Finance and the Financial Manager

Chapter 1
Topics Covered

- What Is A Corporation?
- The Role of The Financial Manager
- Who Is The Financial Manager?
- Separation of Ownership and Management
- Financial Markets
Corporate Structure

- **Sole Proprietorships**
  - Unlimited Liability
  - Personal tax on profits

- **Partnerships**
  - Personal tax on profits

- **Corporations**
  - Limited Liability
  - Corporate tax on profits + Personal tax on dividends
Role of The Financial Manager

Firm's operations → Financial manager → Financial markets

1. Cash raised from investors
2. Cash invested in firm
3. Cash generated by operations
4. Cash reinvested
4a. Cash returned to investors
4b. Cash returned to investors
Who is The Financial Manager?

Chief Financial Officer

- Treasurer
- Comptroller
Ownership vs. Management

Difference in Information

- Stock prices and returns
- Issues of shares and other securities
- Dividends
- Financing

Different Objectives

- Managers vs. stockholders
- Top mgmt vs. operating mgmt
- Stockholders vs. banks and lenders
Financial Markets

Money

- Primary Markets
- Secondary Markets
- OTC Markets
Financial Institutions

Company

Obligations

Funds

Intermediaries

Banks

Insurance Cos.

Brokerage Firms
Financial Institutions

Intermediaries

Obligations

Funds

Investors

Depositors

Policyholders

Investors
Present Value and The Opportunity Cost of Capital
Topics Covered

- Present Value
- Net Present Value
- NPV Rule
- ROR Rule
- Opportunity Cost of Capital
- Managers and the Interests of Shareholders
Present Value

Present Value
Value today of a future cash flow.

Discount Factor
Present value of a $1 future payment.

Discount Rate
Interest rate used to compute present values of future cash flows.
Present Value

**Present Value = PV**

\[ PV = \text{discount factor} \times C_1 \]
Discount Factor = DF = PV of $1

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

Discount Factors can be used to compute the present value of any cash flow.
**Step 1: Forecast cash flows**

Cost of building = \( C_0 = 350 \)
Sale price in Year 1 = \( C_1 = 400 \)

**Step 2: Estimate opportunity cost of capital**

If equally risky investments in the capital market offer a return of 7%, then

Cost of capital = \( r = 7\% \)
Valuing an Office Building

*Step 3: Discount future cash flows*

\[
PV = \frac{C_1}{(1+r)} = \frac{400}{(1+.07)} = 374
\]

*Step 4: Go ahead if PV of payoff exceeds investment*

\[
NPV = -350 + 374 = 24
\]
Net Present Value

NPV = PV - required investment

\[
NPV = C_0 + \frac{C_1}{1 + r}
\]
Higher risk projects require a higher rate of return.

Higher required rates of return cause lower PVs.

\[
PV = \frac{400}{1 + .07} = 374
\]

PV of \(C_1\) = $400 at 7%
Risk and Present Value

PV of $C_1 = $400 at 12%

\[
PV = \frac{400}{1 + .12} = 357
\]

PV of $C_1 = $400 at 7%

\[
PV = \frac{400}{1 + .07} = 374
\]
Rate of Return Rule

- Accept investments that offer rates of return in excess of their opportunity cost of capital.

Example

In the project listed below, the foregone investment opportunity is 12%. Should we do the project?

\[
\text{Return} = \frac{\text{profit}}{\text{investment}} = \frac{400,000 - 350,000}{350,000} = .14 \text{ or } 14\%
\]
Accept investments that have positive net present value.

Example
Suppose we can invest $50 today and receive $60 in one year. Should we accept the project given a 10% expected return?

\[
NPV = -50 + \frac{60}{1.10} = $4.55
\]
**Opportunity Cost of Capital**

**Example**

You may invest $100,000 today. Depending on the state of the economy, you may get one of three possible cash payoffs:

<table>
<thead>
<tr>
<th>Economy</th>
<th>Slump</th>
<th>Normal</th>
<th>Boom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payoff</td>
<td>$80,000</td>
<td>110,000</td>
<td>140,000</td>
</tr>
</tbody>
</table>

Expected payoff \( C_1 = \frac{80,000 + 100,000 + 140,000}{3} = \$110,000 \)
Example - continued

The stock is trading for $95.65. Depending on the state of the economy, the value of the stock at the end of the year is one of three possibilities:

<table>
<thead>
<tr>
<th>Economy</th>
<th>Slump</th>
<th>Normal</th>
<th>Boom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock Price</td>
<td>$80</td>
<td>110</td>
<td>140</td>
</tr>
</tbody>
</table>
**Example - continued**

The stocks expected payoff leads to an expected return.

Expected payoff = \( C_1 = \frac{80 + 100 + 140}{3} = $110 \)

Expected return = \( \frac{\text{expected profit}}{\text{investment}} = \frac{110 - 95.65}{95.65} = .15 \text{ or } 15\% \)
Example - continued

Discounting the expected payoff at the expected return leads to the PV of the project.

$$ PV = \frac{110,000}{1.15} = $95,650 $$
Some people prefer to consume now. Some prefer to invest now and consume later. Borrowing and lending allows us to reconcile these opposing desires which may exist within the firm’s shareholders.
Investment vs. Consumption

Some investors will prefer A and others B.
The grasshopper (G) wants to consume now. The ant (A) wants to wait. But each is happy to invest. A prefers to invest 14%, moving up the red arrow, rather than at the 7% interest rate. G invests and then borrows at 7%, thereby transforming $100 into $106.54 of immediate consumption. Because of the investment, G has $114 next year to pay off the loan. The investment’s NPV is $106.54 - 100 = +6.54
The grasshopper (G) wants to consume now. The ant (A) wants to wait. But each is happy to invest. A prefers to invest 14%, moving up the red arrow, rather than at the 7% interest rate. G invests and then borrows at 7%, thereby transforming $100 into $106.54 of immediate consumption. Because of the investment, G has $114 next year to pay off the loan. The investment’s NPV is $106.54 - 100 = +6.54

G invests $100 now, borrows $106.54 and consumes now.

A invests $100 now and consumes $114 next year
Managers and Shareholder Interests

- Tools to Ensure Management Responsiveness
  - Subject managers to oversight and review by specialists.
  - Internal competition for top level jobs that are appointed by the board of directors.
  - Financial incentives such as stock options.
How to Calculate Present Values

Chapter 3
Topics Covered

- Valuing Long-Lived Assets
- PV Calculation Short Cuts
- Compound Interest
- Interest Rates and Inflation
- Example: Present Values and Bonds
Discount Factor = DF = PV of $1

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

- Discount Factors can be used to compute the present value of any cash flow.
Discount Factors can be used to compute the present value of any cash flow.
Replacing “1” with “t” allows the formula to be used for cash flows that exist at any point in time.
Example
You just bought a new computer for $3,000. The payment terms are 2 years same as cash. If you can earn 8% on your money, how much money should you set aside today in order to make the payment when due in two years?

\[ PV = \frac{3000}{(1.08)^2} = \$2,572.02 \]
Present Values

- PVs can be added together to evaluate multiple cash flows.

\[ PV = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \ldots \]
Given two dollars, one received a year from now and the other two years from now, the value of each is commonly called the Discount Factor. Assume $r_1 = 20\%$ and $r_2 = 7\%$.

$$DF_1 = \frac{1.00}{(1+.20)^1} = .83$$

$$DF_2 = \frac{1.00}{(1+.07)^2} = .87$$
Example

Assume that the cash flows from the construction and sale of an office building is as follows. Given a 7% required rate of return, create a present value worksheet and show the net present value.

<table>
<thead>
<tr>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>−150,000</td>
<td>−100,000</td>
<td>+300,000</td>
</tr>
</tbody>
</table>
Example - continued

Assume that the cash flows from the construction and sale of an office building is as follows. Given a 7% required rate of return, create a present value worksheet and show the net present value.

<table>
<thead>
<tr>
<th>Period</th>
<th>Discount Factor</th>
<th>Cash Flow</th>
<th>Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.0</td>
<td>-150,000</td>
<td>-150,000</td>
</tr>
<tr>
<td>1</td>
<td>(\frac{1}{1.07} = 0.935)</td>
<td>-100,000</td>
<td>-93,500</td>
</tr>
<tr>
<td>2</td>
<td>(\frac{1}{(1.07)^2} = 0.873)</td>
<td>+300,000</td>
<td>+261,900</td>
</tr>
</tbody>
</table>

\[ NPV = Total = 18,400 \]
Short Cuts

- Sometimes there are shortcuts that make it very easy to calculate the present value of an asset that pays off in different periods. These tolls allow us to cut through the calculations quickly.
Perpetuity - Financial concept in which a cash flow is theoretically received forever.

Return = \frac{\text{cash flow}}{\text{present value}}

r = \frac{C}{PV}
Perpetuity - Financial concept in which a cash flow is theoretically received forever.

\[ PV = \frac{C_1}{r} \]
**Annuity** - An asset that pays a fixed sum each year for a specified number of years.

\[
PV \text{ of annuity} = C \times \left[ \frac{1}{r} - \frac{1}{r(1+r)^t} \right]
\]
Example

You agree to lease a car for 4 years at $300 per month. You are not required to pay any money up front or at the end of your agreement. If your opportunity cost of capital is 0.5% per month, what is the cost of the lease?
Example - continued

You agree to lease a car for 4 years at $300 per month. You are not required to pay any money up front or at the end of your agreement. If your opportunity cost of capital is 0.5% per month, what is the cost of the lease?

\[
\text{Lease Cost} = 300 \times \left[ \frac{1}{.005} - \frac{1}{.005(1+.005)^{48}} \right]
\]

\[
\text{Cost} = $12,774.10
\]
### Compound Interest

<table>
<thead>
<tr>
<th>i</th>
<th>ii</th>
<th>iii</th>
<th>iv</th>
<th>v</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periods per year</td>
<td>Interest per period</td>
<td>APR (i x ii)</td>
<td>Value after one year</td>
<td>Annually compounded interest rate</td>
</tr>
<tr>
<td>1</td>
<td>6%</td>
<td>6%</td>
<td>1.06</td>
<td>6.000%</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>6</td>
<td>$1.03^2 = 1.0609$</td>
<td>6.090</td>
</tr>
<tr>
<td>4</td>
<td>1.5</td>
<td>6</td>
<td>$1.015^4 = 1.06136$</td>
<td>6.136</td>
</tr>
<tr>
<td>12</td>
<td>.5</td>
<td>6</td>
<td>$1.005^{12} = 1.06168$</td>
<td>6.168</td>
</tr>
<tr>
<td>52</td>
<td>.1154</td>
<td>6</td>
<td>$1.001154^{52} = 1.06180$</td>
<td>6.180</td>
</tr>
<tr>
<td>365</td>
<td>.0164</td>
<td>6</td>
<td>$1.000164^{365} = 1.06183$</td>
<td>6.183</td>
</tr>
</tbody>
</table>
Compound Interest

- 10% Simple
- 10% Compound
Inflation - Rate at which prices as a whole are increasing.

Nominal Interest Rate - Rate at which money invested grows.

Real Interest Rate - Rate at which the purchasing power of an investment increases.
Inflation

\[ 1 + \text{real interest rate} = \frac{1+\text{nominal interest rate}}{1+\text{inflation rate}} \]
1 + real interest rate = \frac{1 + \text{nominal interest rate}}{1 + \text{inflation rate}}

approximation formula

Real int. rate ≈ nominal int. rate - inflation rate
Example

If the interest rate on one year govt. bonds is 5.9% and the inflation rate is 3.3%, what is the real interest rate?
Inflation

**Example**

*If the interest rate on one year govt. bonds is 5.9% and the inflation rate is 3.3%, what is the real interest rate?*

\[
1 + \text{real interest rate} = \frac{1 + .059}{1 + .033}
\]

\[
1 + \text{real interest rate} = 1.025
\]

\[
\text{real interest rate} = .025 \text{ or } 2.5%
\]
Inflation

Example

If the interest rate on one year govt. bonds is 5.9% and the inflation rate is 3.3%, what is the real interest rate?

\[
1 + \text{real interest rate} = \frac{1 + 0.059}{1 + 0.033}
\]

\[
1 + \text{real interest rate} = 1.025
\]

real interest rate = 0.025 or 2.5%

Approximation = 0.059 - 0.033 = 0.026 or 2.6%
Valuing a Bond

**Example**

If today is October 2000, what is the value of the following bond?

- An IBM Bond pays $115 every Sept for 5 years. In Sept 2005 it pays an additional $1000 and retires the bond.
- The bond is rated AAA (WSJ AAA YTM is 7.5%).

**Cash Flows**

<table>
<thead>
<tr>
<th>Sept 01</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
</tr>
</thead>
<tbody>
<tr>
<td>115</td>
<td>115</td>
<td>115</td>
<td>115</td>
<td>115</td>
</tr>
</tbody>
</table>
Valuing a Bond

Example continued

If today is October 2000, what is the value of the following bond?

- An IBM Bond pays $115 every Sept for 5 years. In Sept 2005 it pays an additional $1000 and retires the bond.
- The bond is rated AAA (WSJ AAA YTM is 7.5%).

\[
PV = \frac{115}{1.075} + \frac{115}{(1.075)^2} + \frac{115}{(1.075)^3} + \frac{115}{(1.075)^4} + \frac{115}{(1.075)^5} + \frac{1,115}{(1.075)^5}
\]

\[
= \$1,161.84
\]
Bond Prices and Yields

- 5 Year 9% Bond
- 1 Year 9% Bond
The Value of Common Stocks
Topics Covered

- How To Value Common Stock
- Capitalization Rates
- Stock Prices and EPS
- Cash Flows and the Value of a Business
Common Stock - Ownership shares in a publicly held corporation.

Secondary Market - market in which already issued securities are traded by investors.

Dividend - Periodic cash distribution from the firm to the shareholders.

P/E Ratio - Price per share divided by earnings per share.
Book Value - Net worth of the firm according to the balance sheet.

Liquidation Value - Net proceeds that would be realized by selling the firm’s assets and paying off its creditors.

Market Value Balance Sheet - Financial statement that uses market value of assets and liabilities.
Valuing Common Stocks

Expected Return - The percentage yield that an investor forecasts from a specific investment over a set period of time. Sometimes called the *market capitalization rate*. 
Valuing Common Stocks

Expected Return - The percentage yield that an investor forecasts from a specific investment over a set period of time. Sometimes called the market capitalization rate.

\[
\text{Expected Return} = r = \frac{\text{Div}_{1} + P_{1} - P_{0}}{P_{0}}
\]
Valuing Common Stocks

The formula can be broken into two parts.

Dividend Yield + Capital Appreciation
Valuing Common Stocks

The formula can be broken into two parts.

Dividend Yield + Capital Appreciation

Expected Return = \( r = \frac{Div_1}{P_0} + \frac{P_1 - P_0}{P_0} \)
Capitalization Rate can be estimated using the perpetuity formula, given minor algebraic manipulation.
Valuing Common Stocks

Capitalization Rate can be estimated using the perpetuity formula, given minor algebraic manipulation.

$$\text{Capitalization Rate} = P_0 = \frac{Div_1}{r - g}$$

$$= r = \frac{Div_1}{P_0} + g$$
Valuing Common Stocks

Return Measurements

Dividend Yield = \frac{\text{Div}_1}{P_0}

Return on Equity = ROE

ROE = \frac{\text{EPS}}{\text{Book Equity Per Share}}
Valuing Common Stocks

Dividend Discount Model - Computation of today’s stock price which states that share value equals the present value of all expected future dividends.
Valuing Common Stocks

Dividend Discount Model - Computation of today’s stock price which states that share value equals the present value of all expected future dividends.

\[
P_0 = \frac{Div_1}{(1+r)^1} + \frac{Div_2}{(1+r)^2} + \ldots + \frac{Div_H + P_H}{(1+r)^H}
\]

H - Time horizon for your investment.
Example

Current forecasts are for XYZ Company to pay dividends of $3, $3.24, and $3.50 over the next three years, respectively. At the end of three years you anticipate selling your stock at a market price of $94.48. What is the price of the stock given a 12% expected return?
Valuing Common Stocks

Example

Current forecasts are for XYZ Company to pay dividends of $3, $3.24, and $3.50 over the next three years, respectively. At the end of three years you anticipate selling your stock at a market price of $94.48. What is the price of the stock given a 12% expected return?

\[
P V = \frac{3.00}{(1+0.12)^1} + \frac{3.24}{(1+0.12)^2} + \frac{3.50 + 94.48}{(1+0.12)^3}
\]

\[
P V = $75.00
\]
If we forecast no growth, and plan to hold out stock indefinitely, we will then value the stock as a **PERPETUITY**.
Valuing Common Stocks

If we forecast no growth, and plan to hold out stock indefinitely, we will then value the stock as a **PERPETUITY**.

\[
\text{Perpetuity} = P_0 = \frac{\text{Div}_1}{r} \quad \text{or} \quad \frac{\text{EPS}_1}{r}
\]

Assumes all earnings are paid to shareholders.
Valuing Common Stocks

**Constant Growth DDM** - A version of the dividend growth model in which dividends grow at a constant rate (*Gordon Growth Model*).
Example- continued

If the same stock is selling for $100 in the stock market, what might the market be assuming about the growth in dividends?

\[
\begin{align*}
$100 &= \frac{$3.00}{.12 - g} \\
g &= .09
\end{align*}
\]

Answer

The market is assuming the dividend will grow at 9% per year, indefinitely.
Valuing Common Stocks

- If a firm elects to pay a lower dividend, and reinvest the funds, the stock price may increase because future dividends may be higher.

**Payout Ratio** - Fraction of earnings paid out as dividends

**Plowback Ratio** - Fraction of earnings retained by the firm.
Growth can be derived from applying the return on equity to the percentage of earnings plowed back into operations.

\[ g = \text{return on equity} \times \text{plowback ratio} \]
Valuing Common Stocks

Example

Our company forecasts to pay a $5.00 dividend next year, which represents 100% of its earnings. This will provide investors with a 12% expected return. Instead, we decide to plow back 40% of the earnings at the firm’s current return on equity of 20%. What is the value of the stock before and after the plowback decision?
Example

Our company forecasts to pay a $5.00 dividend next year, which represents 100% of its earnings. This will provide investors with a 12% expected return. Instead, we decide to blow back 40% of the earnings at the firm’s current return on equity of 20%. What is the value of the stock before and after the plowback decision?

No Growth

\[ P_0 = \frac{5}{.12} = $41.67 \]

With Growth
Valuing Common Stocks

Example

Our company forecasts to pay a $5.00 dividend next year, which represents 100% of its earnings. This will provide investors with a 12% expected return. Instead, we decide to blow back 40% of the earnings at the firm’s current return on equity of 20%. What is the value of the stock before and after the plowback decision?

No Growth

\[ P_0 = \frac{5}{.12} = \$41.67 \]

With Growth

\[ g = .20 \times .40 = .08 \]

\[ P_0 = \frac{3}{.12-.08} = \$75.00 \]
Example - continued

If the company did not plowback some earnings, the stock price would remain at $41.67. With the plowback, the price rose to $75.00.

The difference between these two numbers (75.00-41.67=33.33) is called the Present Value of Growth Opportunities (PVGO).
Valuing Common Stocks

Present Value of Growth Opportunities (PVGO)
- Net present value of a firm’s future investments.

Sustainable Growth Rate - Steady rate at which a firm can grow: plowback ratio X return on equity.
Free Cash Flows (FCF) should be the theoretical basis for all PV calculations.

FCF is a more accurate measurement of PV than either Div or EPS.

The market price does not always reflect the PV of FCF.

When valuing a business for purchase, always use FCF.
Valuing a Business

The value of a business is usually computed as the discounted value of FCF out to a valuation horizon \((H)\).

- The valuation horizon is sometimes called the terminal value and is calculated like \(PVGO\).

\[
P V = \frac{FCF_1}{(1 + r)^1} + \frac{FCF_2}{(1 + r)^2} + \ldots + \frac{FCF_H}{(1 + r)^H} + \frac{PV_H}{(1 + r)^H}
\]
Valuing a Business

\[ PV = \frac{FCF_1}{(1 + r)^1} + \frac{FCF_2}{(1 + r)^2} + \ldots + \frac{FCF_H}{(1 + r)^H} + \frac{PV_H}{(1 + r)^H} \]

PV (free cash flows)  PV (horizon value)
**Example**

*Given the cash flows for Concatenator Manufacturing Division, calculate the PV of near term cash flows, PV (horizon value), and the total value of the firm. \( r=10\% \) and \( g=6\% \)*

<table>
<thead>
<tr>
<th>Year</th>
<th>Asset Value</th>
<th>Earnings</th>
<th>Investment</th>
<th>Free Cash Flow</th>
<th>EPS growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.00</td>
<td>1.20</td>
<td>2.00</td>
<td>-.80</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>12.00</td>
<td>1.44</td>
<td>2.40</td>
<td>-.96</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>14.40</td>
<td>1.73</td>
<td>2.88</td>
<td>-1.15</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>17.28</td>
<td>2.07</td>
<td>3.46</td>
<td>-1.39</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>20.74</td>
<td>2.49</td>
<td>2.69</td>
<td>-.20</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>23.43</td>
<td>2.81</td>
<td>3.04</td>
<td>-.23</td>
<td>13</td>
</tr>
<tr>
<td>7</td>
<td>26.47</td>
<td>3.18</td>
<td>1.59</td>
<td>1.59</td>
<td>13</td>
</tr>
<tr>
<td>8</td>
<td>28.05</td>
<td>3.36</td>
<td>1.68</td>
<td>1.68</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>29.73</td>
<td>3.57</td>
<td>1.78</td>
<td>1.79</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>31.51</td>
<td>3.78</td>
<td>1.89</td>
<td>1.89</td>
<td>6</td>
</tr>
</tbody>
</table>
**Example - continued**

Given the cash flows for Concatenator Manufacturing Division, calculate the PV of near term cash flows, $PV$ (horizon value), and the total value of the firm. $r=10\%$ and $g=6\%$

\[
PV(\text{horizon value}) = \frac{1}{(1.1)^6} \left( \frac{1.59}{.10 - .06} \right) = 22.4
\]

\[
PV(\text{FCF}) = -\frac{.80}{1.1} - \frac{.96}{(1.1)^2} - \frac{1.15}{(1.1)^3} - \frac{1.39}{(1.1)^4} - \frac{.20}{(1.1)^5} - \frac{.23}{(1.1)^6}
\]

\[
= -3.6
\]
Example - continued

Given the cash flows for Concatenator Manufacturing Division, calculate the PV of near term cash flows, PV (horizon value), and the total value of the firm. \( r = 10\% \) and \( g = 6\% \).

\[
PV(\text{business}) = PV(\text{FCF}) + PV(\text{horizon value})
\]
\[
= -3.6 + 22.4
\]
\[
= $18.8
\]
Why Net Present Value Leads to Better Investment Decisions than Other Criteria
Topics Covered

- NPV and its Competitors
- The Payback Period
- The Book Rate of Return
- Internal Rate of Return
- Capital Rationing
NPV and Cash Transfers

- Every possible method for evaluating projects impacts the flow of cash about the company as follows.

**Cash**

- **Investment opportunity (real asset)**
  - Invest

- **Firm**
  - Alternative: pay dividend to shareholders

- **Shareholder**
  - Shareholders invest for themselves

- **Investment opportunities (financial assets)**
**Payback**

- The payback period of a project is the number of years it takes before the cumulative forecasted cash flow equals the initial outlay.
- The payback rule says only accept projects that “payback” in the desired time frame.
- This method is very flawed, primarily because it ignores later year cash flows and the present value of future cash flows.
Payback

Example

Examine the three projects and note the mistake we would make if we insisted on only taking projects with a payback period of 2 years or less.

<table>
<thead>
<tr>
<th>Project</th>
<th>C₀</th>
<th>C₁</th>
<th>C₂</th>
<th>C₃</th>
<th>Payback Period</th>
<th>NPV@ 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-2000</td>
<td>500</td>
<td>500</td>
<td>5000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>-2000</td>
<td>500</td>
<td>1800</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>-2000</td>
<td>1800</td>
<td>500</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Example**

Examine the three projects and note the mistake we would make if we insisted on only taking projects with a payback period of 2 years or less.

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<th>C₀</th>
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<th>NPV@ 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-2000</td>
<td>500</td>
<td>500</td>
<td>5000</td>
<td>3</td>
<td>+2,624</td>
</tr>
<tr>
<td>B</td>
<td>-2000</td>
<td>500</td>
<td>1800</td>
<td>0</td>
<td>2</td>
<td>-58</td>
</tr>
<tr>
<td>C</td>
<td>-2000</td>
<td>1800</td>
<td>500</td>
<td>0</td>
<td>2</td>
<td>+50</td>
</tr>
</tbody>
</table>
Book Rate of Return - Average income divided by average book value over project life. Also called accounting rate of return.

$$\text{Book rate of return} = \frac{\text{book income}}{\text{book assets}}$$

Managers rarely use this measurement to make decisions. The components reflect tax and accounting figures, not market values or cash flows.
Example

You can purchase a turbo powered machine tool gadget for $4,000. The investment will generate $2,000 and $4,000 in cash flows for two years, respectively. What is the IRR on this investment?
Internal Rate of Return

**Example**

You can purchase a turbo powered machine tool gadget for $4,000. The investment will generate $2,000 and $4,000 in cash flows for two years, respectively. What is the IRR on this investment?

\[
NPV = -4,000 + \frac{2,000}{(1 + IRR)^1} + \frac{4,000}{(1 + IRR)^2} = 0
\]
**Example**

You can purchase a turbo powered machine tool gadget for $4,000. The investment will generate $2,000 and $4,000 in cash flows for two years, respectively. What is the IRR on this investment?

\[
NPV = -4,000 + \frac{2,000}{(1 + IRR)^1} + \frac{4,000}{(1 + IRR)^2} = 0
\]

\[
IRR = 28.08\%
\]
Internal Rate of Return

IRR = 28%

Discount rate (%) vs. NPV (,000s)
Pitfall 1 - Lending or Borrowing?

- With some cash flows (as noted below) the NPV of the project increases as the discount rate increases.
- This is contrary to the normal relationship between NPV and discount rates.

<table>
<thead>
<tr>
<th>$C_0$</th>
<th>$C_1$</th>
<th>$C_2$</th>
<th>$C_3$</th>
<th>IRR</th>
<th>$NPV @ 10%$</th>
</tr>
</thead>
<tbody>
<tr>
<td>+1,000</td>
<td>−3,600</td>
<td>−4,320</td>
<td>−1,728</td>
<td>+20%</td>
<td>−.75</td>
</tr>
</tbody>
</table>
Pitfall 1 - Lending or Borrowing?

- With some cash flows (as noted below) the NPV of the project increases as the discount rate increases.
- This is contrary to the normal relationship between NPV and discount rates.
Pitfall 2 - Multiple Rates of Return

- Certain cash flows can generate NPV=0 at two different discount rates.
- The following cash flow generates NPV=0 at both (-50%) and 15.2%.

<table>
<thead>
<tr>
<th>$C_0$</th>
<th>$C_1$</th>
<th>$C_2$</th>
<th>$C_3$</th>
<th>$C_4$</th>
<th>$C_5$</th>
<th>$C_6$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1,000</td>
<td>+800</td>
<td>+150</td>
<td>+150</td>
<td>+150</td>
<td>+150</td>
<td>-150</td>
</tr>
</tbody>
</table>
Pitfall 2 - Multiple Rates of Return

- Certain cash flows can generate NPV=0 at two different discount rates.
- The following cash flow generates NPV=0 at both (-50%) and 15.2%.

![Graph showing NPV vs Discount Rate with IRR at -50% and 15.2%](image-url)
Pitfall 3 - Mutually Exclusive Projects

- IRR sometimes ignores the magnitude of the project.
- The following two projects illustrate that problem.

<table>
<thead>
<tr>
<th>Project</th>
<th>$C_0$</th>
<th>$C_t$</th>
<th>IRR</th>
<th>NPV @ 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E$</td>
<td>$-10,000$</td>
<td>$+20,000$</td>
<td>100</td>
<td>$+8.182$</td>
</tr>
<tr>
<td>$F$</td>
<td>$-20,000$</td>
<td>$+35,000$</td>
<td>75</td>
<td>$+11,818$</td>
</tr>
</tbody>
</table>
Pitfall 4 - Term Structure Assumption

- We assume that discount rates are stable during the term of the project.
- This assumption implies that all funds are reinvested at the IRR.
- This is a false assumption.
Calculating the IRR can be a laborious task. Fortunately, financial calculators can perform this function easily. Note the previous example.
Calculating the IRR can be a laborious task. Fortunately, financial calculators can perform this function easily. Note the previous example.

<table>
<thead>
<tr>
<th>HP-10B</th>
<th>EL-733A</th>
<th>BAI® Plus</th>
</tr>
</thead>
<tbody>
<tr>
<td>-350,000</td>
<td>-350,000</td>
<td>CF</td>
</tr>
<tr>
<td>16,000</td>
<td>16,000</td>
<td>2nd {CLR Work}</td>
</tr>
<tr>
<td>16,000</td>
<td>16,000</td>
<td>-350,000 ENTER ↓</td>
</tr>
<tr>
<td>466,000</td>
<td>466,000</td>
<td>16,000 ENTER ↓</td>
</tr>
<tr>
<td>{IRR/YR}</td>
<td>IRR</td>
<td>16,000 ENTER ↓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>466,000 ENTER ↓</td>
</tr>
</tbody>
</table>

All produce IRR=12.96
Profitability Index

- When resources are limited, the profitability index (PI) provides a tool for selecting among various project combinations and alternatives.
- A set of limited resources and projects can yield various combinations.
- The highest weighted average PI can indicate which projects to select.
Profitability Index

Profitability Index = \( \frac{\text{NPV}}{\text{Investment}} \)

**Example**

*We only have $300,000 to invest. Which do we select?*

<table>
<thead>
<tr>
<th>Proj</th>
<th>NPV</th>
<th>Investment</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>230,000</td>
<td>200,000</td>
<td>1.15</td>
</tr>
<tr>
<td>B</td>
<td>141,250</td>
<td>125,000</td>
<td>1.13</td>
</tr>
<tr>
<td>C</td>
<td>194,250</td>
<td>175,000</td>
<td>1.11</td>
</tr>
<tr>
<td>D</td>
<td>162,000</td>
<td>150,000</td>
<td>1.08</td>
</tr>
</tbody>
</table>
### Profitability Index

**Example - continued**

<table>
<thead>
<tr>
<th>Proj</th>
<th>NPV</th>
<th>Investment</th>
<th>PI</th>
</tr>
</thead>
<tbody>
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</tr>
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<tr>
<td>C</td>
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<td>1.11</td>
</tr>
<tr>
<td>D</td>
<td>162,000</td>
<td>150,000</td>
<td>1.08</td>
</tr>
</tbody>
</table>

Select projects with highest Weighted Avg PI

\[
WAPI (BD) = \frac{1.13(125)}{(300)} + \frac{1.08(150)}{(300)} + \frac{1.0 (25)}{(300)}
\]

\[
= 1.09
\]
**Profitability Index**

*Example - continued*

<table>
<thead>
<tr>
<th>Proj</th>
<th>NPV</th>
<th>Investment</th>
<th>PI</th>
</tr>
</thead>
<tbody>
<tr>
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<td>C</td>
<td>194,250</td>
<td>175,000</td>
<td>1.11</td>
</tr>
<tr>
<td>D</td>
<td>162,000</td>
<td>150,000</td>
<td>1.08</td>
</tr>
</tbody>
</table>

Select projects with highest Weighted Avg PI

- WAPI (BD) = 1.09
- WAPI (A) = 1.10
- WAPI (BC) = 1.12
Linear Programming

- Maximize Cash flows or NPV
- Minimize costs

**Example**

Max NPV = 21Xn + 16 Xb + 12 Xc + 13 Xd

subject to

10Xa + 5Xb + 5Xc + 0Xd <= 10
-30Xa - 5Xb - 5Xc + 40Xd <= 12
Making Investment Decisions with the Net Present Value Rule
Topics Covered

- What To Discount
- IM&C Project
- Project Interaction
  - Timing
  - Equivalent Annual Cost
  - Replacement
  - Cost of Excess Capacity
  - Fluctuating Load Factors
What To Discount

*Only Cash Flow is Relevant*
What To Discount

*Only Cash Flow is Relevant*
Points to “Watch Out For”

- Do not confuse average with incremental payoff.
- Include all incidental effects.
- Do not forget working capital requirements.
- Forget sunk costs.
- Include opportunity costs.
- Beware of allocated overhead costs.
Be consistent in how you handle inflation!!

