the present generally employed figure of .60 to 1 is at least as strong, and will exert a countervailing effect upon the output price granted to a regulated firm. To illustrate this, consider the simple example of a regulated firm in section 4. With a utilization rate on imputation credits of .60 and a cost of equity of .12, the effective tax rate T_e and the valuation equation for the firm were as follows

$$T_e = .30[1 - 1(.60)] = .12$$

$$\$100m = \frac{\$Pm(1-.12)}{1.12} + \frac{\$Pm(1-.12)(1.03)}{(1.12)^2} + ... = \frac{\$Pm(1-.12)}{.12-.03}$$

Solving the last equation yielded an output price of \$10.23. If the cost of equity is raised by .011, then the last equation becomes

$$\$100m = \frac{\$Pm(1-.12)}{1.131} + \frac{\$Pm(1-.12)(1.03)}{(1.131)^2} + ... = \frac{\$Pm(1-.12)}{.131-.03}$$

and this implies that the output price rises from \$10.23 to \$11.48. However, if the utilisation rate is raised to 1, then the effective tax rate falls to zero and the output price drops back to \$10.10, i.e., slightly *less* than the original \$10.23.

In conclusion, no consensus has yet developed amongst Australian academics and practitioners for making an adjustment for differential taxation of capital gains and ordinary income, and it seems inappropriate for the ACCC to lead in this area. Consequently the continued use of the Officer model is recommended. If such an adjustment were made, it would raise the allowed output prices of some firms. However the argument for raising the utilisation rate on imputation credits is at least as strong, and the net effect of the two changes is unlikely to significantly benefit any firm.

8. Conclusion

[32] The largest industry average cash dividend yield in 2001 was .053 for "utilities" (data courtesy of JP Morgan).

This paper has examined a series of issues relating to the cost of equity under dividend imputation. The conclusions are as follows. First, regarding the issue of recognizing foreign investors, continued use of a version of the Capital Asset Pricing Model that assumes that national equity markets are segmented rather than integrated (such as the Officer model) is recommended. It follows that foreign investors must be completely disregarded. Consistent with the disregarding of foreign investors, most investors recognized by the model would then be able to fully utilize imputation credits.

Second, regarding the appropriate adjustment to the company tax rate to reflect the benefits of imputation, the utilization rate for imputation credits should be set at one, and this follows from the first point above. In addition the ratio of imputation credits assigned to company tax paid should be set at the relevant industry average, which appears to be at or close to one for most industries. These two recommendations imply an imputation adjusted company tax rate of zero rather than the generally accepted figure of 50% of the statutory rate. Put another way, they imply that the product of the utilization rate and the ratio of imputation credits assigned to company tax paid (denoted gamma by the ACCC) should be at or close to 1 for most companies rather than the currently employed figure of 0.50. The effect of this change would be to reduce the allowed output prices of regulated firms.

Third, in respect of the market risk premium in the Officer model, the range of methodologies examined give rise to a wide range of possible estimates for the market risk premium and these estimates embrace the current value of 6%. Accordingly, continued use of the 6% estimate is recommended.

Finally, regarding the differential taxation of capital gains and ordinary income, the simplifying assumption in the "Officer" model that they are equally taxed at the personal level could lead to an error in the estimated cost of equity of up to 1.1%, depending upon the relevant industry average cash dividend yield and franking ratio. Prima facie this is a sufficiently large sum to justify use of a cost of equity formula that recognizes differential personal taxation of capital gains and ordinary income, and such a formula is presented in this paper. However a consensus has not yet developed amongst Australian academics and practitioners for making such an adjustment and it seems inappropriate for the ACCC to lead in this area. Consequently the continued use of the Officer model is recommended. If such an adjustment were made, it would raise the allowed output prices of some firms. However the argument for raising the utilisation rate on imputation credits is at least as strong, and the net effect of the two changes is unlikely to significantly benefit any firm.

REFERENCES

Ashton, D. 1989, 'Textbook Formulae and UK Taxation: Modigliani and Miller Revisited', *Accounting and Business Research*, vol.19, pp.207-12.

_________ 1991, 'Corporate Financial Policy: American Analytics and UK Taxation', *Journal of Business Finance and Accounting*, vol.31, 465-482.

Australian Competition and Consumer Commission. 2000, *Access Arrangement by AGL Pipelines (NSW) Pty Ltd for the Central West Pipeline*.

____ 2001, *Final Decision: Access Arrangement Proposed by Epic Energy South Australia for the Moomba to Adelaide Pipeline System*.

Australian Department of Treasury. 1991, 'Financial Monitoring of Government Business Enterprises: An Economic Framework', Treasury Economic Paper No. 14.

_______________________________ 2001, *Mid-Year Economic and Fiscal Outlook 2000-01*.

Australian Stock Exchange. 2001, *ASX Fact Book*.

