Section IV. Financial techniques

The cost of capital and access arrangements

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Introduction

The recently introduced Part IIIA of the *Trade Practices Act 1974* establishes a legal regime under which third parties can in certain circumstances obtain a right of access to services provided by certain essential facilities on fair and reasonable grounds. The policy underlying the regime is set out in the report by the Independent Committee of Inquiry on National Competition Policy (the 'Hilmer Report') which sees access arrangements as being critical to the promotion of competition in some markets. Essential facilities exhibit natural monopoly characteristics, in the sense that they cannot be duplicated economically and may occupy strategic positions in an industry such that access by the third party to the facility is required if it is to be able to compete effectively in a particular upstream or downstream market[1]. Examples of essential facilities include infrastructure assets such as road and railway lines, electricity transmission grids and communication services. Access may be obtained by either ministerial declaration or by the owner or operator of the facility giving a written undertaking to the Australian Competition and Consumer Commission (ACCC) to provide access to a third party. The ACCC may be required to determine access prices in relation to the arbitration of an access dispute or to assess the terms and conditions of an access undertaking from an access provider. To do so, it is necessary to determine the rate of return necessary to compensate supplies of capital (debt, equity or hybrids) to an access provider for the provision of those funds and reflecting the risk involved. The paper thus analyses certain issues associated with cost of capital methodologies in the context of these access arrangements, including:

- possible alternatives to the Capital Asset Pricing Model (CAPM) approach in determining the cost of equity and their feasibility;
- factors affecting the derivation of beta risk and the feasibility of international benchmarking of beta risk;
- determination of beta risk for vertically integrated entities operating in different markets with different contestability/competitive conditions;
- the impact on beta risk of a firm subject to price regulation and the impact of subsequent increases in competitive conditions;

[1] The Hilmer Report, 1993, p. 240.

- the impact on the cost of equity under the CAPM framework in relation to levered and unlevered betas, tax/dividend imputation, and imputation and levered betas;
- treatment of depreciation in the cost of capital;
- relationship between beta risk, pricing principles and asset valuation methodologies and the use of nominal and real values of the Weighted Average Cost of Capital (WACC) in relation to the asset valuation approach; and
- treatment of stranded assets and the determination of an appropriate rate of return.

Alternatives to the CAPM

The cost of equity capital for a company is the rate of return required by investors to provide equity capital to the company[2]. It is a market determined rate reflecting the return required on an investment of equivalent risk. In this context the cost of equity capital is an ex-ante or forward looking concept which measures the return expected by investors on their investment[3]. Accordingly, the terms 'cost of equity capital' and 'required rate of return on equity' may be used interchangeably. There are six principal alternatives to the capital asset pricing model that might be used to estimate a company's cost of equity capital:

- comparable earnings;
- discounted cashflow;
- price earnings ratios;
- risk premium;
- arbitrage pricing theory; and
- the Fama-French model.

Comparable earnings

The comparable earnings method provides for a company's cost of equity capital to be based on the return on equity for a sample of 'comparable companies' where for each company in the sample, the return on equity is calculated as the accounting return on the company's book value of equity. Although this method has been used in relation to public utilities in the USA[4], it suffers from two deficiencies: difficulties in identifying

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2 In this paper, the term 'company' is used generically to refer to access providers which operate in either the public or private sectors and includes non corporate entities.

3 In an ex-post context the cost of capital measures the realised rate of return to equity investors over some prior period. In many cases, expectations of future returns are based on historical returns.

4 Kolbe, Read and Hall, 1986.

comparable companies, and the use of book values of income and equity when the cost of capital is a market related concept[5].

Discounted cashflow

According to Myers and Borucki, 1994, discounted cashflow is the most widely used method to estimate the cost of equity capital for regulated firms in the USA. The discounted cashflow approach defines the cost of equity capital as the discount rate which equates the present value of expected future dividends with the current share price. Algebraically,

$$P_0 = \frac{D_1}{(1+k_e)} + \frac{D_2}{(1+k_e)^2} + \frac{D_3}{(1+k_e)^3} + \ldots.. \qquad (1)$$

where

P_0 is the current share price;

D_t is the expected dividend at time t; and

k_e is the cost of equity capital.

If dividends are assumed to grow at constant rate of g in perpetuity then equation (1) simplifies to:

$$P_0 = \frac{D_1}{k_e - g} \qquad (2)$$

which can then be rearranged to give:

$$k_e = \frac{D_1}{P_0} + g \qquad (3)$$

i.e. the cost of equity capital is equal to the sum of the current dividend yield and the expected long term growth rate in future dividends. Subsequently, in order to use this method in practice we require estimates of the company's expected future dividend stream and its current share price. Major limitations with this method are the requirement to forecast the company's expected future dividend stream and the need for the company to be listed.

Empirical research in the USA by Hickman and Petry (1990) provides evidence that the dividend growth model performs poorly. While that study used estimated discount rates (from the CAPM etc.) and growth rates to calculate value, the accuracy of the reverse approach of inferring the cost of equity capital from current value and growth assumptions is also called into question. Further problems with this approach lie in the fact that the assumed growth rate, g, is not independent of the assumed value creation ability of the company. It is possible that a growth rate assumed could imply an ability of the company to generate returns on investment in excess of the required returns, thereby biasing the estimate of the required rate of return.

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5 For further discussion, see Myers, 1972.

Price earnings ratios

This method provides for a company's cost of equity capital to be derived from the Price Earnings (PE) ratios of a sample of comparable companies. By definition, a company's PE ratio is equal to the ratio of its current share price to its earnings per share and therefore is a derived figure. In the simple no growth case where the comparable company is expected to produce a constant stream of earnings and dividends, then the company's PE ratio is equal to the reciprocal of its cost of equity capital:

$$\frac{P_0}{E} = \frac{1}{k_e} \qquad (4)$$

However a complication arises in using PE ratios of (apparently) comparable companies where those companies differ in terms of growth opportunities. It is, for example, possible to demonstrate that the PE ratio can be written as:

$$\frac{P_0}{E} = \frac{1}{k_e} + \frac{PVGO}{E} \qquad (5)$$

where PVGO (the present value of growth opportunities) represents the extent to which the company is expected to be able to generate earnings in excess of the required rate of return on its current asset base and through future investment opportunities. Using PE ratios from comparable companies to derive a cost of equity capital may therefore incorporate the possibility of assuming that returns in excess of or below the required rate of return can be earned and thus potentially bias the result.