- Use nominal interest rates to discount nominal cash flows.
- Use real interest rates to discount real cash flows.
- You will get the same results, whether you use nominal or real figures.
Example

You own a lease that will cost you $8,000 next year, increasing at 3% a year (the forecasted inflation rate) for 3 additional years (4 years total). If discount rates are 10% what is the present value cost of the lease?
Example

You own a lease that will cost you $8,000 next year, increasing at 3% a year (the forecasted inflation rate) for 3 additional years (4 years total). If discount rates are 10% what is the present value cost of the lease?

\[
1 + \text{real interest rate} = \frac{1 + \text{nominal interest rate}}{1 + \text{inflation rate}}
\]
## Inflation

### Example - nominal figures

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow</th>
<th>PV @ 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8000</td>
<td>$8000 \times 1.10 = 7272.73$</td>
</tr>
<tr>
<td>2</td>
<td>8000 \times 1.03 = 8240</td>
<td>$8240 \times 1.10^2 = 6809.92$</td>
</tr>
<tr>
<td>3</td>
<td>8000 \times 1.03^2 = 8240</td>
<td>$8487.20 \times 1.10^3 = 6376.56$</td>
</tr>
<tr>
<td>4</td>
<td>8000 \times 1.03^3 = 8487.20</td>
<td>$8741.82 \times 1.10^4 = 5970.78$</td>
</tr>
</tbody>
</table>

$\sum = 26,429.99$
### Example - real figures

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow</th>
<th>PV @ 6.7961%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8000/1.03 = 7766.99</td>
<td>7766.99/1.068 = 7272.73</td>
</tr>
<tr>
<td>2</td>
<td>8240/1.03² = 7766.99</td>
<td>7766.99/1.068² = 6809.92</td>
</tr>
<tr>
<td>3</td>
<td>8487.20/1.03³ = 7766.99</td>
<td>7766.99/1.068³ = 6376.56</td>
</tr>
<tr>
<td>4</td>
<td>8741.82/1.03⁴ = 7766.99</td>
<td>7766.99/1.068⁴ = 5970.78</td>
</tr>
<tr>
<td></td>
<td></td>
<td>= $26,429.99</td>
</tr>
</tbody>
</table>
IM&C’s Guano Project

Revised projections ($1000s) reflecting inflation

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Capital investment</td>
<td>10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>−1,949</td>
</tr>
<tr>
<td>2. Accumulated depreciation</td>
<td>1,583</td>
<td>3,167</td>
<td>4,750</td>
<td>6,333</td>
<td>7,917</td>
<td>9,500</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>3. Year-end book value</td>
<td>10,000</td>
<td>8,417</td>
<td>6,833</td>
<td>5,250</td>
<td>3,667</td>
<td>2,083</td>
<td>500</td>
<td>0</td>
</tr>
<tr>
<td>4. Working capital</td>
<td>550</td>
<td>1,289</td>
<td>3,261</td>
<td>4,890</td>
<td>3,583</td>
<td>2,002</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5. Total book value (3 + 4)</td>
<td>10,000</td>
<td>8,967</td>
<td>8,122</td>
<td>8,511</td>
<td>8,557</td>
<td>5,666</td>
<td>2,502</td>
<td>0</td>
</tr>
<tr>
<td>6. Sales</td>
<td>523</td>
<td>12,887</td>
<td>32,610</td>
<td>48,901</td>
<td>35,834</td>
<td>19,717</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Cost of goods sold</td>
<td>837</td>
<td>7,729</td>
<td>19,552</td>
<td>29,345</td>
<td>21,492</td>
<td>11,830</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Other costs</td>
<td>4,000</td>
<td>2,200</td>
<td>1,210</td>
<td>1,331</td>
<td>1,464</td>
<td>1,611</td>
<td>1,772</td>
<td></td>
</tr>
<tr>
<td>9. Depreciation</td>
<td>1,583</td>
<td>1,583</td>
<td>1,583</td>
<td>1,583</td>
<td>1,583</td>
<td>1,583</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Pretax profit (6 − 7 − 8 − 9)</td>
<td>−4,000</td>
<td>−4,097</td>
<td>2,365</td>
<td>10,144</td>
<td>16,509</td>
<td>11,148</td>
<td>4,532</td>
<td>1,449</td>
</tr>
<tr>
<td>11. Tax at 35%</td>
<td>−1,400</td>
<td>−1,434</td>
<td>828</td>
<td>3,550</td>
<td>5,778</td>
<td>3,902</td>
<td>1,586</td>
<td>507</td>
</tr>
<tr>
<td>12. Profit after tax (10 − 11)</td>
<td>−2,600</td>
<td>−2,663</td>
<td>1,537</td>
<td>6,594</td>
<td>10,731</td>
<td>7,246</td>
<td>2,946</td>
<td>942</td>
</tr>
</tbody>
</table>
IM&C’s Guano Project

- NPV using nominal cash flows

\[
NPV = -12,000 - \frac{1,630}{1.20} + \frac{2,381}{(1.20)^2} + \frac{6,205}{(1.20)^3} + \frac{10,685}{(1.20)^4} + \frac{10,136}{(1.20)^5} + \frac{6,110}{(1.20)^6} + \frac{3,444}{(1.20)^7} = 3,519 \text{ or } $3,519,000
\]
## IM&C’s Guano Project

### Cash flow analysis ($1000s)

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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<td>29,345</td>
<td>21,492</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3. Other costs</td>
<td>4,000</td>
<td>2,200</td>
<td>1,210</td>
<td>1,331</td>
<td>1,464</td>
<td>1,611</td>
<td>1,772</td>
<td></td>
</tr>
<tr>
<td>4. Tax on operations</td>
<td>−1,400</td>
<td>−1,434</td>
<td>828</td>
<td>3,550</td>
<td>5,778</td>
<td>3,902</td>
<td>1,586</td>
<td></td>
</tr>
<tr>
<td>5. Cash flow from operations (1 − 2 − 3 − 4)</td>
<td>−2,600</td>
<td>−1,080</td>
<td>3,120</td>
<td>8,177</td>
<td>12,314</td>
<td>8,829</td>
<td>4,529</td>
<td></td>
</tr>
<tr>
<td>6. Change in working capital</td>
<td>−550</td>
<td>−739</td>
<td>−1,972</td>
<td>−1,629</td>
<td>1,307</td>
<td>1,581</td>
<td>2,002</td>
<td></td>
</tr>
<tr>
<td>7. Capital investment and disposal</td>
<td>−10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,442</td>
</tr>
<tr>
<td>8. Net cash flow (5 + 6 + 7)</td>
<td>−12,600</td>
<td>−1,630</td>
<td>2,381</td>
<td>6,205</td>
<td>10,685</td>
<td>10,136</td>
<td>6,110</td>
<td>3,444</td>
</tr>
<tr>
<td>9. Present value at 20% Net present value =</td>
<td>−12,600</td>
<td>−1,358</td>
<td>1,654</td>
<td>3,591</td>
<td>5,153</td>
<td>4,074</td>
<td>2,046</td>
<td>961</td>
</tr>
</tbody>
</table>
Details of cash flow forecast in year 3 ($1000s)

<table>
<thead>
<tr>
<th>Cash Flows</th>
<th>Data from Forecasted Income Statement</th>
<th>Working-Capital Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash inflow $31,110</td>
<td>Sales = 32,610</td>
<td>Increase in accounts receivable - 1,500</td>
</tr>
<tr>
<td>Cash outflow</td>
<td>Cost of goods sold, other costs, and taxes = (19,552 + 1,331 + 3,550)</td>
<td>Increase in inventory net of increase in accounts payable + (972 - 500)</td>
</tr>
<tr>
<td>$24,905</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Net cash flow = cash inflow - cash outflow

$6,205 = 31,110 - 24,905
IM&C’s Guano Project

Tax depreciation allowed under the modified accelerated cost recovery system (MACRS) - (Figures in percent of depreciable investment).

<table>
<thead>
<tr>
<th>Year(s)</th>
<th>3-Year</th>
<th>5-Year</th>
<th>7-Year</th>
<th>10-Year</th>
<th>15-Year</th>
<th>20-Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33.33</td>
<td>20.00</td>
<td>14.29</td>
<td>10.00</td>
<td>5.00</td>
<td>3.75</td>
</tr>
<tr>
<td>2</td>
<td>44.45</td>
<td>32.00</td>
<td>24.49</td>
<td>18.00</td>
<td>9.50</td>
<td>7.22</td>
</tr>
<tr>
<td>3</td>
<td>14.81</td>
<td>19.20</td>
<td>17.49</td>
<td>14.40</td>
<td>8.55</td>
<td>6.68</td>
</tr>
<tr>
<td>4</td>
<td>7.41</td>
<td>11.52</td>
<td>12.49</td>
<td>11.52</td>
<td>7.70</td>
<td>6.18</td>
</tr>
<tr>
<td>5</td>
<td>11.52</td>
<td>8.93</td>
<td>9.22</td>
<td>6.93</td>
<td>5.71</td>
<td></td>
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<tr>
<td>6</td>
<td>5.76</td>
<td>8.93</td>
<td>7.37</td>
<td>6.23</td>
<td>5.28</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>6.55</td>
<td>8.93</td>
<td>6.55</td>
<td>5.90</td>
<td>4.89</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>4.45</td>
<td>6.55</td>
<td>6.55</td>
<td>5.90</td>
<td>4.52</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>6.55</td>
<td>5.90</td>
<td>4.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>6.55</td>
<td>3.29</td>
<td>4.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>5.90</td>
<td>5.90</td>
<td>4.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>5.90</td>
<td>5.90</td>
<td>4.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>5.90</td>
<td>5.90</td>
<td>4.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>5.90</td>
<td>5.90</td>
<td>4.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>5.90</td>
<td>5.90</td>
<td>4.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>2.99</td>
<td>4.46</td>
<td>4.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17–20</td>
<td></td>
<td>4.46</td>
<td>4.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td>2.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# IM&C’s Guano Project

## Tax Payments ($1000s)

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sales*</td>
<td>523</td>
<td>12,887</td>
<td>32,610</td>
<td>48,901</td>
<td>35,834</td>
<td>19,717</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Cost of goods sold*</td>
<td>837</td>
<td>7,729</td>
<td>19,552</td>
<td>29,345</td>
<td>21,492</td>
<td>11,830</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Other costs*</td>
<td>4,000</td>
<td>2,200</td>
<td>1,210</td>
<td>1,331</td>
<td>1,464</td>
<td>1,611</td>
<td>1,772</td>
<td></td>
</tr>
<tr>
<td>4. Tax depreciation</td>
<td>2,000</td>
<td>3,200</td>
<td>1,920</td>
<td>1,152</td>
<td>1,152</td>
<td>576</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Pretax profit</td>
<td>-4,000</td>
<td>-4,514</td>
<td>748</td>
<td>9,807</td>
<td>16,940</td>
<td>11,579</td>
<td>5,539</td>
<td>1,949†</td>
</tr>
<tr>
<td>(1 – 2 – 3 – 4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Taxes at 35%‡</td>
<td>-1,400</td>
<td>-1,580</td>
<td>262</td>
<td>3,432</td>
<td>5,929</td>
<td>4,053</td>
<td>1,939</td>
<td>682</td>
</tr>
</tbody>
</table>

* Figures in thousands of dollars ($1000s).
† Includes a capital gain of $1,949.
‡ Based on a tax rate of 35%.
**Revised cash flow analysis ($1000s)**

<table>
<thead>
<tr>
<th></th>
<th>PERIOD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>1. Sales*</td>
<td>523</td>
</tr>
<tr>
<td>2. Cost of goods sold*</td>
<td>837</td>
</tr>
<tr>
<td>3. Other costs*</td>
<td>4,000</td>
</tr>
<tr>
<td>4. Tax†</td>
<td>−1,400</td>
</tr>
<tr>
<td>5. Cash flow from operations</td>
<td>(1 − 2 − 3 − 4)</td>
</tr>
<tr>
<td>6. Change in working capital</td>
<td>−550</td>
</tr>
<tr>
<td>7. Capital investment and disposal</td>
<td>−10,000</td>
</tr>
<tr>
<td>8. Net cash flow (5 + 6 + 7)</td>
<td>−12,600</td>
</tr>
<tr>
<td>9. Present value at 20%</td>
<td>−12,600</td>
</tr>
</tbody>
</table>

Net present value = +3,802
Even projects with positive NPV may be more valuable if deferred. The actual NPV is then the current value of some future value of the deferred project.

\[
\text{Current NPV} = \frac{\text{Net future value as of date } t}{(1 + r)^t}
\]
Timing

Example

You may harvest a set of trees at anytime over the next 5 years. Given the FV of delaying the harvest, which harvest date maximizes current NPV?

<table>
<thead>
<tr>
<th>Harvest</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Net FV ($1000s)</th>
<th>50</th>
<th>64.4</th>
<th>77.5</th>
<th>89.4</th>
<th>100</th>
<th>109.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>% change in value</td>
<td>28.8</td>
<td>20.3</td>
<td>15.4</td>
<td>11.9</td>
<td>9.4</td>
<td></td>
</tr>
</tbody>
</table>
**Example - continued**

You may harvest a set of trees at anytime over the next 5 years. Given the FV of delaying the harvest, which harvest date maximizes current NPV?

\[
NPV \text{ if harvested in year 1} = \frac{64.4}{1.10} = 58.5
\]
Example - continued

You may harvest a set of trees at anytime over the next 5 years. Given the FV of delaying the harvest, which harvest date maximizes current NPV?

\[
NPV \text{ if harvested in year } 1 = \frac{64.4}{1.10} = 58.5
\]

<table>
<thead>
<tr>
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<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV ($1000s)</td>
<td>0</td>
</tr>
<tr>
<td>50</td>
<td>58.5</td>
</tr>
</tbody>
</table>
Equivalent Annual Cost - The cost per period with the same present value as the cost of buying and operating a machine.
Equivalent Annual Cost - The cost per period with the same present value as the cost of buying and operating a machine.

\[
\text{Equivalent annual cost} = \frac{\text{present value of costs}}{\text{annuity factor}}
\]
Equivalent Annual Cost

Example

Given the following costs of operating two machines and a 6% cost of capital, select the lower cost machine using equivalent annual cost method.
**Equivalent Annual Cost**

**Example**

*Given the following costs of operating two machines and a 6% cost of capital, select the lower cost machine using equivalent annual cost method.*

<table>
<thead>
<tr>
<th>Year</th>
<th>Machine</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>PV@6%</th>
<th>EAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>15</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>28.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>6</td>
<td>6</td>
<td>21.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example

Given the following costs of operating two machines and a 6% cost of capital, select the lower cost machine using equivalent annual cost method.

<table>
<thead>
<tr>
<th>Machine</th>
<th>Year</th>
<th>PV@6%</th>
<th>EAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>15</td>
<td>28.37</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
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<td>A</td>
<td>3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>10</td>
<td>21.00</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
Machinery Replacement

Annual operating cost of old machine = 8

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost of new machine</th>
<th>NPV @ 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>15</td>
<td>27.4</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Equivalent annual cost of new machine =
27.4/(3-year annuity factor) = 27.4/2.5 = 11

MORAL: Do not replace until operating cost of old machine exceeds 11.
Cost of Excess Capacity

A project uses existing warehouse and requires a new one to be built in Year 5 rather than Year 10. A warehouse costs 100 & lasts 20 years.

Equivalent annual cost @ 10% = 100/8.5 = 11.7

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>. . . 5</th>
<th>6</th>
<th>. . . 10</th>
<th>11</th>
<th>. . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>With project</td>
<td>0</td>
<td>0</td>
<td>11.7</td>
<td>11.7</td>
<td>11.7</td>
<td></td>
</tr>
<tr>
<td>Without project</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>11.7</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>0</td>
<td>0</td>
<td>11.7</td>
<td>11.7</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

PV extra cost = \[ \frac{11.7}{(1.1)^6} + \frac{11.7}{(1.1)^7} + \ldots + \frac{11.7}{(1.1)^{10}} = 27.6 \]
## Fluctuating Load Factors

<table>
<thead>
<tr>
<th></th>
<th>Two Old Machines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual output per machine</td>
<td>750 units</td>
</tr>
<tr>
<td>Operating cost per machine</td>
<td>$1,500</td>
</tr>
<tr>
<td>PV operating cost per machine</td>
<td>$15,000</td>
</tr>
<tr>
<td>PV operating cost of two machines</td>
<td>$30,000</td>
</tr>
</tbody>
</table>
# Fluctuating Load Factors

<table>
<thead>
<tr>
<th>Two New Machines</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual output per machine</td>
<td>750 units</td>
</tr>
<tr>
<td>Capital cost per machine</td>
<td>$6,000</td>
</tr>
<tr>
<td>Operating cost per machine</td>
<td>$750</td>
</tr>
<tr>
<td>PV operating cost per machine</td>
<td>$13,500</td>
</tr>
<tr>
<td>PV operating cost of two machines</td>
<td>$27,000</td>
</tr>
</tbody>
</table>
## Fluctuating Load Factors

<table>
<thead>
<tr>
<th></th>
<th>One Old Machine</th>
<th>One New Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual output per machine</td>
<td>500 units</td>
<td>1,000 units</td>
</tr>
<tr>
<td>Capital cost per machine</td>
<td>0</td>
<td>$6,000</td>
</tr>
<tr>
<td>Operating cost per machine</td>
<td>$1,000</td>
<td>$1,000</td>
</tr>
<tr>
<td>PV operating cost per machine</td>
<td>$10,000</td>
<td>$16,000</td>
</tr>
<tr>
<td>PV operating cost of two machines</td>
<td>................................</td>
<td>$26,000</td>
</tr>
</tbody>
</table>
Introduction to Risk, Return, and the Opportunity Cost of Capital
Topics Covered

- 72 Years of Capital Market History
- Measuring Risk
- Portfolio Risk
- Beta and Unique Risk
- Diversification
The Value of an Investment of $1 in 1926

Source: Ibbotson Associates

Year End

Index

S&P
Small Cap
Corp Bonds
Long Bond
T Bill

Source: Ibbotson Associates
The Value of an Investment of $1 in 1926

Source: Ibbotson Associates
Rates of Return 1926-1997

Source: Ibbotson Associates
Measuring Risk

**Variance** - Average value of squared deviations from mean. A measure of volatility.

**Standard Deviation** - Average value of squared deviations from mean. A measure of volatility.
# Measuring Risk

Coin Toss Game-calculating variance and standard deviation

<table>
<thead>
<tr>
<th>(1) Percent Rate of Return</th>
<th>(2) Deviation from Mean</th>
<th>(3) Squared Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ 40</td>
<td>+ 30</td>
<td>900</td>
</tr>
<tr>
<td>+ 10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>+ 10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>- 20</td>
<td>- 30</td>
<td>900</td>
</tr>
</tbody>
</table>

Variance = average of squared deviations = $\frac{1800}{4} = 450$

Standard deviation = square of root variance = $\sqrt{450} = 21.2\%$
Measuring Risk

Histogram of Annual Stock Market Returns

# of Years

Return %
Diversification - Strategy designed to reduce risk by spreading the portfolio across many investments.

Unique Risk - Risk factors affecting only that firm. Also called “diversifiable risk.”

Market Risk - Economy-wide sources of risk that affect the overall stock market. Also called “systematic risk.”
Measuring Risk

Portfolio rate of return = \left( \frac{\text{fraction of portfolio in first asset}}{\text{rate of return on first asset}} \right) \times \left( \frac{\text{fraction of portfolio in second asset}}{\text{rate of return on second asset}} \right)
Measuring Risk

Number of Securities vs. Portfolio standard deviation graph.
Measuring Risk

![Graph showing the relationship between number of securities and portfolio standard deviation, with 'Unique risk' and 'Market risk' indicated.]
The variance of a two stock portfolio is the sum of these four boxes:

<table>
<thead>
<tr>
<th></th>
<th>Stock 1</th>
<th>Stock 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock 1</td>
<td>$x_1 \sigma_1^2$</td>
<td>$x_1 x_2 \tilde{\sigma}_{12}$</td>
</tr>
<tr>
<td></td>
<td>$x_1 x_2 \tilde{\sigma}_{12}$</td>
<td>$x_1 x_2 \tilde{\sigma}<em>{12} \tilde{\sigma}</em>{12}$</td>
</tr>
<tr>
<td>Stock 2</td>
<td>$x_1 x_2 \tilde{\sigma}_{12}$</td>
<td>$x_2 \sigma_2^2$</td>
</tr>
</tbody>
</table>
Example

Suppose you invest $55 in Bristol-Myers and $45 in McDonald’s. The expected dollar return on your BM is \( .10 \times 55 = 5.50 \) and on McDonald’s it is \( .20 \times 45 = 9.90 \). The expected dollar return on your portfolio is \( 5.50 + 9.90 = 14.50 \). The portfolio rate of return is \( 14.50/100 = .145 \) or 14.5%. Assume a correlation coefficient of 1.
Example

Suppose you invest $55 in Bristol-Myers and $45 in McDonald’s. The expected dollar return on your BM is \( .10 \times 55 = 5.50 \) and on McDonald’s it is \( .20 \times 45 = 9.90 \). The expected dollar return on your portfolio is \( 5.50 + 9.50 = 14.50 \). The portfolio rate of return is \( 14.50/100 = .145 \) or 14.5%. Assume a correlation coefficient of 1.

<table>
<thead>
<tr>
<th></th>
<th>Bristol - Myers</th>
<th>McDonald's s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bristol - Myers</strong></td>
<td>( x_1^2 \hat{o}_1^2 = (.55)^2 \times (17.1)^2 )</td>
<td>( x_1x_2 \hat{n}_{12} \hat{o}_1 \hat{o}_2 = .55 \times .45 \times 1 \times 17.1 \times 20.8 )</td>
</tr>
<tr>
<td><strong>McDonald's</strong></td>
<td>( x_1x_2 \hat{n}_{12} \hat{o}_1 \hat{o}_2 = .55 \times .45 \times 1 \times 17.1 \times 20.8 )</td>
<td>( x_2 \hat{o}_2^2 = (.45)^2 \times (20.8)^2 )</td>
</tr>
</tbody>
</table>
Portfolio Risk

Example

Suppose you invest $55 in Bristol-Myers and $45 in McDonald’s. The expected dollar return on your BM is $0.10 \times 55 = 5.50$ and on McDonald’s it is $0.20 \times 45 = 9.90$. The expected dollar return on your portfolio is $5.50 + 9.90 = 14.50$. The portfolio rate of return is $14.50/100 = 0.145$ or 14.5%. Assume a correlation coefficient of 1.

Portfolio Variance = $[(0.55)^2 \times (17.1)^2]$

+ $[(0.45)^2 \times (20.8)^2]$

+ $2(0.55 \times 0.45 \times 1 \times 17.1 \times 20.8) = 352.10$

Standard Deviation = $\sqrt{352.1} = 18.7\%$
Expected Portfolio Return = \( (x_1 r_1) + (x_2 r_2) \)

Portfolio Variance = \( x_1^2 \sigma_1^2 + x_2^2 \sigma_2^2 + 2(x_1 x_2 \tilde{\gamma}_{12} \sigma_1 \sigma_2) \)
The shaded boxes contain variance terms; the remainder contain covariance terms.

To calculate portfolio variance add up the boxes.
1. Total risk = diversifiable risk + market risk
2. Market risk is measured by beta, the sensitivity to market changes.

Expected stock return

Expected market return

+10%

-10%

beta

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Market Portfolio - Portfolio of all assets in the economy. In practice a broad stock market index, such as the S&P Composite, is used to represent the market.

Beta - Sensitivity of a stock’s return to the return on the market portfolio.
Beta and Unique Risk

\[ B_i = \frac{\sigma_{im}}{\sigma_m^2} \]
Beta and Unique Risk

\[ B_i = \frac{\sigma_{im}}{\sigma_m^2} \]

Covariance with the market

Variance of the market
Topics Covered

- Markowitz Portfolio Theory
- Risk and Return Relationship
- Testing the CAPM
- CAPM Alternatives
Combining stocks into portfolios can reduce standard deviation below the level obtained from a simple weighted average calculation. Correlation coefficients make this possible. The various weighted combinations of stocks that create this standard deviations constitute the set of efficient portfolios.
Price changes vs. Normal distribution

Microsoft - Daily % change 1986-1997
Markowitz Portfolio Theory

Price changes vs. Normal distribution

*Microsoft - Daily % change 1986-1997*

Daily % Change

# of Days (frequency)
Markowitz Portfolio Theory

Standard Deviation VS. Expected Return

*Investment C*
Markowitz Portfolio Theory

Standard Deviation VS. Expected Return

Investment D

% probability

% return
Expected Returns and Standard Deviations vary given different weighted combinations of the stocks.

45%  McDonald’s

Bristol-Myers Squibb

Expected Return (%)
• Each half egg shell represents the possible weighted combinations for two stocks.

• The composite of all stock sets constitutes the efficient frontier.
Lending or Borrowing at the risk free rate \( (r_f) \) allows us to exist outside the efficient frontier.


### Efficient Frontier

<table>
<thead>
<tr>
<th>Stocks</th>
<th>( \sigma )</th>
<th>% of Portfolio</th>
<th>Avg Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC Corp</td>
<td>28</td>
<td>60%</td>
<td>15%</td>
</tr>
<tr>
<td>Big Corp</td>
<td>42</td>
<td>40%</td>
<td>21%</td>
</tr>
</tbody>
</table>

Correlation Coefficient = .4

Standard Deviation = weighted avg = 33.6

\[
\text{Standard Deviation = Portfolio } = 28.1
\]

Return = weighted avg = Portfolio = 17.4%
Efficient Frontier

Example

<table>
<thead>
<tr>
<th>Stocks</th>
<th>( \sigma )</th>
<th>% of Portfolio</th>
<th>Avg Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC Corp</td>
<td>28</td>
<td>60%</td>
<td>15%</td>
</tr>
<tr>
<td>Big Corp</td>
<td>42</td>
<td>40%</td>
<td>21%</td>
</tr>
</tbody>
</table>

Correlation Coefficient = 0.4

Standard Deviation = weighted avg = 33.6
Standard Deviation = Portfolio = 28.1
Return = weighted avg = Portfolio = 17.4%

Let’s Add stock New Corp to the portfolio
Efficient Frontier

Example

<table>
<thead>
<tr>
<th>Stocks</th>
<th>σ</th>
<th>% of Portfolio</th>
<th>Avg Return</th>
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</thead>
<tbody>
<tr>
<td>Portfolio</td>
<td>28.1</td>
<td>50%</td>
<td>17.4%</td>
</tr>
<tr>
<td>New Corp</td>
<td>30</td>
<td>50%</td>
<td>19%</td>
</tr>
</tbody>
</table>

NEW Standard Deviation = weighted avg = 31.80

NEW Standard Deviation = Portfolio = 23.43

NEW Return = weighted avg = Portfolio = 18.20%
## Efficient Frontier

### Example

<table>
<thead>
<tr>
<th>Stocks</th>
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**NEW Standard Deviation** = weighted avg = $31.80$

**NEW Standard Deviation** = Portfolio = $23.43$

**NEW Return** = weighted avg = Portfolio = $18.20\%$

**NOTE:** Higher return & Lower risk
## Efficient Frontier

### Example

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NEW Standard Deviation = weighted avg = 31.80
NEW Standard Deviation = Portfolio = 23.43
NEW Return = weighted avg = Portfolio = 18.20\%

NOTE: Higher return & Lower risk
How did we do that?
## Efficient Frontier

### Example

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<th>Avg Return</th>
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<tbody>
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NEW Standard Deviation = weighted avg = 31.80
NEW Standard Deviation = Portfolio = 23.43
NEW Return = weighted avg = Portfolio = 18.20%

**NOTE:** Higher return & Lower risk

How did we do that? **DIVERSIFICATION**
Efficient Frontier

Return

Risk (measured as $\sigma$)
Efficient Frontier

Return

Risk

A

B

AB
Efficient Frontier

Return vs Risk diagram with points A, B, and N.

- A
- B
- AB
- N
Efficient Frontier

Return

Risk

A
B
AB
N
Efficient Frontier

Goal is to move up and left.

WHY?
Efficient Frontier

Return

Low Risk

High Return

Risk
Efficient Frontier

Return

Low Risk  |  High Risk

High Return  |  High Return

Risk
Efficient Frontier

Return

Low Risk  |  High Risk

High Return  |  High Return

Low Risk  |  Low Return

Risk
Efficient Frontier

Return

Low Risk | High Risk
---------|---------
High Return | High Return

Low Risk | High Risk
---------|---------
Low Return | Low Return
Efficient Frontier

Return

Low Risk  High Risk

High Return  High Return

Low Risk  High Risk

Low Return  Low Return

Risk
Efficient Frontier

Return vs. Risk

Points: A, AB, B, ABN, N
Risk Free Return = $r_f$
Security Market Line

Market Return = $r_m$

Risk Free Return = $r_f$

Efficient Portfolio
Security Market Line

Market Return $= r_m$

Risk Free Return $= r_f$

Efficient Portfolio
Security Market Line

Market Return = $r_m$

Risk Free Return = $r_f$

Efficient Portfolio

BETA

Return

1.0
Security Market Line

Market Return = $r_m$

Risk Free Return = $r_f$

Security Market Line (SML)
SML Equation = $r_f + B \left( r_m - r_f \right)$
Capital Asset Pricing Model

\[ R = r_f + B \left( r_m - r_f \right) \]

CAPM
Testing the CAPM

Beta vs. Average Risk Premium

Avg Risk Premium 1931-65

Portfolio Beta

SML

Investors

Market Portfolio

Portfolio Beta
Testing the CAPM

Beta vs. Average Risk Premium

Avg Risk Premium
1966-91

Investors

Market Portfolio

SML

Portfolio Beta
Testing the CAPM

Company Size vs. Average Return

Average Return (%)

Company size

Smallest  Largest
Testing the CAPM

Book-Market vs. Average Return

Average Return (%)
Consumption Betas vs Market Betas

Stocks (and other risky assets)

Wealth = market portfolio
Consumption Betas vs Market Betas

Wealth = market portfolio

Stocks (and other risky assets)

Market risk makes wealth uncertain.
Consumption Betas vs Market Betas

Stocks (and other risky assets)

Market risk makes wealth uncertain.

