**TABLE 2.5**

I. The cash flow identity

Cash flow from assets = Cash flow to creditors (bondholders) + Cash flow to stockholders (owners)

II. Cash flow from assets

Cash flow from assets = Operating cash flow – Net capital spending + Change in net working capital (NWC)

where:

- Operating cash flow = Earnings before interest and taxes (EBIT) + Depreciation – Taxes
- Net capital spending = Ending net fixed assets – Beginning net fixed assets + Depreciation
- Change in NWC = Ending NWC – Beginning NWC

III. Cash flow to creditors (bondholders)

Cash flow to creditors = Interest paid – Net new borrowing

IV. Cash flow to stockholders (owners)

Cash flow to stockholders = Dividends paid – Net new equity raised

**TABLE 3.8**

I. Short-term solvency, or liquidity, ratios

- Current ratio = \( \frac{\text{Current assets}}{\text{Current liabilities}} \)
- Quick ratio = \( \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}} \)
- Cash ratio = \( \frac{\text{Cash}}{\text{Current liabilities}} \)
- Net working capital to total assets = \( \frac{\text{Net working capital}}{\text{Total assets}} \)
- Interval measure = \( \frac{\text{Current assets}}{\text{Average daily operating costs}} \)

II. Long-term solvency, or financial leverage, ratios

- Total debt ratio = \( \frac{\text{Total assets} - \text{Total equity}}{\text{Total assets}} \)
- Debt-equity ratio = \( \frac{\text{Total debt}}{\text{Total equity}} \)
- Equity multiplier = \( \frac{\text{Total assets}}{\text{Total equity}} \)
- Long-term debt ratio = \( \frac{\text{Long-term debt}}{\text{Long-term debt} + \text{Total equity}} \)
- Times interest earned ratio = \( \frac{\text{EBIT}}{\text{Interest}} \)
- Cash coverage ratio = \( \frac{\text{EBIT} + \text{Depreciation}}{\text{Interest}} \)

III. Asset utilization, or turnover, ratios

- Inventory turnover = \( \frac{\text{Cost of goods sold}}{\text{Inventory}} \)
- Days' sales in inventory = \( \frac{365 \text{ days}}{\text{Inventory turnover}} \)
- Receivables turnover = \( \frac{\text{Sales}}{\text{Accounts receivable}} \)
- Days' sales in receivables = \( \frac{365 \text{ days}}{\text{Receivables turnover}} \)
- NWC turnover = \( \frac{\text{Sales}}{\text{NWC}} \)
- Fixed asset turnover = \( \frac{\text{Sales}}{\text{Net fixed assets}} \)
- Total asset turnover = \( \frac{\text{Sales}}{\text{Total assets}} \)

IV. Profitability ratios

- Profit margin = \( \frac{\text{Net income}}{\text{Sales}} \)
- Return on assets (ROA) = \( \frac{\text{Net income}}{\text{Total assets}} \)
- Return on equity (ROE) = \( \frac{\text{Net income}}{\text{Total equity}} \)
- \( \text{ROE} = \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} \)

V. Market value ratios

- Price-earnings ratio = \( \frac{\text{Price per share}}{\text{Earnings per share}} \)
- Market-to-book ratio = \( \frac{\text{Market value per share}}{\text{Book value per share}} \)
I. Internal growth rate

\[ \text{Internal growth rate} = \frac{\text{ROA} \times b}{1 - \text{ROA} \times b} \]

where
\[ \text{ROA} = \frac{\text{Net income}}{\text{Total assets}} \]
\[ b = \text{Plowback (retention ratio)} = \frac{\text{Addition to retained earnings}}{\text{Net income}} \]

The internal growth rate is the maximum growth rate than can be achieved with no external financing of any kind.

II. Sustainable growth rate

\[ \text{Sustainable growth rate} = \frac{\text{ROE} \times b}{1 - \text{ROE} \times b} \]

where
\[ \text{ROE} = \frac{\text{Net income}}{\text{Total equity}} \]
\[ b = \text{Plowback (retention ratio)} = \frac{\text{Addition to retained earnings}}{\text{Net income}} \]

The sustainable growth rate is the maximum growth rate than can be achieved with no external equity financing while maintaining a constant debt-equity ratio.