Risk premium

This method involves deriving an estimate of the extra return required on equity investments over and above the return required on debt investments. In estimating the risk premium, reference is usually made to some study of long term historical rates of returns such as Officer, 1989, and Ball and Bowers, 1986, in the case of Australia and Ibbotson Associates, 1991, for the USA[6]. The return required on debt investments is usually estimated by the yield to maturity on some traded long term government bond. The risk premium plus the current yield to maturity on the long term bond is then used as an estimate of the average cost of equity for all companies. A subjective adjustment may then be made to reflect any difference in the risk between the average company and that of the particular company in question. Although this approach recognises that the cost of equity capital for a company should be related to a benchmark return in the capital markets it provides no guidance as to the size of the risk adjustment for a particular company.

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6 It should be noted that the Officer, 1989, and Ball and Bowers, 1986, studies relate to returns prior to the introduction of the dividend imputation system. Further, both Ball and Bowers, 1986, and Officer, 1989, provide evidence that the market risk premium is non stationary over time being sensitive to the period over which the premium is estimated. For example according to Officer, 1989, the historic market risk premium over the period 1882 to 1987 averaged 7.9% per annum and varies from 0.4% per annum for the ten years from 1968 to 1977 to 11.87% for the ten years from 1978 to 1987. It is possible that higher or lower figures could result if different ten year periods were selected.

Arbitrage pricing theory

The Arbitrage Pricing Theory (APT) developed by Ross, 1976, is based on the idea that in competitive financial markets arbitrage will ensure equilibrium pricing according to risk and return. Similar to the CAPM, investors are assumed to hold well diversified portfolios and accordingly the only risk that matters is systematic risk i.e. the risk that cannot be diversified away. However, whereas the CAPM assumes the only source of systematic risk which effects expected returns is market risk, the APT recognises that there may be more than one source of systematic risk (referred to as ‘risk factors’) which influences expected returns on assets. Assuming there are say n risk factors then the cost of equity capital for a company is given by:

$$k_e = r_f + \beta_1\lambda_1 + \beta_2\lambda_2 + \ldots\ldots + \beta_n\lambda_n \qquad (6)$$

where for i = 1,2, ... ,n:

r_f is the risk free rate of interest;

λ_i is the expected risk premium associated with factor i; and

β_i is the sensitivity or beta to factor i.

The concepts of risk premium and beta in equation (6) correspond to similar notions used in the CAPM and therefore the APT may be thought of as being equivalent to a multi-beta CAPM[7]. The main limitation with the APT is not so much in having to estimate betas, the risk free rate and the risk premia as in actually identifying the relevant risk factors. Unfortunately the APT provides no guidance as to the identity of the relevant factors nor as to how many factors there are[8].

Fama-French model

The most recent development in research relevant to estimating the cost of equity capital (and one which is currently subject to a large amount of contention) stems from the recent work of Fama and French, 1993. Fama and French, 1993, have developed a three factor model of security prices which they claim is superior to the CAPM. They suggest that the cost of equity capital for a company is related not only to market risk (as predicted by CAPM) but also to company size (measured by the market value of the company’s equity) and to the ratio of its book value of equity to its market value of equity. Algebraically,

$$k_e = r_f + \beta_1(r_m - r_f) + \beta_2 SMB + \beta_3 HML \qquad (7)$$

where

r_f is the risk free rate of interest;

7 It should be stressed that this interpretation is heuristic only as the CAPM and the APT are distinct and separate theories based on different underlying assumptions.

8 A number of studies have sought to address this deficiency on both theoretical and empirical grounds including Chen, Roll and Ross (1986) and Eltin, Gruber and Mei (1994).

$r_m - r_f$ is the expected risk premium on the market;

SMB is the expected risk premium associated with the size factor (equal to the expected return on a portfolio of small stocks less the expected return on a portfolio of large stocks);

HML is the expected risk premium associated with the book-to-market factor (equal to the expected return on a portfolio of high book-to-market stocks less the expected return on a portfolio of low book-to-market stocks); and

β_i is the sensitivity or beta to factor i.

Thus the model suggests that the cost of equity capital is higher for smaller companies and for those companies with higher book-to-market ratios. To a certain extent this model may be regarded as an extended-CAPM or as a three factor APT model. There are currently two main limitations with the Fama-French model. Firstly, the model is in its infancy and is not universally accepted with its validity subject to challenge[9]. Secondly, Fama and French, 1992, actually derived the model empirically, rather than starting from a theoretical base, relying on previous research which documented empirical contradictions of the CAPM to identify the two new risk factors. It is therefore likely that the size and book-to-market factors are simply proxies for some other as yet unidentified underlying risk factors which may effect expected returns[10].

