COUNTING THE COSTS OF CAPITAL

PERMJIT SINGH LOOKS AT CALCULATING A COMPANY'S AVERAGE COST OF CAPITAL BY USING THE CAPITAL ASSET PRICING MODEL.

The cost of capital for a project (a company, division, or a single investment) is the cost of its debt and equity finance. Unlike conventional straight debt, calculating the cost of equity is relatively difficult. In this article, we review an established equity pricing model, the capital asset pricing model (CAPM), followed by a discussion of calculating the cost of capital including debt – that is, the weighted average cost of capital (WACC)[1].

WHY THE COST OF CAPITAL IS IMPORTANT. A project can be regarded as a source of income for its investors. To find the value today of a future income stream, a discount rate is required. For example, for a perpetual income stream:

Value = income/discount rate *(1)*

The discount rate is the return investors require in future as compensation for handing over their capital to the project today, that is, it is the cost of capital. As we can see from equation *(1)* above, the project's value is related to its cost of capital. Knowing the cost of capital is therefore a fundamental requirement for capital budgeting and for investment appraisal.

COST OF EQUITY. Equity investors are assumed to be risk-averse – that is, they require a higher return for investing in projects with a higher risk (higher variability of returns). However, they do not expect compensation for risks which they can eliminate through holding a diverse portfolio of investments, that is, for risks that are diversifiable (*unsystematic*).

CAPITAL ASSET PRICING MODEL. The concepts of risk and return, systematic and unsytematic risk, diversification, and risk aversion, are encapsulated in the CAPM. The other key component is beta (β), a measure of the correlation of a security's return relative to the market's return.

In *Figure 1*, the horizontal axis represents the β for securities that make up the market, for example, shares of the FT All Share Index. By definition, the average β of the market securities is set at 1.0, corresponding to a return Rm for the market as a whole. Securities whose β is also 1.0 are expected to have a return, Rs, which rises or falls by the same percentage as the market rises or falls. However, securities whose β is below (above) 1.0, are expected to have a return which moves less (more) than the movement in the market return in response to *systematic* risks.

The diagonal line in *Figure 1* is called the security market line (SML); it intercepts the vertical axis at a rate of return, Rf, which can be obtained on a riskless security (such as short-term government securities), that is, one whose return is independent of systematic risks and hence has a β of 0.0.

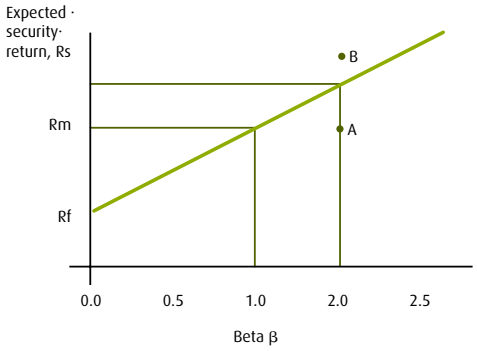
We now have all of the components we need to determine the return of any security comprised in the market using the CAPM, that is:

Rs = Rf + βs (Rm-Rf) *(2)*

where:

Rs = Return on a security, for example, ordinary shares
Rf = Return on a risk free security, for example, government bonds
βs = Beta factor for the security

FIGURE 1
CAPITAL ASSET PRICING MODEL.



(Rm-Rf) = The return on the market Rm in excess of the risk-free return Rf

For example, assuming the market return is 10% and the risk-free rate is 6%, then a security whose β is 2, will have an expected return Rs of:

Rs = 6% + 2(10%-6%) = 14%.

The CAPM provides the equity market's minimum rate of return for a project. If a company fails to generate this return, that is, its return to shareholders falls below the SML (point A in *Figure 1*) but it maintains the same β< then its share price will fall, raising investors' return rises back up to the SML.

Conversely, if a company's return exceeds that expected by the market (point B in *Figure 1*), its share price will rise as investors rush to buy, lowering its return down to the SML. The CAPM therefore provides a hurdle rate that a company must reach to maintain shareholder value.

PROXY COMPANIES. Betas for many companies are available from service providers, but they can be determined using spreadsheet packages or manually. Alternatively, the β for a project can be estimated using the β of one or more proxy companies, that is, companies whose characteristics match those of the project. For example, a textile manufacturer which is entering the transport business could use the β of *transport* companies (not textile companies).

UNGEARING β. So far we have assumed that a project is financed 100% by equity, or that the proxy companies are each 100% equity-financed, that is, each is ungeared (has no debt). However, 100%-equity financing is rare in practice and so the cost of equity must be adjusted for the effect of gearing (debt); usually, this means adjusting the β. Equation *(3)* below shows the relationship between β and gearing:

$$\beta ug = \beta g / 1 + [(D/S)(1-Tc)] \qquad (3)$$

where:

βug = β ungeared
βg = β geared
D = the market value of the company's debt
S = the market value of the company's shares
Tc = the corporate tax rate on debt

To illustrate how to use equation *(3)* to ungear β, imagine a proxy company with a geared β of 1.4, gearing of 0.7 (that is, the ratio of D to S in equation *(3)*), and a corporate tax rate of 30%; its ungeared β using equation *(3)* is therefore 0.99. This is the β we should use as a proxy β in our ungeared project.

If however, we decide to gear up our project to 0.3, the β we use to calculate the cost of equity then becomes, using equation (3), 1.17. The increase in β reflects the increased financial risk (that is, the increased volatility of expected returns) of the project caused by debt.