Wealth = market portfolio

Standard CAPM
Consumption Betas vs Market Betas

Stocks (and other risky assets)

Market risk makes wealth uncertain.

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Standard CAPM

Stocks (and other risky assets)

Consumption
Consumption Betas vs Market Betas

Stocks (and other risky assets)

Market risk makes wealth uncertain.

Wealth = market portfolio

Stocks (and other risky assets)

Wealth is uncertain

Wealth

Consumption is uncertain

Consumption
Consumption Betas vs Market Betas

- Stocks (and other risky assets)
  - Market risk makes wealth uncertain.
  - Wealth = market portfolio

- Wealth is uncertain
  - Standard CAPM

- Consumption is uncertain
  - Consumption
**Arbitrage Pricing Theory**

**Alternative to CAPM**

Expected Risk

\[
\text{Premium} = r - r_f = B_{\text{factor1}}(r_{\text{factor1}} - r_f) + B_{f2}(r_{f2} - r_f) + \ldots
\]
Arbitrage Pricing Theory

**Alternative to CAPM**

Expected Risk

\[
\text{Premium} = r - r_f = \beta_{factor1}(r_{factor1} - r_f) + \beta_{f2}(r_{f2} - r_f) + \ldots
\]

Return

\[
= a + b_{factor1}(r_{factor1}) + b_{f2}(r_{f2}) + \ldots
\]
### Arbitrage Pricing Theory

**Estimated risk premiums for taking on risk factors**

(1978-1990)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Estimated Risk Premium $(r_{\text{factor}} - r_f)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield spread</td>
<td>5.10%</td>
</tr>
<tr>
<td>Interest rate</td>
<td>-.61</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>-.59</td>
</tr>
<tr>
<td>Real GNP</td>
<td>.49</td>
</tr>
<tr>
<td>Inflation</td>
<td>-.83</td>
</tr>
<tr>
<td>Mrket</td>
<td>6.36</td>
</tr>
</tbody>
</table>
Capital Budgeting and Risk
Topics Covered

- Measuring Betas
- Capital Structure and COC
- Discount Rates for Intl. Projects
- Estimating Discount Rates
- Risk and DCF
Company Cost of Capital

- A firm’s value can be stated as the sum of the value of its various assets.

Firm value = PV(AB) = PV(A) + PV(B)
A company’s cost of capital can be compared to the CAPM required return.
Measuring Betas

- The SML shows the relationship between return and risk.
- CAPM uses Beta as a proxy for risk.
- Beta is the slope of the SML, using CAPM terminology.
- Other methods can be employed to determine the slope of the SML and thus Beta.
- Regression analysis can be used to find Beta.
Hewlett Packard Beta

Price data - Jan 78 - Dec 82

\[ R^2 = 0.53 \]

\[ B = 1.35 \]

Slope determined from 60 months of prices and plotting the line of best fit.
Measuring Betas

Hewlett Packard Beta

Price data - Jan 83 - Dec 87

\[ R^2 = .49 \]
\[ B = 1.33 \]

Slope determined from 60 months of prices and plotting the line of best fit.
Hewlett Packard Beta

Price data - Jan 88 - Dec 92

\[ R^2 = 0.45 \]

\[ B = 1.70 \]

Slope determined from 60 months of prices and plotting the line of best fit.
Measuring Betas

Hewlett Packard Beta

Price data - Jan 93 - Dec 97

\[ R^2 = 0.35 \]

\[ B = 1.69 \]

Slope determined from 60 months of prices and plotting the line of best fit.
Measuring Betas

A T & T  Beta

Price data - Jan 78 - Dec 82

\[ R^2 = 0.28 \]

\[ B = 0.21 \]

Slope determined from 60 months of prices and plotting the line of best fit.

Market return (%)
Measuring Betas

A T & T Beta

Price data - Jan 83 - Dec 87

\[ R^2 = 0.23 \]

\[ B = 0.64 \]

Slope determined from 60 months of prices and plotting the line of best fit.

Market return (%)
Measuring Betas

A T & T Beta

Price data - Jan 88 - Dec 92

$R^2 = .28$

$B = 0.90$

Slope determined from 60 months of prices and plotting the line of best fit.
Measuring Betas

A T & T Beta

Price data - Jan 93 - Dec 97

\[ R^2 = 0.17 \]

\[ B = 0.90 \]

Slope determined from 60 months of prices and plotting the line of best fit.
### Beta Stability

<table>
<thead>
<tr>
<th>RISK CLASS</th>
<th>% IN SAME CLASS 5 YEARS LATER</th>
<th>% WITHIN ONE CLASS 5 YEARS LATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 (High betas)</td>
<td>35</td>
<td>69</td>
</tr>
<tr>
<td>9</td>
<td>18</td>
<td>54</td>
</tr>
<tr>
<td>8</td>
<td>16</td>
<td>45</td>
</tr>
<tr>
<td>7</td>
<td>13</td>
<td>41</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>39</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>42</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>45</td>
</tr>
<tr>
<td>2</td>
<td>21</td>
<td>61</td>
</tr>
<tr>
<td>1 (Low betas)</td>
<td>40</td>
<td>62</td>
</tr>
</tbody>
</table>

Source: Sharpe and Cooper (1972)
Modify CAPM (account for proper risk)

- Use COC unique to project, rather than Company COC
- Take into account Capital Structure
Company Cost of Capital (COC) is based on the average beta of the assets.

- The average Beta of the assets is based on the % of funds in each asset.
Company Cost of Capital (COC) is based on the average beta of the assets.

The average Beta of the assets is based on the % of funds in each asset.

**Example**

1/3 New Ventures $B=2.0$

1/3 Expand existing business $B=1.3$

1/3 Plant efficiency $B=0.6$

$AVG \ B \ of \ assets = 1.3$
Capital Structure - the mix of debt & equity within a company

Expand CAPM to include CS

\[ R = r_f + B \left( r_m - r_f \right) \]

becomes

\[ R_{\text{equity}} = r_f + B \left( r_m - r_f \right) \]
Capital Structure & COC

\[ \text{COC} = r_{\text{portfolio}} = r_{\text{assets}} \]
Capital Structure & COC

\[ \text{COC} = r_{\text{portfolio}} = r_{\text{assets}} \]

\[ r_{\text{assets}} = \text{WACC} = \underbrace{r_{\text{debt}}}_D \frac{(D)}{(V)} + \underbrace{r_{\text{equity}}}_E \frac{(E)}{(V)} \]
Capital Structure & COC

\[ \text{COC} = r_{\text{portfolio}} = r_{\text{assets}} \]

\[ r_{\text{assets}} = W\text{ACC} = r_{\text{debt}} \frac{D}{V} + r_{\text{equity}} \frac{E}{V} \]

\[ B_{\text{assets}} = B_{\text{debt}} \frac{D}{V} + B_{\text{equity}} \frac{E}{V} \]
Capital Structure & COC

COC = \( r_{\text{portfolio}} = r_{\text{assets}} \)

\[ \begin{align*}
    r_{\text{assets}} &= \text{WACC} = r_{\text{debt}} \left( \frac{D}{V} \right) + r_{\text{equity}} \left( \frac{E}{V} \right) \\
    B_{\text{assets}} &= B_{\text{debt}} \left( \frac{D}{V} \right) + B_{\text{equity}} \left( \frac{E}{V} \right) \\
    r_{\text{equity}} &= r_f + B_{\text{equity}} \left( r_m - r_f \right)
\end{align*} \]
COC = \( r_{portfolio} = r_{assets} \)

\[ r_{assets} = \text{WACC} = r_{debt} \frac{(D)}{(V)} + r_{equity} \frac{(E)}{(V)} \]

\[ B_{assets} = B_{debt} \frac{(D)}{(V)} + B_{equity} \frac{(E)}{(V)} \]

\[ r_{equity} = r_f + B_{equity} (r_m - r_f) \]

**IMPORTANT**

E, D, and V are all market values
Expected Returns and Betas prior to refinancing

- $R_{\text{equity}} = 15$
- $R_{\text{assets}} = 12.2$
- $R_{\text{rdebt}} = 8$

Expected return (%)
Pinnacle West Corp.

\[ R_{\text{equity}} = r_f + B \left( r_m - r_f \right) \]
\[ = .045 + .51(.08) = .0858 \text{ or } 8.6\% \]

\[ R_{\text{debt}} = \text{YTM on bonds} \]
\[ = 6.9\% \]
<table>
<thead>
<tr>
<th>Company</th>
<th>Beta</th>
<th>Standard. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston Electric</td>
<td>.60</td>
<td>.19</td>
</tr>
<tr>
<td>Central HUDson</td>
<td>.30</td>
<td>.18</td>
</tr>
<tr>
<td>Consolidated Edison</td>
<td>.65</td>
<td>.20</td>
</tr>
<tr>
<td>DTE Energy</td>
<td>.56</td>
<td>.17</td>
</tr>
<tr>
<td>Eastern Utilities Assoc</td>
<td>.66</td>
<td>.19</td>
</tr>
<tr>
<td>GPU Inc</td>
<td>.65</td>
<td>.18</td>
</tr>
<tr>
<td>NE Electric System</td>
<td>.35</td>
<td>.19</td>
</tr>
<tr>
<td>OGE Energy</td>
<td>.39</td>
<td>.15</td>
</tr>
<tr>
<td>PECO Energy</td>
<td>.70</td>
<td>.23</td>
</tr>
<tr>
<td>Pinnacle West Corp</td>
<td>.43</td>
<td>.21</td>
</tr>
<tr>
<td>PP &amp; LResources</td>
<td>.37</td>
<td>.21</td>
</tr>
<tr>
<td>Portfolio Average</td>
<td>.51</td>
<td>.15</td>
</tr>
</tbody>
</table>
Pinnacle West Corp.

\[ COC = r_{\text{assets}} = \frac{D}{V} r_{\text{debt}} + \frac{E}{V} r_{\text{equity}} \]

\[ = .35(.08) + .65(.10) \]

\[ = .093 \text{ or } 9.3\% \]
## International Risk

<table>
<thead>
<tr>
<th>Country</th>
<th>σ Ratio</th>
<th>Correlation coefficient</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>3.52</td>
<td>.416</td>
<td>1.46</td>
</tr>
<tr>
<td>Brazil</td>
<td>3.80</td>
<td>.160</td>
<td>.62</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>2.36</td>
<td>.147</td>
<td>.35</td>
</tr>
<tr>
<td>Taiwan</td>
<td>3.80</td>
<td>.120</td>
<td>.47</td>
</tr>
</tbody>
</table>

Source: The Brattle Group, Inc.

σ Ratio - Ratio of standard deviations, country index vs. S&P composite index
Given three outcomes and their related probabilities and cash flows we can determine an unbiased forecast of cash flows.

<table>
<thead>
<tr>
<th>Possible cash flow</th>
<th>Probability</th>
<th>Prob weighted cash flow</th>
<th>Unbiased forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2</td>
<td>.25</td>
<td>.3</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>.50</td>
<td>.5</td>
<td>$1.0 million</td>
</tr>
<tr>
<td>0.8</td>
<td>.25</td>
<td>.2</td>
<td></td>
</tr>
</tbody>
</table>
Asset Betas

Cash flow = revenue - fixed cost - variable cost

\[ PV(\text{asset}) = PV(\text{revenue}) - PV(\text{fixed cost}) - PV(\text{variable cost}) \]

or

\[ PV(\text{revenue}) = PV(\text{fixed cost}) + PV(\text{variable cost}) + PV(\text{asset}) \]
Asset Betas

\[ B_{\text{revenue}} = B_{\text{fixed cost}} \frac{PV(\text{fixed cost})}{PV(\text{revenue})} + \]
\[ + B_{\text{variable cost}} \frac{PV(\text{variable cost})}{PV(\text{revenue})} + B_{\text{asset}} \frac{PV(\text{asset})}{PV(\text{revenue})} \]
Asset Betas

\[
B_{\text{asset}} = B_{\text{revenue}} \frac{PV(\text{revenue}) - PV(\text{variable cost})}{PV(\text{asset})}
\]

\[
= B_{\text{revenue}} \left[ 1 - \frac{PV(\text{fixed cost})}{PV(\text{asset})} \right]
\]
Example
Project A is expected to produce $\text{CF} = 100$ mil for each of three years. Given a risk free rate of 6%, a market premium of 8%, and beta of 0.75, what is the PV of the project?
Example

Project A is expected to produce CF = $100 mil for each of three years. Given a risk free rate of 6%, a market premium of 8%, and beta of .75, what is the PV of the project?

\[
r = r_f + B(r_m - r_f)
\]

\[
= 6 + .75(8)
\]

\[
= 12\%
\]
Risk, DCF and CEQ

Example

Project A is expected to produce $CF = $100 mil for each of three years. Given a risk free rate of 6%, a market premium of 8%, and beta of .75, what is the PV of the project?

\[
r = r_f + B(r_m - r_f) \\
= 6 + .75(8) \\
= 12\%
\]

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow</th>
<th>PV @ 12%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>89.3</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
<td>79.7</td>
</tr>
<tr>
<td>3</td>
<td>100</td>
<td>71.2</td>
</tr>
<tr>
<td></td>
<td>Total PV</td>
<td>240.2</td>
</tr>
</tbody>
</table>
**Example**

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<td></td>
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Now assume that the cash flows change, but are RISK FREE. What is the new PV?

\[
r = r_f + B(r_m - r_f) \\
= 6 + .75(8) \\
= 12\%\
\]
**Example**

Project A is expected to produce CF = $100 mil for each of three years. Given a risk free rate of 6%, a market premium of 8%, and beta of .75, what is the PV of the project? Now assume that the cash flows change, but are RISK FREE. What is the new PV?

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</tr>
</tbody>
</table>

**Total PV** 240.2

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow</th>
<th>PV @ 6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>94.6</td>
<td>89.3</td>
</tr>
<tr>
<td>2</td>
<td>89.6</td>
<td>79.7</td>
</tr>
<tr>
<td>3</td>
<td>84.8</td>
<td>71.2</td>
</tr>
</tbody>
</table>

**Total PV** 240.2
Example

Project A is expected to produce CF = $100 mil for each of three years. Given a risk free rate of 6%, a market premium of 8%, and beta of .75, what is the PV of the project? Now assume that the cash flows change, but are RISK FREE. What is the new PV?

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<th>Year</th>
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</tbody>
</table>

<table>
<thead>
<tr>
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<th>Cash Flow</th>
<th>PV @ 6%</th>
</tr>
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<td>84.8</td>
<td>71.2</td>
</tr>
<tr>
<td>Total PV</td>
<td></td>
<td>240.2</td>
</tr>
</tbody>
</table>

Since the 94.6 is risk free, we call it a **Certainty Equivalent** of the 100.
Example

Project A is expected to produce CF = $100 mil for each of three years. Given a risk free rate of 6%, a market premium of 8%, and beta of .75, what is the PV of the project?.. Now assume that the cash flows change, but are RISK FREE. What is the new PV?

The difference between the 100 and the certainty equivalent (94.6) is 5.4%…this % can be considered the annual premium on a risky cash flow

\[
\text{Risky cash flow} \div 1.054 = \text{certainty equivalent cash flow}
\]
Example

Project A is expected to produce CF = $100 mil for each of three years. Given a risk free rate of 6%, a market premium of 8%, and beta of .75, what is the PV of the project?.. Now assume that the cash flows change, but are RISK FREE. What is the new PV?

\[
\text{Year 1} = \frac{100}{1.054} = 94.6
\]

\[
\text{Year 2} = \frac{100}{1.054^2} = 89.6
\]

\[
\text{Year 3} = \frac{100}{1.054^3} = 84.8
\]
The prior example leads to a generic certainty equivalent formula.

\[
PV = \frac{C_t}{(1 + r)^t} = \frac{CEQ_t}{(1 + r_f)^t}
\]
A Project Is Not a Black Box
Topics Covered

- Sensitivity Analysis
- Break Even Analysis
- Monte Carlo Simulation
- Decision Trees
How To Handle Uncertainty

**Sensitivity Analysis** - Analysis of the effects of changes in sales, costs, etc. on a project.

**Scenario Analysis** - Project analysis given a particular combination of assumptions.

**Simulation Analysis** - Estimation of the probabilities of different possible outcomes.

**Break Even Analysis** - Analysis of the level of sales (or other variable) at which the company breaks even.
Example

Given the expected cash flow forecasts for Otoban Company’s Motor Scooter project, listed on the next slide, determine the NPV of the project given changes in the cash flow components using a 10% cost of capital. Assume that all variables remain constant, except the one you are changing.
Sensitivity Analysis

Example - continued

<table>
<thead>
<tr>
<th></th>
<th>Year 0</th>
<th>Years 1 - 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment</td>
<td>-15</td>
<td></td>
</tr>
<tr>
<td>Sales</td>
<td>37.5</td>
<td></td>
</tr>
<tr>
<td>Variable Costs</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Fixed Costs</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Depreciation</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Pretax profit</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>.Taxes @ 50%</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Profit after tax</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Operating cash flow</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Net Cash Flow</td>
<td>-15</td>
<td>3</td>
</tr>
</tbody>
</table>

NPV = 3.43 billion Yen
Sensitivity Analysis

Example - continued

Possible Outcomes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pessimistic</th>
<th>Expected</th>
<th>Optimistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Size</td>
<td>.9 mil</td>
<td>51 mil</td>
<td>1.1 mil</td>
</tr>
<tr>
<td>Market Share</td>
<td>.04</td>
<td>.1</td>
<td>.16</td>
</tr>
<tr>
<td>Unit price</td>
<td>350,000</td>
<td>375,000</td>
<td>380,000</td>
</tr>
<tr>
<td>Unit Var Cost</td>
<td>360,000</td>
<td>300,000</td>
<td>275,000</td>
</tr>
<tr>
<td>Fixed Cost</td>
<td>4 bil</td>
<td>3 bil</td>
<td>2 bil</td>
</tr>
</tbody>
</table>
Sensitivity Analysis

Example - continued

**NPV Calculations for Pessimistic Market Size Scenario**

<table>
<thead>
<tr>
<th></th>
<th>Year 0</th>
<th>Years 1 - 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment</td>
<td>-15</td>
<td></td>
</tr>
<tr>
<td>Sales</td>
<td></td>
<td>41.25</td>
</tr>
<tr>
<td>Variable Costs</td>
<td></td>
<td>33</td>
</tr>
<tr>
<td>Fixed Costs</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Depreciation</td>
<td></td>
<td>1.5</td>
</tr>
<tr>
<td>Pretax profit</td>
<td></td>
<td>3.75</td>
</tr>
<tr>
<td>Taxes @ 50%</td>
<td></td>
<td>1.88</td>
</tr>
<tr>
<td>Profit after tax</td>
<td></td>
<td>1.88</td>
</tr>
<tr>
<td>Operating cash flow</td>
<td></td>
<td>3.38</td>
</tr>
<tr>
<td>Net Cash Flow</td>
<td>-15</td>
<td>+ 3.38</td>
</tr>
</tbody>
</table>

NPV = +5.7 bil yen
## Sensitivity Analysis

Example - continued

### NPV Possibilities (Billions Yen)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pessimistic</th>
<th>Expected</th>
<th>Optimistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Size</td>
<td>1.1</td>
<td>3.4</td>
<td>5.7</td>
</tr>
<tr>
<td>Market Share</td>
<td>-10.4</td>
<td>3.4</td>
<td>17.3</td>
</tr>
<tr>
<td>Unit price</td>
<td>-4.2</td>
<td>3.4</td>
<td>5.0</td>
</tr>
<tr>
<td>Unit Var Cost</td>
<td>-15.0</td>
<td>3.4</td>
<td>11.1</td>
</tr>
<tr>
<td>Fixed Cost</td>
<td>0.4</td>
<td>3.4</td>
<td>6.5</td>
</tr>
</tbody>
</table>
Break Even Analysis

- Point at which the NPV=0 is the break even point.
- Otoban Motors has a breakeven point of 8,000 units sold.

<table>
<thead>
<tr>
<th>PV (Yen)</th>
<th>Billions</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>PV Inflows</td>
</tr>
<tr>
<td>200</td>
<td>85</td>
</tr>
<tr>
<td>19.6</td>
<td>NPV=9</td>
</tr>
<tr>
<td></td>
<td>PV Outflows</td>
</tr>
<tr>
<td></td>
<td>Sales, 000’s</td>
</tr>
</tbody>
</table>
Monte Carlo Simulation

Modeling Process

- Step 1: Modeling the Project
- Step 2: Specifying Probabilities
- Step 3: Simulate the Cash Flows
Decision Trees

Turboprop
-550
NPV = ?

-550
+150(.6)
960 (.8)
220(.2)
930(.4)
140(.6)

+30(.4)

0

100(.2)

Piston
-250
NPV = ?

-250
+100(.6)
+100(.6)
or

0

180(.2)

410(.8)

-150

800(.8)

100(.2)

220(.4)

50(.4)

100(.6)
Decision Trees

Turboprop
-550
NPV = ?

NPV = ?

Piston
-250
NPV = ?
Decision Trees

Turboprop
-550
NPV = ?

Piston
-250
NPV = ?

\((960 \times 0.80) + (220 \times 0.20) = 812\)

NPV = 812

NPV = 812
Decision Trees

\[
\frac{660}{1.10} - 150 = 450
\]

Turboprop

\[
\frac{-550}{1.10} + 30(.4) = NPV
\]

NPV = ?

Piston

\[
-250 + 100(.6) = NPV
\]

NPV = ?

NPV = ?

NPV = ?
Decision Trees

NPV = 444.55

Turboprop
-550
NPV = ?

NPV = 888.18

NPV = 184.55

Piston
-250
NPV = ?

NPV = 812

\[ \frac{812}{1.10} + 150 = 888.18 \]

NPV = 888.18

NPV = 456

930 (.4)
140 (.6)

NPV = 660

800 (.8)

NPV = 364

-150
100 (.2)
410 (.8)

NPV = 148

331
180 (.2)
220 (.4)

*450

100 (.6)
Decision Trees

Turboprop

NPV = ?

NPV = 444.55

NPV = 888.18

NPV = 550.00

NPV = 184.55

NPV = 710.73

NPV = 812

NPV = 456

NPV = 660

NPV = -550

NPV = -250

NPV = 403.82

NPV = 100

NPV = 800

NPV = 140

NPV = 148

NPV = 800

NPV = 100

NPV = 410

NPV = 220

NPV = 100

NPV = 410

= \left( 888.18 \times 0.60 \right) + \left( 444.55 \times 0.40 \right)
Decision Trees

Turboprop

NPV = 96.12

-550

NPV = 888.18

+150(.6)

960 (.8)

220(.2)

812

710.73

930(.4)

456

NPV = 444.55

+30(.4)

140(.6)

NPV = 184.55

331

NPV = 117.00

-250

Piston

NPV = 550.00

NPV = 888.18

NPV = 444.55

NPV = 184.55

NPV = 184.55

+30(.4)

140(.6)

100(.6)

148

-150

800(.8)

660

*450

100(.2)

100(.2)

364

148

\[
\frac{710.73}{1.10} - 550 = 96.12
\]
Decision Trees

Turboprop
-550

NPV=96.12

NPV=888.18
+150(.6)
960 (.8)
220(.2)

NPV=444.55
+30(.4)
930(.4)
140(.6)

NPV=550.00
+100(.6)

NPV=550.00
*450
-150
100(.2)

or
0
410(.8)
331
180(.2)

364

Piston
-250

NPV=117.00

NPV=184.55
+50(.4)

NPV=184.55
100(.6)
220(.4)
148

NPV=444.55

NPV=888.18

NPV=184.55

NPV=550.00

NPV=96.12
Where Net Present Values Come From
Topics Covered

- Look First To Market Values
- Forecasting Economic Rents
- Marvin Enterprises
Smart investment decisions make MORE money than smart financing decisions.
Market Values

- Smart investments are worth more than they cost: they have positive NPVs

- Firms calculate project NPVs by discounting forecast cash flows, but . . .
Market Values

- Projects may appear to have positive NPVs because of forecasting errors.

  e.g. some acquisitions result from errors in a DCF analysis.
Market Values

- Positive NPVs stem from a comparative advantage.

- Strategic decision-making identifies this comparative advantage; it does *not* identify growth areas.
Market Values

- *Don’t* make investment decisions on the basis of errors in your DCF analysis.

- Start with the market price of the asset and ask whether it is worth more to you than to others.
Market Values

- *Don’t assume that other firms will watch passively.*

Ask --
How long a lead do I have over my rivals? What will happen to prices when that lead disappears?

In the meantime how will rivals react to my move? Will they cut prices or imitate my product?
Department Store Rents

NPV = -100 + \frac{8}{1.10} + \ldots + \frac{8 + 134}{1.10^{10}} = $1 million

[assumes price of property appreciates by 3% a year]

Rental yield = 10 - 3 = 7%

\begin{align*}
\text{NPV} &= \frac{8 - 7}{1.10} + \frac{8 - 7.21}{1.10^2} + \ldots + \frac{8 - 8.87}{1.10^9} + \frac{8 - 9.13}{1.10^{10}} = $1 million
\end{align*}
EXAMPLE: KING SOLOMON’S MINE

- Investment = $200 million
- Life = 10 years
- Production = .1 million oz. a year
- Production cost = $200 per oz.
- Current gold price = $400 per oz.
- Discount rate = 10%
EXAMPLE: KING SOLOMON’S MINE - continued

If the gold price is forecasted to rise by 5% p.a.:

\[
NPV = -200 + \left(\frac{.1(420 - 200)}{1.10}\right) + \left(\frac{.1(441 - 200)}{1.10^2}\right) + ... = - \$10 \text{ m.}
\]

But if gold is fairly priced, you do not need to forecast future gold prices:

\[
NPV = -\text{investment} + \text{PV revenues} - \text{PV costs}
\]

\[
= 200 + 400 - \sum \left(\frac{.1 \times 200}{1.10^t}\right) = 77 \text{ million}
\]
Do Projects Have Positive NPVs?

- Rents = profits that more than cover the cost of capital.

- NPV = PV (rents)

- Rents come only when you have a better product, lower costs or some other competitive edge.

- Sooner or later competition is likely to eliminate rents.
Proposal to manufacture specialty chemicals

- Raw materials were commodity chemicals imported from Europe.
- Finished product was exported to Europe.
- High early profits, but . . .
- . . . what happens when competitors enter?
<table>
<thead>
<tr>
<th>Technology</th>
<th>Industry</th>
<th>Marvin Capacity</th>
<th>Unit cost Capital</th>
<th>Unit cost Prodn.</th>
<th>Salvage value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 2011</td>
<td>120</td>
<td>-</td>
<td>17.5</td>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>2. 2019</td>
<td>120</td>
<td>24</td>
<td>17.5</td>
<td>5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

* Proposed
## Marvin Enterprises

<table>
<thead>
<tr>
<th>Technology</th>
<th>Production cost</th>
<th>Interest on capital</th>
<th>Interest on salvage</th>
<th>Invest above</th>
<th>Scrap below</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 2011</td>
<td>5.5</td>
<td>3.5</td>
<td>.5</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>2. 2019</td>
<td>3.5</td>
<td>3.5</td>
<td>.5</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>
Demand for Garbage Blasters

Demand = 80 (10 - Price)
Price = 10 * quantity/80
Value of Garbage Blaster Investment

\[ \text{NPV new plant} = 100 \times [-10 + \sum \frac{(6 - 3)}{1.2^t} + \frac{10}{1.25}] = 299 \text{ million} \]

\[ \text{Change PV existing plant} = 24 \times \sum \frac{1}{1.2^t} = 72 \text{ million} \]

\[ \text{Net benefit} = 299 - 72 = 227 \text{ million} \]
Marvin Enterprises

• **VALUE OF CURRENT BUSINESS:**
  
  At price of $7
  
  \[ PV = 24 \times 3.5/0.20 \]
  
  \[ VALUE \]
  
  420

• **WINDFALL LOSS:**
  
  Since price falls to $5 after 5 years,
  
  \[ Loss = -24 \times (2/0.20) \times (1/1.20)^5 \]
  
  \[ VALUE \]
  
  -96

• **VALUE OF NEW INVESTMENT:**
  
  Rent gained on new investment
  
  \[ = 100 \times 1 \text{ for 5 years} = 299 \]
  
  Rent lost on old investment
  
  \[ = -24 \times 1 \text{ for 5 years} = -72 \]
  
  \[ TOTAL VALUE: \]
  
  227
  
  227

**CURRENT MARKET PRICE:**

460
Marvin Enterprises

Alternative Expansion Plans

NPV $m.

NPV new plant

Total NPV of investment

Addition to capacity millions

Change in PV existing plant

Marvin Enterprises

Alternative Expansion Plans

NPV $m.

NPV new plant

Total NPV of investment

Addition to capacity millions

Change in PV existing plant

Marvin Enterprises

Alternative Expansion Plans

NPV $m.

NPV new plant

Total NPV of investment

Addition to capacity millions

Change in PV existing plant
Making Sure Managers Maximize NPV

Chapter 12
Topics Covered

- The capital investment process
- Decision Makers and Information
- Incentives
- Residual Income and EVA
- Accounting Performance Measures
- Economic Profit
The Principal Agent Problem

Question: Who has the power?

Answer: Managers

Shareholders = Owners

Managers = Employees
Capital Investment Decision

Strategic Planning
“Top Down”

Capital Investments

Project Creation
“Bottom Up”
Off Budget Expenditures

- Information Technology
- Research and Development
- Marketing
- Training and Development
Information Problems

1. Consistent Forecasts
2. Reducing Forecast Bias
3. Getting Senior Management Needed Information
4. Eliminating Conflicts of Interest

The correct information is ...
Growth and Returns

Rate of return, %

Rate of growth, %

- Economic rate of return
- Book rate of return
The proportion of proposed projects having a positive NPV at the official corporate hurdle rate is independent of the hurdle rate.
Incentives

Agency Problems in Capital Budgeting

- Reduced effort
- Perks
- Empire building
- Entrenching investment
- Avoiding risk
Incentive Issues

- **Monitoring** - Reviewing the actions of managers and providing incentives to maximize shareholder value.

- **Free Rider Problem** - When owners rely on the efforts of others to monitor the company.

