Learning Goals

1. Describe interest rate fundamentals, the term structure of interest rates, and risk premiums.
2. Review the legal aspects of bond financing and bond cost.
3. Discuss the general features, yields, prices, popular types, and international issues of corporate bonds.
4. Understand the key inputs and basic model used in the valuation process.

Learning Goals (cont.)

5. Apply the basic valuation model to bonds and describe the impact of required return and time to maturity on bond values.
6. Explain the yield to maturity (YTM), its calculation, and the procedure used to value bonds that pay interest semiannually.
Interest Rates & Required Returns

• The interest rate or required return represents the price of money.
• Interest rates act as a regulating device that controls the flow of money between suppliers and demanders of funds.
• The Board of Governors of the Federal Reserve System regularly assess economic conditions and, when necessary, initiate actions to change interest rates to control inflation and economic growth.

Interest Rates & Required Returns: Interest Rate Fundamentals

• Interest rates represent the compensation that a demander of funds must pay a supplier.
• When funds are lent, the cost of borrowing is the interest rate.
• When funds are raised by issuing stocks or bonds, the cost the company must pay is called the required return, which reflects the suppliers expected level of return.

Interest Rates & Required Returns: The Real Rate of Interest

• The real interest rate is the rate that creates an equilibrium between the supply of savings and the demand for investment funds in a perfect world.
• In this context, a perfect world is one in which there is no inflation, where suppliers and demanders have no liquidity preference, and where all outcomes are certain.
• The supply-demand relationship that determines the real rate is shown in Figure 6.1 on the following slide.
Interest Rates & Required Returns: The Real Rate of Interest (cont.)

Figure 6.1 Supply–Demand Relationship

- Ignoring risk factors, the cost of funds is closely tied to inflationary expectations.
- The risk-free rate of interest, RF, which is typically measured by a 3-month U.S. Treasury bill (T-bill) compensates investors only for the real rate of return and for the expected rate of inflation.
- The relationship between the annual rate of inflation and the return on T-bills is shown on the following slide.

Interest Rates & Required Returns: Inflation and the Cost of Money

- The nominal rate of interest is the actual rate of interest charged by the supplier of funds and paid by the demander.
- The nominal rate differs from the real rate of interest, \( k^* \) as a result of two factors:
  - Inflationary expectations reflected in an inflation premium (IP), and
  - Issuer and issue characteristics such as default risks and contractual provisions as reflected in a risk premium (RP).
Using this notation, the nominal rate of interest for security 1, \( k_1 \), is given in equation 6.1, and is further defined in equations 6.2 and 6.3.

\[
\begin{align*}
r_1 &= r^p + IP + RP_1 \\
     &= R_F + RP_1 \\
     &= r^p + IP
\end{align*}
\]

**Figure 6.2** Impact of Inflation

The term structure of interest rates relates the interest rate to the time to maturity for securities with a common default risk profile.

Typically, treasury securities are used to construct yield curves since all have zero risk of default.

However, yield curves could also be constructed with AAA or BBB corporate bonds or other types of similar risk securities.
Figure 6.3  Treasury Yield Curves

Theories of Term Structure: Expectations Theory

- This theory suggests that the shape of the yield curve reflects investors' expectations about the future direction of inflation and interest rates.
- Therefore, an upward-sloping yield curve reflects expectations of higher future inflation and interest rates.
- In general, the very strong relationship between inflation and interest rates supports this theory.

Theories of Term Structure: Liquidity Preference Theory

- This theory contends that long-term interest rates tend to be higher than short-term rates for two reasons:
  - long-term securities are perceived to be riskier than short-term securities
  - borrowers are generally willing to pay more for long-term funds because they can lock in at a rate for a longer period of time and avoid the need to roll over the debt.
Theories of Term Structure: Market Segmentation Theory

- This theory suggests that the market for debt at any point in time is segmented on the basis of maturity.
- As a result, the shape of the yield curve will depend on the supply and demand for a given maturity at a given point in time.