Factors affecting the derivation of beta risk and the feasibility of international benchmarking of beta risk

The total risk of a company's equity returns can be partitioned into two components; systematic risk and unsystematic risk. Systematic risk is due to risk factors which affect **all** companies and therefore cannot be diversified away. The CAPM assumes there is only one source of systematic risk, referred to as 'market risk', which collectively accounts for all those risk factors which affect the overall market as a whole such as changes in the general level of economic activity and political developments. Within the CAPM framework, market risk is also referred to as 'beta risk'. Unsystematic risk is due to risk factors which are unique to a particular company (or industry) such as labour disruptions and technological breakthroughs. An investor can eliminate unsystematic risk by diversification. The concept of diversification is based on the common sense notion of spreading risk across a number of assets or investments rather than investing in a single asset and thereby 'putting your eggs all in one basket'. Diversification involves combining assets in such a way as to reduce the unsystematic risk faced by the investor. Ultimately the only risk that remains in a well diversified portfolio is systematic risk. Since the CAPM assumes investors hold well diversified portfolios (and therefore have eliminated any unsystematic risk) then the only risk that is relevant in determining a company's cost of capital is the only risk that remains being its systematic risk. In this case investors who choose not to diversify

9 See for example, the discussion in Fama and French, 1996.

10 Fama and French, 1996, suggest that HML may proxy for relative distress as weak (strong) firms tend to have high (low) book-to-market ratios and therefore are penalised (rewarded) by the market with higher (lower) costs of capital.

will not be compensated (in the form of a higher required rate of return) for bearing unsystematic risk which is more risk than they otherwise need to bear. Specifically, according to the CAPM, the cost of equity capital is given by:

$$k_e = r_f + \beta(r_m - r_f) \quad (8)$$

where

r_f is the risk free rate of interest;

$r_m - r_f$ is the expected risk premium on the market; and

β is the company's beta.

A company's beta is a **relative** risk measure. It reflects the sensitivity of the company's systematic risk to the systematic risk of the market as a whole. By definition, the beta of the market is one[11]. In general, companies which are more risky than the market will have betas greater than one while companies which are less risky than the market will have betas less than one. Therefore, the broad principle to bear in mind in estimating a company's beta is that beta reflects the **systematic** risk of the company relative to the market. **It is stressed that the beta of a company reflects only its systematic risk and not its total risk.**

As mentioned above market risk collectively accounts for all those risk factors which affect the overall market. Although it is impossible to identify all the possible economic determinants of a company's beta, three factors appear to play a significant role: financial leverage, operating leverage and the sensitivity of a company's cashflows to the general level of economic activity. The impact of each of these determinants on a company's beta is quite intuitive. Financial leverage measures the extent to which a company has funded itself with debt. Since debtholders have a fixed contractual claim on the cashflows of the company, then the higher the company's financial leverage the greater the risk to its equity investors and the higher its beta. The impact of financial leverage is considered further in section titled **Leverage and Betas**. Operating leverage measures the extent to which a company's cost structure is fixed. Since by definition fixed costs do not change with changes in production levels, then the higher the company's operating leverage the higher the risk to its equity investors and the higher its beta. The sensitivity of a company's cashflows to the general level of economic activity measures the extent to which the fortunes of the company are dependent on the state of the business cycle. The more cyclical the company the higher the risk to its equity investors and the higher its beta[12].

Betas may be estimated by three different methods. Firstly a fundamental approach looks at factors such as industry, company size and growth prospects to subjectively derive an estimate of the company's relative risk and hence its beta. Secondly, regression techniques may be used to estimate beta on the basis of past share prices. Thirdly, reference may be made to a published beta risk service (which in turn

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11 The beta of a portfolio is equal to a market value weighted average of the betas of the individual companies in the portfolio.

12 See for example Brealey and Myers, 1996, for further discussion.

generally derive their estimates using regression techniques based on past share prices). It should be noted that it is well documented in the finance literature that beta estimates are sensitive to a number of factors including the estimation period, the frequency of data used and the particular regression technique adopted (for example whether the standard method of Ordinary Least Squares is used or whether a technique which seeks to adjust estimates for thin trading in securities markets such as the Scholes-Williams procedures is used).

In addition, a number of specific factors need to be taken into account in estimating a company's beta including:

- where the company operates in more than one line of business i.e. a multi-business company;
- where the company is subject to price regulation; and
- where the company is unlisted.

Issues associated with multi-business companies are discussed in the section titled **Determination Of Beta Risk For Vertically Integrated Entities Operating In Different Markets With Different Contestability/Competitive Conditions** and the impact of price regulation is discussed in the section titled **Price Regulation, Competition and Beta**. The issue of unlisted companies is discussed below.

When a company is unlisted there is the obvious problem in that there is no share price history on which to base the beta estimate. In this case, guidance may be provided by examining the betas of other comparable listed companies (i.e. companies with the same risk profile) and then making subjective adjustments to take into account any remaining differences between the comparable companies and the company in question[13].[14] In this regard it may be appropriate to focus on the average beta for the sample of comparable companies rather than on the beta for any one particular company in the sample since this reduces the likelihood of estimation error. There may of course be difficulties in identifying comparable companies in Australia and in some cases they may not even exist. This leads to the issue of the suitability of international benchmarking. Beta estimates of similar companies in different countries may be sought particularly from the USA and UK with their large capital markets and rich data sources. However caution needs to be applied in the employment of such international comparisons. By definition, beta is a relative concept and therefore is market specific. The beta of an Australian company reflects its systematic risk relative to the Australian market whereas the beta of a USA company reflects its systematic risk relative to the USA market. Complications may arise in international beta comparisons due to different structural and institutional differences between the markets particularly in respect of alternative capital structures and tax systems. However casual empiricism suggests there are broad similarities once the effects of leverage are removed, for example, utilities tend to have lower than average betas in most countries while airlines tend to have above average betas in most countries. Care also needs to be exercised in

13 Usually, the most critical of these is a difference in leverage.

14 In a valuation context, Lonergan, 1994, p. 27 notes that the use of comparable listed companies for the valuation of unquoted shares has been endorsed by the courts.

using international comparisons in industries which are subject to regulation as any differences in the regulatory environments need to be taken into account. Finally, it is considered worthwhile to briefly refer to the issue of how precise beta estimates should be. From a theoretical perspective, beta is the key determinant of a company's cost of capital but from a practical perspective, this importance is somewhat reduced when one takes into account the relative amount of subjectivity that exists in the other input variables particularly the market risk premium. For example, as mentioned in the section titled **Risk Premium**, the expected risk premium is usually based on some empirical study of long term historical rates of return with typical values presented being in the order of 6 to 8 per cent per annum. Given that there is 2 per cent variation in generally accepted values for the market risk premium, it is suggested that estimating beta to beyond two significant figures is attempting to incorporate a degree of precision which just isn't there.