---

TABLE 5.4

I. Symbols:

\[ PV = \text{Present value, what future cash flows are worth today} \]
\[ FV_t = \text{Future value, what cash flows are worth in the future} \]
\[ r = \text{Interest rate, rate of return, or discount rate per period—typically, but not always, one year} \]
\[ t = \text{Number of periods—typically, but not always, the number of years} \]
\[ C = \text{Cash amount} \]

II. Future value of \( C \) invested at \( r \) percent for \( t \) periods:

\[ FV_t = C \times (1 + r)^t \]

The term \((1 + r)^t\) is called the future value factor.

III. Present value of \( C \) to be received in \( t \) periods at \( r \) percent per period:

\[ PV = \frac{C}{(1 + r)^t} \]

The term \(1/(1 + r)^t\) is called the present value factor.

IV. The basic present value equation giving the relationship between present and future value is:

\[ PV = \frac{FV_t}{(1 + r)^t} \]
### TABLE 5.4

<table>
<thead>
<tr>
<th>I. Symbols:</th>
<th></th>
</tr>
</thead>
<tbody>
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<td></td>
</tr>
<tr>
<td>C = Cash amount</td>
<td></td>
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</tbody>
</table>

| II. Future value of C invested at r percent for t periods: |  |
| FV, = C × (1 + r)^t |  |
| The term (1 + r)^t is called the future value factor. |  |

| III. Present value of C to be received in t periods at r percent per period: |  |
| PV = C/(1 + r)^t |  |
| The term 1/(1 + r)^t is called the present value factor. |  |

| IV. The basic present value equation giving the relationship between present and future value is: |  |
| PV = FV,/(1 + r)^t |  |

### TABLE 6.2

<table>
<thead>
<tr>
<th>I. Symbols:</th>
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</thead>
<tbody>
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</tr>
<tr>
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<td></td>
</tr>
</tbody>
</table>

| II. Future value of C per period for t periods at r percent per period: |  |
| FV, = C × (1 + r)^t |  |
| A series of identical cash flows is called an annuity, and the term [(1 + r)^t − 1]/r is called the annuity future value factor. |  |

| III. Present value of C per period for t periods at r percent per period: |  |
| PV = C × (1 − (1/(1 + r))^t)/r |  |
| The term (1 − 1/(1 + r)^t)/r is called the annuity present value factor. |  |

| IV. Present value of a perpetuity of C per period: |  |
| PV = C/r |  |
| A perpetuity has the same cash flow every year forever. |  |

### TABLE 7.1

| I. Finding the value of a bond |  |
| Bond value = C × [1 − 1/(1 + r)^t]/r + F/(1 + r)^t |  |

| where |  |
| C = Coupon paid each period |  |
| r = Rate per period |  |
| t = Number of periods |  |
| F = Bond's face value |  |

| II. Finding the yield on a bond |  |
| Given a bond value, coupon, time to maturity, and face value, it is possible to find the implicit discount rate, or yield to maturity, by trial and error only. To do this, try different discount rates until the calculated bond value equals the given value (or let a financial calculator do it for you). Remember that increasing the rate decreases the bond value. |  |
I. The general case
In general, the price today of a share of stock, $P_0$, is the present value of all of its future dividends, $D_1, D_2, D_3, \ldots$:

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

where $R$ is the required return.

II. Constant growth case
If the dividend grows at a steady rate, $g$, then the price can be written as:

$$P_0 = \frac{D_1}{R - g}$$

This result is called the dividend growth model.

III. Supernormal growth
If the dividend grows steadily after $t$ periods, then the price can be written as:

$$P_0 = \frac{D_1}{(1 + R)^1} + \frac{D_2}{(1 + R)^2} + \ldots + \frac{D_t}{(1 + R)^t} + \frac{P_t}{(1 + R)^t}$$

where

$$P_t = \frac{D_t \times (1 + g)}{(R - g)}$$

IV. The required return
The required return, $R$, can be written as the sum of two things:

$$R = \frac{D_t}{P_0} + g$$

where $D_t/P_0$ is the dividend yield and $g$ is the capital gains yield (which is the same thing as the growth rate in dividends for the steady growth case).
I. Discounted cash flow criteria

A. *Net present value (NPV).* The NPV of an investment is the difference between its market value and its cost. The NPV rule is to take a project if its NPV is positive. NPV is frequently estimated by calculating the present value of the future cash flows (to estimate market value) and then subtracting the cost. NPV has no serious flaws; it is the preferred decision criterion.