Risk Premiums: Issue and Issuer Characteristics

<table>
<thead>
<tr>
<th>Maturity, ( t )</th>
<th>Nominal interest rate, ( r_n )</th>
<th>Real interest rate, ( r^* )</th>
<th>Inflation expectation, ( \Pi )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year</td>
<td>3.50%</td>
<td>2.88%</td>
<td>0.56%</td>
</tr>
<tr>
<td>5 years</td>
<td>2.81%</td>
<td>2.16%</td>
<td>0.91%</td>
</tr>
<tr>
<td>10 years</td>
<td>3.83%</td>
<td>3.20%</td>
<td>1.13%</td>
</tr>
<tr>
<td>30 years</td>
<td>3.49%</td>
<td>2.70%</td>
<td>1.79%</td>
</tr>
</tbody>
</table>

Risk Premiums: Issue and Issuer Characteristics (cont.)

- The data in the table below is from May 17, 2004.

<table>
<thead>
<tr>
<th>Security</th>
<th>Nominal interest rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Treasury bonds (average)</td>
<td>5.44%</td>
</tr>
<tr>
<td>Corporate bonds (by ratings):</td>
<td></td>
</tr>
<tr>
<td>High quality (Aaa–Aa)</td>
<td>6.04%</td>
</tr>
<tr>
<td>Medium quality (A–Baa)</td>
<td>6.82%</td>
</tr>
<tr>
<td>Speculative (B–C)</td>
<td>11.32%</td>
</tr>
<tr>
<td>Utility bonds (average rating)</td>
<td>6.61%</td>
</tr>
</tbody>
</table>
• The data in the table below is from May 17, 2004.

<table>
<thead>
<tr>
<th>Security</th>
<th>Risk premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate bonds (by ratings): High quality (AA-A1)</td>
<td>6.06% - 5.46% - 0.46%</td>
</tr>
<tr>
<td>Medium quality (BB-Ba)</td>
<td>5.82 - 5.46 - 5.38</td>
</tr>
<tr>
<td>Speculative (B-C)</td>
<td>11.32 - 5.46 - 5.00</td>
</tr>
<tr>
<td>Utility bonds (average rating)</td>
<td>6.61 - 5.46 - 1.77</td>
</tr>
</tbody>
</table>

---

### Table 6.1 Debt-Specific Issue- and Issuer-Related Risk Premium Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default risk</td>
<td>The probability that the issuer of debt will not pay the contractual interest or principal as scheduled. The greater the risk of default, the higher the risk premium. High bond ratings offer low default risk, and low bond ratings offer high default risk.</td>
</tr>
<tr>
<td>Maturity risk</td>
<td>The fact that the longer the maturity, the lower the risk of default due to changes in interest rates. Longer maturity increases the risk of default risk.</td>
</tr>
<tr>
<td>Contracted provision risk</td>
<td>Conditions that are often included in debt agreements or a stock issue that in some way reduces the risk (for the lender) or the cost (for the borrower) of the provision, such as a call or put option.</td>
</tr>
</tbody>
</table>

Note: Table 6.1 summarizes the effects of various factors on the price of bonds and other fixed-income securities to generate returns to investors. (See the text for details.)

---

### Corporate Bonds

- A **bond** is a long-term debt instrument that pays the bondholder a specified amount of periodic interest rate over a specified period of time.
- The bond’s **principal** is the amount borrowed by the company and the amount owed to the bond holder on the maturity date.
- The bond’s **maturity date** is the time at which a bond becomes due and the principal must be repaid.
- The bond’s **coupon rate** is the specified interest rate (or $ amount) that must be periodically paid.
Corporate Bonds (cont.)

- The bond’s **current yield** is the annual interest (income) divided by the current price of the security.
- The bond’s **yield-to-maturity** is the yield (expressed as a compound rate of return) earned on a bond from the time it is acquired until the maturity date of the bond.
- A **yield curve** graphically shows the relationship between the time to maturity and yields for debt in a given risk class.

Legal Aspects of Corporate Bonds

- The **bond indenture** is a legal document that specifies both the rights of the bondholders and the duties of the issuing corporation.
- **Standard debt provisions** in the indenture specify certain record keeping and general business procedures that the issuer must follow.
- **Restrictive debt provisions** are contractual clauses in a bond indenture that place operating and financial constraints on the borrower.

Legal Aspects of Corporate Bonds (cont.)