Ball, R. and Bowers, J. 1988, 'The Cost of Equity Capital under the Australian Imputation Tax System', working paper.

Blume, M. 1974, 'Unbiased Estimation of Long-Run Expected Rates of Return', *Journal of the American Statistical Association*, vol.69, pp.634-38.

Bookstaber, R. and Pomerantz, S. 1991, 'An Information-Based Model of Market Volatility', *Financial Analysts Journal*, Nov-Dec, pp.37-46.

Booth, L. 1999, 'Estimating the Equity Risk Premium and Equity Costs: New Ways of Looking at Old Data', *Bank of America Journal of Applied Corporate Finance*, Vol 12 No. 1, pp. 100-112.

Brailsford, T. and Davis, K. 1995, 'Valuation with Imputation', *JASSA*, March, pp.14-18.

___________ Faff, R. and Oliver, B. 1997, *Research Design Issues in the Estimation of Beta*, McGraw-Hill Series in Advanced Finance, Volume 1, McGraw-Hill Australia, Sydney.

Brown, P. and Walter, T. 1986, 'Ex-Dividend Day Behaviour of Australian Share Prices', *Australian Journal of Management*, vol.11, pp.139-52.

________ and Clarke, A. 1993, 'The Ex-Dividend Day Behaviour of Australian Share Prices Before and After Dividend Imputation', *Australian Journal of Management*, vol.18, pp.1-40.

Brown, S., Goetzmann, W. and Ross, S. 1995, 'Survival', *Journal of Finance*, vol.50, pp.853-73.

Bruckner, K., Dews, N. and White, D. 1994, 'Capturing Value from Dividend Imputation', *McKinsey and Company*.

Campbell, J. 1987, 'Stock Returns and the Term Structure', *Journal of Financial Economics*, vol.18, pp.373-99.

Chan, K., Karolyi, A. and Stulz, R. 1992, 'Global Financial Markets and the Risk Premium on US Equity', *Journal of Financial Economics,* vol.32, pp.137-67.

Cavaglia, S., Brightman, C. & Aked, M. 2000, 'The Increasing Importance of Industry Factors', *Financial Analysts Journal*, Sept-Oct, pp. 41-54.

Claus, J. and Thomas, J. 1999, 'The Equity Risk Premium is Much Lower than you think it is: Estimates from a New Approach', working paper.

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

Cliffe, C. and Marsden, A. 1992, 'The Effect of Dividend Imputation on Company Financing Decisions and the Cost of Capital in New Zealand', *Pacific Accounting Review*, vol.4, pp.1-30.

Constantinides, G., 1984, Optimal Stock Trading with Personal Taxes: Implications for Prices and the Abnormal January Returns, *Journal of Financial Economics* 13, 65-89.

Cooper, I. 1996, 'Arithmetic Versus Geometric Mean Estimators: Setting Discount Rates for Capital Budgeting', *European Financial Management*, vol.2, pp.157-67.

________ and Kaplanis, E. 1994, 'Home Bias in Equity Portfolios, Inflation Hedging and International Capital Market Equilibrium', *The Review of Financial Studies*, vol.7, pp.45-60.

Copeland, T., Koller, T. and Murrin, J. 1994, *Valuation: Measuring and Managing the Value of Companies*, J.Wiley & Sons Inc., New York.

Cornell, B. 1999, *The Equity Risk Premium*, John Wiley & Sons, New York.

Damodaran, A. 1997, *Corporate Finance: Theory and Practice*, John Wiley & Sons, New York.

Davis, K. 1998, *The Weighted Average Cost of Capital for the Gas Industry*, report prepared for Australian Competition and Consumer Commission and Office of the Regulator General.

Dempsey, M. 1996, 'The Cost of Equity Capital at the Corporate and Investor Levels Allowing a Rational Expectations Model with Personal Taxation', *Journal of Business Finance and Accounting*, vol.23, pp.1319-31.

Dimson, E., Marsh, P. and Staunton, M. 2000, 'Twelve Centuries of Capital Market Returns', working paper.

Fama, E. and French, J. 1988a, 'Permanent and Transitory Components of Stock Prices', *Journal of Political Economy*, pp.246-73.

_____________________ 1988b, 'Dividend Yields and Expected Stock Returns', *Journal of Financial Economics*, vol.22, pp.3-25.

______________________ 1989, 'Business Conditions and Expected Returns on Stocks and Bonds', *Journal of Financial Economics*, vol.25, pp.23-49.

______________________ 2002, 'The Equity Premium', *The Journal of Finance*, vol. 57, pp. 637-659.

Frank, M. and Jagannathan, R. 1998, 'Why do Stocks Prices Drop by less than the Value of the Dividend? Evidence from a Country Without Taxes', *Journal of Financial Economics*, vol.47, pp.161-88.