Determination of beta risk for vertically integrated entities operating in different markets with different contestability/competitive conditions

In the section titled **Factors Affecting The Derivation Of Beta Risk And The Feasibility Of International Benchmarking Of Beta Risk** we stated that the beta of a company is a measure of its systematic risk relative to the systematic risk of the market as a whole. A number of complications may arise in relation to companies which operate in more than one line of business. One issue that needs to be addressed is whether the beta for such a multi-business company can be applied to an individual business unit of the company. The answer lay in comparing the systematic risk of the individual business unit to the systematic risk of the company as a whole. In general if the business unit is just as risky as the company then the beta of the business unit will be the same as the beta of the company. However if the business unit is more or less risky then it would be inappropriate to use the company's beta as an estimate of the beta of the business unit.

A second albeit related issue concerns determining the beta for a multi-business company. If we regard a multi-business company as being equivalent to a portfolio of its underlying business units then the systematic risk of the company reflects the average systematic risk of all its business units. Since the beta of a portfolio is equal to a weighted average of the betas of the individual companies in the portfolio, then similarly the beta of a multi-business company is equivalent to the weighted average of the betas of its underlying business units. Algebraically, for a company consisting of k business units:

$$\beta_e = \omega_1\beta_1 + \omega_2\beta_2 + \ldots\ldots + \omega_k\beta_k \quad (9)$$

where for i = 1,2, ... ,k:

β_e is the beta of the company;

β_i is the beta of the ith business unit; and

ω_i is the weight applied to the ith business unit.

In theory, ω_i is a market value weight representing the equity value of the ith business unit relative to the equity value of the company. In practice, however, there may be difficulties in not only determining the equity values of the individual business units but also in actually identifying the actual business units as distinct and separate operations[15]. This leads to a further issue which specifically relates to the subject of this paper. If the access provider is a single purpose company which does not compete in any other market, then the position is quite clear: the relevant beta to be estimated is the company beta. However if the access provider is a vertically integrated entity operating in different markets with different contestability/competitive conditions, an issue arises as to whether it is the beta of the entire entity or just the beta of the business unit which operates the essential facility that is required[16]. In either case, the appropriate principles outlined in this section may be used. It is considered worthwhile stressing that beta relates only to the company's systematic risk and not its total risk.

Price regulation, competition and beta

If a company is subject to price regulation then its systematic risk may be different to the systematic risk of an otherwise equivalent unregulated company. The specific impact of price regulation on a company's beta is dependent on the nature of the regulation. In general if the price regulation serves to reduce the impact of market risk on the company's equity returns (such as from transferring risk from the company's shareholders to its customers) then the company's beta should be lower than it otherwise would in the absence of the regulation. Similarly if the price regulation serves to increase the impact of market risk on the company's equity returns then this should result in a higher beta compared to an otherwise equivalent unregulated firm. As any subsequent increase in competitive conditions is likely to expose the company's equity investors to greater market risk then the company's beta should be closer to that which would prevail if the company was completely unregulated. Again it is stressed that in considering the impact of regulation on the company's risk, the relevant measure to focus on is the company's systematic risk and not its total risk.

The CAPM, dividend imputation, leverage and betas

Vigorous debate has occurred in Australia over the appropriate form of the CAPM following the introduction of the dividend imputation tax system. Part of the debate has reflected differences of opinion (and confusion) about the best way to measure rates of return, whereas part has reflected the ultimately empirical (but difficult) issue of the value investors place on imputation tax credits. The problems are best seen by initially examining the standard CAPM equation for a classical tax system, given by equation (8) and repeated here:

$$k_e = r_f + \beta(r_m - r_f) \qquad (8)$$

15 Empirical support comes from Fuller and Kerr, 1981, who have shown that the beta for a multi-business company is equal to a weighted average of the betas of its business units. In this case however the weights were based on business unit sales rather than business unit equity values.

16 The Trade Practices Act states that the matters to be taken into account by the ACCC in making a determination include the legitimate business interests of the provider and the provider's investment in the facility and the direct costs of providing access to the service (s. 44X).

Recall that the required return on equity of a company exceeds the risk free interest rate by a risk factor equal to the market risk premium multiplied by the company's beta. Note that under a classical tax system the CAPM equation given above is for rates of return calculated on an after company tax but before personal (investor) tax basis. In principle asset pricing is based on an equilibrium relationship after personal taxes. However, if all rates of return are subject to the same personal tax rate t_p then the after personal tax CAPM relationship derived from equation (8) is:

$$k_e\left(1-t_p\right)=r_f\left(1-t_p\right)+\beta\left(r_m\left(1-t_p\right)-r_f\left(1-t_p\right)\right) \quad (10)$$

which on cancelling out the common term $\left(1-t_p\right)$ leaves the original equation (8). In practice, most classical tax systems have involved somewhat different personal tax treatment of equity income to interest income because of preferential treatment of capital gains. While the CAPM can be amended to allow for that difference, in practice this complication has been largely ignored.

Following the introduction in Australia of the imputation tax system in 1987 (and inclusion of capital gains in the income tax base in 1985) it is not possible to ignore such complications. Equity income is now formally subject to different personal tax treatment to interest income. Most importantly, equity income taking the form of franked dividends is 'grossed up' for the calculation of assessable income for tax purposes and a tax credit of equivalent dollar value given to the investor. This has had a number of consequences relevant for using the CAPM including:

- there are different ways in which equity returns can be calculated, depending upon at which point in the taxation process they are considered;
- the definition of cash flows used in any valuation process must be consistent with the way in which equity returns have been calculated;
- it is conceptually possible to define the company tax rate in (at least) two ways. One, used here, is to define it by reference to tax actually paid by companies. The other, advocated by Officer, 1994, is to define it using that part of tax paid by companies which is not offset by reduced personal tax payments due to imputation tax credits received;
- the value of imputation tax credits will differ between investors. Most Australian taxpayers will benefit from an equivalent reduction in tax payable and value $1 of imputation credits as being worth $1. Foreign taxpayers, in the absence of a market for the sale of imputation credits, may value them at zero[17]. This raises the question of what value should be placed on imputation credits in the derivation of the CAPM;

17 The value of imputation credits to a foreign shareholder is dependent upon the tax laws in the shareholder's home country.