B. *Internal rate of return (IRR).* The IRR is the discount rate that makes the estimated NPV of an investment equal to zero; it is sometimes called the *discounted cash flow (DCF) return.* The IRR rule is to take a project when its IRR exceeds the required return. IRR is closely related to NPV, and it leads to exactly the same decisions as NPV for conventional, independent projects. When project cash flows are not conventional, there may be no IRR or there may be more than one. More seriously, the IRR cannot be used to rank mutually exclusive projects; the project with the highest IRR is not necessarily the preferred investment.

C. *Profitability index (PI).* The PI, also called the *benefit-cost ratio,* is the ratio of present value to cost. The PI rule is to take an investment if the index exceeds 1. The PI measures the present value of an investment per dollar invested. It is quite similar to NPV, but, like IRR, it cannot be used to rank mutually exclusive projects. However, it is sometimes used to rank projects when a firm has more positive NPV investments than it can currently finance.

II. Payback criteria

A. *Payback period.* The payback period is the length of time until the sum of an investment's cash flows equals its cost. The payback period rule is to take a project if its payback is *less* than some cutoff. The payback period is a flawed criterion, primarily because it ignores risk, the time value of money, and cash flows beyond the cutoff point.

B. *Discounted payback period.* The discounted payback period is the length of time until the sum of an investment's discounted cash flows equals its cost. The discounted payback period rule is to take an investment if the discounted payback is *less* than some cutoff. The discounted payback rule is flawed, primarily because it ignores cash flows after the cutoff.

III. Accounting criterion

A. *Average accounting return (AAR).* The AAR is a measure of accounting profit relative to book value. It is *not* related to the IRR, but it is similar to the accounting return on assets (ROA) measure in Chapter 3. The AAR rule is to take an investment if its AAR exceeds a benchmark AAR. The AAR is seriously flawed for a variety of reasons, and it has little to recommend it.

### SUMMARY AND CONCLUSIONS

This chapter has covered the different criteria used to evaluate proposed investments. The six criteria, in the order we discussed them, are:

1. Net present value (NPV)
2. Payback period
3. Discounted payback period
4. Average accounting return (AAR)
5. Internal rate of return (IRR)
6. Profitability index (PI)

We illustrated how to calculate each of these and discussed the interpretation of the results. We also described the advantages and disadvantages of each of them. Ultimately, a good capital budgeting criterion must tell us two things. First, is a particular
I. The cost of equity, $R_E$

A. Dividend growth model approach (from Chapter 8):

\[ R_E = \frac{D_1}{P_0} + g \]

where $D_1$ is the expected dividend in one period, $g$ is the dividend growth rate, and $P_0$ is the current stock price.

B. SML approach (from Chapter 13):

\[ R_E = R_f + \beta_E \times (R_M - R_f) \]

where $R_f$ is the risk-free rate, $R_M$ is the expected return on the overall market, and $\beta_E$ is the systematic risk of the equity.

II. The cost of debt, $R_D$

A. For a firm with publicly held debt, the cost of debt can be measured as the yield to maturity on the outstanding debt. The coupon rate is irrelevant. Yield to maturity is covered in Chapter 7.

B. If the firm has no publicly traded debt, then the cost of debt can be measured as the yield to maturity on similarly rated bonds (bond ratings are discussed in Chapter 7).

III. The weighted average cost of capital, WACC

A. The firm’s WACC is the overall required return on the firm as a whole. It is the appropriate discount rate to use for cash flows similar in risk to those of the overall firm.

B. The WACC is calculated as:

\[ \text{WACC} = \frac{E}{V} \times R_E + \frac{D}{V} \times R_D \times (1 - T_c) \]

where $T_c$ is the corporate tax rate, $E$ is the market value of the firm’s equity, $D$ is the market value of the firm’s debt, and $V = E + D$. Note that $E/V$ is the percentage of the firm’s financing (in market value terms) that is equity, and $D/V$ is the percentage that is debt.