7 Capital Gearing and the Cost of Capital

Introduction

If an *all-equity* company undertakes a capital project using the *marginal* cost of equity as its discount rate, the total market value of ordinary shares should increase by the project's NPV. However, most firms use a *mix* of ownership capital and borrowed funds from financial institutions for new investments. The relationship between the two is termed *capital gearing* or *leverage*. A company is highly geared (levered) when it has a significant proportion of borrowing relative to shares in its capital structure. It is lowly geared when the ratio of debt to equity is small.

In Chapter Six we observed that corporate borrowing is attractive to management because interest rates on debt are typically lower than equity and often qualify for tax relief As a consequence, a judicious amount of debt introduced into a firm's capital structure should lower the overall or *weighted average cost of capital* (WACC) employed as a cut-off rate for the appraisal of new projects, thereby increasing their expected NPV and corporate value.

You will also recall from Chapter Six that a company's component capital costs are derived by identifying the *opportunity cost* of each fund source using valuation models that determine debt and equity yields under various guises. Thus, our current analysis answers a logical series of questions, given the normative assumption of financial management, namely maximum profit at minimum cost.

How do individual capital costs combine to define WACC for use in investment appraisal?

How valid are the theoretical assumptions that underpin WACC computations?

What are the real-world problems associated with WACC estimations?

7.1 The Weighted Average Cost of Capital (WACC)

Let us begin our analysis by first defining an overall cost of capital in *taxless* world where management has access to only two sources of finance: equity and debt.

A general formula for WACC is given by the formula for a *simple weighted average*:

(1) $K = K_e (V_E / V_E + V_D) + K_d (V_D / V_E + V_D)$
where: K = WACC,
K_e = cost of equity
K_d = cost of debt
V_E = market value of equity
V_D = market value of debt

If we now introduce corporate taxation (at a rate t) the after tax cost of debt K_{dt} should be substituted into the preceding equation using the appropriate debt formulae from Chapter Six as follows.

(2) $K = K_e (V_E / V_E + V_D) + K_{d\,t} (V_D / V_E + V_D)$

This is equivalent to:

(3) $K = K_e (V_E / V_E + V_D) + K_d (1\text{-}t) [(V_D / V_E + V_D)]$

Equations (2) and (3) may be rewritten using simpler notation. For example, with tax:

(4) $K = K_e (W_E) + K_{dt} (W_D)$

where: W_E = the weighting applied to equity $(V_E / V_E + V_D)$
W_D = the weighting applied to debt $(V_D / V_E + V_D)$

Thus, a firm financed equally by equity and debt yielding 10 percent and 5 percent, respectively, would calculate its WACC using Equation (4)as follows:

K = 10% (0.5) + 5% (0.5) = 7.5%

Activity 1

Given the following company data:

K_e = 12%, K_d = 8%, V_E = £6 million, V_D = 4 million

Calculate WACC and jot down your thoughts on any assumptions that might validate its use as a discount rate for project appraisal before reading the next section

The individual costs of equity and debt capital are weighted by their proportion of the company's total market value. Using Equation (1) and simplifying:

$$K = [(0.12 \times 0.6) + (0.08 \times 0.4)] / 1.0 = 0.104$$

So, the WACC used as the company discount rate for new project appraisal is 10.4 percent.

7.2 WACC Assumptions

WACC use as a corporate discount rate for investment appraisal depends upon three assumptions.

- New projects have the same *risk-return* profile as the company's existing activities.
- Each project is *marginal* to the scale of existing operations.
- The company will retain its *existing* capital structure, leaving *financial risk* unchanged.

The reason for the first assumption is obvious. A company's component capital costs reflect the variability of future expected dividend and interest flows. Thus, it follows, that WACC also reflects the overall risk of these combined flows. So, if we use this figure as a discount rate in project appraisal, the new investment's risk-return characteristics must satisfy the company's existing expected dividend and interest payments.