- **Compensation** - How to pay managers so as to reduce the cost and need for monitoring and to maximize shareholder value.
Residual Income & EVA

- Techniques for overcoming errors in accounting measurements of performance.
- Emphasizes NPV concepts in performance evaluation over accounting standards.
- Looks more to long term than short term decisions.
- More closely tracks shareholder value than accounting measurements.
<table>
<thead>
<tr>
<th>Income</th>
<th>Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales 550</td>
<td>Net W.C. 80</td>
</tr>
<tr>
<td>COGS 275</td>
<td>Property, plant and equipment 1170</td>
</tr>
<tr>
<td>Selling, G&amp;A 75</td>
<td>less depr. 360</td>
</tr>
<tr>
<td></td>
<td>Net Invest.. 810</td>
</tr>
<tr>
<td>taxes @ 35% 70</td>
<td>Other assets 110</td>
</tr>
<tr>
<td>Net Income $130</td>
<td>Total Assets $1,000</td>
</tr>
</tbody>
</table>
**Quayle City Subduction Plant ($mil)**

\[ ROI = \frac{130}{1,000} = .13 \]

Given COC = 10%

\[ NetROI = 13\% - 10\% = 3\% \]
Residual Income or EVA = Net Dollar return after deducting the cost of capital.

\[ EVA = \text{Residual Income} \]

\[ = \text{Income Earned} - \text{income required} \]

\[ = \text{Income Earned} - \left[ \text{Cost of Capital} \times \text{Investment} \right] \]

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Quayle City Subduction Plant ($mil)

Given COC = 12%

\[ EV = \text{Residual Income} \\
= 130 - (0.12 \times 1,000) \\
= +$10 million \]
Economic Profit

*Economic Profit* = capital invested multiplied by the spread between return on investment and the cost of capital.

\[ EP = (ROI - r) \times \text{Capital Invested} \]

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Economic Profit

**Quayle City Subduction Plant ($mil)**

Example at 12% COC continued.

\[
EP = (ROI - r) \times \text{Capital Invested}
\]

\[
= (.13 - .12) \times 1,000
\]

\[
= $10\text{million}
\]

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Message of EVA

+ Managers are motivated to only invest in projects that earn more than they cost.
+ EVA makes cost of capital visible to managers.
+ Leads to a reduction in assets employed.
- EVA does not measure present value.
- Rewards quick paybacks and ignores time value of money.
## EVA of US firms - 1997

<table>
<thead>
<tr>
<th>Company</th>
<th>EVA</th>
<th>Capital Invested</th>
<th>Return on Capital</th>
<th>Cost of Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coca Cola</td>
<td>$2,442</td>
<td>$10,814</td>
<td>36.0%</td>
<td>9.7%</td>
</tr>
<tr>
<td>Dow Chemical</td>
<td>6,81</td>
<td>23,024</td>
<td>12.2</td>
<td>9.0</td>
</tr>
<tr>
<td>Ford Motor</td>
<td>1,719</td>
<td>58,272</td>
<td>12.1</td>
<td>9.1</td>
</tr>
<tr>
<td>General Electric</td>
<td>2,515</td>
<td>53,567</td>
<td>17.7</td>
<td>12.7</td>
</tr>
<tr>
<td>General Motors</td>
<td>-3,527</td>
<td>82,887</td>
<td>5.9</td>
<td>9.7</td>
</tr>
<tr>
<td>Hewlett - Packard</td>
<td>-99</td>
<td>24,185</td>
<td>15.2</td>
<td>15.7</td>
</tr>
<tr>
<td>IBM</td>
<td>-2,743</td>
<td>67,431</td>
<td>7.8</td>
<td>11.8</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>1,327</td>
<td>18,138</td>
<td>21.8</td>
<td>13.3</td>
</tr>
<tr>
<td>Merck</td>
<td>1,688</td>
<td>22,219</td>
<td>23.0</td>
<td>14.5</td>
</tr>
<tr>
<td>Microsoft</td>
<td>1,727</td>
<td>5,680</td>
<td>47.1</td>
<td>11.8</td>
</tr>
<tr>
<td>Philip Morris</td>
<td>3,119</td>
<td>42,885</td>
<td>20.1</td>
<td>12.5</td>
</tr>
<tr>
<td>Safeway</td>
<td>335</td>
<td>4,963</td>
<td>15.7</td>
<td>8.5</td>
</tr>
<tr>
<td>UAL</td>
<td>298</td>
<td>13,420</td>
<td>9.8</td>
<td>7.2</td>
</tr>
<tr>
<td>Walt Disney</td>
<td>-347</td>
<td>30,702</td>
<td>11.0</td>
<td>12.6</td>
</tr>
</tbody>
</table>
Accounting Measurements

Rate of return = \frac{\text{cash receipts} + \text{change in price}}{\text{beginning price}}

= \frac{C_1 + (P_1 - P_0)}{P_0}
Rate of return = \( \frac{\text{cash receipts} + \text{change in price}}{\text{beginning price}} \)

\[ = \frac{C_1 + (P_1 - P_0)}{P_0} \]

Economic income = cash flow + change in present value

Rate of return = \( \frac{C_1 + (PV_1 - PV_0)}{PV_0} \)
# Accounting Measurements

<table>
<thead>
<tr>
<th><strong>ECONOMIC</strong></th>
<th><strong>ACCOUNTING</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash flow +</td>
<td>Cash flow +</td>
</tr>
<tr>
<td>change in PV =</td>
<td>change in book value =</td>
</tr>
<tr>
<td>Cash flow -</td>
<td>Cash flow -</td>
</tr>
<tr>
<td>economic depreciation</td>
<td>accounting depreciation</td>
</tr>
</tbody>
</table>

**INCOME**

**RETURN**

<table>
<thead>
<tr>
<th>Economic income</th>
<th>Accounting income</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV at start of year</td>
<td>BV at start of year</td>
</tr>
</tbody>
</table>
### Nodhead Store Forecasts

<table>
<thead>
<tr>
<th>YEAR</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash flow</td>
<td>100</td>
<td>200</td>
<td>250</td>
<td>298</td>
<td>298</td>
<td>298</td>
</tr>
<tr>
<td>PV at start of year (r = 10%)</td>
<td>1000</td>
<td>1000</td>
<td>901</td>
<td>741</td>
<td>517</td>
<td>271</td>
</tr>
<tr>
<td>PV at end of year (r = 10%)</td>
<td>1000</td>
<td>901</td>
<td>741</td>
<td>517</td>
<td>271</td>
<td>0</td>
</tr>
<tr>
<td>Change in value</td>
<td>0</td>
<td>-99</td>
<td>-160</td>
<td>-224</td>
<td>-246</td>
<td>-271</td>
</tr>
<tr>
<td>Economic income</td>
<td>100</td>
<td>101</td>
<td>90</td>
<td>74</td>
<td>52</td>
<td>27</td>
</tr>
<tr>
<td>Rate of return %</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Economic depn.</td>
<td>0</td>
<td>99</td>
<td>160</td>
<td>224</td>
<td>246</td>
<td>271</td>
</tr>
</tbody>
</table>
# Nodhead Book Income & ROI

<table>
<thead>
<tr>
<th>YEAR</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash flow</td>
<td>100</td>
<td>200</td>
<td>250</td>
<td>298</td>
<td>298</td>
<td>298</td>
</tr>
<tr>
<td>BV at start of year, strt line depn</td>
<td>1000</td>
<td>833</td>
<td>667</td>
<td>500</td>
<td>333</td>
<td>167</td>
</tr>
<tr>
<td>BV at end of year, strt line depn</td>
<td>833</td>
<td>667</td>
<td>500</td>
<td>333</td>
<td>167</td>
<td>0</td>
</tr>
<tr>
<td>Change in BV</td>
<td>-167</td>
<td>-167</td>
<td>-167</td>
<td>-167</td>
<td>-167</td>
<td>-167</td>
</tr>
<tr>
<td>Book income</td>
<td>-67</td>
<td>+33</td>
<td>+83</td>
<td>+131</td>
<td>+131</td>
<td>+131</td>
</tr>
<tr>
<td>Book ROI %</td>
<td>-6.7</td>
<td>4.0</td>
<td>12.4</td>
<td>26.2</td>
<td>39.3</td>
<td>78.4</td>
</tr>
<tr>
<td>Book depn.</td>
<td>167</td>
<td>167</td>
<td>167</td>
<td>167</td>
<td>167</td>
<td>167</td>
</tr>
</tbody>
</table>
Corporate Financing and the Six Lessons of Market Efficiency
Topics Covered

- We Always Come Back to NPV
- What is an Efficient Market?
  - Random Walk
- Efficient Market Theory
- The Evidence on Market Efficiency
- Six Lessons of Market Efficiency
Return to NPV

- NPV employs discount rates.
- These discount rates are risk adjusted.
- The risk adjustment is a byproduct of market established prices.
- Adjustable discount rates change asset values.
Example

The government is lending you $100,000 for 10 years at 3% and only requiring interest payments prior to maturity. Since 3% is obviously below market, what is the value of the below market rate loan?

NPV = amount borrowed - PV of interest pmts - PV of loan repayment
Example

The government is lending you $100,000 for 10 years at 3% and only requiring interest payments prior to maturity. Since 3% is obviously below market, what is the value of the below market rate loan?

Assume the market return on equivalent risk projects is 10%.

\[
\text{NPV} = 100,000 - \left[ \sum_{t=1}^{10} \frac{3,000}{(1.10)^t} \right] - \frac{100,000}{(1.10)^{10}}
\]

\[
= 100,000 - 56,988
\]

\[
= $43,012
\]
Random Walk Theory

- The movement of stock prices from day to day DO NOT reflect any pattern.
- Statistically speaking, the movement of stock prices is random \((skewed \text{ positive over the long term})\).
Random Walk Theory

Coin Toss Game

$100.00

Heads

$103.00

Heads

$106.09

Tails

$100.43

Tails

$95.06

Heads

$100.43

Tails

$97.50
S&P 500 Five Year Trend?
or
5 yrs of the Coin Toss Game?
Random Walk Theory

S&P 500 Five Year Trend?
or
5 yrs of the Coin Toss Game?
Random Walk Theory

The diagram illustrates a scatter plot of Microsoft returns on day t+1, percent, against returns on day t, percent. The plot shows a pattern of points scattered randomly across the axes, indicating that returns do not exhibit predictability or structure.
Random Walk Theory

Figure 13.4.a: FTSE autocorr = -1%
Random Walk Theory
Random Walk Theory
Random Walk Theory
Efficient Market Theory

- **Weak Form Efficiency**
  - Market prices reflect all historical information.

- **Semi-Strong Form Efficiency**
  - Market prices reflect all publicly available information.

- **Strong Form Efficiency**
  - Market prices reflect all information, both public and private.
Efficient Market Theory

- Fundamental Analysts
  - Research the value of stocks using NPV and other measurements of cash flow.
Technical Analysts

Forecast stock prices based on the watching the fluctuations in historical prices (thus “wiggle watchers”).
Cycles disappear once identified
Efficient Market Theory

Cumulative Abnormal Return (%)

Days Relative to announcement date

Announcement Date
Efficient Market Theory

Average Annual Return on 1493 Mutual Funds and the Market Index
Efficient Market Theory

IPO Non-Excess Returns

<table>
<thead>
<tr>
<th>Year After Offering</th>
<th>IPO</th>
<th>Matched Stocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fourth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fifth</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Efficient Market Theory

1987 Stock Market Crash

\[ PV(\text{index})_{\text{pre crash}} = \frac{\text{Div}}{r - g} = \frac{16.7}{.114 - .10} = 1193 \]
Efficient Market Theory

1987 Stock Market Crash

\[
P_{\text{PV (index) pre crash}} = \frac{\text{Div}}{r - g} = \frac{16.7}{.114 - .10} = 1193
\]

\[
P_{\text{PV (index) post crash}} = \frac{\text{Div}}{r - g} = \frac{16.7}{.114 - .096} = 928
\]
Lessons of Market Efficiency

- Markets have no memory
- Trust market prices
- Read the entrails
- There are no financial illusions
- The *do it yourself* alternative
- Seen one stock, seen them all
Example: How stock splits affect value

Source: Fama, Fisher, Jensen & Roll
An Overview of Corporate Financing
Topics Covered

- Patterns of Corporate Financing
- Common Stock
- Preferred Stock
- Debt
- Derivatives
Patterns of Corporate Financing

- Firms may raise funds from external sources or plow back profits rather than distribute them to shareholders.
- Should a firm elect external financing, they may choose between debt or equity sources.
TABLE 14-1  Sources and uses of funds in nonfinancial corporations expressed as percentage of each year's total investment.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Uses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Capital expenditures</td>
<td>74</td>
<td>87</td>
<td>87</td>
<td>98</td>
<td>73</td>
<td>89</td>
<td>92</td>
<td>77</td>
<td>81</td>
<td>83</td>
</tr>
<tr>
<td>2. Investment in net working capital and other usesa</td>
<td>26</td>
<td>13</td>
<td>13</td>
<td>2</td>
<td>27</td>
<td>19</td>
<td>20</td>
<td>23</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>3. Total investment</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>Sources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Internally generated cash b</td>
<td>81</td>
<td>87</td>
<td>90</td>
<td>112</td>
<td>88</td>
<td>88</td>
<td>86</td>
<td>78</td>
<td>89</td>
<td>85</td>
</tr>
<tr>
<td>5. Financial deficit (5 - 4); equals required external financing Financial deficit covered by:</td>
<td>19</td>
<td>13</td>
<td>10</td>
<td>-12</td>
<td>12</td>
<td>12</td>
<td>14</td>
<td>22</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>6. Net stock issues</td>
<td>-26</td>
<td>-27</td>
<td>-14</td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>-7</td>
<td>-8</td>
<td>-9</td>
<td>-14</td>
</tr>
<tr>
<td>7. Net increase in debt</td>
<td>45</td>
<td>40</td>
<td>24</td>
<td>-14</td>
<td>7</td>
<td>8</td>
<td>21</td>
<td>30</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

a Changes in short-term borrowing are shown under net increase in debt. "Other uses" are net of any increase in miscellaneous liabilities and any statistical discrepancy.

b Net income plus depreciation less cash dividends paid to stockholders


<table>
<thead>
<tr>
<th>Category</th>
<th>Amount (Billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current assets</td>
<td>$1,320</td>
</tr>
<tr>
<td>Fixed assets</td>
<td>2,181</td>
</tr>
<tr>
<td>Less</td>
<td>1,097</td>
</tr>
<tr>
<td><strong>Net fixed assets</strong></td>
<td><strong>1,085</strong></td>
</tr>
<tr>
<td>Current liabilities</td>
<td>$997</td>
</tr>
<tr>
<td>Long term debt</td>
<td>815</td>
</tr>
<tr>
<td>Other long term liabilities</td>
<td>576</td>
</tr>
<tr>
<td><strong>Total long term liabilities</strong></td>
<td><strong>1,391</strong></td>
</tr>
<tr>
<td>Other long term</td>
<td>1,491</td>
</tr>
<tr>
<td><strong>Total assets</strong></td>
<td><strong>3,896</strong></td>
</tr>
<tr>
<td>Stockholders' equity</td>
<td>1,508</td>
</tr>
<tr>
<td><strong>Total liabilities and stockholders' equity</strong></td>
<td><strong>3,896</strong></td>
</tr>
</tbody>
</table>
Patterns of Corporate Financing

? How do we define debt?

\[
\frac{\text{Debt}}{\text{Total assets}} = \frac{997 + 1391}{3896} = .61
\]

\[
\frac{\text{Long term liabilities}}{\text{Long term liabilities + equity}} = \frac{1391}{1391 + 1508} = .48
\]
Patterns of Corporate Financing

<table>
<thead>
<tr>
<th>Country</th>
<th>Book</th>
<th>Book, Adjusted</th>
<th>Market</th>
<th>Market, Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>39%</td>
<td>37%</td>
<td>35%</td>
<td>32%</td>
</tr>
<tr>
<td>France</td>
<td>48</td>
<td>34</td>
<td>41</td>
<td>28</td>
</tr>
<tr>
<td>Germany</td>
<td>38</td>
<td>18</td>
<td>23</td>
<td>15</td>
</tr>
<tr>
<td>Italy</td>
<td>47</td>
<td>39</td>
<td>46</td>
<td>36</td>
</tr>
<tr>
<td>Japan</td>
<td>53</td>
<td>37</td>
<td>29</td>
<td>17</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>28</td>
<td>16</td>
<td>19</td>
<td>11</td>
</tr>
<tr>
<td>United States</td>
<td>37</td>
<td>33</td>
<td>28</td>
<td>23</td>
</tr>
</tbody>
</table>
Common Stock

Book Value vs. Market Value

Book value is a backward looking measure. It tells us how much capital the firm has raised from shareholders in the past. It does not measure the value that shareholders place on those shares today. The market value of the firm is forward looking, it depends on the future dividends that shareholders expect to receive.
**Common Stock**

**Example - Mobil Book Value vs. Market Value (12/97)**

Total Shares outstanding = 783.4 million

<table>
<thead>
<tr>
<th>Component</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Shares ($1 par)</td>
<td>894</td>
</tr>
<tr>
<td>Additional paid in capital</td>
<td>1,549</td>
</tr>
<tr>
<td>Retained earnings</td>
<td>20,661</td>
</tr>
<tr>
<td>Currency adjustment</td>
<td>-821</td>
</tr>
<tr>
<td>Treasury shares at cost</td>
<td>-3,158</td>
</tr>
<tr>
<td><strong>Net common equity (Book Value)</strong></td>
<td><strong>19,125</strong></td>
</tr>
</tbody>
</table>
Common Stock

Example - Mobil Book Value vs. Market Value (12/97)
Total Shares outstanding = 783.4 million

Dec 1997 Market price = $72/sh

\[
\text{Market Value} = \frac{\text{# of shares} \times 783.4}{783.4} = \$56.4 \text{ billion}
\]
Preferred Stock - Stock that takes priority over common stock in regards to dividends.

Net Worth - Book value of common shareholder’s equity plus preferred stock.

Floating-Rate Preferred - Preferred stock paying dividends that vary with short term interest rates.
Corporate Debt

- Debt has the unique feature of allowing the borrowers to walk away from their obligation to pay, in exchange for the assets of the company.
- “Default Risk” is the term used to describe the likelihood that a firm will walk away from its obligation, either voluntarily or involuntarily.
- “Bond Ratings” are issued on debt instruments to help investors assess the default risk of a firm.
**TABLE 14-5** Large firms typically issue many different securities. This table shows some of the debt securities on Mobil Corporation's balance sheet at the end of 1996 and 1997 (figures in millions).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6 1/2% notes 1997</td>
<td>$148</td>
<td></td>
</tr>
<tr>
<td>6 3/8% notes 1998</td>
<td>200</td>
<td>$200</td>
</tr>
<tr>
<td>7 1/4% notes 1999</td>
<td>162</td>
<td>148</td>
</tr>
<tr>
<td>8 3/8% notes 2001</td>
<td>200</td>
<td>180</td>
</tr>
<tr>
<td>8 5/8% notes 2006</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>8 5/8% debentures 2021</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>7 5/8% debentures 2033</td>
<td>240</td>
<td>216</td>
</tr>
<tr>
<td>8% debentures 2032</td>
<td>250</td>
<td>164</td>
</tr>
<tr>
<td>8 1/8% Canadian dollar eurobonds 1998 a</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>9 % ECU eurobonds 1997 b</td>
<td>148</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 14-5 Large firms typically issue many different securities. This table shows some of the debt securities on Mobil Corporation's balance sheet at the end of 1996 and 1997 (figures in millions).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9 5/8% sterling eurobonds 1999</td>
<td>187</td>
<td>182</td>
</tr>
<tr>
<td>Variable rate notes 1999</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>Japanese yen loans 2003-2005</td>
<td>388</td>
<td>347</td>
</tr>
<tr>
<td>Variable rate project financing 1998</td>
<td>105</td>
<td>52</td>
</tr>
<tr>
<td>Industrial revenue bonds 1998-2030</td>
<td>491</td>
<td>484</td>
</tr>
<tr>
<td>Other foreign currencies due 1997-2030</td>
<td>1090</td>
<td>764</td>
</tr>
<tr>
<td>Other long-term debt</td>
<td>660</td>
<td>716</td>
</tr>
<tr>
<td>Capital leases</td>
<td>247</td>
<td>335</td>
</tr>
<tr>
<td>Commercial paper</td>
<td>1634</td>
<td>1097</td>
</tr>
<tr>
<td>Bank and other short</td>
<td>894</td>
<td>1168</td>
</tr>
</tbody>
</table>
Corporate Debt

**Prime Rate** - Benchmark interest rate charged by banks.

**Funded Debt** - Debt with more than 1 year remaining to maturity.

**Sinking Fund** - Fund established to retire debt before maturity.

**Callable Bond** - Bond that may be repurchased by firm before maturity at specified call price.
Corporate Debt

**Subordinate Debt** - Debt that may be repaid in bankruptcy only after senior debt is repaid.

**Secured Debt** - Debt that has first claim on specified collateral in the event of default.

**Investment Grade** - Bonds rated Baa or above by Moody’s or BBB or above by S&P.

**Junk Bond** - Bond with a rating below Baa or BBB.
Corporate Debt

**Eurodollars** - Dollars held on deposit in a bank outside the United States.

**Eurobond** - Bond that is marketed internationally.

**Private Placement** - Sale of securities to a limited number of investors without a public offering.

**Protective Covenants** - Restriction on a firm to protect bondholders.

**Lease** - Long-term rental agreement.
Warrant - Right to buy shares from a company at a stipulated price before a set date.

Convertible Bond - Bond that the holder may exchange for a specified amount of another security.

*Convertibles are a combined security, consisting of both a bond and a call option.*
Derivatives

**Traded Options** - A derivative that gives the firm the right (but not the obligation) to buy or sell an asset in the future at a price that is agreed upon today.

**Futures** - A contractual obligation entered into in advance to buy or sell an asset or commodity.

**Forwards** - A tailor made contract for the purchase of an asset. Not traded on exchanges like futures.

**Swaps** - An agreement between two parties to exchange the interest rate characteristics of two loans.
How Corporations Issue Securities

Chapter 15
Topics Covered

- Venture Capital
- The Initial Public Offering
- The Underwriters
- General Cash Offers
- Rights Issue
Venture Capital

Money invested to finance a new firm
Since success of a new firm is highly dependent on the effort of the managers, restrictions are placed on management by the venture capital company and funds are usually dispersed in stages, after a certain level of success is achieved.
# Venture Capital

## First Stage Market Value Balance Sheet ($mil)

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities and Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash from new equity</td>
<td>New equity from venture capital</td>
</tr>
<tr>
<td>Other assets</td>
<td>Your original equity</td>
</tr>
<tr>
<td>Value</td>
<td>Value</td>
</tr>
<tr>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>
## Venture Capital

### Second Stage Market Value Balance Sheet ($mil)

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities and Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash from new equity</td>
<td>New equity from 2nd stage</td>
</tr>
<tr>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Fixed assets</td>
<td>Equity from 1st stage</td>
</tr>
<tr>
<td>1.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Other assets</td>
<td>Your original equity</td>
</tr>
<tr>
<td>9.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Value</td>
<td>Value</td>
</tr>
<tr>
<td>14.0</td>
<td>14.0</td>
</tr>
</tbody>
</table>
Initial Public Offering (IPO) - First offering of stock to the general public.

Underwriter - Firm that buys an issue of securities from a company and resells it to the public.

Spread - Difference between public offer price and price paid by underwriter.

Prospectus - Formal summary that provides information on an issue of securities.

Underpricing - Issuing securities at an offering price set below the true value of the security.
# The Underwriters

## Top U.S. Underwriters in 1997

($bil of total issues)

<table>
<thead>
<tr>
<th>Underwriter</th>
<th>Total Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merrill Lynch</td>
<td>$208</td>
</tr>
<tr>
<td>Saloman Smith Barney</td>
<td>167</td>
</tr>
<tr>
<td>Morgan Stanley</td>
<td>140</td>
</tr>
<tr>
<td>Goldman Sachs</td>
<td>137</td>
</tr>
<tr>
<td>Lehman Brothers</td>
<td>121</td>
</tr>
<tr>
<td>JPMorgan</td>
<td>104</td>
</tr>
<tr>
<td>Credit Suisse First Boston</td>
<td>68</td>
</tr>
<tr>
<td>Bear Stearns</td>
<td>58</td>
</tr>
<tr>
<td>Donaldson Lufkin Jenrette</td>
<td>46</td>
</tr>
<tr>
<td>Chase</td>
<td>33</td>
</tr>
</tbody>
</table>

**All Underwriters** 1,293
## The Underwriters

### Top Intl. Underwriters in 1997

($bil of total issues)

<table>
<thead>
<tr>
<th>Underwriter</th>
<th>$bil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merrill Lynch</td>
<td>$37</td>
</tr>
<tr>
<td>Goldman Sachs</td>
<td>32</td>
</tr>
<tr>
<td>SBC Warburg</td>
<td>29</td>
</tr>
<tr>
<td>Deutsche Morgan</td>
<td>29</td>
</tr>
<tr>
<td>Credit Suisse First Boston</td>
<td>27</td>
</tr>
<tr>
<td>JPMorgan</td>
<td>24</td>
</tr>
<tr>
<td>Morgan Stanley</td>
<td>23</td>
</tr>
<tr>
<td>ABN AMRO Hoare</td>
<td>22</td>
</tr>
<tr>
<td>Lehman Brothers</td>
<td>18</td>
</tr>
<tr>
<td>Paribas</td>
<td>18</td>
</tr>
<tr>
<td><strong>All Underwriters</strong></td>
<td><strong>496</strong></td>
</tr>
</tbody>
</table>
# Initial Offering

## Average Expenses on 1767 IPOs from 1990-1994

<table>
<thead>
<tr>
<th>Value of Issues ($mil)</th>
<th>Direct Costs (%)</th>
<th>Avg First Day Return (%)</th>
<th>Total Costs (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - 9.99</td>
<td>16.96</td>
<td>16.36</td>
<td>25.16</td>
</tr>
<tr>
<td>10 - 19.99</td>
<td>11.63</td>
<td>9.65</td>
<td>18.15</td>
</tr>
<tr>
<td>20 - 39.99</td>
<td>9.7</td>
<td>12.48</td>
<td>18.18</td>
</tr>
<tr>
<td>40 - 59.99</td>
<td>8.72</td>
<td>13.65</td>
<td>17.95</td>
</tr>
<tr>
<td>60 - 79.99</td>
<td>8.2</td>
<td>11.31</td>
<td>16.35</td>
</tr>
<tr>
<td>80 - 99.99</td>
<td>7.91</td>
<td>8.91</td>
<td>14.14</td>
</tr>
<tr>
<td>100 - 199.99</td>
<td>7.06</td>
<td>7.16</td>
<td>12.78</td>
</tr>
<tr>
<td>200 - 499.99</td>
<td>6.53</td>
<td>5.70</td>
<td>11.10</td>
</tr>
<tr>
<td>500 and up</td>
<td>5.72</td>
<td>7.53</td>
<td>10.36</td>
</tr>
<tr>
<td>All Issues</td>
<td>11.00</td>
<td>12.05</td>
<td>18.69</td>
</tr>
</tbody>
</table>
Tombstone

12,937,500 Shares

The MONY Group Inc.

Common Stock
(par value $0.01 per share)

Price $23.50 Per Share

10,925,000 Shares

Goldman, Sachs & Co. Donaldson, Lufkin & Jenrette
Morgan Stanley Dean Witter Salomon Smith Barney

CIBC Oppenheimer Conning & Company A.G. Edwards & Sons, Inc.
Fox-Pitt, Kelton Inc. Schroder & Co. Inc. Allen & Company

2,012,500 Shares

Goldman Sachs International Donaldson, Lufkin & Jenrette
Morgan Stanley Dean Witter Salomon Smith Barney International
**General Cash Offers**

**Seasoned Offering** - Sale of securities by a firm that is already publicly traded.

**General Cash Offer** - Sale of securities open to all investors by an already public company.

**Shelf Registration** - A procedure that allows firms to file one registration statement for several issues of the same security.

**Private Placement** - Sale of securities to a limited number of investors without a public offering.
## Underwriting Spreads

**Gross underwriter spreads of selected issues, 1998**

<table>
<thead>
<tr>
<th>Type</th>
<th>Company</th>
<th>Issue amount, millions of dollars</th>
<th>Underwriter's spread, percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPO</td>
<td>Hypertension Diagnostics, Inc.</td>
<td>9.3</td>
<td>8.49</td>
</tr>
<tr>
<td>IPO</td>
<td>Actuate Software Corp.</td>
<td>33.0</td>
<td>7.00</td>
</tr>
<tr>
<td>IPO</td>
<td>Enterprise Product Partners</td>
<td>264.0</td>
<td>6.36</td>
</tr>
<tr>
<td>IPO</td>
<td>EquantNY</td>
<td>282.2</td>
<td>5.25</td>
</tr>
<tr>
<td>IPO</td>
<td>Conoco</td>
<td>4403.5</td>
<td>3.99</td>
</tr>
<tr>
<td>Seasoned</td>
<td>Coulter Pharmaceuticals</td>
<td>60.0</td>
<td>5.48</td>
</tr>
<tr>
<td>Seasoned</td>
<td>Stillwater Mining</td>
<td>61.5</td>
<td>5.00</td>
</tr>
<tr>
<td>Seasoned</td>
<td>Metronet Communciations Corp.</td>
<td>232.6</td>
<td>5.00</td>
</tr>
<tr>
<td>Seasoned</td>
<td>Staples, Inc.</td>
<td>446.6</td>
<td>3.25</td>
</tr>
<tr>
<td>Seasoned</td>
<td>Safeway, Inc.</td>
<td>1125.0</td>
<td>2.75</td>
</tr>
<tr>
<td>Seasoned</td>
<td>Media One Group</td>
<td>1511.3</td>
<td>2.74</td>
</tr>
<tr>
<td>Debt:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-year notes</td>
<td>General Motors Acceptance Corp.</td>
<td>100</td>
<td>0.18</td>
</tr>
<tr>
<td>30-year debentures</td>
<td>Bausch &amp; Lomb, Inc.</td>
<td>200</td>
<td>0.88</td>
</tr>
<tr>
<td>6-year notes</td>
<td>Arinonark Corp.</td>
<td>300</td>
<td>0.63</td>
</tr>
<tr>
<td>15-year subordinated notes</td>
<td>Banque Paribas</td>
<td>400</td>
<td>0.75</td>
</tr>
<tr>
<td>Convertible zero-coupon</td>
<td>Aspect Telecommunications</td>
<td>490</td>
<td>3.00</td>
</tr>
<tr>
<td>bonds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-year notes</td>
<td>Federal Home Loan Mortgage Corp</td>
<td>1500</td>
<td>0.15</td>
</tr>
</tbody>
</table>
Rights Issue - Issue of securities offered only to current stockholders.
**Rights Issue** - Issue of securities offered only to current stockholders.

**Example** - AEP Corp currently has 11 million shares outstanding. The market price is $24/sh. AEP decides to raise additional funds via a 1 for 11 rights offer at $22 per share. If we assume 100% subscription, what is the value of each right?
Example - AEP Corp currently has 11 million shares outstanding. The market price is $24/sh. AEP decides to raise additional funds via a 1 for 11 rights offer at $22 per share. If we assume 100% subscription, what is the value of each right?