INTERNATIONAL PROJECTS. CAPM can also be applied where equity investors and the project are located in different countries, although care should be taken when selecting the appropriate β. For example, a Swiss company which locates its pharmaceuticals division in the US should determine the project's equity β in terms of the movement of US-based pharmaceutical companies' β relative to the *Swiss* equity market, not relative to the US equity market.

WEIGHTED AVERAGE COST OF CAPITAL (WACC). As its name implies, WACC is a weighted average of the costs of various types of capital which finance a company or a project. For debt and equity, it can be represented as:

$$WACC = [Rd(1-Tc)D/V] + [Re(E/V)] \qquad (4)$$

where:

Rd = the pre-tax interest rate of debt
Tc = the corporate tax rate
D = the market value of debt
V = the market value of the company (the sum of the market values of D and E)
Re = the rate of return on ordinary shares
E = the market value of ordinary shares

A number of factors should be borne in mind when using WACC:

- The cost of short-term debt should be included in the WACC calculation where this forms a *permanent* source of finance for a project.
- When determining which cashflows to discount at the WACC rate, *do not* deduct interest payments, because the WACC rate includes the cost of debt, and *do not* adjust the interest payments for the tax benefit of debt, because this benefit is picked up in the WACC rate (if the company has no taxable profits however, Tc in equation *(4)* should be set to zero). Other taxes (such as that payable on profits) should be treated as though the project is 100% equity financed. For example, consider a project that does not depreciate and which generates earnings of £2.085m in perpetuity before interest and corporation tax of 35% (EBIT). The project's value is: £1.355m [£2.085m x (1-0.35)] divided by the WACC rate (10.84%), that is, £12.502m.

The WACC rate is derived from £7.502m of equity costing 14.6%, and £5m of debt costing 8%. The project's value can be shown to equal the combined *market values* of equity and debt:

Value of equity = cashflow to equity investors/cost of equity
= (EBIT-debt interest) x (1-0.35) / 0.146
= (2.085-0.4) x 0.65 / 0.146
= £7.502m
Value of debt = cashflow to debt investors/cost of debt
= debt interest / 0.08
= 0.4 / 0.08
= £5m

- Base the calculation of WACC on the long-run, not short-run, ratio of debt to equity. For example, a project may be financed 100% by debt in the short term (perhaps because debt financing is available at short notice) but its long-term ratio might be 30:70 debt:equity. This is the appropriate ratio to use for calculating the project's WACC.
- The application of WACC is based on a number of assumptions, which, if they cease to be applicable, can significantly alter the economic validity of previous capital budgeting or investment appraisal decisions, unless the WACC is adjusted. For example, the

project's assumed gearing might change; its ability to shield taxable profits from corporate tax might reduce, so that all the expected benefits of tax deductibility, (1-Tc) in equation *(4)*, will no longer be obtained; or its expected systematic risk might increase, warranting a higher cost of equity.

UNGEARING WACC. Discounting a project's cashflows at a particular WACC (for example, that of the company or a proxy project) assumes that the gearing implicit in the WACC will remain constant. If the gearing assumption is no longer valid, the WACC must be adjusted – using a three-step process.

To illustrate the adjustment, suppose a company with a current ratio of debt to debt plus equity (D/V) of 0.4 intends to change its ratio to 0.2. Assume also that its corporate tax rate is 35%, the market value of debt is 50, the market value of equity is 75, the pre-tax cost of debt is 8%, the cost of equity Re is 14.6% before the reduction in debt, and that the reduction in debt reduces the cost of debt to 7%. What will its WACC be after the reduction in D/V?

Using equation *(4)*:

At D/V = 0.4
WACC = 0.08(1-0.35)(50/125) + 0.146(75/125) = 0.1084 = 10.84%

Step 1: to ungear the WACC we must recalculate it using equation (4) but excluding the tax effect (1-Tc):

WACC = [Rd(D/V)] + [Re(E/V)] *(5)*

WACC = 0.08(50/125) + 0.146(75/125) = 0.1196 = 11.96%

Note that equation *(5)* is based on Modigliani and Miller's first proposition, that a company's cost of capital is independent of the ratio of debt to equity.

Step 2: we take the ungeared WACC and use Modigliani and Miller's second proposition, that the cost of equity is directly proportional to the level of debt, taking care to use the ratio of debt to equity (D/E) not debt to debt plus equity (D/V) used in calculating the ungeared WACC, and to adjust the cost of debt to the new D/E ratio. Therefore:

Cost of geared equity Re = 0.1196 + (0.1196-0.07)(25/100) = 0.132 = 13.2%.

Step 3: having calculated the cost of equity at the lower D/E ratio, we then use it to recalculate WACC at the lower D/V ratio, using equation (4):

At D/V = 0.2
WACC = 0.07(1-0.35)(25/125) + 0.132(100/125) = 0.1147 = 11.47%

Therefore, reducing gearing lowers financial risk and the cost of equity Re (and in our example, lowers the cost of debt too), but it raises the WACC rate by the reduction in the value of the tax benefit of debt (0.63% in our example).

ADDING UP THE COSTS. Calculating a project's cost of capital (whether the project is a company, a division, or a single investment) affects shareholder value, and so the decision to proceed or not with the project. The calculation involves first calculating the cost of each type of capital, and then calculating a weighted average of these types, and it takes into account the effect of corporate tax. The CAPM intuitively links risk to return, however, there are several caveats to its use (including its historical performance; efficient markets; choice of market portfolio and risk-free rate; and market anomolies).

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Note

A more detailed discussion, including alternative models, will be published in the Association's Treasurer's Handbook 2003 *in late February.*

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