The second assumption is also common sense. When firms consider new investment, the relevant costs refer to the returns that the company must earn on relatively small incremental additions to its total capital base. From an economic viewpoint, they are *marginal* costs of capital and are only applicable to the appraisal of marginal investments: projects that are small relative to the size of the company.

Finally, the third assumption is necessary because WACC can only provide an appropriate discount rate if new projects are financed in the *same proportion* as existing assets. This arises for two reasons.

If a company alters its capital structure, the weights applied to the component costs in the WACC calculation would also change, leading to a new discount rate.

A change in the capital mix (gearing) might also affect the investors' perception of the *financial* risk associated with their investment in the firm. They may then react by buying or selling (as opposed to holding) their securities, thereby affecting the respective yields which determine the WACC.

For example, a new debt issue could increase the uncertainly experienced by the shareholders when they recognise that debt-holders will receive their claim to earnings (interest) before any dividend payment. With increased risk, they sell their holding equity prices may fall because the market requires a higher return as compensation. For the firm, what seems a simple change in the debt-equity ratio is, therefore, a complex decision. Quite apart from revised weightings at new market prices, it must also consider the explicit *marginal* cost of issuing debt *and* the *implicit* cost to the shareholders of their increased financial risk. All three may combine to produce a drastic change in WACC.

Activity 2

Changes in the financial mix (gearing) of a company and the impact of risk on its overall cost of capital and value do not necessarily invalidate the use of WACC as an investment criterion.

Can you think of any reasons for this?

Whilst corporate investment decisions should determine a firm's overall cost of capital, management should avoid the mistake of always associating the explicit marginal costs of new capital issues with a specific project. Often it will be difficult, if not impossible to assign a particular project to a particular source of finance. A company's funds should therefore be viewed *collectively*. In as much as finance is withdrawn from a *pool* of funds to invest in new projects, the pool is replenished as fresh capital is raised from outside, or profits are retained. Thus, the cost of capital used for any particular project is not the cost of a specific source of funds, but the overall cost of the company's pool: namely WACC.

In the short run, it is frequently the case that certain funds might also be secured at advantageous rates depending upon prevailing market conditions. This will encourage firms to depart briefly from their long-run capital structure. Under such circumstances, however, WACC still represents an appropriate discount rate for long-term investment, providing the projects exhibit a similar risk-return profile.

Even if funds are raised explicitly from one source to finance an incremental investment, there are sound reasons for using the WACC as a discount rate, particularly if the change in the capital structure represents a short-run deviation from the desired capital mix. First, a rational choice of funds is a *financial* decision taken not in relation to the *investment* decision but in relation to the firm's long-term capital structure. Second, there are substantial economies of scale to be gained in terms of reduced issue costs by raising large amounts of capital from one source and then another.

7.3 The Real-World Problems of WACC Estimation

Given the assumptions of *homogenous* risk, *marginal* investment and a *stable* capital structure, WACC seems an appropriate *minimum* return criterion for new projects that will hopefully *maximise* wealth.

However, a company's overall cost of capital is a complex concept, which may include far more than shareholder dividend-growth expectations and fixed rates of debt interest. Moreover, the WACC model assumes that once they are determined, the variables selected for inclusion in the model are correctly defined and will not change. But think about it?

WACC is applied to investment projects that extend over numerous time periods. Thus, its value is likely to change with economic circumstances, thereby invalidating original NPV calculations. A simple problem concerns the estimation of after-tax capital costs determined by an existing tax regime that changes. More complex is the 2008 global financial meltdown, not only with revisions to interest rates but also equity yields and values characterised by markets unwilling to finance the most "blue chip" of firms.

Even if we ignore recent catastrophic events, it is important to realise that at any point in *normal* economic cycles, the cost of capital and financial mix for individual companies can vary considerably, even within the same sector. Some firms are naturally more risky than others. Different companies may have different capital structures, by accident if not design. As we shall discover, differences in WACC have important consequences for the relative economic performance of companies and wealth creation.