⇒ Current Market Value = 2mil x $24 = $264 mil
⇒ Total Shares = 11 mil + 1 mil = 12 mil
⇒ Amount of new funds = 1 mil x $22 = $22 mil
⇒ New Share Price = (264 + 22) / 12 = $23.83/sh
⇒ Value of a Right = 24 - 23.83 = $0.17
The Dividend Controversy
Topics Covered

- How Dividends Are Paid
- How Do Companies Decide on Dividend Payments?
- Information in Dividends and Stock Repurchases
- Dividend Policy is Irrelevant
- The Rightists
- Taxes and the Radical Left
- The Middle of the Roaders
Types of Dividends

- Cash Div
- Regular Cash Div
- Special Cash Div
- Stock Div
- Stock Repurchase (3 methods)
  1. Buy shares on the market
  2. Tender Offer to Shareholders
  3. Private Negotiation (Green Mail)
**Cash Dividend** - Payment of cash by the firm to its shareholders.
Dividend Payments

**Cash Dividend** - Payment of cash by the firm to its shareholders.

**Ex-Dividend Date** - Date that determines whether a stockholder is entitled to a dividend payment; anyone holding stock before this date is entitled to a dividend.
Dividend Payments

**Cash Dividend** - Payment of cash by the firm to its shareholders.

**Ex-Dividend Date** - Date that determines whether a stockholder is entitled to a dividend payment; anyone holding stock before this date is entitled to a dividend.

**Record Date** - Person who owns stock on this date received the dividend.
**Stock Dividend** - Distribution of additional shares to a firm’s stockholders.
Dividend Payments

**Stock Dividend** - Distribution of additional shares to a firm’s stockholders.

**Stock Splits** - Issue of additional shares to firm’s stockholders.
Dividend Payments

**Stock Dividend** - Distribution of additional shares to a firm’s stockholders.

**Stock Splits** - Issue of additional shares to firm’s stockholders.

**Stock Repurchase** - Firm buys back stock from its shareholders.
Stock Repurchases

U.S. Stock Repurchases 1985-1997

$ Billions

Dividend Payments

Maytag’s Quarterly Dividend

- Declaration date: Aug 14
- With-dividend date: Aug 25
- Ex-dividend date: Aug 26
- Record date: Sept 1
- Payment date: Sept 15

Share price falls
The Dividend Decision

Lintner’s “Stylized Facts”

(How Dividends are Determined)

1. Firms have longer term target dividend payout ratios.
2. Managers focus more on dividend changes than on absolute levels.
3. Dividends changes follow shifts in long-run, sustainable levels of earnings rather than short-run changes in earnings.
4. Managers are reluctant to make dividend changes that might have to be reversed.
The Dividend Decision

- Attitudes concerning dividend targets vary

\[
\text{DIV}_1 = \text{target dividend} = \text{target ratio} \times \text{EPS}_1
\]

- Dividend Change

\[
\text{DIV}_1 - \text{DIV}_0 = \text{target change} = \text{target ratio} \times \text{EPS}_1 - \text{DIV}_0
\]
The Dividend Decision

- Dividend changes confirm the following:

\[ \text{DIV}_1 - \text{DIV}_0 = \text{adjustment rate} \times \text{target change} \]

\[ = \text{adjustment rate} \times \left( \text{target ratio} \times \text{EPS}_1 - \text{DIV}_0 \right) \]
Dividend Policy

Impact of Dividend Changes on EPS

Source: Healy & Palepu (1988)
Dividend Policy is Irrelevant

- Since investors do not need dividends to convert shares to cash they will not pay higher prices for firms with higher dividend payouts. In other words, dividend policy will have no impact on the value of the firm.
Dividend Policy is Irrelevant

**Example** - Assume Rational Demiconductor has no extra cash, but declares a $1,000 dividend. They also require $1,000 for current investment needs. Using M&M Theory, and given the following balance sheet information, show how the value of the firm is not altered when new shares are issued to pay for the dividend.

<table>
<thead>
<tr>
<th>Record Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
</tr>
<tr>
<td>Asset Value</td>
</tr>
<tr>
<td>Total Value</td>
</tr>
<tr>
<td>New Proj NPV</td>
</tr>
<tr>
<td># of Shares</td>
</tr>
<tr>
<td>price/share</td>
</tr>
</tbody>
</table>
Dividend Policy is Irrelevant

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<table>
<thead>
<tr>
<th>Record Date</th>
<th>Pmt Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>1,000</td>
</tr>
<tr>
<td>Asset Value</td>
<td>9,000</td>
</tr>
<tr>
<td>Total Value</td>
<td>10,000+</td>
</tr>
<tr>
<td>New Proj NPV</td>
<td>2,000</td>
</tr>
<tr>
<td># of Shares</td>
<td>1,000</td>
</tr>
<tr>
<td>price/share</td>
<td>$12</td>
</tr>
</tbody>
</table>
Dividend Policy is Irrelevant

Example - Assume Rational Demiconductor has no extra cash, but declares a $1,000 dividend. They also require $1,000 for current investment needs. Using M&M Theory, and given the following balance sheet information, show how the value of the firm is not altered when new shares are issued to pay for the dividend.

<table>
<thead>
<tr>
<th>Record Date</th>
<th>Pmt Date</th>
<th>Post Pmt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>1,000</td>
<td>0</td>
</tr>
<tr>
<td>Asset Value</td>
<td>9,000</td>
<td>9,000</td>
</tr>
<tr>
<td>Total Value</td>
<td>10,000+</td>
<td>9,000</td>
</tr>
<tr>
<td>New Proj NPV</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td># of Shares</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>price/share</td>
<td>$12</td>
<td>$11</td>
</tr>
</tbody>
</table>

NEW SHARES ARE ISSUED
Dividend Policy is Irrelevant

Example - continued - Shareholder Value

<table>
<thead>
<tr>
<th>Record</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>12,000</td>
</tr>
<tr>
<td>Cash</td>
<td>0</td>
</tr>
</tbody>
</table>

Total Value 12,000

Stock = 1,000 sh @ $12 = 12,000
Example - continued - Shareholder Value

<table>
<thead>
<tr>
<th></th>
<th>Record</th>
<th>Pmt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>12,000</td>
<td>11,000</td>
</tr>
<tr>
<td>Cash</td>
<td>0</td>
<td>1,000</td>
</tr>
</tbody>
</table>

Total Value 12,000 12,000

Stock = 1,000sh @ $11 = 11,000
### Dividend Policy is Irrelevant

**Example - continued - Shareholder Value**

<table>
<thead>
<tr>
<th></th>
<th>Record</th>
<th>Pmt</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>12,000</td>
<td>11,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Cash</td>
<td>0</td>
<td>1,000</td>
<td>0</td>
</tr>
</tbody>
</table>

**Total Value**

<table>
<thead>
<tr>
<th></th>
<th>Record</th>
<th>Pmt</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>12,000</td>
<td>12,000</td>
<td>12,000</td>
</tr>
</tbody>
</table>

**Stock = 1,091sh @ $115 = 12,000**

- Assume stockholders purchase the new issue with the cash dividend proceeds.
Market Imperfections and Clientele Effect

There are natural clients for high-payout stocks, but it does not follow that any particular firm can benefit by increasing its dividends. The high dividend clientele already have plenty of high dividend stock to choose from.

These clients increase the price of the stock through their demand for a dividend paying stock.
Dividends Increase Value

**Dividends as Signals**

Dividend increases send good news about cash flows and earnings. Dividend cuts send bad news.

Because a high dividend payout policy will be costly to firms that do not have the cash flow to support it, dividend increases signal a company’s good fortune and its manager’s confidence in future cash flows.
Dividends Decrease Value

**Tax Consequences**

Companies can convert dividends into capital gains by shifting their dividend policies. If dividends are taxed more heavily than capital gains, taxpaying investors should welcome such a move and value the firm more favorably.

In such a tax environment, the total cash flow retained by the firm and/or held by shareholders will be higher than if dividends are paid.
Taxes and Dividend Policy

- Since capital gains are taxed at a lower rate than dividend income, companies should pay the lowest dividend possible.
- Dividend policy should adjust to changes in the tax code.
## Taxes and Dividend Policy

<table>
<thead>
<tr>
<th></th>
<th>Firm A (no dividend)</th>
<th>Firm B (high dividend)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next year's price</td>
<td>112.50</td>
<td>102.50</td>
</tr>
<tr>
<td>Dividend</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Total pretax payoff</td>
<td>112.50</td>
<td>112.50</td>
</tr>
<tr>
<td>Today's stock price</td>
<td>100</td>
<td>96.67</td>
</tr>
<tr>
<td>Capital gain</td>
<td>12.50</td>
<td>5.83</td>
</tr>
<tr>
<td>Pretax rate of return (%)</td>
<td>( \frac{12.5}{100} \times 100 = 12.5 )</td>
<td>( \frac{15.83}{96.67} \times 100 = 16.4 )</td>
</tr>
<tr>
<td>Tax on div @ 50%</td>
<td>0</td>
<td>.50 \times 10 = 5.00</td>
</tr>
<tr>
<td>Tax on Cap Gain @ 20%</td>
<td>.20 \times 12.50 = 2.50</td>
<td>.20 \times 5.83 = 1.17</td>
</tr>
<tr>
<td>Total After Tax income</td>
<td>(0 + 12.50) - 2.50 = 10</td>
<td>(10 - 5.83) - (5 + 1.17) = 9.66</td>
</tr>
<tr>
<td>(div + cap gain - taxes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After tax rate of return (%)</td>
<td>( \frac{10}{100} \times 100 = 10.0 )</td>
<td>( \frac{9.66}{96.67} \times 100 = 10.0 )</td>
</tr>
</tbody>
</table>
### 1998 Marginal Income Tax Brackets

<table>
<thead>
<tr>
<th>Marginal Tax Rate</th>
<th>Single</th>
<th>Married (joint return)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15%</td>
<td>$0 - $25,350</td>
<td>$0 - $42,350</td>
</tr>
<tr>
<td>28</td>
<td>25,351 - 61,400</td>
<td>42,351 - 102,300</td>
</tr>
<tr>
<td>31</td>
<td>61,401 - 128,100</td>
<td>102,301 - 155,950</td>
</tr>
<tr>
<td>36</td>
<td>128,101 - 278,450</td>
<td>155,951 - 278,450</td>
</tr>
<tr>
<td>39.6</td>
<td>over 278,450</td>
<td>over 278,450</td>
</tr>
</tbody>
</table>
Taxes and Dividend Policy

In U.S., shareholders are taxed twice (figures in dollars)

<table>
<thead>
<tr>
<th></th>
<th>Rate of Income tax</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>Operating Income</td>
<td>100</td>
</tr>
<tr>
<td>Corporate tax (Tc=.35)</td>
<td>35</td>
</tr>
<tr>
<td>After Tax income (paid as div)</td>
<td>65</td>
</tr>
<tr>
<td>Income tax</td>
<td>0</td>
</tr>
<tr>
<td>Cash to Shareholder</td>
<td>65</td>
</tr>
</tbody>
</table>
### Taxes and Dividend Policy

Under imputed tax systems, such as that in Australia, shareholders receive a tax credit for the corporate tax the firm pays (figures in Australian dollars).

<table>
<thead>
<tr>
<th>Rate of Income tax</th>
<th>15%</th>
<th>33%</th>
<th>47%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Income</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Corporate tax (Tc=.33)</td>
<td>35</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>After Tax income</td>
<td>67</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>Grossed up Dividend</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Income tax</td>
<td>15</td>
<td>33</td>
<td>47</td>
</tr>
<tr>
<td>Tax credit for Corp Pmt</td>
<td>-33</td>
<td>-33</td>
<td>-33</td>
</tr>
<tr>
<td>Tax due from shareholder</td>
<td>-18</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Cash to Shareholder</td>
<td>85</td>
<td>67</td>
<td>53</td>
</tr>
</tbody>
</table>
Does Debt Policy Matter?
Topics Covered

- Leverage in a Tax Free Environment
- How Leverage Effects Returns
- The Traditional Position
M&M (Debt Policy Doesn’t Matter)

- Modigliani & Miller
  - When there are no taxes and capital markets function well, it makes no difference whether the firm borrows or individual shareholders borrow. Therefore, the market value of a company does not depend on its capital structure.
M&M (Debt Policy Doesn’t Matter)

Assumptions

- By issuing 1 security rather than 2, company diminishes investor choice. This does not reduce value if:
  - Investors do not need choice, OR
  - There are sufficient alternative securities
- Capital structure does not affect cash flows e.g....
  - No taxes
  - No bankruptcy costs
  - No effect on management incentives
## M&M (Debt Policy Doesn’t Matter)

### Example - Macbeth Spot Removers - All Equity Financed

#### Data

<table>
<thead>
<tr>
<th>Number of shares</th>
<th>1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price per share</td>
<td>$10</td>
</tr>
<tr>
<td>Market Value of Shares</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

#### Outcomes

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Income</td>
<td>$500</td>
<td>1,000</td>
<td>1,500</td>
<td>2,000</td>
</tr>
<tr>
<td>Earnings per share</td>
<td>$.50</td>
<td>1.00</td>
<td>1.50</td>
<td>2.00</td>
</tr>
<tr>
<td>Return on shares (%)</td>
<td>5 %</td>
<td>10</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>

Expected outcome

M&M (Debt Policy Doesn’t Matter)
### Example cont.

50% debt

#### Data

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td>Number of shares</td>
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<td>Market Value of Shares</td>
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</tr>
<tr>
<td>Market value of debt</td>
<td>$5,000</td>
</tr>
</tbody>
</table>

#### Outcomes

<table>
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<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Income</td>
<td>$500</td>
<td>1,000</td>
<td>1,500</td>
<td>2,000</td>
</tr>
<tr>
<td>Interest</td>
<td>$500</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Equity earnings</td>
<td>$0</td>
<td>500</td>
<td>1,000</td>
<td>1,500</td>
</tr>
<tr>
<td>Earnings per share</td>
<td>$0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Return on shares (%)</td>
<td>0%</td>
<td>15</td>
<td>25</td>
<td>30</td>
</tr>
</tbody>
</table>
**M&M (Debt Policy Doesn’t Matter)**

**Example** - Macbeth’s

- All Equity Financed
- Debt replicated by investors

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Earnings on two shares</strong></td>
<td>$1.00</td>
<td>2.00</td>
<td>3.00</td>
<td>4.00</td>
</tr>
<tr>
<td><strong>LESS : Interest @ 10%</strong></td>
<td>$1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Net earnings on investment</strong></td>
<td>$0</td>
<td>1.00</td>
<td>2.00</td>
<td>3.00</td>
</tr>
<tr>
<td><strong>Return on $10 investment (%)</strong></td>
<td>0%</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
</tr>
</tbody>
</table>
MM'S PROPOSITION I

If capital markets are doing their job, firms cannot increase value by tinkering with capital structure.

V is independent of the debt ratio.

AN EVERYDAY ANALOGY

It should cost no more to assemble a chicken than to buy one whole.
### Macbeth continued

<table>
<thead>
<tr>
<th></th>
<th>Current Structure:</th>
<th>Proposed Structure:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Equity</td>
<td>Equal Debt and Equity</td>
</tr>
<tr>
<td>Expected earnings per share ($)</td>
<td>1.50</td>
<td>2.00</td>
</tr>
<tr>
<td>Price per share ($)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Expected return per share (%)</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>
Leverage and Returns

Expected return on assets = $r_a = \frac{\text{expected operating income}}{\text{market value of all securities}}$

$r_A = \left( \frac{D}{D + A} \times r_D \right) + \left( \frac{E}{D + E} \times r_E \right)$
M&M Proposition II

\[ r_E = r_A + \frac{D}{V} (r_A - r_D) \]

\[ r_E = r_A = \frac{\text{expected operating income}}{\text{market value of all securities}} \]

\[ = \frac{1500}{10,000} = .15 \]
M&M Proposition II

\[ r_E = r_A + \frac{D}{V} (r_A - r_D) \]

\[ r_E = r_A = \frac{\text{expected operating income}}{\text{market value of all securities}} \]

\[ = \frac{1500}{10,000} = .15 \]

\[ r_E = .15 + \frac{5000}{5000} (.15 - .10) \]

\[ = .20 \text{ or } 20\% \]
M&M Proposition II

Risk free debt $\rightarrow$ Risky debt

$r_D$ $r_A$ $r_E$
Leverage and Risk

Macbeth continued

Leverage increases the risk of Macbeth shares

<table>
<thead>
<tr>
<th></th>
<th>Operating</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>All equity</td>
<td>$500</td>
<td>$1,500</td>
</tr>
<tr>
<td>Earnings per share ($)</td>
<td>.50</td>
<td>1.50</td>
</tr>
<tr>
<td>Return on shares</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>50% debt:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earnings per share ($)</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Return on shares</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>
Leverage and Returns

\[ B_A = \left( \frac{D}{D + A} \times B_D \right) + \left( \frac{E}{D + E} \times B_E \right) \]

\[ B_E = B_A + \frac{D}{V} (B_A - B_D) \]
WACC

WACC is the traditional view of capital structure, risk and return.

\[ WACC = r_A = \left( \frac{D}{V} \times r_D \right) + \left( \frac{E}{V} \times r_E \right) \]
Example - A firm has $2 mil of debt and 100,000 of outstanding shares at $30 each. If they can borrow at 8% and the stockholders require 15% return what is the firm’s WACC?

\[ D = \$2 \text{ million} \]
\[ E = 100,000 \text{ shares} \times \$30 \text{ per share} = \$3 \text{ million} \]
\[ V = D + E = 2 + 3 = \$5 \text{ million} \]
**Example** - A firm has $2$ mil of debt and $100,000$ of outstanding shares at $30$ each. If they can borrow at $8\%$ and the stockholders require $15\%$ return what is the firm’s WACC?

- **D** = $2$ million
- **E** = $100,000$ shares $\times$ $30$ per share = $3$ million
- **V** = **D** + **E** = $2 + 3 = 5$ million

\[
WACC = \left( \frac{D}{V} \times r_D \right) + \left( \frac{E}{V} \times r_E \right)
\]

\[
= \left( \frac{2}{5} \times .08 \right) + \left( \frac{3}{5} \times .15 \right)
\]

\[
= .122 \text{ or } 12.2\%
\]
WACC

\[ r_E = \text{WACC} \]
WACC (traditional view)
WACC (M&M view)
How Much Should a Firm Borrow?
Topics Covered

- Corporate Taxes and Value
- Corporate and Personal Taxes
- Cost of Financial Distress
- Pecking Order of Financial Choices
**Financial Risk** - Risk to shareholders resulting from the use of debt.

**Financial Leverage** - Increase in the variability of shareholder returns that comes from the use of debt.

**Interest Tax Shield** - Tax savings resulting from deductibility of interest payments.
Example - You own all the equity of Space Babies Diaper Co.. The company has no debt. The company’s annual cash flow is $1,000, before interest and taxes. The corporate tax rate is 40%. You have the option to exchange 1/2 of your equity position for 10% bonds with a face value of $1,000.

Should you do this and why?
**Example** - You own all the equity of Space Babies Diaper Co.. The company has no debt. The company’s annual cash flow is $1,000, before interest and taxes. The corporate tax rate is 40%. You have the option to exchange 1/2 of your equity position for 10% bonds with a face value of $1,000. Should you do this and why?

<table>
<thead>
<tr>
<th></th>
<th>All Equity</th>
<th>1/2 Debt</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EBIT</strong></td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td><strong>Interest Pmt</strong></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Pretax Income</strong></td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td><strong>Taxes @ 40%</strong></td>
<td>400</td>
<td></td>
</tr>
<tr>
<td><strong>Net Cash Flow</strong></td>
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</tr>
<tr>
<td>Pretax Income</td>
<td>1,000</td>
<td>900</td>
</tr>
<tr>
<td>Taxes @ 40%</td>
<td>400</td>
<td>360</td>
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<tr>
<td>Net Cash Flow</td>
<td>$600</td>
<td>$540</td>
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<td>360</td>
</tr>
<tr>
<td>Net Cash Flow</td>
<td>$600</td>
<td>$540</td>
</tr>
</tbody>
</table>

**Total Cash Flow**

- **All Equity = 600**
- **1/2 Debt = 640**
  
  (540 + 100)
Capital Structure

PV of Tax Shield = \( \frac{D \times r_D \times T_c}{r_D} = D \times T_c \)

(assume perpetuity)
Capital Structure

PV of Tax Shield = \( \frac{D \times r_D \times Tc}{r_D} \) (assume perpetuity) = \( D \times Tc \)

Example:

Tax benefit = \( 1000 \times 0.10 \times 0.40 \) = $40
Capital Structure

PV of Tax Shield = \( \frac{D \times r_D \times T_c}{r_D} = D \times T_c \)

(assume perpetuity)

Example:

Tax benefit = 1000 \times (.10) \times (.40) = $40

PV of 40 perpetuity = 40 / .10 = $400
Capital Structure

PV of Tax Shield = \( \frac{D \times r_D \times Tc}{r_D} \) = D \times Tc

(assume perpetuity)

Example:

Tax benefit = 1000 \times (.10) \times (.40) = $40

PV of 40 perpetuity = 40 / .10 = $400

PV Tax Shield = D \times Tc = 1000 \times .4 = $400
Capital Structure

Firm Value =

Value of All Equity Firm + PV Tax Shield
Capital Structure

Firm Value = Value of All Equity Firm + PV Tax Shield

Example
All Equity Value = 600 / .10 = 6,000
Capital Structure

Firm Value =

Value of All Equity Firm + PV Tax Shield

Example

All Equity Value = 600 / 0.10 = 6,000

PV Tax Shield = 400
Capital Structure

Firm Value =
Value of All Equity Firm + PV Tax Shield

Example

All Equity Value = 600 / .10 = 6,000
PV Tax Shield = 400

Firm Value with 1/2 Debt = $6,400
Relative Advantage Formula

( Debt vs Equity )

\[
\frac{1 - T_P}{(1 - T_{PE}) (1 - T_C)}
\]
Relative Advantage Formula

(Debt vs Equity)

\[
\frac{1-T_P}{(1-T_{PE}) (1-T_C)}
\]

Advantage

RAF > 1  Debt
RAF < 1  Equity
### Example 1

<table>
<thead>
<tr>
<th></th>
<th>All Debt</th>
<th>All Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income $BT_{CP}$</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>less TC=.46</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Income $BT_{P}$</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Taxes $T_{P} = .5$ $T_{PE}=0$</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>After Tax Income</td>
<td>0.50</td>
<td></td>
</tr>
</tbody>
</table>
### Example 1

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<td>0.54</td>
</tr>
<tr>
<td>Taxes $TP=0.5$ $TPE=0$</td>
<td>0.50</td>
<td>0.00</td>
</tr>
<tr>
<td>After Tax Income</td>
<td>0.50</td>
<td>0.54</td>
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<tr>
<td>Taxes $TP = .5$</td>
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<td>0.00</td>
</tr>
<tr>
<td>After Tax Income</td>
<td>0.50</td>
<td>0.54</td>
</tr>
</tbody>
</table>

RAF = .926 Advantage Equity
### Example 2

<table>
<thead>
<tr>
<th></th>
<th>All Debt</th>
<th>All Equity</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1.00</td>
<td></td>
</tr>
<tr>
<td>less $TC = .34$</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Income $BT_P$</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Taxes $T_P = .28$</td>
<td></td>
<td>0.28</td>
</tr>
<tr>
<td>$T_{PE} = .21$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After Tax Income</td>
<td>0.72</td>
<td></td>
</tr>
</tbody>
</table>
## Example 2

<table>
<thead>
<tr>
<th></th>
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</tr>
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<td>0.34</td>
</tr>
<tr>
<td>Income $BT_P$</td>
<td>1.00</td>
<td>0.66</td>
</tr>
<tr>
<td>Taxes $T_P=.28$</td>
<td>0.28</td>
<td>0.139</td>
</tr>
<tr>
<td>After Tax Income</td>
<td>0.72</td>
<td>0.521</td>
</tr>
</tbody>
</table>

C.S. & Taxes (Personal & Corp)
## Example 2

<table>
<thead>
<tr>
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<th>All Equity</th>
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<tbody>
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<td></td>
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<td>After Tax Income</td>
<td>0.72</td>
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</tr>
</tbody>
</table>

RAF = 1.381  
Advantage Debt
Today’s RAF & Debt vs Equity preference.

\[
\text{RAF} = \frac{1-.28}{(1-.28)(1-.34)} = 1.52
\]

Old Tax Code
Today’s RAF & Debt vs Equity preference.

\[
\text{RAF} = \frac{1-.28}{(1-.20)(1-.34)} = 1.36
\]

New Tax Code
Today’s RAF & Debt vs Equity preference.

\[
\text{RAF} = \frac{1-0.28}{(1-0.20)(1-0.34)} = 1.36
\]

Why are companies not all debt?
Structure of Bond Yield Rates
Weighted Average Cost of Capital
without taxes (traditional view)

Includes Bankruptcy Risk
Financial Distress

Costs of Financial Distress - Costs arising from bankruptcy or distorted business decisions before bankruptcy.
Financial Distress

Costs of Financial Distress - Costs arising from bankruptcy or distorted business decisions before bankruptcy.

\[
\text{Market Value} = \text{Value if all Equity Financed} + \text{PV Tax Shield} - \text{PV Costs of Financial Distress}
\]
Financial Distress

- Maximum value of firm
- Costs of financial distress
- Value of levered firm
- PV of interest tax shields
- Value of unlevered firm
- Optimal amount of debt

Market Value of The Firm vs. Debt
Conflicts of Interest

Circular File Company has $50 of 1-year debt.

<table>
<thead>
<tr>
<th>Circular File Company (Book Values)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net W.C.</td>
</tr>
<tr>
<td>Fixed assets</td>
</tr>
<tr>
<td>Total assets</td>
</tr>
</tbody>
</table>
Conflicts of Interest

Circular File Company has $50 of 1-year debt.

- Why does the equity have any value?
- Shareholders have an option -- they can obtain the rights to the assets by paying off the $50 debt.
Circular File Company has may invest $10 as follows.

<table>
<thead>
<tr>
<th>Now</th>
<th>Possible Payoffs Next Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invest $10</td>
<td>$120 (10% probability)</td>
</tr>
<tr>
<td></td>
<td>$0 (90% probability)</td>
</tr>
</tbody>
</table>

➢ Assume the NPV of the project is (-$2).
What is the effect on the market values?
Conflicts of Interest

Circular File Company value (post project)

- Firm value falls by $2, but equity holder gains $3
Conflicts of Interest

Circular File Company value (assumes a safe project with NPV = $5)

- While firm value rises, the lack of a high potential payoff for shareholders causes a decrease in equity value.
Financial Distress Games

- Cash In and Run
- Playing for Time
- Bait and Switch
Financial Choices

**Trade-off Theory** - Theory that capital structure is based on a trade-off between tax savings and distress costs of debt.

**Pecking Order Theory** - Theory stating that firms prefer to issue debt rather than equity if internal finance is insufficient.
1. Stock-for-debt exchange offers
   Debt-for-stock exchange offers

2. Issuing common stock drives down stock prices; repurchase increases stock prices.

3. Issuing straight debt has a small negative impact.
Why do security issues affect stock price? The demand for a firm’s securities ought to be flat.

- Any firm is a drop in the bucket.
- Plenty of close substitutes.
- Large debt issues don’t significantly depress the stock price.
Consider the following story:

The announcement of a stock issue drives down the stock price because investors believe managers are more likely to issue when shares are overpriced.

Therefore firms prefer internal finance since funds can be raised without sending adverse signals.

If external finance is required, firms issue debt first and equity as a last resort.

The most profitable firms borrow less not because they have lower target debt ratios but because they don't need external finance.
Pecking Order Theory

Some Implications:

- Internal equity may be better than external equity.
- Financial slack is valuable.
- If external capital is required, debt is better. (There is less room for difference in opinions about what debt is worth).
Interactions of Investment and Financing Decisions
Topics Covered

- After Tax WACC
- Tricks of the Trade
- Capital Structure and WACC
- Adjusted Present Value
After Tax WACC

- The tax benefit from interest expense deductibility must be included in the cost of funds.
- This tax benefit reduces the effective cost of debt by a factor of the marginal tax rate.

\[
WACC = \left( \frac{D}{V} \times r_D \right) + \left( \frac{E}{V} \times r_E \right)
\]

Old Formula
After Tax WACC

*Tax Adjusted Formula*

\[
WACC = (1 - Tc) \left( \frac{D}{V} \times r_D \right) + \left( \frac{E}{V} \times r_E \right)
\]
Example - Sangria Corporation

The firm has a marginal tax rate of 35%. The cost of equity is 14.6% and the pretax cost of debt is 8%. Given the book and market value balance sheets, what is the tax adjusted WACC?
### Balance Sheet (Book Value, millions)

<table>
<thead>
<tr>
<th></th>
<th>Assets 100</th>
<th>Debt 50</th>
<th>Total liabilities 100</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
<td>100</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td><strong>Total assets</strong></td>
<td>100</td>
<td>50 Equity</td>
<td></td>
</tr>
</tbody>
</table>
After Tax WACC

Example - Sangria Corporation - continued

<table>
<thead>
<tr>
<th>Balance Sheet (Market Value, millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total assets</td>
</tr>
</tbody>
</table>
After Tax WACC

Example - Sangria Corporation - continued

Debt ratio = (D/V) = 50/125 = .4 or 40%

Equity ratio = (E/V) = 75/125 = .6 or 60%

\[ WACC = (1 - Tc) \left( \frac{D}{V} \times r_D \right) + \left( \frac{E}{V} \times r_E \right) \]
After Tax WACC

Example - Sangria Corporation - continued

\[
WACC = (1 - Tc) \left( \frac{D}{V} \times r_D \right) + \left( \frac{E}{V} \times r_E \right)
\]

\[
WACC = (1 - .35) \left( \frac{50}{125} \times .08 \right) + \left( \frac{75}{125} \times .146 \right)
\]

= .1084

= 10.84%
The company would like to invest in a perpetual crushing machine with cash flows of $2.085 million per year pre-tax.

Given an initial investment of $12.5 million, what is the value of the machine?
Example - Sangria Corporation - continued

The company would like to invest in a perpetual crushing machine with cash flows of $2.085 million per year pre-tax. Given an initial investment of $12.5 million, what is the value of the machine?

<table>
<thead>
<tr>
<th>Cash Flows</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretax cash flow</td>
<td>2.085</td>
</tr>
<tr>
<td>Tax @ 35%</td>
<td>0.73</td>
</tr>
<tr>
<td>After-tax cash flow</td>
<td>$1.355 million</td>
</tr>
</tbody>
</table>
After Tax WACC

Example - Sangria Corporation - continued

The company would like to invest in a perpetual crushing machine with cash flows of $2.085 million per year pre-tax. Given an initial investment of $12.5 million, what is the value of the machine?

\[
NPV = C_0 + \frac{C_1}{r - g}
\]

\[
= -12.5 + \frac{1.355}{0.1084}
\]

\[
= 0
\]
After Tax WACC

- Preferred stock and other forms of financing must be included in the formula.

\[
WACC = (1 - Tc) \left( \frac{D}{V} \times r_D \right) + \left( \frac{P}{V} \times r_P \right) + \left( \frac{E}{V} \times r_E \right)
\]
Example - Sangria Corporation - continued

Calculate WACC given preferred stock is $25 mil of total equity and yields 10%.

<table>
<thead>
<tr>
<th>Balance Sheet (Market Value, millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total assets</td>
</tr>
</tbody>
</table>

\[
WACC = (1 - .35) \left( \frac{50}{125} \times .08 \right) + \left( \frac{25}{125} \times .10 \right) + \left( \frac{50}{125} \times .146 \right)
\]

\[
= .1104
\]

\[
= 11.04\%
\]
What should be included with debt?

- Long-term debt?
- Short-term debt?
- Cash (netted off?)
- Receivables?
- Deferred tax?
Tricks of the Trade

How are costs of financing determined?