- equity income can take three forms (franked dividends, unfranked dividends, and capital gains) each subject to different tax treatment, introducing the complication of allowing for these differences; and
- while the CAPM takes the market risk premium, defined above as $r_m - r_f$, as an externally given parameter, this may have changed as a result of the introduction of imputation.

Terminology and measurement

Debate on the CAPM under imputation has intermingled two separable issues. The first concerns that of whether equity returns (and the cost of equity capital) should be measured in a way which adds in the value of imputation credits or not. The second concerns the value which investors place on imputation credits.

To examine these issues, consider for example a company with an initial and end of year share price of \$10.00 which pays a franked dividend of \$0.64 (when the company tax is 36 per cent) to a shareholder on a personal tax rate of 40 per cent. It is possible to define the shareholder return in, at least, four different ways:

Definition	Calculation	Rate%	Comment
Fully grossed up	(dividend+credit)/price = (0.64 +0.36)/10.00	10.00	Relates to cash flows prior to company tax payments
Partially grossed up	(dividend +value of credit)/price = (0.64 + 0.5x0.36)/10.00	8.20	(Value of credit assumed to be 0.5) Relates to cash flows grossed up by some proportion (here 0.5) of company tax payments
Ungrossed	(dividend)/price = 0.64/10.00	6.40	Relates to cash flows after company tax payments
After investor tax	(dividend+credit)(1-t_p)/price = (0.64+0.36)(0.60)/10.00 =	6.00	Relates to cash flows after both company and personal tax payments

Conceptually, all of these definitions are useable, but each has different implications for the methods to be used in valuation and in formulating the CAPM. First, each relates to a different measure of cash flows. Second, the current relevance of historical values for the market risk premium (derived under a classical tax system) for each definition needs to be carefully considered.

If returns are measured on an 'ungrossed' basis, it is to be expected that the market risk premium will have declined following the introduction of imputation. This is most easily seen by examining the risk premium after personal tax, under the simplifying assumption that returns on the market take the form of fully franked dividends, post imputation. Assume that the risk premium was 8 per cent per annum prior to imputation, the risk free interest rate is unchanged at 6 per cent per annum, the company tax rate is unchanged at 36 per cent, and that the marginal investor's personal tax rate is 40 per cent. The after tax investor risk premium prior to imputation was then:

$$r_m\left(1 - t_p\right) - r_f\left(1 - t_p\right) = \left(r_m - r_f\right)\left(1 - t_p\right) = 0.08 \times 0.6 = 4.8\% \quad (11)$$

Assume that the value of the after investor tax risk premium has remained unchanged since the introduction of imputation (and there are no strong arguments which have been advanced to suggest otherwise). Under imputation, the after tax risk premium is calculated as:

$$\frac{r_m\left(1-t_p\right)}{1-t_c}-r_f\left(1-t_p\right) \quad (12)$$

where the $1/\left(1-t_c\right)$ term reflects the grossing up of taxable income associated with the receipt of franking credits. Equating this expression to the historical after tax risk premium of 4.8 per cent we are able to calculate an implied value for r_m and thus for $r_m - r_f$ as follows:

$$\frac{r_m\left(1-t_p\right)}{1-t_c}-r_f\left(1-t_p\right)=\frac{r_m(0.6)}{0.64}-0.06(0.6)=0.048$$

$$r_m = 0.0896 = 8.96\% \qquad (13)$$

i.e. the market risk premium (measured by $r_m - r_f$) has fallen to 2.96 per cent (although note that the ‘grossed up’ return on the market has remained at 8.96/0.64 = 14 per cent, equivalent to the pre imputation value, and the market risk premium using that definition of returns has remained at 8 per cent).

The import of this example is clear. If returns are measured without grossing up for franking credits, the market risk premium utilised in the CAPM should be lower. If returns are grossed up, the historical value for the market risk premium may still be appropriate for use in the CAPM where returns are measured on a ‘grossed up’ basis.

In practice, matters are complicated relative to this example by two issues. First, market returns and returns for individual stocks can comprise a mix of franked and unfranked dividends and capital gains. Second, franking credits may not be fully valued by some (notably foreign) investors. It is however possible to derive an estimate of the size of the market risk premium following the introduction of imputation by examining the composition of returns on the market portfolio[18].

The significance of franking credit valuation

Officer, 1994, and McKinsey & Company, 1994, have argued that franking credits may have a value to investors of less than their dollar amount. Underpinning this view is the argument that foreign investors may not be able to utilise franking credits to reduce tax

[18] See for example by Van Horne et. al., 1995.

in their home jurisdiction. Hence, they appear to suggest that returns should be 'partially' grossed up by the **value** of the franking credits to the investor. If a $1 franking credit has a 'value' of $0.40, ($\gamma$ = 0.4), a franked dividend of $64 with a franking credit of $36 would be regarded as having a value of $(64 + 36 x 0.4) = $ 78.40. Note that this approach requires that valuation of any cash flow series requires those cash flows to be similarly amended. For example, if a cash flow of $c is generated on which company tax is paid leaving $c(1-t) available for distribution as a franked dividend, the cash flow needs to be augmented by the value of the franking credit which is γtc. Hence the cash flow to be evaluated is $c(1-t(1-$\gamma$)).