- Common restrictive covenants include provisions that specify:
  - Minimum equity levels
  - Prohibition against factoring receivables
  - Fixed asset restrictions
  - Constraints on subsequent borrowing
  - Limitations on cash dividends.
- In general, violations of restrictive covenants give bondholders the right to demand immediate repayment.
Legal Aspects of Corporate Bonds
(cont.)

- **Sinking fund requirements** are restrictive provisions often included in bond indentures that provide for the systematic retirement of bonds prior to their maturity.
- The **bond indenture** identifies any collateral (security) pledged against the bond and specifies how it is to be maintained.
- A **trustee** is a paid individual, corporation, or commercial bank trust department that acts as the third party to a bond indenture.

Corporate Bonds: Cost of Bonds to the Issuer

- In general, the **longer the bond’s maturity**, the higher the interest rate (or cost) to the firm.
- In addition, the **larger the size** of the offering, the lower will be the cost (in % terms) of the bond.
- Also, the **greater the risk** of the issuing firm, the higher the cost of the issue.
- Finally, the **cost of money** in the capital market is the basis form determining a bond’s **coupon interest rate**.

Corporate Bonds: General Features

- The **conversion feature** of **convertible bonds** allows bondholders to exchange their bonds for a specified number of shares of common stock.
- Bondholders will exercise this option only when the market price of the stock is greater than the conversion price.
- A **call feature**, which is included in most corporate issues, gives the issuer the opportunity to repurchase the bond prior to maturity at the call price.
Corporate Bonds: General Features (cont.)

• In general, the call premium is equal to one year of coupon interest and compensates the holder for having it called prior to maturity.
• Furthermore, issuers will exercise the call feature when interest rates fall and the issuer can refund the issue at a lower cost.
• Issuers typically must pay a higher rate to investors for the call feature compared to issues without the feature.

Corporate Bonds: General Features (cont.)

• Bonds also are occasionally issued with stock purchase warrants attached to them to make them more attractive to investors.
• Warrants give the bondholder the right to purchase a certain number of shares of the same firm’s common stock at a specified price during a specified period of time.
• Including warrants typically allows the firm to raise debt capital at a lower cost than would be possible in their absence.

Corporate Bonds: Bond Yields

• A bond’s yield or rate of return is frequently used to assess its performance over a given period, typically 1 year.
• The three most widely cited yields are:
  – Current yield
  – Yield to maturity (YTM)
  – Yield to call (YTC)
Corporate Bonds: Bond Prices

- Because most corporate bonds are purchased and held by institutional investors, bond trading and price data is not readily available to individuals.
- Although most corporate bonds are issued with a par or face value of $1,000, all bonds are quoted as a percentage of par.
- See Table 6.2

Table 6.2 Data on Selected Bonds

<table>
<thead>
<tr>
<th>Company</th>
<th>Coupon</th>
<th>Maturity</th>
<th>Price</th>
<th>Yield (YTM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>6.25%</td>
<td>Nov. 1, 2013</td>
<td>103.234</td>
<td>6.80%</td>
</tr>
<tr>
<td>Company B</td>
<td>6.00%</td>
<td>Nov. 31, 2016</td>
<td>104.007</td>
<td>6.45%</td>
</tr>
<tr>
<td>Company C</td>
<td>7.80%</td>
<td>Jan. 1, 2014</td>
<td>103.158</td>
<td>6.69%</td>
</tr>
<tr>
<td>Company D</td>
<td>5.00%</td>
<td>Jan. 31, 2017</td>
<td>99.149</td>
<td>5.81%</td>
</tr>
<tr>
<td>Company E</td>
<td>5.80%</td>
<td>Jan. 1, 2012</td>
<td>100.876</td>
<td>5.67%</td>
</tr>
</tbody>
</table>