- Return on equity can be derived from market data.
- Cost of debt is set by the market given the specific rating of a firm’s debt.
- Preferred stock often has a preset dividend rate.
Historical WACC
If you discount at WACC, cash flows have to be projected just as you would for a capital investment project. Do not deduct interest. Calculate taxes as if the company were 41-equity financed. The value of interest tax shields is picked up in the WACC formula.
WACC vs. Flow to Equity

The company's cash flows will probably not be forecasted to infinity. Financial managers usually forecast to a medium-term horizon -- ten years, say -- and add a terminal value to the cash flows in the horizon year. The terminal value is the present value at the horizon of post-horizon flows. Estimating the terminal value requires careful attention, because it often accounts for the majority of the value of the company.
WACC vs. Flow to Equity

- Discounting at WACC values the assets and operations of the company. If the object is to value the company's equity, that is, its common stock, don't forget to subtract the value of the company's outstanding debt.
Adjusted Present Value

APV = Base Case NPV + PV Impact

- Base Case = All equity finance firm NPV.
- PV Impact = all costs/benefits directly resulting from project.
example:

Project A has an NPV of $150,000. In order to finance the project we must issue stock, with a brokerage cost of $200,000.
example:

Project A has an NPV of $150,000. In order to finance the project we must issue stock, with a brokerage cost of $200,000.

\[
\text{Project NPV} = 150,000 \\
\text{Stock issue cost} = -200,000 \\
\text{Adjusted NPV} = -50,000
\]

don’t do the project
example:

Project B has a NPV of -$20,000. We can issue debt at 8% to finance the project. The new debt has a PV Tax Shield of $60,000. Assume that Project B is your only option.
example:

Project B has a NPV of -$20,000. We can issue debt at 8% to finance the project. The new debt has a PV Tax Shield of $60,000. Assume that Project B is your only option.

Project NPV = - 20,000
Stock issue cost = 60,000
Adjusted NPV = 40,000

do the project
Miles and Ezzell

\[ WACC = r - L r_D T_c \left( \frac{1 + r}{1 + r_D} \right) \]
Spotting and Valuing Options

Chapter 20
Topics Covered

- Calls, Puts and Shares
- Financial Alchemy with Options
- What Determines Option Value
- Option Valuation
Call Option

Right to buy an asset at a specified exercise price on or before the exercise date.
Option Terminology

**Call Option**
Right to buy an asset at a specified exercise price on or before the exercise date.

**Put Option**
Right to sell an asset at a specified exercise price on or before the exercise date.
## Option Obligations

<table>
<thead>
<tr>
<th>Buyer</th>
<th>Seller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call option</td>
<td>Right to buy asset</td>
</tr>
<tr>
<td></td>
<td>Obligation to sell asset</td>
</tr>
<tr>
<td>Put option</td>
<td>Right to sell asset</td>
</tr>
<tr>
<td></td>
<td>Obligation to buy asset</td>
</tr>
</tbody>
</table>
The value of an option at expiration is a function of the stock price and the exercise price.
The value of an option at expiration is a function of the stock price and the exercise price.

**Example** - Option values given a exercise price of $85

<table>
<thead>
<tr>
<th>Stock Price</th>
<th>$60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call Value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Put Value</td>
<td>25</td>
<td>15</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Option Value

Call option value (graphic) given a $85 exercise price.
Put option value (graphic) given a $85 exercise price.
Option Value

Call option payoff (to seller) given a $85 exercise price.
Put option payoff (to seller) given a $85 exercise price.
Option Value

Protective Put - Long stock and long put

Position Value vs. Share Price

Long Stock
Option Value

**Protective Put** - Long stock and long put

![Graph showing the relationship between share price and position value for a protective put option.](image)
Option Value

Protective Put - Long stock and long put

Position Value vs. Share Price

Long Stock

Protective Put

Long Put
Option Value

Protective Put - Long stock and long put

Position Value

Share Price
Straddle - Long call and long put
- Strategy for profiting from high volatility
Option Value

**Straddle** - Long call and long put
- Strategy for profiting from high volatility

![Diagram showing a straddle strategy](image)
Option Value

**Straddle** - Long call and long put
- Strategy for profiting from high volatility
**Option Value**

**Straddle** - Long call and long put
- Strategy for profiting from high volatility
Option Value

Stock Price

Upper Limit
Option Value

Stock Price

Upper Limit

Lower Limit

(Stock price - exercise price) or 0 whichever is higher
Option Value

**Components of the Option Price**
1 - Underlying stock price
2 - Striking or Exercise price
3 - Volatility of the stock returns (standard deviation of annual returns)
4 - Time to option expiration
5 - Time value of money (discount rate)
Black-Scholes Option Pricing Model

\[ O_C = P_s[N(d_1)] - S[N(d_2)]e^{-rt} \]
Black-Scholes Option Pricing Model

\[ O_C = P_s[N(d_1)] - S[N(d_2)] e^{-rt} \]

**OC** - Call Option Price

**\( P_s \)** - Stock Price

**\( N(d_1) \)** - Cumulative normal density function of \((d_1)\)

**\( S \)** - Strike or Exercise price

**\( N(d_2) \)** - Cumulative normal density function of \((d_2)\)

**\( r \)** - discount rate (90 day comm paper rate or risk free rate)

**\( t \)** - time to maturity of option (as % of year)

**\( \nu \)** - volatility - annualized standard deviation of daily returns
Black-Scholes Option Pricing Model

(d₁) = \frac{P_s}{S} \ln \left( \frac{S}{P_s} \right) + \left( r + \frac{\sigma^2}{2} \right) t \frac{1}{\sigma \sqrt{t}}

N(d₁) =
Cumulative Normal Density Function

\[(d_1) = \frac{P_s}{S} \ln \left( r + \frac{v^2}{2} \right) t + \frac{v}{\sqrt{t}} \]

\[(d_2) = d_1 - v \sqrt{t} \]
Call Option

Example
What is the price of a call option given the following?
P = 36  r = 10\%  v = .40
S = 40  t = 90 \text{ days} / 365
Call Option

Example
What is the price of a call option given the following?
P = 36  \quad r = 10\%  \quad v = .40
S = 40  \quad t = 90 \text{ days} / 365

\[
(d_1) = \frac{\ln \left( \frac{P_s}{S} \right) + \left( r + \frac{v^2}{2} \right) t}{v \sqrt{t}}
\]

\[
(d_1) = - .3070 \quad N(d_1) = 1 - .6206 = .3794
\]
Call Option

Example
What is the price of a call option given the following?

\( P = 36 \quad r = 10\% \quad v = .40 \)
\( S = 40 \quad t = 90 \text{ days} / 365 \)

\[
(d_2) = d_1 - v \sqrt{t}
\]

\( (d_2) = - .5056 \)

\[
N(d_2) = 1 - .6935 = .3065
\]
Example
What is the price of a call option given the following?

\[ P = 36 \quad r = 10\% \quad v = .40 \]
\[ S = 40 \quad t = 90 \text{ days} / 365 \]

\[
O_C = P_s[N(d_1)] - S[N(d_2)]e^{-rt}
\]

\[
O_C = 36[.3794] - 40[.3065]e^{-(.10)(.2466)}
\]

\[
O_C = $1.70
\]
Put - Call Parity

Put Price = Oc + S - P - Carrying Cost + Div.

Carrying cost = r x S x t
Example

ABC is selling at $41 a share. A six month May 40 Call is selling for $4.00. If a May $ .50 dividend is expected and r=10%, what is the put price?

Put - Call Parity
Put - Call Parity

Example

ABC is selling at $41 a share. A six month May 40 Call is selling for $4.00. If a May $ .50 dividend is expected and r=10%, what is the put price?

\[ Op = Oc + S - P - \text{Carrying Cost} + \text{Div.} \]

\[ Op = 4 + 40 - 41 - (0.10 \times 40 \times 0.50) + 0.50 \]

\[ Op = 3 - 2 + 0.5 \]

\[ Op = $1.50 \]
Topics Covered

- Real Options
  - Follow Up Investments
  - Abandon
  - Wait
  - Vary Output or Production
- Binomial Model
Corporate Options

4 types of “Real Options”
1 - The opportunity to make follow-up investments.
2 - The opportunity to abandon a project
3 - The opportunity to “wait” and invest later.
4 - The opportunity to vary the firm’s output or production methods.

Value “Real Option” = NPV with option
- NPV w/o option
Option to Wait

Intrinsic Value

Option Price

Stock Price
Option to Wait

Intrinsic Value + Time Premium = Option Value

Time Premium = Value of being able to wait
Option to Wait

More time = More value
Example - Abandon

Mrs. Mulla gives you a non-retractable offer to buy your company for $150 mil at anytime within the next year. Given the following decision tree of possible outcomes, what is the value of the offer (i.e. the put option) and what is the most Mrs. Mulla could charge for the option?

Use a discount rate of 10%
**Example - Abandon**

Mrs. Mulla gives you a non-retractable offer to buy your company for $150 mil at anytime within the next year. Given the following decision tree of possible outcomes, what is the value of the offer (i.e. the put option) and what is the most Mrs. Mulla could charge for the option?

<table>
<thead>
<tr>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV = 145</td>
<td>120 (.6)</td>
<td>70 (.6)</td>
</tr>
<tr>
<td>100 (.6)</td>
<td>90 (.4)</td>
<td>50 (.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 (.4)</td>
</tr>
</tbody>
</table>
### Example - Abandon

Mrs. Mulla gives you a non-retractable offer to buy your company for $150 mil at anytime within the next year. Given the following decision tree of possible outcomes, what is the value of the offer (i.e. the put option) and what is the most Mrs. Mulla could charge for the option?

<table>
<thead>
<tr>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV = 162</td>
<td>100 (.6)</td>
<td>120 (.6)</td>
</tr>
<tr>
<td></td>
<td>150 (.4)</td>
<td>90 (.4)</td>
</tr>
</tbody>
</table>

Option Value = 162 - 145 = $17 mil
Corporate Options

Reality

- Decision trees for valuing “real options” in a corporate setting cannot be practically done by hand.
- We must introduce binomial theory & B-S models.
Binomial Pricing

Probability Up = \( p = \frac{(a - d)}{(u - d)} \)

Prob Down = 1 - p

\( a = e^{r \Delta t} \)
\( d = e^{-\sigma [\Delta t]^{.5}} \)
\( u = e^{\sigma [\Delta t]^{.5}} \)

\( \Delta t = \) time intervals as % of year
Binomial Pricing

Example

Price = 36  \( \sigma = .40 \)  \( t = 90/365 \)  \( \Delta t = 30/365 \)
Strike = 40  \( r = 10\% \)

\( a = 1.0083 \)
\( u = 1.1215 \)
\( d = .8917 \)
\( Pu = .5075 \)
\( Pd = .4925 \)
Binomial Pricing

\[ P_0 \times U = P_{U_1} \]

\[ 36 \times 1.1215 = 40.37 \]
Binomial Pricing

\[ P_0 \times U = P_{U_1} \]
\[ 36 \times 1.1215 = 40.37 \]

\[ P_0 \times D = P_{D_1} \]
\[ 36 \times .8917 = 32.10 \]
Binomial Pricing

\[ P_t \times U = P_{t+1} \]
Binomial Pricing

50.78 = price
10.78 = intrinsic value

45.28

40.37

36

36

32.10

28.62

32.10

25.52

0

0

40.37

.37
The greater of:

\[ [(O_u \times P_u) + (U_d \times P_d)] \times (e^{-r\Delta t}) \]
Binomial Pricing

\[
\left[ \left( O_u \times P_u \right) + \left( U_d \times P_d \right) \right] \times \left( e^{-r\Delta t} \right)
\]

\[
\begin{align*}
45.28 & \quad 50.78 = \text{price} \\
5.60 & \quad 10.78 = \text{intrinsic value} \\
40.37 & \\
2.91 & \\
36.00 & \\
32.10 & .10 \\
28.62 & 0 \\
36.00 & 1.51 \\
40.37 & .37 \\
5.60 & \\
45.28 & 
\end{align*}
\]
Binomial Pricing

\[
\left( O_u \times P_u \right) + \left( U_d \times P_d \right) \times \left( e^{-r\Delta t} \right)
\]

50.78 = price
10.78 = intrinsic value

\[
\begin{array}{c}
\begin{array}{c}
45.28 \\
5.60 \\
40.37 \\
2.91 \\
36 \\
36 \\
32.10 \\
.10 \\
28.62 \\
0 \\
25.52 \\
0
\end{array}
\end{array}
\]

[Image of binomial tree with values and calculations]
Expanding the binomial model to allow more possible price changes

1 step
(2 outcomes)

2 steps
(3 outcomes)

4 steps
(5 outcomes)

etc. etc.
# Binomial vs. Black Scholes

How estimated call price changes as number of binomial steps increases

<table>
<thead>
<tr>
<th>No. of steps</th>
<th>Estimated value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>48.1</td>
</tr>
<tr>
<td>2</td>
<td>41.0</td>
</tr>
<tr>
<td>3</td>
<td>42.1</td>
</tr>
<tr>
<td>5</td>
<td>41.8</td>
</tr>
<tr>
<td>10</td>
<td>41.4</td>
</tr>
<tr>
<td>50</td>
<td>40.3</td>
</tr>
<tr>
<td>100</td>
<td>40.6</td>
</tr>
<tr>
<td>Black-Scholes</td>
<td>40.5</td>
</tr>
</tbody>
</table>
Warrants and Convertibles
Topics Covered

- What is a Warrant?
- What is a Convertible Bond?
- The Difference Between Warrants and Convertibles
- Why do Companies Issue Warrants and Convertibles?
**Example:**

BJ Services warrants, January 1999

- Exercise price: $15
- Warrant price: $9
- Share price: $16

Warrant price at maturity

![Graph showing the relationship between BJ Services share price and warrant price at maturity.](image-url)
Warrant Value vs. Stock Price

Value of warrant

Actual warrant value prior to expiration

Theoretical value (warrant lower limit)

Exercise price = $15

Stock price

Exercise price = $15
United Glue Warrants

- United glue has just issued $2 million package of debt and warrants. Using the following data, calculate the warrant value.

  - # shares outstanding = 1 mil
  - Current stock price = $12
  - Number of shares issued per share outstanding = 0.10
  - Total number of warrants issued = 100,000
  - Exercise price of warrants = $10
  - Time to expiration of warrants = 4 years
  - Annualized standard deviation of stock daily returns = 0.40
  - Rate of return = 10 percent
United Glue Warrants

- United glue has just issued $2 million package of debt and warrants. Using the following data, calculate the warrant value.

Cost of warrants = total financing - value of loans w/o warrants

\[ 500,000 = 2,000,000 - 1,500,000 \]

\[ \$5 = \frac{500,000}{100,000} \text{ Cost of each warrant} \]
United Glue Warrants

- United glue has just issued $2 million package of debt and warrants. Using the following data, calculate the warrant value.

\[
\begin{align*}
(d_1) &= 1.104 \\
N(d_1) &= .865 \\
(d_2) &= .304 \\
N(d_2) &= .620
\end{align*}
\]
United Glue Warrants

- United glue has just issued $2 million package of debt and warrants. Using the following data, calculate the warrant value.

\[
Warrant = 12 \times 0.865 - 0.620 \times \frac{10}{1.1^4}
\]

\[= 6.15\]
United Glue Warrants

- United glue has just issued $2 million package of debt and warrants. Using the following data, calculate the warrant value.

- Value of warrant with dilution

\[
V = \text{Value of United's total assets} - \text{value of loans}
\]

\[
V = 18 - 5.5 = $12.5 \text{million}
\]
United Glue Warrants

- United glue has just issued $2 million package of debt and warrants. Using the following data, calculate the warrant value.

- Value of warrant with dilution

\[
\text{Current share price of alternative firm} = \frac{V}{N} = \frac{12.5 \text{ million}}{1 \text{ million}} = $12.50
\]

Black Scholes formula gives value = $6.64
United Glue Warrants

- United glue has just issued $2 million package of debt and warrants. Using the following data, calculate the warrant value.

- Value of warrant with dilution

\[
\frac{1}{1 + q} \times \text{value of call on alternative firm}
\]

\[
\frac{1}{1.10} \times 6.64 = $6.03
\]
What is a Convertible Bond?

- **ALZA**
  - 5% Convertible 2006
  - Convertible into 26.2 shares
  - Conversion ratio 26.2
  - Conversion price = \( \frac{1000}{26.2} = 38.17 \)
  - Market price of shares = $28
What is a Convertible Bond?

- **ALZA**
  - 5% Convertible 2006
  - Convertible into 26.2 shares
  - Conversion ratio 26.2
  - Conversion price = 1000/26.2 = $38.17
  - Market price of shares = $28

- Lower bound of value
  - Bond value
  - Conversion value = 26.2 x 28 = 733.60
What is a Convertible Bond?

- How bond value varies with firm value at maturity.

![Graph showing the relationship between bond value and firm value at maturity. The graph illustrates that as the value of the firm increases, the bond value also increases. At a certain point, the bond repays in full, and at lower values, the bond defaults.](image-url)
What is a Convertible Bond?

- How conversion value at maturity varies with firm value.
What is a Convertible Bond?

- How value of convertible at maturity varies with firm value.

Value of convertible ($ thousands)

Value of firm ($ million)

- default
- bond repaid in full
- convert
Chapter 23

Valuing Debt
Topics Covered

- The Classical Theory of Interest
- The Term Structure and YTM
- Duration and Volatility
- Explaining the Term Structure
- Allowing for the Risk of Default
Classical Theory of Interest Rates (Economics)

- developed by Irving Fisher
Classical Theory of Interest Rates (Economics)

- developed by Irving Fisher

Nominal Interest Rate = The rate you actually pay when you borrow money.
Debt & Interest Rates

Classical Theory of Interest Rates (Economics)
- developed by Irving Fisher

Nominal Interest Rate = The rate you actually pay when you borrow money.

Real Interest Rate = The theoretical rate you pay when you borrow money, as determined by supply and demand.
Debt & Interest Rates

Nominal \( r \) = Real \( r \) + expected inflation

Real \( r \) is theoretically somewhat stable

Inflation is a large variable

Q: Why do we care?
A: This theory allows us to understand the Term Structure of Interest Rates.

Q: So What?
A: The Term Structure tells us the cost of debt.
**Term Structure**

**Spot Rate** - The actual interest rate today (t=0)

**Forward Rate** - The interest rate, fixed today, on a loan made in the future at a fixed time.

**Future Rate** - The spot rate that is expected in the future.

**Yield To Maturity (YTM)** - The IRR on an interest bearing instrument.
**Debt & Risk**

Example (Bond 1)

Calculate the duration of our 10.5% bond @ 8.5% YTM

<table>
<thead>
<tr>
<th>Year</th>
<th>CF</th>
<th>PV@YTM</th>
<th>% of Total PV</th>
<th>% x Year</th>
</tr>
</thead>
</table>
Example (Bond 1)

Calculate the duration of our 10.5% bond @ 8.5% YTM

<table>
<thead>
<tr>
<th>Year</th>
<th>CF</th>
<th>PV@YTM</th>
<th>% of Total PV</th>
<th>% x Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>105</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>105</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>105</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>105</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1105</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Example (Bond 1)

Calculate the duration of our 10.5% bond @ 8.5% YTM

<table>
<thead>
<tr>
<th>Year</th>
<th>CF</th>
<th>PV@YTM</th>
<th>% of Total PV</th>
<th>% x Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>105</td>
<td>96.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>105</td>
<td>89.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>105</td>
<td>82.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>105</td>
<td>75.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1105</td>
<td>734.88</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total** 1078.82
Example (Bond 1)

Calculate the duration of our 10.5% bond @ 8.5% YTM

<table>
<thead>
<tr>
<th>Year</th>
<th>CF</th>
<th>PV@YTM</th>
<th>% of Total PV</th>
<th>% x Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>105</td>
<td>96.77</td>
<td>.090</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>105</td>
<td>89.19</td>
<td>.083</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>105</td>
<td>82.21</td>
<td>.076</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>105</td>
<td>75.77</td>
<td>.070</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1105</td>
<td>734.88</td>
<td>.681</td>
<td></td>
</tr>
</tbody>
</table>

1078.82 1.00
Example (Bond 1)

Calculate the duration of our 10.5% bond @ 8.5% YTM

<table>
<thead>
<tr>
<th>Year</th>
<th>CF</th>
<th>PV@YTM</th>
<th>% of Total PV</th>
<th>% x Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>105</td>
<td>96.77</td>
<td>0.090</td>
<td>0.090</td>
</tr>
<tr>
<td>2</td>
<td>105</td>
<td>89.19</td>
<td>0.083</td>
<td>0.164</td>
</tr>
<tr>
<td>3</td>
<td>105</td>
<td>82.21</td>
<td>0.076</td>
<td>0.227</td>
</tr>
<tr>
<td>4</td>
<td>105</td>
<td>75.77</td>
<td>0.070</td>
<td>0.279</td>
</tr>
<tr>
<td>5</td>
<td>1105</td>
<td>734.88</td>
<td>0.681</td>
<td>3.406</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1078.82</td>
<td>1.00</td>
<td><strong>4.166 Duration</strong></td>
</tr>
</tbody>
</table>
Example (Bond 2)

Given a 5 year, 9.0%, $1000 bond, with a 8.5% YTM, what is this bond’s duration?

<table>
<thead>
<tr>
<th>Year</th>
<th>CF</th>
<th>PV@YTM</th>
<th>% of Total PV</th>
<th>% x Year</th>
</tr>
</thead>
</table>

Example (Bond 2)

Given a 5 year, 9.0%, $1000 bond, with a 8.5% YTM, what is this bond’s duration?

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<thead>
<tr>
<th>Year</th>
<th>CF</th>
<th>PV@YTM</th>
<th>% of Total PV</th>
<th>% x Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1090</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example (Bond 2)

Given a 5 year, 9.0%, $1000 bond, with a 8.5% YTM, what is this bond’s duration?

<table>
<thead>
<tr>
<th>Year</th>
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<th>PV@YTM</th>
<th>% of Total PV</th>
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<tbody>
<tr>
<td>1</td>
<td>90</td>
<td>82.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>90</td>
<td>76.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>90</td>
<td>70.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td>64.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1090</td>
<td>724.90</td>
<td>724.90</td>
<td>724.90</td>
</tr>
</tbody>
</table>

1019.70
Example (Bond 2)

Given a 5 year, 9.0%, $1000 bond, with a 8.5% YTM, what is this bond’s duration?

<table>
<thead>
<tr>
<th>Year</th>
<th>CF</th>
<th>PV@YTM</th>
<th>% of Total PV</th>
<th>% x Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>90</td>
<td>82.95</td>
<td>.081</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>90</td>
<td>76.45</td>
<td>.075</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>90</td>
<td>70.46</td>
<td>.069</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td>64.94</td>
<td>.064</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1090</td>
<td>724.90</td>
<td>.711</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1019.70</td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>
Example (Bond 2)

Given a 5 year, 9.0%, $1000 bond, with a 8.5% YTM, what is this bond’s duration?

<table>
<thead>
<tr>
<th>Year</th>
<th>CF</th>
<th>PV@YTM</th>
<th>% of Total PV</th>
<th>% x Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>90</td>
<td>82.95</td>
<td>.081</td>
<td>0.081</td>
</tr>
<tr>
<td>2</td>
<td>90</td>
<td>76.45</td>
<td>.075</td>
<td>0.150</td>
</tr>
<tr>
<td>3</td>
<td>90</td>
<td>70.46</td>
<td>.069</td>
<td>0.207</td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td>64.94</td>
<td>.064</td>
<td>0.256</td>
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<tr>
<td>5</td>
<td>1090</td>
<td>724.90</td>
<td>.711</td>
<td>3.555</td>
</tr>
<tr>
<td></td>
<td>1019.70</td>
<td>1.00</td>
<td></td>
<td><strong>4.249 Duration</strong></td>
</tr>
</tbody>
</table>
Term Structure

What Determines the Shape of the TS?
1 - Unbiased Expectations Theory
2 - Liquidity Premium Theory
3 - Market Segmentation Hypothesis

Term Structure & Capital Budgeting
- CF should be discounted using Term Structure info.
- Since the spot rate incorporates all forward rates, then you should use the spot rate that equals the term of your project.
- If you believe in other theories take advantage of the arbitrage.
Yield To Maturity

- All interest bearing instruments are priced to fit the term structure.
- This is accomplished by modifying the asset price.
- The modified price creates a New Yield, which fits the Term Structure.
- The new yield is called the Yield To Maturity (YTM).
Yield to Maturity

Example

- A $1000 treasury bond expires in 5 years. It pays a coupon rate of 10.5%. If the market price of this bond is 107-88, what is the YTM?
Yield to Maturity

Example

- A $1000 treasury bond expires in 5 years. It pays a coupon rate of 10.5%. If the market price of this bond is 107-88, what is the YTM?

<table>
<thead>
<tr>
<th>C0</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>C5</th>
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</thead>
<tbody>
<tr>
<td>-1078.80</td>
<td>105</td>
<td>105</td>
<td>105</td>
<td>105</td>
<td>1105</td>
</tr>
</tbody>
</table>

Calculate IRR = 8.5%
The risk of default changes the price of a bond and the YTM.

Book Example

We have a 9% 1 year bond. The built in price is $1000. But, there is a 20% chance the company will go into bankruptcy and not be able to pay. What is the bond’s value?

A:
Book Example

We have a 9% 1 year bond. The built in price is $1000. But, there is a 20% chance the company will go into bankruptcy and not be able to pay. What is the bond’s value?

A: Bond Value  Prob

<table>
<thead>
<tr>
<th>Value</th>
<th>Prob</th>
<th>Expected CF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1090</td>
<td>.80</td>
<td>872.00</td>
</tr>
<tr>
<td>0</td>
<td>.20</td>
<td>0</td>
</tr>
</tbody>
</table>

Value = \( \frac{872}{1.09} = 800 \)

YTM = \( \frac{1090}{800} = 36.3\% \)

872.00 = expected CF
Conversely - If on top of default risk, investors require an additional 2 percent market risk premium, the price and YTM is as follows:

\[
Value = \frac{872}{1.11} = $785.59
\]

\[
YTM = \frac{1090}{785.59} = 38.8\%
\]
The Many Different Kinds of Debt
Topics Covered

- Domestic Bonds and International Bonds
- The Bond Contract
- Security and Seniority Asset-Backed Securities
- Repayment Provisions
- Restrictive Covenants
- Private Placements and Project Finance
- Innovation in the Bond Market
Bond Terminology

- Foreign bonds - Bonds that are sold to local investors in another country's bond market.

- Yankee bond - a bond sold publicly by a foreign company in the United States.

- Sumari - a bond sold by a foreign firm in Japan.

- Eurobond market - wind European and American multinationals were forced to tap into international markets for capital.
Bond Terminology

- Indenture or trust deed - the bond agreement between the borrower and a trust company.

- Registered bond - a bond in which the Company's records show ownership and interest and principle are paid directly to each owner.

- Bearer bonds - the bond holder must send in coupons to claim interest and must send a certificate to claim the final payment of principle.
Accrued interest - the amount of accumulated interest since the last coupon payment

Debentures - long-term unsecured issues on debt

Mortgage bonds - long-term secured debt often containing a claim against a specific building or property

Asset-backed securities - the sale of cash flows derived directly from a specific set of bundled assets
**Bond Terminology**

- **Sinking fund** - a fund established to retire debt before maturity.

- **Callable bond** - a bond that may be repurchased by a firm before maturity at a specified call price.

- **Defeasance** - a method of retiring corporate debt involving the creation of a trust funded with treasury bonds.
Straight Bond vs. Callable Bond

Value of straight bond

Value of callable bond at 100
Bond Terminology

- **Restrictive covenants** - Limitations set by bondholders on the actions of the Corporation.

- **Negative Pledge Clause** - the processing of giving unsecured debentures equal protection and when assets are mortgaged.

- **Poison Put** - a clause that obliges the borrower to repay the bond if a large quantity of stock is bought by single investor, which causes the firms bonds to beat down rated.
Pay in kind (PIK) - a bond that makes regular interest payments, but in the early years of the bond's life, the issuer can choose to pay interest in the form of either cash or more bonds with an equivalent face value.
Covenants

- Debt ratios:
  - Senior debt limits senior borrowing
  - Junior debt limits senior & junior borrowing
- Security:
  - Negative pledge
- Dividends
- Event risk
- Positive covenants:
  - Working capital
  - Net worth
October 1993 Marriott spun off its hotel management business worth 80% of its value.

Before the spin-off, Marriott’s long-term book debt ratio was $2891/3644 = 79\%$. Almost all the debt remained with the parent (renamed Host Marriott), whose debt ratio therefore rose to 93\%.

Marriott’s stock price rose 13.8\% and its bond prices declined by up to 30\%.

Bondholders sued and Marriott modified its spinoff plan.
Project Finance

1. Project is set up as a separate company.

2. A major proportion of equity is held by project manager or contractor, so provision of finance and management are linked.

3. The company is highly levered.
Parties In Project Finance

- Contractor
- Supplier(s)
- Equity investors
- Equity sponsor
- Lenders
- Purchaser(s)
- Government
## Risk Allocation

<table>
<thead>
<tr>
<th>Risk</th>
<th>Shifted to:</th>
<th>Contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completion/ continuing management</td>
<td>Sponsor</td>
<td>Management contract/ completion gtees / working capital maintenance</td>
</tr>
<tr>
<td>Construction cost</td>
<td>Contractor</td>
<td>Turnkey contract/ fixed price/ delay penalties</td>
</tr>
<tr>
<td>Raw materials</td>
<td>Supplier(s)</td>
<td>Long-term contract/ indexed prices/ supply or pay</td>
</tr>
<tr>
<td>Revenues</td>
<td>Purchaser(s)</td>
<td>Long-term contract/ indexed to costs/ take or pay/ throughput agreements/ tolling contract</td>
</tr>
<tr>
<td>Concession/regulation</td>
<td>Government</td>
<td>Concession agreement/ provision of supporting infrastructure</td>
</tr>
<tr>
<td>Currency convertibility</td>
<td>Government</td>
<td>Gtees or comfort letters/ hard currency paid to offshore escrow account</td>
</tr>
</tbody>
</table>
Leasing

Chapter 25
Topics Covered

- What is a Lease?
- Why Lease?
- Operating Leases
- Valuing Financial Leases
- When Do Financial Leases Pay?
Lease Terms

- Operating Leases
- Financial Leases
  - Rental Lease
  - Net lease
  - Direct lease
  - Leveraged lease
Why Lease?

- **Sensible Reasons for Leasing**
  - Short-term leases are convenient
  - Cancellation options are valuable
  - Maintenance is provided
  - Standardization leads to low costs
  - Tax shields can be used
  - Avoiding the alternative minimum tax
Why Lease?

Dubious Reasons for Leasing

- Leasing avoids capital expenditure controls
- Leasing preserves capital
- Leases may be off balance sheet financing
- Leasing effects book income
**Example**

Acme Limo has a client who will sign a lease for 7 years, with lease payments due at the start of each year. The following table shows the NPV of the limo if Acme purchases the new limo for $75,000 and leases it our for 7 years.
Operating Lease

**Example - cont**

Acme Limo has a client who will sign a lease for 7 years, with lease payments due at the start of each year. The following table shows the NPV of the limo if Acme purchases the new limo for $75,000 and leases it out for 7 years.