The benefit of this approach is that **if the true value of γ can be established**, the historical value of the market risk premium can be used in the CAPM, and the standard CAPM used (with returns defined in this partially grossed up fashion). However, there are a number of problems with this approach. First, γ is not readily determined. Second, it is not clear whether γ is an economy wide measure or a measure applicable to individual companies. Third, in practice γ generally takes on values of approximately 0 or 1 for investors who are non-taxpayers or Australian taxpayers respectively. Some average value of γ can be calculated but has no theoretical justification for being included in an asset pricing equation such as the CAPM.

If the cost of equity capital is to be measured on an 'ungrossed' basis (i.e. using the cash value of dividends plus share price capital gains) as is common in international practice, it is necessary to recognise that the return required by shareholders will reflect the type of dividends paid. A return of 10 per cent per annum consisting entirely of a franked dividend, is more valuable to an Australian taxpayer than a 10 per cent per annum return consisting of an unfranked dividend. If it is assumed that franking credits are fully valued by investors, it is possible to derive expressions for the cost of equity capital for companies expected to provide returns taking different forms. Van Horne et. al., 1995, demonstrate that the CAPM takes the following forms:

- for returns in the form of franked dividends:

$$k_e^f = r_f(1-t_c) + \beta(r_m - r_f(1-t_c)) \qquad (14)$$

- for returns in the form of unfranked dividends:

$$k_e^u = r_f + \beta\left(\frac{r_m}{1-t_c} - r_f\right) \qquad (15)$$

- for returns in the form of unfranked dividends and capital gains:

$$k_e^{u\&g} = \frac{r_f(1-t_c)}{z} + \beta\left(\frac{r_m(1-t_p)}{z(1-t_c)} - \frac{r_f(1-t_p)}{z}\right) \qquad (16)$$

where $z = \left[1 - D\left(t_p - t_g\right) - t_g\right]$, D is the proportion of returns in the form of unfranked dividends and t_g is the effective tax rate on capital gains. For companies of equivalent risk (i.e. equal β's),

$$k_e^f < k_e^{u\&g} < k_e^u \qquad (17)$$

i.e. investors will require the lowest rate of return on companies expected to provide returns in the form of franked dividends, and require lower returns from companies which provide some return as capital gains rather than as unfranked dividends.

A potential complication arises in the case where the owners of an Australian tax paying company are foreigners who are unable to utilise the franking credits generated. It might be argued that the required return for equity of such owners is higher than that prevailing in the Australian market, because of the lack of value of franking credits to foreigners. Consequently, prices should be set to allow the achievement of the required rate of return of the foreign owners. To the extent that there is no substantive difference between operational efficiency under domestic or foreign ownership, this argument is not supported. In that case, the activity can be undertaken by domestic owners for whom the cost of equity is lower. There is no rationale for compensating foreign owners for their (tax induced) disadvantage by allowing prices to be set higher than would be the case for an Australian owner with a lower cost of equity. The tax disadvantage need not be borne for the activity to be undertaken efficiently, and there is thus no need to compensate owners who elect to take on that disadvantage.

In the case where the foreign owners have some particular skills or expertise which enable them to operate the activity with greater operational efficiency than domestic owners, the issue is more complex. If the skills or expertise are of a form such that they can be subcontracted from foreign suppliers without the necessity of foreigners providing the equity finance, there is again no apparent argument to justify pricing based on the higher cost of equity capital. However, if the skills and expertise are of a form where ownership is a necessary condition of supply (for example where it is necessary to protect commercial information), the situation is different. Even allowing for a higher cost of equity, the required price may be lower than if the activity were undertaken by the less efficient domestic owner. It would appear necessary to examine these matters on a case by case basis.

The cost of equity and the WACC

If the cost of equity capital is measured on an 'ungrossed' basis, then the conventional approach to measuring the WACC can be followed. The WACC is given by:

$$\text{WACC} = k_e \frac{E}{D+E} + k_d\left(1 - t_c\right)\frac{D}{D+E} \qquad (18)$$

where $k_d\left(1 - t_c\right)$ is the company's after tax cost of debt and D/E is the company's debt to equity ratio measured in market value terms. This discount rate is used to evaluate cash flows after company tax **where the cash flows and tax are estimated as if the company were unlevered**. This measure of cash flows is used because:

- the focus is upon the returns to all providers of capital (debt and equity) and thus needs to consider all cash flows available to them; and
- the company tax benefits gained by the company from the tax deductibility of interest is taken into account in the use of an after tax cost of debt and thus should not be considered in measuring cash flows.

Leverage and betas

A simple approach to the impact of leverage on the systematic risk of a company (as measured by its beta (β)) is to note that the required return can conceptually be broken up into three components:

Required return = risk free rate + business risk premium + financial risk premium

In this formulation, the risk free rate is that required by investors in risk free assets and can be thought of as an indication of pure time preference. For assets involving risky returns, investors will require a premium over the risk free rate to compensate. The business risk premium measures this and can be thought of as that associated with an unlevered company with assets of a particular level of systematic risk. Since the company has no debt, the systematic risk of the assets is equal to the systematic risk of the company's equity. The business risk premium depends upon two factors, those being the market risk premium and the β of the assets. Each must be estimated, and although most attention is commonly given to the accuracy of the estimate of β, both are equally important. In fact, there are probably greater errors associated with mis-estimation of the market risk premium than with β.

The financial risk premium reflects the impact of leverage on the systematic risk of the company. For a more highly leveraged firm, the volatility of asset returns (and systematic risk) becomes magnified when equity returns associated with those leveraged assets are considered. The precise nature of the relationship depends upon the tax system in place. In a world without taxes, the required return relationship is:

$$k_e = r_f + \beta_u (r_m - r_f) + \beta_u (r_m - r_f) D/E \qquad (19)$$

where

$\beta_u (r_m - r_f)$ is the business risk premium;

$\beta_u (r_m - r_f) D/E$ is the financial risk premium; and

D/E is the company's debt to equity ratio measured in market value terms.

