# 1. Investment discount rate

## 1.1 Weighted average cost of capital (WACC)

The accurate calculation of the cost of capital is crucial to a firm's investment decisions. In addition, the results of discounted cash flow analysis are extremely sensitive to the cost of capital used in the calculations. The ultimate goal in the calculation of the cost of capital is to obtain the firm's marginal cost of capital to use in, for example, capital budgeting decisions or in valuation analysis. The firm's marginal cost of capital is defined as "the weighted average of the opportunity costs of its financing sources." The cost of capital, required to evaluate a given project, will be same as the WACC of the firm when the project under consideration is in line with the existing projects of the firm in terms of risk. A typical company will employ long-term debt, preferred stock and common equity as sources of capital. To determine the weighted average cost of capital (WACC) of a firm, the cost of each source of funds must be calculated individually. Then, market value weights for each source of capital must be determined and applied to each of the debt components as the weighting factor. It is important to note that all WACC costs are expressed on an after-tax basis.

### *1.1.1 Cost of debt*

#### *1.1.1.1 Cost of long-term debt*

A business firm can employ a variety of long-term debt instruments (known as debentures or bonds), to raise funds. These can be convertible (where the holder of the debenture can exchange the debt instrument for a specific number of common shares in the future) or non-convertible. Some of the common features of long-term debt instruments are:

1. They call for payment of interest at a specified coupon rate at regular intervals.
2. There is a specified maturity date at which time the issuer will make the final mandatory redemption payment (usually face value plus interest).

The cost of long-term debt (or cost of borrowing) is defined, as "the unit cost a company must pay for the use of borrowed funds". In other words, it is the rate of return that the company must earn on the investment made using the borrowed funds to generate enough cash to service the debt (i.e., pay the interest on the borrowed funds and to repay the principal on time). The cost of debt for a firm is taken as the yield to maturity (YTM) on the debt instrument (kd). The YTM of a debt issue is generally calculated using a trial and error procedure to solve the following equation for kd:

$$P = \sum_{t=1}^{n} \frac{C}{(1+k_d)^t} + \frac{F}{(1+k_d)^n}$$

The YTM is only a good estimate of the firm's cost of debt if the risk of default is relatively small. If, however, there is significant risk that the firm will default on its obligation, the YTM of the firm's debt, which is its promised return, will overstate investors' expected return. It may therefore be necessary to adjust the YTM based on the firm's default risk. One way to adjust for this effect is to calculate the cost of debt, *kd*, as *kd = YTM – Prob(default)×Expected Loss rate.* The average probability of default and expected loss rates can be inferred from data provided by credit rating agencies. For instance, if the average loss rate for unsecured debt is about 60 percent, and a firm has a B-rated bond outstanding with a (historical) default probability of 5.5 percent, the expected return to debt holders (kd) would be approximately 0.055×0.60 = 3.3 percent below the bond's quoted yield. See Berk and DeMarzo, Corporate Finance, page 412 for further details.

A simpler method is to use an approximate formula to solve for kd. The following approximate formula can be used to determine the value of kd with a reasonable degree of accuracy.

$$k_d = \frac{C(1-T) + \dfrac{(F-P)}{n}}{\dfrac{(P+F)}{2}}$$

In both the above formulae, the symbols used have the following meaning:

| | |
|---|---|
| P | amount realised on debt issue after deducting expenses, transaction costs etc. |
| C | annual debt interest payment |
| T | tax-rate applicable to the firm |
| F | redemption price, which is generally the face value |
| n | maturity period of the debt |

**Example:**
Unicredito Italiano, the product of a merger of Credito Italiano and three Italian regional banks, is a commercial bank with its main-basis in Italy and assets in Eastern Europe. It issues debentures with a coupon of 11 percent, face value EUR 100. The net amount realised per debenture is EUR 98.75. The debentures are redeemable at par after 15 years. The firm pays 40 percent tax on its income. Find out the cost of debt.

**Solution:**

$$k_d = \frac{11\cdot(1-0.4) + \dfrac{(100-98.75)}{15}}{\dfrac{(100+98.75)}{2}} = 6.73\%$$

If the debt capital of the firm is perpetual (where there is no finite maturity date), then the cost of debt is calculated using the following equation, solving for kd:

$$k_d = \frac{C(1-T)}{P}$$

#### *1.1.1.2 Term Loans*

The term loan is a medium-term debt financing instrument made by banks and insurance companies. The repayment of the loan can be tailored to the cash flow pattern of the borrowing company. For example, the first payment rate might be delayed for a year; if the business reason makes sense and the borrowing company remains creditworthy. Usually, term loans are repaid in level amounts (e.g. annuities) over the period of the loan. A large final "Balloon" payment or just single "Bullet" payments at maturity are possible too. After taxes, the cost of a term loan to a company is expressed as:

$$k_d = \text{Interest rate} \cdot (1 - \text{tax rate})$$

**Example:**
Cadbury-Schweppes, the English soft-drink and confectionery producer, took a term loan of EUR 300 million from Barclays Bank on 16th May 2001. The semi-annual interest rate on this loan is 5 percent and the repayment schedule provides for 16 half-yearly instalments starting on 20th February 2003 and ending on 20th August 2010. Assume that the firms' tax rate is 35 percent. Calculate the semi-annual post-tax cost of the term loan.