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial cost</td>
<td>-75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance, insurance, selling, and administrative costs</td>
<td>-12</td>
<td>-12</td>
<td>-12</td>
<td>-12</td>
<td>-12</td>
<td>-12</td>
<td>-12</td>
</tr>
<tr>
<td>Tax shield on costs</td>
<td>4.2</td>
<td>4.2</td>
<td>4.2</td>
<td>4.2</td>
<td>4.2</td>
<td>4.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Depreciation tax shield</td>
<td>0</td>
<td>5.25</td>
<td>8.4</td>
<td>5.04</td>
<td>3.02</td>
<td>3.02</td>
<td>1.51</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>-82.8</strong></td>
<td><strong>-2.55</strong></td>
<td><strong>0.6</strong></td>
<td><strong>-2.76</strong></td>
<td><strong>-4.78</strong></td>
<td><strong>-4.78</strong></td>
<td><strong>-6.29</strong></td>
</tr>
</tbody>
</table>

**NPV @ 7% = - $98.15**

| Break even rent(level) | 26.18 | 26.18 | 26.18 | 26.18 | 26.18 | 26.18 | 26.18 |
| **Break even rent after-tax** | **17.02** | **17.02** | **17.02** | **17.02** | **17.02** | **17.02** | **17.02** |

**NPV @ 7% = - $98.15**
Example

Greymore Bus Lines is considering a lease. Your operating manager wants to buy a new bus for $100,000. The bus has an 8 year life. The bus saleswoman says she will lease Greymore the bus for 8 years at $16,900 per year, but Greymore assumes all operating and maintenance costs.

Should Greymore buy or lease the bus?
Example - cont

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Should Greymore buy or lease the bus?

Cash flow consequences of the lease contract to Greymore

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of new bus</td>
<td>100.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lost Depr tax shield</td>
<td></td>
<td>(7.00)</td>
<td>(11.20)</td>
<td>(6.72)</td>
<td>(4.03)</td>
<td>(4.03)</td>
<td>(2.02)</td>
<td>-</td>
</tr>
<tr>
<td>Tax shield of lease</td>
<td>5.92</td>
<td>5.92</td>
<td>5.92</td>
<td>5.92</td>
<td>5.92</td>
<td>5.92</td>
<td>5.92</td>
<td>5.92</td>
</tr>
<tr>
<td>Cash flow of lease</td>
<td>89.02</td>
<td>(17.98)</td>
<td>(22.18)</td>
<td>(17.70)</td>
<td>(15.01)</td>
<td>(15.01)</td>
<td>(13.00)</td>
<td>(10.98)</td>
</tr>
</tbody>
</table>
Financial Leases

Example - cont

Greymore Bus Lines is considering a lease. Your operating manager wants to buy a new bus for $100,000. The bus has an 8 year life. The bus saleswoman says she will lease Greymore the bus for 8 years at $16,900 per year, but Greymore assumes all operating and maintenance costs. Should Greymore buy or lease the bus?

Cash flow consequences of the lease contract to Greymore:

• Greymore saves the $100,000 cost of the bus.
• Loss of depreciation benefit of owning the bus.
• $16,900 lease payment is due at the start of each year.
• Lease payments are tax deductible.
Financial Leases

Example - cont

Greymore Bus Lines Balance Sheet without lease

<table>
<thead>
<tr>
<th>Greymore Bus Lines (figures in $1,000s)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>10</td>
</tr>
<tr>
<td>All other assets</td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Loan secured by bus</td>
<td>100</td>
</tr>
<tr>
<td>Other loans</td>
<td>450</td>
</tr>
<tr>
<td>Equity</td>
<td>550</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Assets</td>
<td>1100</td>
</tr>
</tbody>
</table>

Equivalent lease balance sheet

<table>
<thead>
<tr>
<th>Greymore Bus Lines (figures in $1,000s)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>10</td>
</tr>
<tr>
<td>All other assets</td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial lease</td>
<td>100</td>
</tr>
<tr>
<td>Other loans</td>
<td>450</td>
</tr>
<tr>
<td>Equity</td>
<td>550</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Assets</td>
<td>1100</td>
</tr>
<tr>
<td>Total liabilities</td>
<td>1100</td>
</tr>
</tbody>
</table>
Financial Leases

Example - cont

Greymore Bus Lines can borrow at 10%, thus the value of the lease should be discounted at 6.5% or \(0.1 \times (1 - 0.35)\). The result will tell us if Greymore should lease or buy the bus.
Financial Leases

Example - cont

Greymore Bus Lines can borrow at 10%, thus the value of the lease should be discounted at 6.5% or .10 x (1-.35). The result will tell us if Greymore should lease or buy the bus.

\[
\text{NPV lease} = 89.02 - \frac{17.99}{1.065} - \frac{22.19}{(1.065)^2} - \frac{17.71}{(1.065)^3} - \frac{15.02}{(1.065)^4} - \frac{15.02}{(1.065)^5} - \frac{13.00}{(1.065)^6} - \frac{10.98}{(1.065)^7} \\
= -.70 \text{ or } -700
\]
Financial Leases

Example - cont

Greymore Bus Lines lease cash flows can also be thought of as loan equivalent cash flows.
**Example - cont**

Greymore Bus Lines lease cash flows can also be thought of as loan equivalent cash flows.

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount borrowed at year end</td>
<td>89.72</td>
<td>77.56</td>
<td>60.42</td>
<td>46.64</td>
<td>34.66</td>
<td>21.89</td>
<td>10.31</td>
<td>0.00</td>
</tr>
<tr>
<td>Interest paid @ 10%</td>
<td>-8.97</td>
<td>-7.76</td>
<td>-6.04</td>
<td>-4.66</td>
<td>-3.47</td>
<td>-2.19</td>
<td>-1.03</td>
<td></td>
</tr>
<tr>
<td>Tax shield @ 35%</td>
<td>3.14</td>
<td>2.71</td>
<td>2.11</td>
<td>1.63</td>
<td>1.21</td>
<td>0.77</td>
<td>0.36</td>
<td></td>
</tr>
<tr>
<td>Interest paid after tax</td>
<td>-5.83</td>
<td>-5.04</td>
<td>-3.93</td>
<td>-3.03</td>
<td>-2.25</td>
<td>-1.42</td>
<td>-0.67</td>
<td></td>
</tr>
<tr>
<td>Net cash flow of equivalent loan</td>
<td>89.72</td>
<td>-17.99</td>
<td>-22.19</td>
<td>-17.71</td>
<td>-15.02</td>
<td>-15.02</td>
<td>-13.00</td>
<td>-10.98</td>
</tr>
</tbody>
</table>
Financial Leases

*Example - cont*

The Greymore Bus Lines lease cash flows can also be treated as a favorable financing alternative and valued using APV.

\[
\text{APV} = \text{NPV of project} + \text{NPV of lease}\n\]

\[
\text{APV} = -5,000 + 8,000 = $3,000
\]
Managing Risk
Topics Covered

- Insurance
- Hedging With Futures
- Speculating and Margin
- SWAPS
Insurance

- Most businesses face the possibility of a hazard that can bankrupt the company in an instant.
- These risks are neither financial or business and can not be diversified.
- The cost and risk of a loss due to a hazard, however, can be shared by others who share the same risk.
Insurance

Example

An offshore oil platform is valued at $1 billion. Expert meteorologist reports indicate that a 1 in 10,000 chance exists that the platform may be destroyed by a storm over the course of the next year.

How can the cost of this hazard be shared?
Insurance

Example - cont.
An offshore oil platform is valued at $1 billion. Expert meteorologist reports indicate that a 1 in 10,000 chance exists that the platform may be destroyed by a storm over the course of the next year.

How can the cost of this hazard be shared?

Answer: A large number of companies with similar risks can each contribute pay into a fund that is set aside to pay the cost should a member of this risk sharing group experience the 1 in 10,000 loss. The other 9,999 firms may not experience a loss, but also avoided the risk of not being compensated should a loss have occurred.
Example - cont.

An offshore oil platform is valued at $1 billion. Expert meteorologist reports indicate that a 1 in 10,000 chance exists that the platform may be destroyed by a storm over the course of the next year.

What would the cost to each group member be for this protection?

Answer:

\[
\frac{1,000,000,000}{10,000} = \$100,000
\]
Why would an insurance company not offer a policy on this oil platform for $100,000?

- Administrative costs
- Adverse selection
- Moral hazard
Insurance

- The loss of an oil platform by a storm may be 1 in 10,000. The risk, however, is larger for an insurance company since all the platforms in the same area may be insured, thus if a storm damages one in may damage all in the same area. The result is a much larger risk to the insurer.

- Catastrophe Bonds - (CAT Bonds) Allow insurers to transfer their risk to bond holders by selling bonds whose cash flow payments depend on the level of insurable losses NOT occurring.
Hedging

Business has risk

Business Risk - variable costs

Financial Risk - Interest rate changes

Goal - Eliminate risk

HOW?

Hedging & Futures Contracts
Ex - Kellogg produces cereal. A major component and cost factor is sugar.

- Forecasted income & sales volume is set by using a fixed selling price.
- Changes in cost can impact these forecasts.
- To fix your sugar costs, you would ideally like to purchase all your sugar today, since you like today’s price, and made your forecasts based on it. But, you can not.
- You can, however, sign a contract to purchase sugar at various points in the future for a price negotiated today.
- This contract is called a “Futures Contract.”
- This technique of managing your sugar costs is called “Hedging.”
1- Spot Contract - A contract for immediate sale & delivery of an asset.

2- Forward Contract - A contract between two people for the delivery of an asset at a negotiated price on a set date in the future.

3- Futures Contract - A contract similar to a forward contract, except there is an intermediary that creates a standardized contract. Thus, the two parties do not have to negotiate the terms of the contract.

The intermediary is the Commodity Clearing Corp (CCC). The CCC guarantees all trades & “provides” a secondary market for the speculation of Futures.
Types of Futures

Commodity Futures
- Sugar  - Corn  - OJ
- Wheat - Soy beans  - Pork bellies

Financial Futures
- Tbills  - Yen  - GNMA
- Stocks  - Eurodollars

Index Futures
- S&P 500  - Value Line Index
- Vanguard Index
Futures Contract Concepts

Not an actual sale
Always a winner & a loser (unlike stocks)
K are “settled” every day. (Marked to Market)
Hedge - K used to eliminate risk by locking in prices
Speculation - K used to gamble
Margin - not a sale - post partial amount

Hog K = 30,000 lbs
Tbill K = $1.0 mil
Value line Index K = $index x 500
**Example** - You are speculating in Hog Futures. You think that the Spot Price of hogs will rise in the future. Thus, you go Long on 10 Hog Futures. If the price drops .17 cents per pound ($0.0017) what is total change in your position?
Example - You are speculating in Hog Futures. You think that the Spot Price of hogs will rise in the future. Thus, you go Long on 10 Hog Futures. If the price drops 0.17 cents per pound ($0.0017), what is total change in your position?

\[
30,000 \text{ lbs} \times 0.0017 \text{ loss} \times 10 \text{ Ks} = 510.00 \text{ loss}
\]

Since you must settle your account every day, you must give your broker $510.00.
Commodity Hedge

In June, farmer John Smith expects to harvest 10,000 bushels of corn during the month of August. In June, the September corn futures are selling for $2.94 per bushel (1K = 5,000 bushels). Farmer Smith wishes to lock in this price.

Show the transactions if the Sept spot price drops to $2.80.
Commodity Hedge

In June, farmer John Smith expects to harvest 10,000 bushels of corn during the month of August. In June, the September corn futures are selling for $2.94 per bushel (1K = 5,000 bushels). Farmer Smith wishes to lock in this price.

Show the transactions if the Sept spot price drops to $2.80.

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue from Crop: 10,000 x 2.80</td>
<td>28,000</td>
</tr>
<tr>
<td>June: Short 2K @ 2.94 = 2.94</td>
<td>29,400</td>
</tr>
<tr>
<td>Sept: Long 2K @ 2.80 = 28,000</td>
<td></td>
</tr>
<tr>
<td>Gain on Position:</td>
<td>1,400</td>
</tr>
<tr>
<td>Total Revenue:</td>
<td>$29,400</td>
</tr>
</tbody>
</table>
Commodity Hedge

In June, farmer John Smith expects to harvest 10,000 bushels of corn during the month of August. In June, the September corn futures are selling for $2.94 per bushel (1K = 5,000 bushels). Farmer Smith wishes to lock in this price.

Show the transactions if the Sept spot price rises to $3.05.
In June, farmer John Smith expects to harvest 10,000 bushels of corn during the month of August. In June, the September corn futures are selling for $2.94 per bushel (1K = 5,000 bushels). Farmer Smith wishes to lock in this price.

Show the transactions if the Sept spot price rises to $3.05.

Revenue from Crop: 10,000 x 3.05 = 30,500

June: Short 2K @ 2.94 = 29,400

Sept: Long 2K @ 3.05 = 30,500

Loss on Position = ( 1,100 )

Total Revenue $ 29,400
You have lived in NYC your whole life and are independently wealthy. You think you know everything there is to know about pork bellies (uncurred bacon) because your butler fixes it for you every morning. Because you have decided to go on a diet, you think the price will drop over the next few months. On the CME, each PB K is 38,000 lbs. Today, you decide to short three May Ks @ 44.00 cents per lbs. In Feb, the price rises to 48.5 cents and you decide to close your position. What is your gain/loss?
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Nov: Short 3 May K (.4400 x 38,000 x 3 ) = + 50,160
Feb: Long 3 May K (.4850 x 38,000 x 3 ) = - 55,290
Loss of 10.23 % = - 5,130
The amount (percentage) of a Futures Contract Value that must be on deposit with a broker. Since a Futures Contract is not an actual sale, you need only pay a fraction of the asset value to open a position = margin.

CME margin requirements are 15%

Thus, you can control $100,000 of assets with only $15,000.
You have lived in NYC your whole life and are independently wealthy. You think you know everything there is to know about pork bellies (uncurred bacon) because your butler fixes it for you every morning. Because you have decided to go on a diet, you think the price will drop over the next few months. On the CME, each PB K is 38,000 lbs. Today, you decide to short three May Ks @ 44.00 cents per lbs. In Feb, the price rises to 48.5 cents and you decide to close your position. What is your gain/loss?
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\[
\begin{align*}
\text{Nov: Short 3 May K } & (0.4400 \times 38,000 \times 3 ) = + 50,160 \\
\text{Feb: Long 3 May K } & (0.4850 \times 38,000 \times 3 ) = - 55,290 \\
\text{Loss } & = - 5,130 \\
\text{Loss Margin } & = \frac{5130}{50160 \times 0.15} = 68\% \text{ loss}
\end{align*}
\]
SWAPS

Birth 1981

Definition - An agreement between two firms, in which each firm agrees to exchange the “interest rate characteristics” of two different financial instruments of identical principal

Key points
Spread inefficiencies
Same notation principle
Only interest exchanged
“Plain Vanilla Swap” - (generic swap)

- fixed rate payer
- floating rate payer
- counterparties
- settlement date
- trade date
- effective date
- terms

Swap Gain = fixed spread - floating spread
example (vanilla/annually settled)

<table>
<thead>
<tr>
<th></th>
<th>XYZ</th>
<th>ABC</th>
</tr>
</thead>
<tbody>
<tr>
<td>fixed</td>
<td>10%</td>
<td>11.5%</td>
</tr>
<tr>
<td>floating</td>
<td>libor + .25</td>
<td>libor + .50</td>
</tr>
</tbody>
</table>

Q: if libor = 7%, what swap can be made 7 what is the profit (assume $1mil face value loans)

A:
XYZ borrows $1mil @ 10% fixed
ABC borrows $1mil @ 7.5% floating
XYZ pays floating @ 7.25%
ABC pays fixed @ 10.50%
example - cont.

Benefit to XYZ
flooding +7.25 -7.25
fixed +10.50 -10.00
Net gain

Benefit ABC
flooding +7.25 - 7.50
fixed -10.50 + 11.50
net gain

Net position
0
+.50
+.50%

Net Position
-.25
+1.00
+.75%
example - cont.

Settlement date
ABC pmt 10.50 x 1mil = 105,000
XYZ pmt 7.25 x 1mil = 72,500
net cash pmt by ABC = 32,500

if libor rises to 9%

settlement date
ABC pmt 10.50 x 1mil = 105,000
XYZ pmt 9.25 x 1mil = 92,500
net cash pmt by ABC = 12,500
SWAPS

- transactions
- rarely done direct
- banks = middleman
- bank profit = part of “swap gain”

example - same continued
XYZ & ABC go to bank separately
XYZ term = SWAP floating @ libor + .25 for fixed @ 10.50
ABC terms = swap floating libor + .25 for fixed 10.75
example - cont.
settlement date - XYZ
Bank pmt 10.50 x 1mil = 105,000
XYZ pmt 7.25 x 1mil = 72,500
net Bank pmt to XYZ = 32,500

settlement date - ABC
Bank pmt 7.25 x 1mil = 72,500
ABC pmt 10.75 x 1mil = 107,500
net ABC pmt to bank = 35,000

bank “swap gain” = +35,000 - 32,500 = +2,500
example - cont.

benefit to XYZ
floating 7.25 - 7.25 = 0
fixed 10.50 - 10.00 = +.50 net gain .50

benefit to ABC
floating 7.25 - 7.50 = - .25
fixed -10.75 + 11.50 = + .75 net gain .50

benefit to bank
floating +7.25 - 7.25 = 0
fixed 10.75 - 10.50 = + .25 net gain +.25

total benefit = 12,500 (same as w/o bank)
Managing International Risk
Topics Covered

- Foreign Exchange Markets
- Some Basic Relationships
- Hedging Currency Risk
- Exchange Risk and International Investment Decisions
Foreign Exchange Markets

Exchange Rate - Amount of one currency needed to purchase one unit of another.

Spot Rate of Exchange - Exchange rate for an immediate transaction.

Forward Exchange Rate - Exchange rate for a forward transaction.
Example - The yen spot price is 112.645 yen per dollar and the 6 month forward rate is 111.300 yen per dollar, what is the premium and discount relationship?
Forward Premiums and Forward Discounts

**Example** - The yen spot price is 112.645 yen per dollar and the 6 month forward rate is 111.300 yen per dollar, what is the premium and discount relationship?

\[
\frac{\text{Forward Price} - \text{Spot Price}}{\text{Spot Price}} = \text{Premium or (-Discount)}
\]

\[
4 \times \frac{112.645 - 111.300}{111.300} \times 100 = 4.8\%
\]
Forward Premiums and Forward Discounts

Example - The yen spot price is 112.645 yen per dollar and the 6 month forward rate is 111.300 yen per dollar, what is the premium and discount relationship?

Answer - The dollar is selling at a 4.8% premium, relative to the yen. The yen is selling at a 4.8% discount, relative to the dollar.
Basic Relationships

\[
\frac{1 + r_{\text{foreign}}}{1 + r_{\$}} \quad \text{equals} \quad \frac{1 + i_{\text{foreign}}}{1 + i_{\$}}
\]

\[
\frac{f_{\text{foreign} / \$}}{S_{\text{foreign} / \$}} \quad \text{equals} \quad \frac{E(s_{\text{foreign} / \$})}{S_{\text{foreign} / \$}}
\]
1) Interest Rate Parity Theory

\[
\frac{1 + r_{\text{foreign}}}{1 + r_{\$}} = \frac{f_{\text{foreign} / \$}}{S_{\text{foreign} / \$}}
\]

- The ratio between the risk free interest rates in two different countries is equal to the ratio between the forward and spot exchange rates.
Example - You have the opportunity to invest $1,000,000 for one year. All other things being equal, you have the opportunity to obtain a 1 year Japanese bond (in yen) @ 0.25 % or a 1 year US bond (in dollars) @ 5%. The spot rate is 112.645 yen:$1 The 1 year forward rate is 107.495 yen:$1

Which bond will you prefer and why?

Ignore transaction costs.
Example - You have the opportunity to invest $1,000,000 for one year. All other things being equal, you have the opportunity to obtain a 1 year Japanese bond (in yen) @ 0.25% or a 1 year US bond (in dollars) @ 5%. The spot rate is 112.645 yen:$1 The 1 year forward rate is 107.495 yen:$1

Which bond will you prefer and why? Ignore transaction costs.

Value of US bond = $100,000 x 1.05 = $105,000
Exchange Rate Relationships

Example - You have the opportunity to invest $1,000,000 for one year. All other things being equal, you have the opportunity to obtain a 1 year Japanese bond (in yen) @ 0.25 % or a 1 year US bond (in dollars) @ 5%. The spot rate is 112.645 yen:$1 The 1 year forward rate is 107.495 yen:$1

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Value of US bond = $100,000 x 1.05 = $105,000

Value of Japan bond = $100,000 x 112.645 = 112,645,000 yen exchange
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Value of US bond = $100,000 x 1.05 = $105,000

Value of Japan bond = $100,000 x 112.645 = 112,645,000 yen exchange

112,645,000 yen x 1.08 = 112,927,000 yen bond pmt
Exchange Rate Relationships

**Example** - You have the opportunity to invest $1,000,000 for one year. All other things being equal, you have the opportunity to obtain a 1 year Japanese bond (in yen) @ 0.25 % or a 1 year US bond (in dollars) @ 5%. The spot rate is 112.645 yen:$1 The 1 year forward rate is 107.495 yen:$1

Which bond will you prefer and why? Ignore transaction costs

Value of US bond = $100,000 x 1.05 = $105,000

Value of Japan bond = $100,000 x 112.645 = 112,645,000 yen exchange

112,645,000 yen x 1.08 = 112,927,000 yen bond pmt

112,927,000 yen / 107.495 = $1,050,500 exchange
2) Expectations Theory of Exchange Rates

\[
\frac{f_{\text{foreign} / \$}}{S_{\text{foreign} / \$}} = \frac{E(S_{\text{foreign} / \$})}{S_{\text{foreign} / \$}}
\]

Theory that the expected spot exchange rate equals the forward rate.
3) Purchasing Power Parity

\[
\frac{1 + i_{\text{foreign}}}{1 + i_{\$}} = \frac{E(S_{\text{foreign} / \$})}{S_{\text{foreign} / \$}}
\]

The expected change in the spot rate equals the expected difference in inflation between the two countries.
Exchange Rate Relationships

Example

If inflation in the US is forecasted at 2.0% this year and Japan is forecasted to fall 2.5%, what do we know about the expected spot rate?

Given a spot rate of 112.645yen:$1
Exchange Rate Relationships

Example - If inflation in the US is forecasted at 2.0% this year and Japan is forecasted to fall 2.5%, what do we know about the expected spot rate?

Given a spot rate of 112.645yen:$1

\[
\frac{1 + i_{\text{foreign}}}{1 + i_{\$}} = \frac{E(s_{\text{foreign/\$}})}{S_{\text{foreign/\$}}}
\]
Exchange Rate Relationships

Example - If inflation in the US is forecasted at 2.0% this year and Japan is forecasted to fall 2.5%, what do we know about the expected spot rate?

Given a spot rate of 112.645 yen:$1

\[
\frac{1 + i_{\text{foreign}}}{1 + i_s} = \frac{E(s_{\text{foreign}}/\$)}{S_{\text{foreign}}/\$}
\]

\[
\frac{1 - .025}{1 + .02} = \frac{E(s_{\text{foreign}}/\$)}{112.645}
\]
**Example** - If inflation in the US is forecasted at 2.0% this year and Japan is forecasted to fall 2.5%, what do we know about the expected spot rate?

Given a spot rate of 112.645 yen:$1

\[
\frac{1 + i_{\text{foreign}}}{1 + i_{\$}} = \frac{E(s_{\text{foreign}}/\$)}{S_{\text{foreign}}/\$}
\]

\[
\frac{1 - .025}{1 + .02} = \frac{E(s_{\text{foreign}}/\$)}{112.645}
\]

\[
E_s = 107.68
\]
4) International Fisher effect

\[
\frac{1 + r_{\text{foreign}}}{1 + r_s} = \frac{1 + i_{\text{foreign}}}{1 + i_s}
\]

The expected difference in inflation rates equals the difference in current interest rates.

Also called common real interest rates.
Example - The real interest rate in each country is about the same.

\[
r(\text{real}) = \frac{1 + r_{\text{foreign}}}{1 + i_{\text{foreign}}} = \frac{1.0025}{.975} = .028
\]

\[
r(\text{real}) = \frac{1 + r_{\$}}{1 + i_{\$}} = \frac{1.05}{1.02} = .029
\]
Example - Honda builds a new car in Japan for a cost + profit of 1,715,000 yen. At an exchange rate of 101.18:$1 the car sells for $16,950 in Baltimore. If the dollar rises in value, against the yen, to an exchange rate of 105:$1, what will be the price of the car?
Example - Honda builds a new car in Japan for a cost + profit of 1,715,000 yen. At an exchange rate of 101.18:$1 the car sells for $16,950 in Baltimore. If the dollar rises in value, against the yen, to an exchange rate of 105:$1, what will be the price of the car?

\[
\frac{1,715,000}{105} = \$16,333
\]
**Exchange Rate Risk**

**Example** - Honda builds a new car in Japan for a cost + profit of 1,715,000 yen. At an exchange rate of 101.18:$1 the car sells for $16,950 in Baltimore. If the dollar rises in value, against the yen, to an exchange rate of 105:$1, what will be the price of the car?

\[
\frac{1,715,000}{105} = \$16,333
\]

Conversely, if the yen is trading at a forward discount, Japan will experience a decrease in purchasing power.
Exchange Rate Risk

**Example** - Harley Davidson builds a motorcycle for a cost plus profit of $12,000. At an exchange rate of 101.18:$1, the motorcycle sells for 1,214,160 yen in Japan. If the dollar rises in value and the exchange rate is 105:$1, what will the motorcycle cost in Japan?
Exchange Rate Risk

**Example** - Harley Davidson builds a motorcycle for a cost plus profit of $12,000. At an exchange rate of 101.18:$1, the motorcycle sells for 1,214,160 yen in Japan. If the dollar rises in value and the exchange rate is 105:$1, what will the motorcycle cost in Japan?

\[ \$12,000 \times 105 = 1,260,000 \text{ yen (3.78\% rise)} \]
Currency Risk can be reduced by using various financial instruments.

Currency forward contracts, futures contracts, and even options on these contracts are available to control the risk.
Capital Budgeting

Techniques

1) Exchange to $ and analyze.

2) Discount using foreign cash flows and interest rates, then exchange to $.

3) Choose a currency standard ($) and hedge all non dollar CF.
Topics Covered

- Executive Paper Corporation
- Financial Ratios
- The DuPont System
- Financial Planning
- Growth and External Financing
### Executive Paper Balance Sheet

<table>
<thead>
<tr>
<th></th>
<th>Dec 1998</th>
<th>Dec 1999</th>
<th>diff</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Current Assets</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash &amp; Securities</td>
<td>100.0</td>
<td>110.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Receivables</td>
<td>433.1</td>
<td>440.0</td>
<td>6.9</td>
</tr>
<tr>
<td>Inventory</td>
<td>339.9</td>
<td>350.0</td>
<td>10.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>873.0</td>
<td>900.0</td>
<td>27.0</td>
</tr>
<tr>
<td><strong>Fixed Assets</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P, P, E</td>
<td>929.8</td>
<td>100.0</td>
<td>-829.8</td>
</tr>
<tr>
<td>accum Depr</td>
<td>396.7</td>
<td>450.0</td>
<td>53.3</td>
</tr>
<tr>
<td><strong>Net Fixed Assets</strong></td>
<td>533.1</td>
<td>550.0</td>
<td>16.9</td>
</tr>
<tr>
<td><strong>Total Assets</strong></td>
<td>1,406.1</td>
<td>1,450.0</td>
<td>43.9</td>
</tr>
</tbody>
</table>
## Liabilities and Equity

<table>
<thead>
<tr>
<th></th>
<th>Dec 1998</th>
<th>Dec 1999</th>
<th>diff</th>
</tr>
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<tbody>
<tr>
<td><strong>Current Liabilities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debt due in 1 year</td>
<td>96.6</td>
<td>100.0</td>
<td>3.4</td>
</tr>
<tr>
<td>Payable</td>
<td>349.9</td>
<td>360.0</td>
<td>10.1</td>
</tr>
<tr>
<td><strong>Total current liabilities</strong></td>
<td>446.5</td>
<td>460.0</td>
<td>13.5</td>
</tr>
<tr>
<td><strong>Long term debt</strong></td>
<td>400.0</td>
<td>400.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Shareholders equity</strong></td>
<td>559.6</td>
<td>590.0</td>
<td>30.4</td>
</tr>
<tr>
<td><strong>Total liabilities and equity</strong></td>
<td>1,406.1</td>
<td>1,450.0</td>
<td>43.9</td>
</tr>
</tbody>
</table>
### Executive Paper - Other Data

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated replacement cost of assets</td>
<td>1110</td>
<td>1231</td>
</tr>
<tr>
<td>Market value of equity</td>
<td>598</td>
<td>708</td>
</tr>
<tr>
<td>Average number of shares, millions</td>
<td>14.16</td>
<td>14.16</td>
</tr>
<tr>
<td>Share price, dollars</td>
<td>42.25</td>
<td>50</td>
</tr>
<tr>
<td>Executive Paper Income Statement (1999)</td>
<td>$ millions</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>Revenues</td>
<td>2,200.00</td>
<td></td>
</tr>
<tr>
<td>Costs</td>
<td>1,980.00</td>
<td></td>
</tr>
<tr>
<td>Depreciation</td>
<td>53.30</td>
<td></td>
</tr>
<tr>
<td>EBIT</td>
<td>166.70</td>
<td></td>
</tr>
<tr>
<td>Interest</td>
<td>40.00</td>
<td></td>
</tr>
<tr>
<td>Tax</td>
<td>50.70</td>
<td></td>
</tr>
<tr>
<td><strong>Net income</strong></td>
<td><strong>76.00</strong></td>
<td></td>
</tr>
</tbody>
</table>

Dividend 45.60  
Retained earnings 30.40  
Earnings per share, dollars 5.37  
Dividend per share, dollars 3.22
### Executive Paper Sources and Uses of Funds (1999)

**Sources:**

<table>
<thead>
<tr>
<th>Source</th>
<th>$ millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Income</td>
<td>76.00</td>
</tr>
<tr>
<td>Depreciation</td>
<td>53.30</td>
</tr>
<tr>
<td>Operating cash flow</td>
<td>129.30</td>
</tr>
<tr>
<td>Borrowing</td>
<td>-</td>
</tr>
<tr>
<td>Stock issues</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total sources</strong></td>
<td><strong>129.30</strong></td>
</tr>
</tbody>
</table>

**Uses:**

<table>
<thead>
<tr>
<th>Use</th>
<th>$ millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in net working capital</td>
<td>13.50</td>
</tr>
<tr>
<td>Investment</td>
<td>70.20</td>
</tr>
<tr>
<td>Dividends</td>
<td>45.60</td>
</tr>
<tr>
<td><strong>Total uses</strong></td>
<td><strong>129.30</strong></td>
</tr>
</tbody>
</table>
Leverage Ratios

Long term debt ratio = \frac{\text{long term debt}}{\text{long term debt} + \text{equity}}

Debt equity ratio = \frac{\text{long term debt} + \text{value of leases}}{\text{equity}}
Leverage Ratios

Total debt ratio = \( \frac{\text{total liabilities}}{\text{total assets}} \)

Times interest earned = \( \frac{\text{EBIT}}{\text{interest payments}} \)

Cash cover age ratio = \( \frac{\text{EBIT} + \text{depreciation}}{\text{interest payments}} \)
Liquidity Ratios

Net working capital to total assets ratio = \( \frac{\text{Net working capital}}{\text{Total assets}} \)

Current ratio = \( \frac{\text{current assets}}{\text{current liabilities}} \)
Liquidity Ratios

Quick ratio $= \frac{\text{cash} + \text{marketable securities} + \text{receivables}}{\text{current liabilities}}$

Cash ratio $= \frac{\text{cash} + \text{marketable securities}}{\text{current liabilities}}$

Interval measure $= \frac{\text{cash} + \text{marketable securities} + \text{receivables}}{\text{average daily expenditures from operations}}$
Efficiency Ratios

Asset turnover ratio = \( \frac{\text{Sales}}{\text{Average total assets}} \)

NWCTurnover = \( \frac{\text{sales}}{\text{average net working capital}} \)
Efficiency Ratios

Inventory turnover ratio \[= \frac{\text{cost of goods sold}}{\text{average inventory}}\]

Days' sales in inventory \[= \frac{\text{average inventory}}{\text{cost of goods sold} / 365}\]

Average collection period \[= \frac{\text{average receivables}}{\text{average daily sales}}\]
Profitability Ratios

Net profit margin = \( \frac{EBIT - tax}{sales} \)

Return on assets = \( \frac{EBIT - tax}{average \ total \ assets} \)

Return on equity = \( \frac{earnings \ available \ for \ common \ stock}{average \ equity} \)
Profitability Ratios

Payout ratio = \frac{\text{dividends}}{\text{earnings}}

Plowback ratio = \frac{\text{earnings} - \text{dividends}}{\text{earnings}}

= 1 - \text{payout ratio}

Growth in equity from plowback = \frac{\text{earnings} - \text{dividends}}{\text{earnings}}
Market Value Ratios

PE Ratio = \frac{\text{stock price}}{\text{earnings per share}}

\text{Forecasted PE ratio} = \frac{P_0}{\text{aveEPS}_1} = \frac{\text{Div}_1}{\text{EPS}_1} \times \frac{1}{r - g}

\text{Dividend yield} = \frac{\text{dividend per share}}{\text{stock price}}
Market Value Ratios

Price per share \( P_0 \) = \( \frac{\text{Div}_1}{r - g} \)

Market to book ratio = \( \frac{\text{stock price}}{\text{book value per share}} \)

Tobins Q = \( \frac{\text{market value of assets}}{\text{estimated replacement cost}} \)
The DuPont System

- A breakdown of ROE and ROA into component ratios:

\[
\text{ROA} = \frac{\text{EBIT} - \text{taxes}}{\text{assets}}
\]

\[
\text{ROE} = \frac{\text{earnings available for common stock}}{\text{equity}}
\]
The DuPont System

\[
\text{ROA} = \frac{\text{sales}}{\text{assets}} \times \frac{\text{EBIT} - \text{taxes}}{\text{sales}}
\]
The DuPont System

\[
\text{ROA} = \frac{\text{sales}}{\text{assets}} \times \frac{\text{EBIT} - \text{taxes}}{\text{sales}}
\]
The DuPont System

\[ \text{ROE} = \frac{\text{assets}}{\text{equity}} \times \frac{\text{sales}}{\text{assets}} \times \frac{\text{EBIT} - \text{taxes}}{\text{sales}} \times \frac{\text{EBIT} - \text{taxes} - \text{interest}}{\text{EBIT} - \text{taxes}} \]
The DuPont System

\[ \text{ROE} = \frac{\text{assets}}{\text{equity}} \times \frac{\text{sales}}{\text{assets}} \times \frac{\text{EBIT} - \text{taxes}}{\text{sales}} \times \frac{\text{EBIT} - \text{taxes} - \text{interest}}{\text{EBIT} - \text{taxes}} \]

- leverage ratio
- asset turnover
- profit margin
- debt burden
Short Term Financial Planning

Chapter 29
Topics Covered

- Working Capital
- Links Between Long-Term and Short-Term Financing
- Tracing Changes in Cash and Working Capital
- Cash Budgeting
- A Short-Term Financing Plan
Net Working Capital - Current assets minus current liabilities. Often called working capital.

