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Chapter 8: RISK & RETURN

Total rate of return:

$$r_t = \frac{C_t + P_t - P_{t-1}}{P_{t-1}} \quad (8.1)$$

where

r_t = actual, expected, or required rate of return during period t
C_t = cash (flow) received from the asset investment in the time period $t - 1$ to t
P_t = price (value) of asset at time t
P_{t-1} = price (value) of asset at time $t - 1$

Expected return:

$$\bar{r} = \sum_{j=1}^{n} r_j \times Pr_j$$

where

r_j = return for the jth outcome
Pr_j = probability of occurrence of the jth outcome
n = number of outcomes considered

3. The formula for finding the expected value of return, $\bar{r}$, when all of the outcomes, r_j, are known and their related probabilities are equal, is a simple arithmetic average:

$$\bar{r} = \frac{\sum_{j=1}^{n} r_j}{n} \quad (8.2a)$$

where n is the number of observations.

Standard deviation of returns:

The expression for the *standard deviation of returns*, σ_r, is[4]

$$\sigma_r = \sqrt{\sum_{j=1}^{n} (r_j - \bar{r})^2 \times Pr_j} \quad (8.3)$$

Coefficient of variation:

$$CV = \frac{\sigma_r}{\bar{r}} \quad (8.4)$$

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Portfolio return:

$$r_p = (w_1 \times r_1) + (w_2 \times r_2) + \cdots + (w_n \times r_n) = \sum_{j=1}^{n} w_j \times r_j \qquad (8.5)$$

where

w_j = proportion of the portfolio's total dollar value represented by asset j

r_j = return on asset j

Of course, $\sum_{j=1}^{n} w_j = 1$, which means that 100 percent of the portfolio's assets must be included in this computation.

Total Security Risk:

$$\text{Total security risk} = \text{Nondiversifiable risk} + \text{Diversifiable risk} \qquad (8.6)$$

Portfolio beta:

$$\beta_p = (w_1 \times \beta_1) + (w_2 \times \beta_2) + \cdots + (w_n \times \beta_n) = \sum_{j=1}^{n} w_j \times \beta_j \qquad (8.7)$$

Of course, $\sum_{j=1}^{n} w_j = 1$, which means that 100 percent of the portfolio's assets must be included in this computation.

The capital asset pricing model (CAPM):

$$r_j = R_F + [\beta_j \times (r_m - R_F)] \qquad (8.8)$$

where

r_j = required return on asset j

R_F = risk-free rate of return, commonly measured by the return on a U.S. Treasury bill

β_j = beta coefficient or index of nondiversifiable risk for asset j

r_m = market return; return on the market portfolio of assets

Risk-free rate of return:

$$R_F = r^* + IP \qquad (8.9)$$

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Chapter 6: INTEREST RATES AND BOND VALUATION

Nominal rate of interest:

Risk premium:

Risk-free rate:

$$r_1 = \underbrace{r^* + IP}_{\substack{\text{risk-free} \\ \text{rate, } R_F}} + \underbrace{RP_1}_{\substack{\text{risk} \\ \text{premium}}} \tag{6.1}$$

As the horizontal braces below the equation indicate, the nominal rate, r_1, can be viewed as having two basic components: a risk-free rate of return, R_F, and a risk premium, RP_1:

$$r_1 = R_F + RP_1 \tag{6.2}$$

For the moment, ignore the risk premium, RP_1, and focus exclusively on the risk-free rate. Equation 6.1 says that the risk-free rate can be represented as

$$R_F = r^* + IP \tag{6.3}$$

Risky non-Treasury issues:

$$r_1 = \underbrace{r^* + IP}_{\substack{\text{risk-free} \\ \text{rate, } R_F}} + \underbrace{RP_1}_{\substack{\text{risk} \\ \text{premium}}}$$

In words, the nominal rate of interest for security 1 (r_1) is equal to the risk-free rate, consisting of the real rate of interest (r^*) plus the inflation expectation premium (IP), plus the risk premium (RP_1). The *risk premium* varies with specific issuer and issue characteristics.

Value of any asset at time zero:

$$V_0 = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \cdots + \frac{CF_n}{(1+r)^n} \tag{6.4}$$

where

V_0 = value of the asset at time zero
CF_t = cash flow *expected* at the end of year t
r = appropriate required return (discount rate)
n = relevant time period

We can use Equation 6.4 to determine the value of any asset.

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Basic model for the value:

$$B_0 = I \times \left[\sum_{t=1}^{n} \frac{1}{(1 + r_d)^t}\right] + M \times \left[\frac{1}{(1 + r_d)^n}\right] \quad (6.5)$$

where

B_0 = value of the bond at time zero
I = *annual* interest paid in dollars
n = number of years to maturity
M = par value in dollars
r_d = required return on the bond

Present value instead of future value:

1. Converting annual interest, I, to semiannual interest by dividing I by 2.
2. Converting the number of years to maturity, n, to the number of 6-month periods to maturity by multiplying n by 2.
3. Converting the required stated (rather than effective)[6] annual return for similar-risk bonds that also pay semiannual interest from an annual rate, r_d, to a semiannual rate by dividing r_d by 2.

$$B_0 = \frac{I}{2} \times \left[\sum_{t=1}^{2n} \frac{1}{\left(1 + \frac{r_d}{2}\right)^t}\right] + M \times \left[\frac{1}{\left(1 + \frac{r_d}{2}\right)^{2n}}\right] \quad (6.6)$$