From equation (19) the beta of the leveraged company β_L is:

$$\beta_L = \beta_u \left(1 + D/E\right) \qquad (20)$$

In a classical tax world, the required return relationship is:

$$k_e = r_f + \beta_u (r_m - r_f) + \beta_u (r_m - r_f)(1 - t_c) D/E \qquad (21)$$

From equation (21) the beta of the leveraged company β_L is:

$$\beta_L = \beta_u \left(1 + \frac{D}{E}(1 - t_c)\right) \qquad (22)$$

Under the imputation tax system, the required return relationship if imputation credits are fully valued is:

$$k_e = r_f(1 - t_c) + \beta_u\left(r_m - r_f(1 - t_c)\right) + \beta_u\left(r_m - r_f(1 - t_c)\right)(1 - t_c) D/E \quad (23)$$

From equation (23) the beta of the leveraged company β_L is:

$$\beta_L = \beta_u \left(1 + D/E\right) \qquad (24)$$

In practice, the appropriate adjustment for leverage under the Australian tax system is likely to lie somewhere between the classical and pure imputation adjustments described above. That is:

$$\beta_L = \beta_u \left(1 + \frac{D}{E}(1 - \alpha t_c)\right) \qquad (25)$$

where $0 < \alpha < 1$. Unfortunately there is little empirical evidence on whether these adjustments apply in practice and thus there is little guidance on what value α might take. However, not too much should be made of this, since the impact on required rates of return is relatively minor compared to other possible estimation errors in calculating required rates of return. For example, if $\beta_u = 1$, $D/E = 1$ and $t_c = 30\%$ then the effect on β_L of choosing different α values is as given below:

α	0	0.5	1
β_L	2	1.85	1.7

Since this is being applied to a market risk premium in the order of 5 per cent per annum, the difference between the case where β=2 and β=1.7 is equivalent to a rate of return difference of 10 per cent versus 8.5 per cent. While this is not insignificant, estimates of the market risk premium (pre imputation) are typically presented as being of the order of between 6–8 per cent, i.e. having a greater margin for error. Clearly, on a theoretical basis a leverage adjustment should be undertaken, but concern over the precise nature of the tax adjustment probably involves concern of an unnecessary degree of precision.

Pricing principles and asset valuation methodologies

Beta, pricing principles and asset valuation

Once an acceptable cost of equity capital has been derived it may be appropriate to compare it to the company's economic rate of return defined as:

$$\mathrm{ERR} = \frac{\mathrm{d} + \Delta \mathrm{E}}{\mathrm{E}} \qquad (26)$$

where E is the market value of the company's equity and d is the value of dividends paid over the period. This in turn can be linked back to the company's cash flow, cf, by noting that:

$$\mathrm{E} = \mathrm{MVA} + \mathrm{G} \qquad (27)$$

and

$$\mathrm{d} + \Delta \mathrm{MVA} = \mathrm{cf} - \mathrm{ED} \qquad (28)$$

where

MVA is the market value of assets in place, G is the value of growth opportunities and ED is economic depreciation (the decline in the market value of assets in place), so that:

$$\mathrm{ERR} = \frac{\mathrm{cf} - \mathrm{ED} + \Delta \mathrm{G}}{\mathrm{E}} \qquad (29)$$

In practice, accounting data provides us with a measure of the accounting rate of return defined by:

$$\mathrm{ARR} = \frac{\mathrm{d} + \mathrm{RE}}{\mathrm{BVA}} = \frac{\mathrm{cf} - \mathrm{AD}}{\mathrm{BVA}} \qquad (30)$$

where AD is accounting depreciation, BVA is book value of assets in place, and minor differences between accounting accruals and cash flows are ignored. Since accounting relationships will provide information on the links between product price charged and ARR, it is possible to impute an acceptable price once an acceptable ARR is determined. The problem in practice is that ARR and ERR can differ significantly, and the required ERR cannot be simply translated into a required ARR. The differences arise from several factors.

Growth opportunities

Stock market value and return on equity reflect the value (and change in value) of growth opportunities available to the company. These are the opportunities available to the company to invest in (and/or earn on current assets) a rate of return in excess of that required by investors. Where such opportunities exist, the stock market value can exceed the market value of assets in place. Consequently, the base value upon which a return is required differs between accounting and economic rate of return measures, even where assets in place are marked to market value. However, if the company in question can earn only the required rate of return, the two valuations should coincide — as the value of growth opportunities will be zero. Thus if the assets in place are marked to market value, there will be no difference between the bases of the rate of return calculations.

Non verifiable asset value

The problem referred to here is that where such assets do not have alternative uses from which a competitive market valuation can be obtained, their mark to market value cannot be determined independently of the prices which the company can charge. Thus, for example, if the pricing regime allows a stream of profits in perpetuity of $10 and the required rate of return is 10 per cent, the asset value is $100, whereas a profit stream of $20 would cause the asset value to be $200.

Depreciation

Divergence between accounting and economic depreciation creates two potential problems. First, because of the cumulation of differences, the book value of assets may differ from the mark to market value and thus affect the base on which returns are to be calculated. Second, in any period accounting income and economic income may differ.

The implication of the above discussion is as follows. Given the determination of an acceptable return on equity capital, the regulatory setting of prices is hampered by differences between accounting income and economic income, and by the problems of obtaining independent market values for assets in place. If asset values can be determined, then price determination can proceed by using economic depreciation rather than accounting depreciation in the determination of income[19].

Value added approaches

A fashionable approach to measuring corporate performance is to estimate value added by the company, based on an estimate of the return achieved over and above the cost of capital used by the company. Thus, for example, temporarily ignoring complications associated with accounting information:

Value added = [return on investment - WACC] x capital invested.

[19] If prices are set with the objective of ensuring a return equal to the required return, there will be no discrepancy between stock market value and mark to market value of assets.