Table 6.3 Moody’s and Standard & Poor’s Bond Ratings

<table>
<thead>
<tr>
<th>Mood’s</th>
<th>Interpretation</th>
<th>Standard &amp; Poor’s Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaa</td>
<td>Prime quality</td>
<td>AAA</td>
</tr>
<tr>
<td>Aa</td>
<td>High grade</td>
<td>AA</td>
</tr>
<tr>
<td>A</td>
<td>Upper medium grade</td>
<td>A</td>
</tr>
<tr>
<td>Baa</td>
<td>Medium grade</td>
<td>BB</td>
</tr>
<tr>
<td>Ba</td>
<td>Lower medium grade</td>
<td>B</td>
</tr>
<tr>
<td>B</td>
<td>Speculative</td>
<td>B</td>
</tr>
<tr>
<td>Caa</td>
<td>Flourished speculative</td>
<td>CCC</td>
</tr>
<tr>
<td>C</td>
<td>Lower grade</td>
<td>C</td>
</tr>
<tr>
<td>Cc</td>
<td>Reinces or in default</td>
<td>CC</td>
</tr>
<tr>
<td>Cc</td>
<td>More bond in default</td>
<td>D</td>
</tr>
</tbody>
</table>

Note: Ratings are subject to change with changing market conditions; the numbers in Moody’s International Moody’s and Standard & Poor’s Bond Ratings are subject to change. Moody’s International Moody’s and Standard & Poor’s Bond Ratings are subject to change. Moody’s International Moody’s and Standard & Poor’s Bond Ratings are subject to change. Moody’s International Moody’s and Standard & Poor’s Bond Ratings are subject to change. Moody’s International Moody’s and Standard & Poor’s Bond Ratings are subject to change. Moody’s International Moody’s and Standard & Poor’s Bond Ratings are subject to change.
Table 6.4 Characteristics and Priority of Lender’s Claim of Traditional Types of Bonds

<table>
<thead>
<tr>
<th>Bond Type</th>
<th>Characteristics</th>
<th>Priority of Lender’s Claim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortgage bond</td>
<td>Lender has a security interest in the property mortgaged</td>
<td>Senior</td>
</tr>
<tr>
<td>Subordinated debenture</td>
<td>Lender has an unsecured claim on the assets of the company</td>
<td>Subordinate</td>
</tr>
<tr>
<td>Income bond</td>
<td>Interest payments are made periodically based on the bond terms</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Senior bond</td>
<td>Lender has a security interest in the property mortgaged</td>
<td>Senior</td>
</tr>
</tbody>
</table>

Table 6.5 Characteristics of Contemporary Types of Bonds

<table>
<thead>
<tr>
<th>Bond Type</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eurobond</td>
<td>Issued by an international borrower and sold to investors in countries with currencies other than the currency in which the bond is denominated.</td>
</tr>
<tr>
<td>Foreign bond</td>
<td>Issued in a host country’s financial market, in the host country’s currency, by a foreign borrower.</td>
</tr>
</tbody>
</table>

Corporate Bonds: International Bond Issues

- Companies and governments borrow internationally by issuing bonds in the Eurobond market and the foreign bond market.
- A Eurobond is issued by an international borrower and sold to investors in countries with currencies other than the currency in which the bond is denominated.
- In contrast, a foreign bond is issued in a host country’s financial market, in the host country’s currency, by a foreign borrower.
Valuation Fundamentals

- The **market value** of any investment asset is simply the **present value** of expected cash flows.
- The interest rate that these cash flows are discounted at is called the asset’s **required return**.
- The required return is a function of the expected rate of **inflation** and the perceived **risk** of the asset.
- Higher perceived risk results in a higher required return and lower asset market values.

Basic Valuation Model

\[ V_0 = \frac{CF_1}{(1 + r)^1} + \frac{CF_2}{(1 + r)^2} + \cdots + \frac{CF_n}{(1 + r)^n} \]

- \( V_0 \) = 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

\[ V_0 = [CF_1 \times (PVIF_{1,0})] + [CF_2 \times (PVIF_{2,0})] + \cdots + [CF_n \times (PVIF_{n,0})] \]