French, K., Schwert, W. and Stambaugh, R. 1987, 'Expected Stock Returns and Volatility', *Journal of Financial Economics*, vol.19, pp.13-29.

Friend, I. and Blume, M. 1975, 'The Demand for Risky Assets', *American Economic Review*, vol.65, pp.900-22.

Froot, K., Perold, A. and Stein, J. 1992, 'Shareholder Trading Practices and Corporate Investment Horizons', *Continental Bank Journal of Applied Corporate Finance*, pp. 42-58.

Glosten, L., Jagannathan, R. and Runkle, D. 1993, 'On the Relation Between the Expected Value and the Volatility of the Nominal Excess Return on Stocks', *The Journal of Finance*, vol.40, pp.1779-1801.

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

_________ and Gould, L. 1984, ‘The Nominal Yield and Risk Premium on the TSE-300, 1956-1982’, *Canadian Journal of Administrative Sciences*, vol.1(1), pp.50-60.

Gray, S. 1999, *Response to Consultation Paper No. 4: Cost of Capital Financing*, submitted to the Office of the Regulator-General Victoria as part of the 2001 Electricity Distribution Price Review.

Hamson, D. and P. Ziegler, 1990, The Impact of Dividend Imputation on Firms’ Financial Decisions, *Accounting and Finance* 30, 29-53.

Harris, R. and Marston, F. 1992, ‘Estimating Shareholder Risk Premia Using Analysts’ Growth Forecasts’, *Financial Management*, vol.21 (2), pp.63-70.

_________________________ 2001, ‘The Market Risk Premium: Expectational Estimates Using Analysts’ Forecasts’, working paper.

Hathaway, N. and Dodd, P. 1993, ‘Australian Public Sector Cost of Capital: A Critical Look at the Treasury Model’, working paper, The University of Melbourne.

___________ and Officer, R. 1995, ‘The Value of Imputation Tax Credits’, working paper, University of Melbourne.

Harvey, C. 1991, ‘The World Price of Covariance Risk’, *The Journal of Finance*, vol.46, pp.111-57.

Howard, P. and R. Brown, 1992, Dividend Policy and Capital Structure under the Imputation Tax System: Some Clarifying Comments, *Accounting and Finance* 32, 51-61.

Huberman, Gur. 2001, ‘Familiarity Breeds Investment’, *The Review of Financial Studies*, vol. 14, pp. 659-680.

Ibbotson, R. and Sinquefield, R. 1976, ‘Stocks, Bonds, Bills and Inflation: Year-by-Year Historical Returns (1926-1974)’, *Journal of Business*, pp. 11-47.

Indro, D. and Lee, W. 1997, ‘Biases in Arithmetic and Geometric Averages as Estimates of Long-Run Expected Returns and Risk Premia’, *Financial Management*, vol. 26, no. 4, pp.81-90.

Jagannathan, R., McGrattan, E. and Scherbina, A. 2000, ‘The Declining US Equity Premium’, *Federal Bank of Minneapolis Quarterly Review*, vol. 24, pp. 3-19.

J. B. Were, 1996, *Australian Equity Market Profile March 1996*.

Jorion, P. and Goetzmann, W. 1999, ‘Global Stock Markets in the 20th Century’, *The Journal of Finance*, vol. 54, pp. 953-980.

Kandel, S. and Stambaugh, R. 1987, ‘On Correlation and Inferences about Mean-Variance Efficiency’, *Journal of Financial Economics*, vol.18, pp.61-90.

Keim, D. and Stambaugh, R. 1986, 'Predicting Returns in the Stock and Bond Markets', *Journal of Financial Economics*, vol.17, pp.357-90.

Lally, M. 1992, 'The CAPM Under Dividend Imputation', *Pacific Accounting Review*, vol.4, pp. 31-44.

________ 1995, 'The Accuracy of CAPM Proxies for Estimating a Firm's Cost of Equity', *Accounting and Finance*, vol.35, pp. 63-72.

________ 1996, 'The CAPM under Dividend Imputation and International Portfolio Selection', *Pacific Accounting Review*, vol.8, pp. 48-65.

________ 1998, 'The CAPM with Personal Taxes and International Portfolio Selection', *The New Zealand Investment Analyst*, vol.19, pp. 22-24.

________ 2000a, 'The Real Cost of Capital in New Zealand: Is it too High?', *New Zealand Business Roundtable*, Wellington.

________ 2000b, *The Cost of Equity Capital and its Estimation*, McGraw-Hill Series in Advanced Finance, vol. 3, McGraw-Hill Australia, Sydney.

________ and van Zijl, A. 2001, 'Capital Gains and the Capital Asset Pricing Model', working paper, Victoria University of Wellington.