Such measures, it is argued, provide a single performance measure incorporating the effects of operating, investment, and financing decisions. In the current context, the relevance of such an approach is that a competitive industry would achieve a value added measure of zero since it would just achieve a return sufficient to compensate suppliers of capital for the risk borne.

In practice, there are various approaches to the measurement of value added, recognising the problems of converting accounting information into a form compatible with economic concepts. Stern-Stewart Inc. advocate a concept known as Economic Value Added (EVA) which involves adjustments to accounting data specific to the user in order to measure return on investment, and which uses a book value of invested capital. The Boston Consulting Group utilises a method of 'cash on cash', preferring to derive explicit estimates of cash flow generated and the initial cash flow commitment of investors. A.T. Kearney (Australian Financial Review, 26th August 1996, p. 14) use a similar approach, calculating measures of shareholder value creation and economic profitability.

In the case of access arrangements, where the facilities are most likely to involve significant depreciable assets which may have limited alternative uses, the adjustments required to accounting data are likely to be quite specific to the case involved, and potentially complex.

Nominal and real values of WACC

As a general rule, the valuation of an asset may be undertaken using either nominal or real data provided both the cashflows and discount rate are defined on a consistent basis. Specifically this means applying a real discount rate to cashflows expressed in real dollar terms or applying a nominal discount rate to cashflows expressed in nominal dollar terms. Because of difficulties associated with forecasting future inflation levels it is often easier to forecast cashflows in real terms. However there are two complications which should be kept in mind if real values are to be used. Firstly, because tax depreciation is based on nominal historical costs, distortions may occur in the calculation of depreciation tax shields. Secondly, similar distortions in tax liabilities may arise from the fact that the valuation of inventories is also based on nominal and not real costs.

Stranded assets and an appropriate rate of return

Where investments are undertaken and prove to be a failure, economic income can be determined by recognising the loss in market value when it occurs. This means that the market value of remaining assets will then exclude that asset, and reflect the market value of capital to shareholders. The negative return associated with the asset will be recorded in the period in which it occurs, depressing the return to shareholders below that expected.

The possibility of such negative returns occurring raises the question of whether 'fair pricing' needs to allow for such losses. For example, including the original (depreciated at accounting standards) value of stranded assets in the asset base on which the required return is applied would allow shareholders to recoup the loss over time (by passing it on to customers). There is no general case for such an approach, since such losses can be thought of as reflecting unsystematic risk and thus not relevant for determining required rates of return. Over time, greater than anticipated returns on some assets can be expected to offset such losses. While the owners of the business may not be sufficiently diversified to make the loss associated with this risk irrelevant, from the perspective of the capital market as a whole such risks are diversifiable and thus not priced. If the owner chooses to be less than fully diversified, they are entitled to bear the upside and downside of such non-systematic risks, but cannot be expected to warrant a higher rate of return in a competitive market place. Only if the regulatory process distorts the non-systematic risk facing an undiversified owner, for example by inhibiting positive unsystematic returns while permitting negative outcomes might a case be made.

Changes in the WACC and value of assets in place

Regulatory determination of an appropriate price is further complicated by the fact that the WACC can change over time. Consequently, the WACC prevailing today may not have the same value as the WACC prevailing when an operational asset was first purchased. This raises the questions of whether the current or original WACC value should be used in regulatory determination of prices and how the asset value should be calculated as the base for application of the WACC.

A useful way to address this question is to ask whether owners of the assets should bear the risk of changes in the WACC. The answer to this is yes. Investment decisions involve undertaking activities which rearrange the timing of cash flows and one risk involved is that of market changes in the value of time (interest rates). An increase (decrease) in market interest rates leads to a decrease (increase) in the market value of an asset which has a set of future operating cash flows expected (and unaffected by the change in interest rates).

This does not mean that the future cash flows associated with the asset should change (or be allowed to change) when interest rates change. The risk borne by the owners of the asset is that the present (market) value of the predetermined (risky) future cash flows will change. Consequently, regulatory price determination should not be conducted in such a way as to lead to changes in allowed prices on production arising out of past investments when interest rates change.

Implementing an approach which achieves this outcome is difficult. If market (reproduction) values of assets were available the current WACC value could be applied to the asset base calculated in that way to determine allowable prices. Implemented correctly, this would lead to no changes in allowable prices from output arising from past investment decisions arising from a change in market interest rates and the WACC. Owners of the organisation would bear the risk of changes in discount rates via changes in the market value of assets in place and realised returns (incorporating asset value changes) would move inversely with unanticipated changes in discount rates. Using market (reproduction) values would also impose technological risk upon owners of the assets, which would seem appropriate. Consider, for example, a situation where a new discovery meant that existing assets were no longer the most efficient available. Their lower market value combined with current WACC would lead to a reduction in allowable prices reflecting the benefits of the new discovery.

Unfortunately, utilising market (reproduction) values involves considerable complexities when there is no market based estimates available and where those values depend upon discretionary determinations of future cash flows by the regulatory authorities. Nevertheless, the conceptual appeal of the approach suggests that it warrants continued attention as a method to be aimed for.

An alternative approach might be to utilise accounting values of asset value and to apply a required rate of return based on the WACC prevailing at the time the assets were purchased. This is conceptually simple (although it may require more from accounting systems than they can deliver) and has one advantage and one drawback. The advantage is that changes in the WACC will not lead to changes in allowed prices. Owners will still bear the risk arising from changes in discount rate, although these will not be recognised in the accounting rates of return used. The disadvantage is that this approach will shield owners from technological risk, unless asset valuations take account of such effects. Consider a situation where a new innovation significantly reduces the cost of production relative to using existing assets. Unless the asset valuation approach uses a (now lower) replacement cost value reflecting the new technology, the allowable price will not be changed and the benefits of the new technology not passed on to consumers. Since the objective of the regulatory pricing policy is to mimic to some degree a competitive outcome, this appears inappropriate and shield owners from risks which they can be reasonably expected to bear.

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