**Solution:**
$5\% \cdot (1 - 0.35) = 3.25\%$

### *1.1.2 The cost of equity capital*

The cost of equity capital can be defined, as "the minimum rate of return the firm should earn on the net equity funds raised by it in order to leave the market price of the equity stock unaffected." To determine the cost of equity capital, it is necessary to know the rate of return required by the equity stockholders. When the cost of new equity capital is to be calculated, the above rate is adjusted to take into account the flotation costs incurred when the firm issues additional stock.

There are several methods commonly used to estimate the rate of return:

- Capital asset pricing approach (CAPM);
- Arbitrage pricing model (APM);
- Dividend forecast approach;
- Realised rate of return approach;
- Bond yield plus risk premium approach; and
- Earnings price-ratio approach.

In their latest book about valuation, Copeland and his co-authors recommend the use of only the capital asset pricing model (CAPM)[1] and the arbitrage pricing theory (APM). Although the authors admit that both of these methods are hard to apply and are subject to measurement problems, they are considered to be the most theoretically correct. In their view, the other common approaches used to determine the cost of equity are conceptually flawed and give incorrect results. However, in developing markets such as Brazil, India, Malaysia, South Korea, etc. it is extremely difficult to use the CAPM and APM models.

#### *1.1.2.1 Capital Asset Pricing Model*

The premise for the Capital Asset Pricing Model (CAPM) is that the cost of equity is equal to the return on risk-free securities, plus the company's systematic risk (beta), multiplied by the market price of risk (market risk premium). The equation to determine cost of equity is as follows:

$$k_E = r_f + [E(r_m) - r_f] \cdot \beta E$$

where:

| | |
|---|---|
| rf | risk-free rate of return |
| E(rm) | expected rate of return on the overall market portfolio |
| E(rm)-rf | market risk premium |
| βE | systematic risk of the equity |

Suppose Kraft Food's stock has a beta of 0.50. If the risk-free rate is 4 percent, and the expected return of the market portfolio is 9.5 percent, what is the firm's cost of equity capital? ke = 0.04 + 0.5×0.055 = 6.75 percent.

Three factors need to be estimated in order to implement the CAPM approach: the risk-free rate, the market risk premium, and the systematic risk or beta.

The market risk premium is the difference between the expected rate of return on the market portfolio and the risk-free rate. Copeland generally recommends a 5-6 percent market risk premium for U.S. firms, although it may vary based on the specific company being evaluated. Damodaran ("*Damodaran on Valuation: Security Analysis for Investment & Corporate Finance*", Aswath Damodaran, John Wiley & Sons, Inc., 1994) points out that although the historical data on stock returns is easily obtainable in the U.S., reliable data on premiums for other countries for long periods of time are usually difficult to gather.

The following chart lists Damodran's guidelines of risk premiums which could be used depending on the financial market characteristics of a country.

[1] We might also mention Sharpe (1964) and Lintner (1965) for the capital asset pricing model (CAPM), and Ross (1976) and Roll and Ross (1980) for arbitrage pricing theory (APT).

| Financial Market Characteristics | Premiums over Govt. Bond Rate |
|---|---|
| Emerging markets with political risk<br>(South America, East European Markets) | 8,50% |
| Emerging markets<br>(Mexico, Asian markets other than Japan) | 7,50% |
| Developed markets with wide listings<br>(United States, Japan, Britain) | 5,50% |
| Developed markets with limited listings<br>(Western Europe, except Germany and Switzerland) | 4.5% to 5.5% |
| Developed markets with limited listings and stable economies<br><br>( Germany and Switzerland) | 3.5% to 4% |

Source: "Damodaran on Valuation: Security Analysis for Investment & Corporate Finance", Aswath Damodaran, John Wiley & Sons, Inc., 1994, p.23

**Table 1-1: Country risk premiums**

The practical application will be covered in more detail in the equities chapters. The "correct" risk premium is in fact the subject of ongoing debate among investors. We will describe the key aspects of this when the time comes.

#### *1.1.2.2 The Dividend forecast Approach*

This approach is based on the premise that the value of an equity stock is the sum of the present value of dividends paid on it. The simplified formula to calculate the rate of return required by equity stockholders, if the dividend is expected to grow annually at a set rate into infinity, is:

$$k_e = \frac{D_1}{P} + g$$

where:

| | |
|---|---|
| P | market price per share of equity stock |
| D1 | dividend expected at the end of year 1 |
| ke | rate of return required by equity stockholders |
| g | growth rate of dividends |

If the dividend is expected to remain constant over the years, the value of ke is calculated by inserting the value of g in the above equation as zero.

**Example:**
The market price per share of Danone, one of the world's biggest food producers, is EUR 131. The expected dividend (due in one year) is EUR 2.79 per share and the dividend is expected to grow at a constant rate of 4.9 percent per annum. Find out the cost of equity capital.