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CHAPTER 7: STOCK VALUATION

Basic valuation model for common stock:

$$P_0 = \frac{D_1}{(1+r_s)^1} + \frac{D_2}{(1+r_s)^2} + \cdots + \frac{D_\infty}{(1+r_s)^\infty} \quad (7.1)$$

where

P_0 = value today of common stock
D_t = per-share dividend *expected* at the end of year t
r_s = required return on common stock

Zero-Growth Model:

$$P_0 = D_1 \times \sum_{t=1}^{\infty} \frac{1}{(1+r_s)^t} = D_1 \times \frac{1}{r_s} = \frac{D_1}{r_s} \quad (7.2)$$

D_1 represent the amount of the annual dividend

Constant-Growth Model:

Gordon growth model:

By letting D_0 represent the most recent dividend, we can rewrite Equation 7.1 as

$$P_0 = \frac{D_0 \times (1+g)^1}{(1+r_s)^1} + \frac{D_0 \times (1+g)^2}{(1+r_s)^2} + \cdots + \frac{D_0 \times (1+g)^\infty}{(1+r_s)^\infty} \quad (7.3)$$

If we simplify Equation 7.3, it can be rewritten as

$$P_0 = \frac{D_1}{r_s - g} \quad (7.4)$$

Value of the stock:

$$P_0 = \underbrace{\sum_{t=1}^{N} \frac{D_0 \times (1+g_1)^t}{(1+r_s)^t}}_{\substack{\text{Present value of} \\ \text{dividends} \\ \text{during initial} \\ \text{growth period}}} + \underbrace{\left[\frac{1}{(1+r_s)^N} \times \frac{D_{N+1}}{r_s - g_2}\right]}_{\substack{\text{Present value of} \\ \text{price of stock} \\ \text{at end of initial} \\ \text{growth period}}} \quad (7.5)$$

Free cash flow valuation model:

$$V_C = \frac{FCF_1}{(1+r_a)^1} + \frac{FCF_2}{(1+r_a)^2} + \cdots + \frac{FCF_\infty}{(1+r_a)^\infty} \quad (7.6)$$

where

V_C = value of the entire company
FCF_t = free cash flow *expected* at the end of year t
r_a = the firms weighted average cost of capital

Find common stock value:

$$V_S = V_C - V_D - V_P \quad (7.7)$$

To find common stock value: VS, we must subtract the market value of all the firm's debt: VD, and the market value of preferred stock: VP from VC:

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CHAPTER 9: COST OF CAPITAL

Before-tax cost of debt:

$$r_d = \frac{I + \frac{\$1{,}000 - N_d}{n}}{\frac{N_d + \$1{,}000}{2}} \quad (9.1)$$

where

I = annual interest in dollars
N_d = net proceeds from the sale of debt (bond)
n = number of years to the bond's maturity

After-tax cost of debt:

$$r_i = r_d \times (1 - T) \quad (9.2)$$

where

Tax rate: T

Cost of preferred stock:

$$r_p = \frac{D_p}{N_p} \quad (9.3)$$

where

annual dollar dividend= Dp

net proceeds from the sale of the stock Np

Gordon growth model:

$$P_0 = \frac{D_1}{r_s - g} \quad (9.4)$$

where

P_0 = value of common stock
D_1 = per-share dividend *expected* at the end of year 1
r_s = required return on common stock
g = constant rate of growth in dividends

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Cost of common stock equity:

$$r_s = \frac{D_1}{P_0} + g \qquad (9.5)$$

Required return:

$$r_s = R_F + [\beta \times (r_m - R_F)] \qquad (9.6)$$

where

R_F = risk-free rate of return
r_m = market return; return on the market portfolio of assets

Cost of retained earnings:

$$r_r = r_s \qquad (9.7)$$

Cost of a new issue of common stock:

$$r_n = \frac{D_1}{N_n} + g \qquad (9.8)$$

If we let Nn represent the net proceeds from the sale of new common stock after subtracting underpricing and flotation costs, the cost of the new issue, Rn.

Weighted average cost of capital (WACC):

$$r_a = (w_i \times r_i) + (w_p \times r_p) + (w_s \times r_{r \text{ or } n}) \qquad (9.9)$$

where

w_i = proportion of long-term debt in capital structure
w_p = proportion of preferred stock in capital structure
w_s = proportion of common stock equity in capital structure
$w_i + w_p + w_s = 1.0$

Ra = weighted average cost of capital

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Chapter 10 :CAPITAL BUDGETING TECHNIQUES

Net present value (NVP):

The **net present value** (**NPV**) is found by subtracting a project's initial investment (CF_0) from the present value of its cash inflows (CF_t) discounted at a rate equal to the firm's cost of capital (r):

$$\text{NPV} = \text{Present value of cash inflows} - \text{Initial investment}$$

$$\text{NPV} = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} - CF_0 \quad (10.1)$$

Profitability index (PI):

$$\text{PI} = \frac{\sum_{t=1}^{n} \frac{CF_t}{(1+r)^t}}{CF_0} \quad (10.2)$$

Internal Rate of Return (IRR):

$$\$0 = \sum_{t=1}^{n} \frac{CF_t}{(1+IRR)^t} - CF_0 \quad (10.3)$$

$$\sum_{t=1}^{n} \frac{CF_t}{(1+IRR)^t} = CF_0 \quad (10.3a)$$

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