Lintner, J. 1965, 'The Valuation of Risky Assets and the Selection of Investments in Stock Portfolios and Capital Budgets', *Review of Economics and Statistics*, vol.47, pp.13-37.

Lonergan, W. 2001, 'The Disappearing Returns', *JASSA*, Autumn, pp. 8-17.

McDonald, R. 2001, 'Cross-Border Investing with Tax Arbitrage: The Case of German Dividend Tax Credits', *The Review of Financial Studies*, vol. 14, pp. 617-657.

Merton, R. 1980, 'On Estimating the Expected Return on the Market', *Journal of Financial Economics*, vol.8, pp.323-61.

Monkhouse, P. 1993, 'The Cost of Equity under the Australian Dividend Imputation Tax System', *Accounting and Finance*, vol.33, pp.1-18.

____________ 1996, 'The Valuation of Projects under the Dividend Imputation Tax System', *Accounting and Finance*, vol. 36, pp. 185-212.

Mossin, J. 1966, 'Equilibrium in a Capital Asset Market', *Econometrica*, vol.24, pp.768-83.

New Zealand Treasury, 1997, *Estimating the Cost of Capital for Crown Entities and State-Owned-Enterprises*.

Odier, P. and Solnik, B. 1993, 'Lessons for International Asset Allocation', *Financial Analysts Journal*, March/April, pp. 63-77.

Officer, R. 1989. 'Rates of Return to Shares, Bond Yields and Inflation Rates: An Historical Perspective', in *Share Markets and Portfolio Theory*, 2nd edition, (Eds: R Ball, F Finn, P. Brown and R. Officer), University of Queensland Press.

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

Pastor, L. and Stambaugh, R. 2001, 'The Equity Premium and Structural Breaks', *The Journal of Finance*, vol. 56, pp. 1207-39.

Poterba, J. and Summers, L. 1988, 'Mean Reversion in Stock Prices: Evidence and Implications', *Journal of Financial Economics*, vol.22, pp.27-59.

Protopapadakis, A. 1983, 'Some Indirect Evidence on Effective Capital Gains Taxes', *Journal of Business*, vol.56, pp.127-38.

Ragunathan, V., Faff, R. and Brooks, R. 1999, 'Australian Industry Beta Risk, the Choice of Market Index and Business Cycles', *Applied Financial Economics*, vol. 10, pp. 49-58.

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

______ and Ross, S. 1994, 'On the Cross-Sectional Relation Between Expected Returns and Betas', *Journal of Finance*, vol.49, pp.101-21.

Schwert, G. 1990, 'Stock Returns and Real Activity: A Century of Evidence', *Journal of Finance*, vol.45, pp.1237-57.

Scruggs, J. 1998, 'Resolving the Puzzling Intertemporal Relation Between the Market Risk Premium and Conditional Market Variance: A Two-Factor Approach', *Journal of Finance*, vol.53, pp.575-603.

Shanken, J. 1987, 'Multivariate Proxies and Asset Pricing Relations: Living with the Roll Critique', *Journal of Financial Economics*, vol.18, pp.91-110.

Sharpe, W. 1964, 'Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk', *Journal of Finance*, vol.19, pp.425-42.

Siegel, J. 1992, 'The Equity Premium: Stock and Bond Returns since 1802', *Financial Analysts Journal*, Jan-Feb, pp.28-38.

________ 1999, 'The Shrinking Equity Premium', *Journal of Portfolio Management*, Fall, pp. 10-17.

Solnik, B. 1974, 'An Equilibrium Model of the International Capital Market', *Journal of Economic Theory*, vol.8, pp.500-24.

Stambaugh, R. 1982, 'On the Exclusion of Assets from Tests of the Two-Parameter Model: A Sensitivity Analysis', *Journal of Financial Economics*, vol.10, pp.237-68.

Stulz, R. 1995, 'The Cost of Capital in Internationally Integrated Markets: The Case of Nestle', *European Financial Management*, vol.1. pp.11-22.

Tesar, L. and Werner, I. 1995, 'Home Bias and High Turnover', *Journal of International Money and Finance*, vol.14, pp.467-92.

Van Horne, J., Davis, K., Nicol, R. and Wright, K. 1990, *Financial Management and Policy in Australia*, 3rd edition, Prentice-Hall, New York.

Walker, S. & Partington, G. 1999, 'The Value of Dividends: Evidence from Cum-Dividend Trading in the Ex-Dividend Period', *Accounting and Finance*, vol. 39, pp. 275-96.

Welch, I. 2001, 'The Equity Premium Consensus Forecast Revisited', working paper.

Wood, J. 1997, 'A Simple Model for Pricing Imputation Tax Credits under Australia's Dividend Imputation Tax System', *Pacific-Basin Finance Journal*, vol.5, pp.465-80.