Review Activity

You are asked to evaluate an investment costing £100,000 and yielding £11,500 per annum for the foreseeable future, subject to the constraints that its acceptance will not alter the firm's existing risk-return profile and capital structure:

- Derive and explain WACC as a discount rate if the corporate tax rate is 25 per cent.
- Evaluate the project's viability by applying the NPV decision rule.
- Outline the implications for shareholder wealth.

The following information is available:

(i) Existing Capital Structure (£k at cost)

Ordinary shares (12 million)	12,000
Retained Earnings	4,000
6% Preference shares	2,000
6% Irredeemable Debentures	6,000

(ii) Ordinary Shares
The current market price (*ex div*) is £7.00. Forecast total dividends are £6 million, which represent 75 per cent of earnings. Dividends have been growing at an annual compound rate of 5 percent. If new ordinary shares were issued now the costs incurred would represent 25 pence per share and a reduction below market value of 50 pence per share would also be required to ensure full subscription.

(iii) Preference Shares
Despite a par value of £1.00, current trades are only at 43 pence with new issues at 40 pence.

(iv) Debentures
£100 loan stock currently priced at £92 would need to be issued at £90 per cent

The derivation of WACC is straightforward using the appropriate capitalisation formulae, incorporating tax and issue costs where appropriate.

- *Marginal* component costs are defined as follows:

Issue of ordinary shares = (dividend per share / net proceeds of issue) + growth rate
= (0.50 / 6.25) + 0.05 = 13%

Retained earnings = dividend yield + growth rate
= (0.50 / 7.00) + 0.05 = 12.1%

Preference Shares = dividend per share / net proceeds of issue
= 0.06 / 0.40 = 15%

Debentures (post-tax) = [interest per debenture (1 – tax rate)] / net proceeds of issue
= 6.00(1 – 0.25) / 90.00 = 5.0%

- *WACC is defined* by weighting these individual costs by their proportion in the company's existing capital structure and summating the products to arrive at their WACC. One method is to use balance sheet data as follows:

	Capital Structure (£ million)	*Weight*	Component Cost (%)	Weighted Cost (%)
Ordinary shares	12	0.50	13.0	6.50
Retained Earnings	4	0.17	12.1	2.06
Preference Shares	2	0.08	15.0	1.20
Debentures	6	0.25	5.0	1.25
Totals	24	1.00		11.01

Weighted Average Cost of Capital: Book Value

However, this approach invites criticism. Although the capital mix will not change, *book* weights have been applied to component costs when clearly *market values* consequential upon additions to the capital structure are more appropriate. What is required for *new* investment is a weighted average of its *marginal* costs of capital and not *historical* costs.

	Capital Structure (£ million)	Weight	Component Cost (%)	Weighted Cost (%)
Ordinary Shares	84.0	0.89	13.0	11.57
Retained Earnings	4	0.04	12.1	0.48
Preference Shares	0.8	0.01	15.0	0.15
Debentures	5.4	0.06	5.0	0.30
Totals	94.2	1.00		12.50

Weighted Average Cost of Capital: Market Value

The substitution of market values for book values in our WACC calculation raises the company's discount rate from 11.01 percent to 12.5 percent.

Project viability is established by applying the NPV decision rule to the project data using the 12.5 per cent WACC based on market values as the cut-off rate. The NPV of the £100k investment yielding £11.5k in perpetuity is given by:

$$\text{NPV} = [(11{,}500 / 0.125) = £92{,}000] - £100{,}000 = (£8{,}000)$$

So, the project *under-recovers* and should be *rejected*. However, it is worth noting that if we had applied book values to WACC the project would appear acceptable.

$$\text{NPV} = [(11{,}500 / 0.1101) = £104{,}450] - £100{,}000 = £4{,}450$$

Even so, you will be in no doubt as to which decision is correct if wealth is to be maximised. Projects must always be evaluated in terms of current investment opportunities foregone. Hence, the market value of capital employed and its corresponding incremental yield are the correct factors to determine a firm's WACC as an overall cut-off rate for investment.