Table 6.6 Valuation of Assets by Celia Sargent

<table>
<thead>
<tr>
<th>Unit</th>
<th>Cash Flows (CF)</th>
<th>Present Value (PV)</th>
<th>Value (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Money Receipts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End of year  3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1,000</td>
<td>0.75</td>
<td>0.75 \times 1 = 0.7500</td>
</tr>
<tr>
<td>2</td>
<td>1,000</td>
<td>0.62</td>
<td>0.62 \times 1 = 0.6200</td>
</tr>
<tr>
<td>4</td>
<td>1,000</td>
<td>0.56</td>
<td>0.56 \times 1 = 0.5600</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bond Payments</th>
<th>Present Value (PV)</th>
<th>Value (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>End of year 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1,000</td>
<td>0.83</td>
</tr>
<tr>
<td>2</td>
<td>1,000</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Results in Table 6.6 illustrate how the different types of cash flows and bond payments contribute to the calculation of the present value of the asset. The calculations are done by discounting each cash flow or bond payment at the appropriate discount rate (\( r \)).
A noted earlier, bonds are long-term debt instruments used by businesses and government to raise large sums of money, typically from a diverse group of lenders.

Most bonds pay interest semiannually at a stated coupon interest rate, have an initial maturity of 10 to 30 years, and have a par value of $1,000 that must be repaid at maturity.

Mills Company, a large defense contractor, on January 1, 2007, issued a 10% coupon interest rate, 10-year bond with a $1,000 par value that pays interest semiannually.

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

\[ = I \times (PVIFA_{10\%}) + M \times (PVIF_{10\%}) \]

- \( B_0 \) = value of the bond at time zero
- \( I \) = annual interest paid in dollars\(^1\)
- \( n \) = number of years to maturity
- \( M \) = par value in dollars
- \( r_d \) = required return on a bond

End of Year

- 2007: $614.90
- 2008: $614.90
- 2009: $614.90
- 2010: $614.90
- 2011: $614.90
- 2012: $614.90
- 2013: $614.90
- 2014: $614.90
- 2015: $614.90
- 2016: $614.90
- 2017: $614.90
- 2018: $614.90
- 2019: $614.90

\[ B_p = 1,000 + 286.90 \]

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### Table 6.7 Bond Values for Various Required Returns
(Mills Company’s 10% Coupon Interest Rate, 10-Year Maturity, $1,000 Par, January 1, 2010, Issue Paying Annual Interest)

<table>
<thead>
<tr>
<th>Required return, r</th>
<th>Bond value, Bt</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>12%</td>
<td>$907.00</td>
<td>Discount</td>
</tr>
<tr>
<td>10</td>
<td>$1,200.00</td>
<td>Par value</td>
</tr>
<tr>
<td>8</td>
<td>$1,344.30</td>
<td>Premium</td>
</tr>
</tbody>
</table>
Figure 6.4 Bond Values and Required Returns

Bond Valuation:
Bond Fundamentals (cont.)
Bond Valuation: Bond Fundamentals (cont.)

Figure 6.5 Time to Maturity and Bond Values

Yield to Maturity (YTM)

- The **yield to maturity** measures the compound annual return to an investor and considers all bond cash flows. It is essentially the bond’s IRR based on the current price.
- Note that the yield to maturity will only be equal if the bond is selling for its face value ($1,000).
- And that rate will be the same as the bond’s coupon rate.
- For premium bonds, the current yield > YTM.
- For discount bonds, the current yield < YTM.

Yield to Maturity (YTM) (cont.)

The Mills Company bond, which currently sells for $1,080, has a 10% coupon interest rate and $1,000 par value, pays interest annually, and has 10 years to maturity. What is the bond’s YTM?

\[
$1,080 = \$100 \times (PVIFA_{10\%,10\text{yrs}}) + \$1,000 \times (PVIF_{10\%,10\text{yrs}})
\]

\[
= \$100 \times (6.1446) + \$1,000 \times (0.3855)
\]

\[
= \$614.46 + \$385.50
\]

\[
= \$1,000.00
\]
Yield to Maturity (YTM) (cont.)

Yield to Maturity, Annual Interest

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>YIELD TO MATURITY, ANNUAL INTEREST</td>
</tr>
<tr>
<td>2</td>
<td>Annual Interest payment</td>
</tr>
<tr>
<td>3</td>
<td>Coupon Interest rate</td>
</tr>
<tr>
<td>4</td>
<td>Number of years to maturity</td>
</tr>
<tr>
<td>5</td>
<td>YTM</td>
</tr>
<tr>
<td>7</td>
<td>Yield to maturity</td>
</tr>
</tbody>
</table>

Guess and Error Method:

Choose various interest rates and place them in cell A14.