**Solution:**

$$k_e = \frac{D_1}{P} + g = \frac{2.79}{131} + 0.049 = 0.070 \text{ or } 7.0\%$$

If the expected growth rate of the dividends over time is expected to vary, the equation needs to be suitably modified. The following equation assumes a three-phase growth.

$$P_0 = \sum_{t=1}^{n_1} \frac{D_1 \cdot (1+g_1)^{t-1}}{(1+k_e)^t} + \sum_{t=1}^{n_2} \frac{D_{n_1} \cdot (1+g_2)^t}{(1+k_e)^{n_1+t}} + \sum_{t=1}^{\infty} \frac{D_{n_1+n_2} \cdot (1+g_3)^t}{(1+k_e)^{n_1+n_2+t}}$$

where:

| | |
|---|---|
| $P_0$ | price per share of equity stock |
| $g_1$ | expected growth rate in first phase |
| $g_2$ | expected growth rate in second phase |
| $g_3$ | expected growth rate in third phase |
| $n_t$ | the number of years |
| $D_t$ | dividend expected at the end of the period |
| $k_e$ | rate of return required by equity stockholders |

**Example:**
The price per share of Unilever, the Anglo-Dutch food and customer-products producer, is currently EUR 62. The dividend expected a year from now, D1, is EUR 1.57. After that, the dividends grow at 6 percent a year until the end of year 5. For the next 5 years after that, the dividend growth rate will be 8 percent, and subsequently it will be 7 percent forever. What is the cost of equity capital?

**Solution:**

$$62 = \sum_{t=1}^{5} \frac{1.57 \cdot 1.06^{t-1}}{(1+k_e)^t} + \sum_{t=1}^{5} \frac{1.57 \cdot 1.06^4 \cdot 1.08^t}{(1+k_e)^{5+t}} + \sum_{t=1}^{\infty} \frac{1.57 \cdot 1.06^4 \cdot 1.08^5 \cdot 1.07^t}{(1+k_e)^{10+t}}$$

Solving for ke by trial and error, we get ke = 9.54 percent

Since the expected rate of growth of dividends per share is an integral part in the calculation of the cost of equity capital to a firm, its estimation must be made as accurately as possible.

### *1.1.2.3 Realised Rate of Return Approach*

This approach is based on the premise that the rate of return realised by equity shareholder in the past can be regarded as a proxy for the rate of return required by them today and in the future. The yield on an equity stock for the year is:

$$R_t = \frac{D_t + P_t}{P_{t-1}} - 1$$

where:

| | |
|---|---|
| Rt | realised rate of return for year t |
| Dt | dividend per share for year t payable at the end of the year |
| Pt | price per share at end of year t |
| Pt-1 | price per share at the end of year t-1, or at the beginning of year t |

Note: $\frac{D_t + P_t}{P_{t-1}}$ in the above-mentioned formula is referred to as the “wealth ratio”

**Example:**
The dividend per share and price per share data of Deutsche Bank, one of the world's biggest banking groups, is given below (figures in EUR):

| **Year** | **1998** | **1999** | **2000** | **2001** | **2002** | **2003** |
|---|---|---|---|---|---|---|
| **Dividend per share** | 0.9 | 1.1 | 1.2 | 1.3 | 1.3 | 1.3 |
| **Price per share at the beginning of the year** | 63.2 | 48.8 | 79.1 | 88.8 | 79.3 | 43.9 |

Calculate the annual wealth ratios and the realised rate of return for the given period.

**Solution:**
The annual wealth ratios are as follows:

| **Year** | **1998** | **1999** | **2000** | **2001** | **2002** |
|---|---|---|---|---|---|
| **Wealth ratio** | 0.7864 | 1.6434 | 1.1378 | 0.9077 | 0.5700 |

The rate of return over the five-year period is:

$$(0.79 \cdot 1.64 \cdot 1.14 \cdot 0.91 \cdot 0.57)^{1/5} - 1 = -5.3\%$$

This approach assumes that the yield earned by investors in the past met their expectations and also that the same yield as in the past will satisfy their expectations in the future. This is an extremely unrealistic scenario considering the rate of inflation and changing interest rates. As a result, caution must be used in using past figures to predict the future.

### *1.1.2.4 Bond yield plus Risk Premium Approach*

This approach assumes that the rate of return required by the equity investors of a firm equals the yield on the long-term bonds of the firm plus a risk premium due to the added risk of equity over debt issues.

The assumption is that since equity investors bear a higher degree of risk then, say, bond investors, their required rate of return should include a premium for the higher risk. Generally, the premium figure ranges from 2 percent to 6 percent.

### *1.1.2.5 Earnings-Price Ratio Approach*

This approach calculates the rate of return required by equity investors using the following formula:

$$k_e = \frac{EPS_1}{P}$$

where:

EPS1 expected earnings per share (EPS) for the next year
P current market price per share

Note: EPS1 may be estimated as: (current EPS) · (1+growth rate of EPS)

This approach provides an accurate measurement of the rate of return required by equity investors under only two specific scenarios:

- When the earnings per share are expected to remain constant and the dividend payout ratio is 100 percent; or