The shareholder wealth implications of the correct accept-reject decision using WACC as a discount rate can be confirmed by analysing the investment's impact on the equity yield. Using market weights from the previous table, let us first calculate the proportion of equity applied to the investment:

£100,000 (0.890) = £89,000

Next calculate the annual cash return available to the *new* ordinary shareholders.

	Capital Investment £	Capital Cost %	Investor Return £
Annual Cash Inflow			11,500
Retained Earnings £100,000 x 0.04	4,000	12.1	484
Preference Shares £100,000 x 0.01	1,000	15.0	150
Debentures £100,000 x 0.06	6,000	5.0	300
	11,000		**934**
Ordinary Shares			10,566

Finally, let us reformulate this cash return as a yield on the ordinary share issue associated with the investment.

Project equity yield = £10,566 / £89,000 = 11.87%

Since this is less than the 13 per cent *marginal* cost of new issues calculated at the outset of our analysis, we can confirm that the investment proposal should be rejected. You may also care to confirm that even if the 12.1 per cent cost of retained earnings were incorporated into the yield calculation to provide a more comprehensive measure of the equity rate (i.e. dividends plus retentions) the overall return would only be 11.88 per cent. Since this too, is lower than the 12.1 per cent yield on shares currently in issue, the project should still be turned down.

7.4 Summary and Conclusions

The previous Activity serves as a timely reminder that to maximise shareholder wealth, efficient financial management should comprise two distinct but *inter-related* functions.

- The *investment decision*, which identifies and selects opportunities to maximise expected NPV.
- The *finance decision*, which identifies potential fund sources required to sustain investment, evaluates the return expected by each and selects the optimum mix that minimises their combined cost (WACC).

> As mentioned earlier, the detailed derivation of an optimal capital structure and minimum WACC is better left to a more advanced treatment of finance. What we have observed, however, is that the issue of lower-cost debt (which incorporates tax relief) rather than equity should reduce WACC and increase corporate value. But it is worth noting that this *may only be true up to a point*.

One school of thought (the traditional view) states that when debt is introduced into a firm's capital structure it may initially reduce WACC and increase total value. But when shareholders and debt financiers perceive that the gearing level is excessive, the WACC will increase again and value fall. This *saucer-shaped* WACC plotted against increasing leverage is caused by combining a higher return required on existing equity with higher interest rates on new debt issues to compensate both capital providers for the higher *financial risk* of their investment. Beyond some minimum point, incremental borrowing will not reduce the WACC. It increases because of the detrimental effect on existing equity prices, thereby increasing shares yields. In turn, this leads to higher marginal costs of debt on further increments of borrowing, resulting in subsequent increases in the cost of all the equity in issue.

A contrary view originally synthesised by Modigliani and Miller (MM) as far back as1958, for which there is considerable empirical support, maintains that WACC and value are *constant* irrespective of the level of gearing. MM maintain that, just like dividends and retained earnings, equity and debt are also *perfect economic substitutes*. Any change in the gearing ratio immediately elicits a compensatory change in the cost of equity to counter the change in the level of financial risk.

If you are perplexed don't worry. The *dynamics* of leverage, like much else in finance, are in total disarray since the 2008 global meltdown. Suffice it to say that, if a firm's capital structure is *stable*, managerial investment and financing decisions *should* be inter-related by the overall cost of capital.

> In terms of the *investment decision*, the WACC occupies a pivotal position as an opportunity cost criterion (return) which justifies the *finance decision*. A company wishing to maximise shareholders' wealth would only deploy funds if their marginal yield at least matched the rates of return its investors can earn elsewhere at commensurate risk.

7.5 Selected Reference

Modigliani, F. and Miller, M.H., "The Cost of Capital, Corporation Finance and the Theory of Investment", *American Economic Review,* Vol. XLVIII, No.3, June 1958.