The spreadsheet will recalculate with these. Continue the process until the value offered does the convergence of the bond (in the example, n=10, 000).

10%: $952
15%: $935
20%: $918
25%: $902

Bond Value: $902.10

Yield to Maturity (YTM): Semiannual Interest and Bond Values

\[ R_0 = \frac{I}{2} \times \left[ \frac{1}{2} \right] + M \times \left[ \frac{1}{2} \right] \]

16. As in used in Chapter 4, the effective annual rate of payment, \( R_0 \), for annual interest rate \( r \), when interest is paid semiannually \( n=2 \), can be found by using Equation 6.25:

\[ R_0 = \left( 1 + \frac{R_0}{2} \right)^2 - 1 \]

For example, if used with a 15% annual interest rate, \( r \), after semiannual interest would have an effective annual rate of:

\[ R_0 = \left( 1 + \frac{0.15}{2} \right)^2 - 1 = 1.075625 - 1 = 0.075625 = 7.5625\%

Because semiannual and annual interest rates are equal to 7.56%, the annual interest rate is generally higher than their actual annual rate.
Assuming that the Mills Company bond pays interest semiannually and that the required stated annual return, \( k_d \) is 12% for similar risk bonds that also pay semiannual interest, substituting these values into Equation 6.8a yields

\[
B_0 = S_0 \times (PVIFA_{8\% \times 2 \text{periods}}) + S_1 \times (PVIF_{8\% \times 2 \text{periods}})
\]

\[
= S_0 \times (11.470) + S_1 \times (0.312) = $885.50
\]
Coupon Effects on Price Volatility

- The amount of bond price volatility depends on three basic factors:
  - length of time to maturity
  - risk
  - amount of coupon interest paid by the bond
- First, we already have seen that the longer the term to maturity, the greater is a bond’s volatility.
- Second, the riskier a bond, the more variable the required return will be, resulting in greater price volatility.

Coupon Effects on Price Volatility (cont.)

- Finally, the amount of coupon interest also impacts a bond’s price volatility.
- Specifically, the lower the coupon, the greater will be the bond’s volatility, because it will be longer before the investor receives a significant portion of the cash flow from his or her investment.

Current Yield

- The Current Yield measures the annual return to an investor based on the current price.

\[
\text{Current Yield} = \frac{\text{Annual Coupon Interest}}{\text{Current Market Price}}
\]

For example, a 10% coupon bond which is currently selling at $1,150 would have a current yield of:

\[
\text{Current Yield} = \frac{\$100}{\$1,150} = 8.7\%
\]
### Table 6.8 Summary of Key Valuation Definitions and Formulas for Any Asset and for Bonds

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_0$</td>
<td>Cash flow at time 0</td>
</tr>
<tr>
<td>$C_t$</td>
<td>Cash flow at time t</td>
</tr>
<tr>
<td>$r$</td>
<td>Required rate of return</td>
</tr>
<tr>
<td>$t$</td>
<td>Time period in years</td>
</tr>
<tr>
<td>$n$</td>
<td>Number of years to maturity</td>
</tr>
</tbody>
</table>

#### Value of an Asset

<table>
<thead>
<tr>
<th>Formula</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V = \sum_{t=0}^{n} \frac{C_t}{(1+r)^t}$</td>
<td>Equation 6.6</td>
</tr>
<tr>
<td>$V = \sum_{t=0}^{n} \frac{C_t}{f(t)}$</td>
<td>Equation 6.3</td>
</tr>
</tbody>
</table>

#### Bond Value

<table>
<thead>
<tr>
<th>Formula</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V = \frac{C_0}{1 + r} + \frac{C_1}{(1 + r)^2} + \cdots + \frac{C_n}{(1 + r)^n}$</td>
<td>Equation 6.7</td>
</tr>
<tr>
<td>$V = \frac{C_0}{1 + r} + \frac{C_1}{(1 + r)^2} + \cdots + \frac{C_n}{(1 + r)^n}$</td>
<td>Equation 6.5</td>
</tr>
</tbody>
</table>

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