Cash Conversion Cycle - Period between firm’s payment for materials and collection on its sales.

Carrying Costs - Costs of maintaining current assets, including opportunity cost of capital.

Shortage Costs - Costs incurred from shortages in current assets.
Lines A, B, and C show alternative amounts of long-term finance.

**Strategy A:** A permanent cash surplus
**Strategy B:** Short-term lender for part of year and borrower for remainder
**Strategy C:** A permanent short-term borrower
Working Capital

Simple Cycle of operations

Cash
Working Capital

Simple Cycle of operations

Cash

Raw materials inventory
Simple Cycle of operations

- Cash
- Raw materials inventory
- Finished goods inventory
Working Capital

Simple Cycle of operations

- Cash
- Receivables
- Finished goods inventory
- Raw materials inventory
Working Capital

Simple Cycle of operations

- Receivables
- Cash
- Finished goods inventory
- Raw materials inventory
## Changes in Cash & W.C.

### Example - Dynamic Mattress Company

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Assets</td>
<td>4</td>
<td>5</td>
<td>Current Liabilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash</td>
<td>4</td>
<td>5</td>
<td>Bank Loans</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Mark Securities</td>
<td>0</td>
<td>5</td>
<td>Accts Payable</td>
<td>20</td>
<td>27</td>
</tr>
<tr>
<td>Inventory</td>
<td>26</td>
<td>25</td>
<td>Total Curr Liab</td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>Accts Recv</td>
<td>25</td>
<td>30</td>
<td>Long Term Debt</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Total Curr Assets</td>
<td>55</td>
<td>65</td>
<td>Net Worth</td>
<td>65</td>
<td>76</td>
</tr>
<tr>
<td>Fixed Assets</td>
<td></td>
<td></td>
<td>Total Liab and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross investment</td>
<td>56</td>
<td>70</td>
<td>owner's equity</td>
<td>95</td>
<td>115</td>
</tr>
<tr>
<td>less Depr</td>
<td>16</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Fixed Assets</td>
<td>40</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Assets</td>
<td>95</td>
<td>115</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Example - Dynamic Mattress Company

**Income Statement**

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$350</td>
</tr>
<tr>
<td>Operating Costs</td>
<td>321</td>
</tr>
<tr>
<td>Depreciation</td>
<td>4</td>
</tr>
<tr>
<td>EBIT</td>
<td>25</td>
</tr>
<tr>
<td>Interest</td>
<td>1</td>
</tr>
<tr>
<td>Pretax income</td>
<td>24</td>
</tr>
<tr>
<td>. Tax at 50%</td>
<td>12</td>
</tr>
<tr>
<td>Net Income</td>
<td>$12</td>
</tr>
</tbody>
</table>

Assume

- dividend = $1 mil
- R.E. = $11 mil
# Changes in Cash & W.C.

## Example - Dynamic Mattress Company

<table>
<thead>
<tr>
<th>Sources</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issued long term debt</td>
<td>7</td>
</tr>
<tr>
<td>Reduced inventories</td>
<td>1</td>
</tr>
<tr>
<td>Increased accounts payable</td>
<td>7</td>
</tr>
<tr>
<td>Net income</td>
<td>12</td>
</tr>
<tr>
<td>Depreciation</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Sources</strong></td>
<td><strong>$31</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Uses</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repaid short term bank loan</td>
<td>5</td>
</tr>
<tr>
<td>Invested in fixed assets</td>
<td>14</td>
</tr>
<tr>
<td>Purchased marketable securities</td>
<td>5</td>
</tr>
<tr>
<td>Increased accounts receivable</td>
<td>5</td>
</tr>
<tr>
<td>Dividend</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Uses</strong></td>
<td><strong>$30</strong></td>
</tr>
</tbody>
</table>

**Increase in cash balance**: $1
Example - Dynamic Mattress Company

Dynamic used cash as follows:
- Paid $1 mil dividend.
- Repaid $5 mil short term bank loan.
- Invested $14 mil.
- Purchased $5 mil of marketable securities.
- Accounts receivable expanded by $5 mil.
Cash Budgeting

Steps to preparing a cash budget
Step 1 - Forecast the sources of cash.
Step 2 - Forecast uses of cash.
Step 3 - Calculate whether the firm is facing a cash shortage or surplus.
## Cash Budgeting

**Example - Dynamic Mattress Company**

Dynamic forecasted sources of cash

<table>
<thead>
<tr>
<th>Quarter</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales, $mil</td>
<td>87.50</td>
<td>78.50</td>
<td>116.00</td>
<td>131.00</td>
</tr>
</tbody>
</table>

AR ending balance = AR beginning balance + sales - collections
## Example - Dynamic Mattress Company

### Dynamic collections on AR

<table>
<thead>
<tr>
<th></th>
<th>Qtr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st</td>
</tr>
<tr>
<td>1. Beginning receivables</td>
<td>30.0</td>
</tr>
<tr>
<td>2. Sales</td>
<td>87.5</td>
</tr>
<tr>
<td>3. Collections</td>
<td></td>
</tr>
<tr>
<td>. Sales in current Qtr (80%)</td>
<td>70</td>
</tr>
<tr>
<td>. Sales in previous Qtr (20%)</td>
<td>15.0</td>
</tr>
<tr>
<td>Total collections</td>
<td>85.0</td>
</tr>
<tr>
<td>4. Receivables at end of period</td>
<td></td>
</tr>
<tr>
<td>. (4 = 1 + 2 - 3)</td>
<td>$32.5</td>
</tr>
</tbody>
</table>
Cash Budgeting

Example - Dynamic Mattress Company

Dynamic forecasted uses of cash
- Payment of accounts payable
- Labor, administration, and other expenses
- Capital expenditures
- Taxes, interest, and dividend payments
## Cash Budgeting

### Example - Dynamic Mattress Company

#### Dynamic cash budget

<table>
<thead>
<tr>
<th></th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources of cash</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>collections on AR</td>
<td>85.0</td>
<td>80.3</td>
<td>108.5</td>
<td>128.0</td>
</tr>
<tr>
<td>other</td>
<td>0.0</td>
<td>0.0</td>
<td>12.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Total Sources</td>
<td>85.0</td>
<td>80.3</td>
<td>121.0</td>
<td>128.0</td>
</tr>
<tr>
<td>Uses of cash</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>payment of AP</td>
<td>65.0</td>
<td>60.0</td>
<td>55.0</td>
<td>50.0</td>
</tr>
<tr>
<td>labor and admin expenses</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
<td>30.0</td>
</tr>
<tr>
<td>capital expenditures</td>
<td>32.5</td>
<td>1.3</td>
<td>5.5</td>
<td>8.0</td>
</tr>
<tr>
<td>taxes, interest, &amp; dividends</td>
<td>4.0</td>
<td>4.0</td>
<td>4.5</td>
<td>5.0</td>
</tr>
<tr>
<td>Total uses of cash</td>
<td>131.5</td>
<td>95.3</td>
<td>95.0</td>
<td>93.0</td>
</tr>
<tr>
<td>Net cash inflow</td>
<td>$46.5</td>
<td>$15.0</td>
<td>$26.0</td>
<td>$35.0</td>
</tr>
<tr>
<td>(sources minus uses)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Cash Budgeting

**Example** - Dynamic Mattress Company

**Dynamic short term financing requirements**

<table>
<thead>
<tr>
<th>Description</th>
<th>5</th>
<th>-41.5</th>
<th>-56.5</th>
<th>-30.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash at start of period</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ Net cash flow</td>
<td>-46.5</td>
<td>-15</td>
<td>+26</td>
<td>+35</td>
</tr>
<tr>
<td>= Cash at end of period</td>
<td>-41.5</td>
<td>-56.5</td>
<td>-30.5</td>
<td>+4.5</td>
</tr>
<tr>
<td>Min operating cash balance</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Cumulative short term financing required</td>
<td>$46.5</td>
<td>$61.5</td>
<td>$35.5</td>
<td>-$.5</td>
</tr>
</tbody>
</table>

(required (minimum cash balance minus cash at end of period)
A Short Term Financing Plan

Example - Dynamic Mattress Company

Dynamic forecasted deferrable expenses

<table>
<thead>
<tr>
<th>Quarter</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount Deferrable, $mil</td>
<td>52</td>
<td>48</td>
<td>44</td>
<td>40</td>
</tr>
</tbody>
</table>
### Dynamic Mattress Company - Financing Plan

#### New Borrowing

<table>
<thead>
<tr>
<th></th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Line of credit</td>
<td>41.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2. Stretching payables</td>
<td>3.6</td>
<td>20.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>3. Total</td>
<td>44.6</td>
<td>20.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

#### Repayments

<table>
<thead>
<tr>
<th></th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Line of credit</td>
<td>0.0</td>
<td>0.0</td>
<td>4.8</td>
<td>36.2</td>
</tr>
<tr>
<td>5. Stretched payables</td>
<td>0.0</td>
<td>3.6</td>
<td>20.0</td>
<td>0.0</td>
</tr>
<tr>
<td>6. Total</td>
<td>0.0</td>
<td>3.6</td>
<td>24.8</td>
<td>36.2</td>
</tr>
</tbody>
</table>

#### Net New Borrowing

<table>
<thead>
<tr>
<th></th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Net new borrowing</td>
<td>44.6</td>
<td>16.4</td>
<td>-24.8</td>
<td>-36.2</td>
</tr>
</tbody>
</table>

#### Interest Payments

<table>
<thead>
<tr>
<th></th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Line of credit</td>
<td>0.0</td>
<td>1.2</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>12. Stretching payables</td>
<td>0.0</td>
<td>0.2</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>13. Less interest on securities</td>
<td>-0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>14. Net interest paid</td>
<td>-0.1</td>
<td>1.4</td>
<td>2.2</td>
<td>1.0</td>
</tr>
<tr>
<td>15. Funds for Compensating balances</td>
<td>3.2</td>
<td>0.0</td>
<td>-1.0</td>
<td>-2.2</td>
</tr>
<tr>
<td>16. Cash required for operations</td>
<td>46.5</td>
<td>15.0</td>
<td>0.3</td>
<td>-35.0</td>
</tr>
<tr>
<td>17. Total cash required</td>
<td>49.6</td>
<td>16.4</td>
<td>-24.8</td>
<td>-36.2</td>
</tr>
</tbody>
</table>
Topics Covered

- Terms of Sale
- Commercial Credit Instruments
- Credit Analysis
- The Credit Decision
- Collection Policy
- Bankruptcy
Terms of Sale - Credit, discount, and payment terms offered on a sale.

Example - 5/10 net 30

5 - percent discount for early payment
10 - number of days that the discount is available
net 30 - number of days before payment is due
A firm that buys on credit is in effect borrowing from its supplier. It saves cash today but will have to pay later. This, of course, is an implicit loan from the supplier.

We can calculate the implicit cost of this loan.
A firm that buys on credit is in effect borrowing from its supplier. It saves cash today but will have to pay later. This, of course, is an implicit loan from the supplier.

We can calculate the implicit cost of this loan

**Effective annual rate**

\[
eff = \left( 1 + \frac{\text{discount}}{\text{discounted price}} \right)^{\frac{365}{\text{extra days credit}}} - 1
\]
**Example** - On a $100 sale, with terms 5/10 net 60, what is the implied interest rate on the credit given?
Example - On a $100 sale, with terms 5/10 net 60, what is the implied interest rate on the credit given?

Effective annual rate

$$\left(1 + \frac{\text{discount}}{\text{discounted price}}\right)^{\frac{365}{\text{extra days credit}}} - 1$$

$$= \left(1 + \frac{5}{95}\right)^{365/50} - 1 = .454, \text{ or } 45.4\%$$
Credit Instruments

- Terminology
  - open account
  - promissory note
  - commercial draft
  - sight draft
  - time draft
  - trade acceptance
  - banker’s acceptance
Credit Analysis - Procedure to determine the likelihood a customer will pay its bills.

- Credit agencies, such as Dun & Bradstreet provide reports on the credit worthiness of a potential customer.

- Financial ratios can be calculated to help determine a customer’s ability to pay its bills.
Credit Analysis

Numerical Credit Scoring categories

- The customer’s character
- The customer’s capacity to pay
- The customer’s capital
- The collateral provided by the customer
- The condition of the customer’s business
Credit Analysis

Multiple Discriminant Analysis - A technique used to develop a measurement of solvency, sometimes called a Z Score. Edward Altman developed a Z Score formula that was able to identify bankrupt firms approximately 95% of the time.
Multiple Discriminant Analysis - A technique used to develop a measurement of solvency, sometimes called a Z Score. Edward Altman developed a Z Score formula that was able to identify bankrupt firms approximately 95% of the time.

Altman Z Score formula

\[
Z = 3.3 \frac{EBIT}{total\ assets} + 1.0 \frac{sales}{total\ assets} + 0.6 \frac{market\ value\ of\ equity}{total\ book\ debt} + 1.4 \frac{retained\ earnings}{total\ assets} + 1.2 \frac{working\ capital}{total\ assets}
\]
Example - If the Altman Z score cut off for a credit worthy business is 2.7 or higher, would we accept the following client?
Example - If the Altman Z score cut off for a creditworthy business is 2.7 or higher, would we accept the following client?

\[
\begin{align*}
\frac{\text{EBIT}}{\text{total assets}} &= 1.2 \\
\frac{\text{sales}}{\text{total assets}} &= 1.4 \\
\frac{\text{market equity}}{\text{book debt}} &= 9 \\
\frac{\text{retained earnings}}{\text{total assets}} &= 4 \\
\frac{\text{working capital}}{\text{total assets}} &= 12
\end{align*}
\]
Credit Analysis

Example - If the Altman Z score cut off for a credit worthy business is 2.7 or higher, would we accept the following client?

Firm's Z Score

\[(3.3 \times 1.2) + (1.0 \times 1.4) + (0.6 \times 0.9) + (1.4 \times 4) + (1.2 \times 12) = 3.04\]

A score above 2.7 indicates good credit.
Credit Analysis

- Credit analysis is only worth while if the expected savings exceed the cost.
  - Don’t undertake a full credit analysis unless the order is big enough to justify it.
  - Undertake a full credit analysis for the doubtful orders only.
Credit Policy - Standards set to determine the amount and nature of credit to extend to customers.

- Extending credit gives you the probability of making a profit, not the guarantee. There is still a chance of default.
- Denying credit guarantees neither profit or loss.
The credit decision and its probable payoffs

- Offer credit
- Refuse credit
The Credit Decision

The credit decision and its probable payoffs

- Offer credit
  - Customer pays = p
  - Customer defaults = 1-p
- Refuse credit
  - Payoff = 0
The credit decision and its probable payoffs

- Offer credit
  - Customer pays = \( p \)
    - Payoff = \( \text{Rev} - \text{Cost} \)
  - Customer defaults = \( 1-p \)
    - Payoff = - Cost

- Refuse credit
  - Payoff = 0
Based on the probability of payoffs, the expected profit can be expressed as:
The Credit Decision

- Based on the probability of payoffs, the expected profit can be expressed as:

\[ p \times PV(Rev - Cost) - (1 - p) \times (PV(cost)) \]
The Credit Decision

- Based on the probability of payoffs, the expected profit can be expressed as:

\[ p \times PV(Rev - Cost) - (1 - p) \times (PV(cost)) \]

- The break even probability of collection is:

\[ p = \frac{PV(Cost)}{PV(Rev)} \]
Collection Policy - Procedures to collect and monitor receivables.

Aging Schedule - Classification of accounts receivable by time outstanding.
## Collection Policy

### Sample aging schedule for accounts receivable

<table>
<thead>
<tr>
<th>Customer's Name</th>
<th>Amount Yet Due</th>
<th>1 Month Overdue</th>
<th>More than 1 Month Overdue</th>
<th>Total Owed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha</td>
<td>10,000</td>
<td>0</td>
<td>0</td>
<td>10,000</td>
</tr>
<tr>
<td>Beta</td>
<td>0</td>
<td>0</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Omega</td>
<td>5,000</td>
<td>4,000</td>
<td>21,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Total</td>
<td>$200,000</td>
<td>$40,000</td>
<td>$58,000</td>
<td>$298,000</td>
</tr>
</tbody>
</table>
Cash Management

Chapter 31
Topics Covered

- Inventories and Cash Balances
- Cash Collection and Disbursement Systems
  - Float
- Bank Relations
**Economic Order Quantity** - Order size that minimizes total inventory costs.

\[
\text{Economic Order Quantity} = \sqrt{\frac{2 \times \text{annual sales} \times \text{cost per order}}{\text{carrying cost}}}
\]
Inventories & Cash Balances

Determination of optimal order size

- **Inventory costs, dollars**
- **Total costs**
- **Carrying costs**
- **Total order costs**

Optimal order size vs. Order size graph
The optimal amount of short term securities sold to raise cash will be higher when annual cash outflows are higher and when the cost per sale of securities is higher. Conversely, the initial cash balance falls when the interest is higher.

Initial cash balance = \[ \sqrt{\frac{2 \times \text{annual cash outflows} \times \text{cost per sale of securities}}{\text{interest rate}}} \]
Money Market - market for short term financial assets.

- commercial paper
- certificates of deposit
- repurchase agreements
Inventories & Cash Balances

Value of bills sold = \( Q = \)

\[ \sqrt{\frac{2 \times \text{annual cash disbursement} \times \text{cost per sale}}{\text{interest rate}}} = \]

\[ \sqrt{\frac{2 \times 1260 \times 20}{.08}} = 25 \]
Float

- Time exists between the moment a check is written and the moment the funds are deposited in the recipient’s account.
- This time spread is called *Float*.

**Payment Float** - Checks written by a company that have not yet cleared.

**Availability Float** - Checks already deposited that have not yet cleared.
Float

Payment Float illustration - The company issues a $200,000 check that has not yet cleared.
Payment Float illustration - The company issues a $200,000 check that has not yet cleared.

<table>
<thead>
<tr>
<th>Company’s ledger balance</th>
<th>+</th>
<th>Payment float</th>
</tr>
</thead>
<tbody>
<tr>
<td>$800,000</td>
<td></td>
<td>$200,000</td>
</tr>
</tbody>
</table>
**Payment Float illustration** - The company issues a $200,000 check that has not yet cleared.

Company’s ledger balance + Payment float

$800,000 + $200,000 = $1,000,000

Bank’s ledger balance

$1,000,000
Float

**Availability Float illustration** - The company deposits a $100,000 check that has not yet cleared.
**Availability Float illustration** - The company deposits a $100,000 check that has not yet cleared.

<table>
<thead>
<tr>
<th>Company’s ledger balance</th>
<th>+</th>
<th>Payment float</th>
</tr>
</thead>
<tbody>
<tr>
<td>$900,000</td>
<td></td>
<td>$200,000</td>
</tr>
</tbody>
</table>
**Float**

**Availability Float illustration** - The company deposits a $100,000 check that has not yet cleared.

- The company deposits a $100,000 check that has not yet cleared.

  - Company’s ledger balance: $900,000
  - Payment float: $200,000

  \[ \text{Company’s ledger balance} + \text{Payment float} = \text{Bank’s ledger balance} \]

  \[ \text{equals} \]

  \[ \text{Bank’s ledger balance} = $1,100,000 \]
Float

Net Float illustration

Net float = payment float - availability float
Float

Net Float illustration

Net float = payment float - availability float

Bank’s ledger balance

$1,100,000
Float

Net Float illustration

Net float = payment float - availability float

Bank’s ledger balance

$1,100,000

equals

Available balance + Availability float

$1,000,000 + $100,000
Managing Float

- Payers attempt to create delays in the check clearing process.
- Recipients attempt to remove delays in the check clearing process.

- Sources of delay
  - Time it takes to mail check
  - Time for recipient to process check
  - Time for bank to clear check
Managing Float

Check mailed
Managing Float

- Check mailed
  - Mail float
- Check received
Managing Float

Check mailed

Check received

Check deposited

Mail float

Processing float
Managing Float

- Check mailed
  - Mail float
  - Processing float
  - Availability float
    - Cash available to recipient
  - Presentation float
    - Check charged to payer’s account

Check received
Check deposited
Managing Float

**Concentration Banking** - system whereby customers make payments to a regional collection center which transfers the funds to a principal bank.

**Lock-Box System** - System whereby customers send payments to a post office box and a local bank collects and processes checks.

**Zero-Balance Accounts** - Regional bank accounts to which just enough funds are transferred daily to pay each day’s bills.
Topics Covered

- Short-Term Lending
- Money Market Instruments
- Floating Rate Preferred Stock
- Short Term Borrowing
Sources of Short Term Financing

- Money Markets
- Commercial paper
- Secured loans
- Eurodollars
Cost of Short-Term Loans

Simple Interest

\[ \text{Amount of loan} \times \frac{\text{annual interest rate}}{\text{number of periods in the year}} \]
Cost of Short-Term Loans

Simple Interest

Amount of loan \times \frac{\text{annual interest rate}}{\text{number of periods in the year}}

Effective annual rate

\left(1 + \frac{\text{quoted annual interest rate}}{n}\right)^n - 1
Cost of Short-Term Loans

Discount Interest

Face value of loan \( X \left( 1 - \frac{\text{quoted annual interest rate}}{\text{number of periods in the year}} \right) \)
Calculating Yields

Example

In January of 1999, 91-day T-bills were issued at a discount of 4.36%.

1. Price of bill = 100 - 91/360 x 4.36 = 98.898
2. 91-day return = (100 - 98.898) / 98.898 = 1.11%
3. Annual return = 1.11 x 365/91 = 4.47% simple interest
   
   or

   \[(1.0111)^{365/91} - 1 = 4.55\% \text{ compound interest}\]
Money Market Investments

- US Treasury Bills
- Federal Agency Securities
- Short-Term Tax-Exempts
- Bank Time Deposits and CDs
- Commercial Paper
- Medium Term Notes
- Bankers’ Acceptances
- Repos
Credit Rationing

*Example* - Henrietta Ketchup

<table>
<thead>
<tr>
<th>Investments</th>
<th>Payoff</th>
<th>Prob. of Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1</td>
<td>-12</td>
<td>15</td>
</tr>
</tbody>
</table>
| Project 2   | -12     | 24 or 0         | .5 or .5
Credit Rationing

*Example* - Henrietta Ketchup

<table>
<thead>
<tr>
<th></th>
<th>Expected Payoff to Bank</th>
<th>Expected Payoff to Ms. Ketchup</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project 1</strong></td>
<td>110</td>
<td>15</td>
</tr>
<tr>
<td><strong>Project 2</strong></td>
<td>(.5x10) + (.5x0) = +5</td>
<td>.5 x (24-10) = +7</td>
</tr>
</tbody>
</table>
Credit Rationing

**Example** - Henrietta Ketchup

<table>
<thead>
<tr>
<th>Expected Payoff to Bank</th>
<th>Expected Payoff to Ms. Ketchup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1</td>
<td>5</td>
</tr>
<tr>
<td>Project 2</td>
<td>(.5x5) + (.5x0) = +2.5</td>
</tr>
</tbody>
</table>
Mergers

Chapter 33
Topics Covered

- Sensible Motives for Mergers
- Some Dubious Reasons for Mergers
- Estimating Merger Gains and Costs
- The Mechanics of a Merger
- Takeover Battles
- Mergers and the Economy
# 1997 and 1998 Mergers

<table>
<thead>
<tr>
<th>Selling Company</th>
<th>Acquiring Company</th>
<th>Payment, billions of dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYNEX</td>
<td>Bell Atlantic</td>
<td>21.0</td>
</tr>
<tr>
<td>McDonnell Douglas</td>
<td>Boeing</td>
<td>13.4</td>
</tr>
<tr>
<td>Digital Equipment</td>
<td>Compaq Computer</td>
<td>9.1</td>
</tr>
<tr>
<td>Schweizerischer Energy</td>
<td>Union Bank of Swiz.</td>
<td>23.0</td>
</tr>
<tr>
<td>Group PCC</td>
<td>Texas Utilities</td>
<td>11.0</td>
</tr>
<tr>
<td>Amoco Corp.</td>
<td>British Petroleum</td>
<td>48.2</td>
</tr>
<tr>
<td>Sun America</td>
<td>American Intl.</td>
<td>18.0</td>
</tr>
<tr>
<td>BankAmerica Corp.</td>
<td>Nationsbank Corp.</td>
<td>61.6</td>
</tr>
<tr>
<td>Chrysler</td>
<td>Daimler-Benz</td>
<td>38.3</td>
</tr>
<tr>
<td>Bankers Trust Corp.</td>
<td>Deutsche Bank AG</td>
<td>9.7</td>
</tr>
<tr>
<td>Netscape</td>
<td>America Online</td>
<td>4.2</td>
</tr>
<tr>
<td>Citicorp</td>
<td>Travelers Group Inc.</td>
<td>83.0</td>
</tr>
</tbody>
</table>
Sensible Reasons for Mergers

Economies of Scale

A larger firm may be able to reduce its per unit cost by using excess capacity or spreading fixed costs across more units.

$\rightarrow \text{Reduces costs}\rightarrow$
Sensible Reasons for Mergers

Economies of Vertical Integration

- Control over suppliers “may” reduce costs.
- Over integration can cause the opposite effect.
Sensible Reasons for Mergers

Economies of Vertical Integration

- Control over suppliers “may” reduce costs.
- Over integration can cause the opposite effect.

Pre-integration
(less efficient)
Sensible Reasons for Mergers

Economies of Vertical Integration

- Control over suppliers “may” reduce costs.
- Over integration can cause the opposite effect.

Pre-integration (less efficient)

Post-integration (more efficient)
Combining Complementary Resources

Merging may result in each firm filling in the “missing pieces” of their firm with pieces from the other firm.
Combining Complementary Resources

Merging may result in each firm filling in the “missing pieces” of their firm with pieces from the other firm.
Mergers as a Use for Surplus Funds

If your firm is in a mature industry with few, if any, positive NPV projects available, acquisition may be the best use of your funds.
Dubious Reasons for Mergers

- Diversification
  - Investors should not pay a premium for diversification since they can do it themselves.
Dubious Reasons for Mergers

The Bootstrap Game

Acquiring Firm has high P/E ratio
Dubious Reasons for Mergers

The Bootstrap Game

Acquiring Firm has high P/E ratio

Selling firm has low P/E ratio (due to low number of shares)
Dubious Reasons for Mergers

The Bootstrap Game

- Acquiring Firm has high P/E ratio
- Selling firm has low P/E ratio (due to low number of shares)
- After merger, acquiring firm has short term EPS rise
Dubious Reasons for Mergers

The Bootstrap Game

- Acquiring Firm has high P/E ratio
- Selling firm has low P/E ratio (due to low number of shares)
- After merger, acquiring firm has short term EPS rise
- Long term, acquirer will have slower than normal EPS growth due to share dilution.
Dubious Reasons for Mergers

Earnings per dollar invested (log scale)

- Muck & Slurry
- World Enterprises (before merger)
- World Enterprises (after merger)

Now

Time

0.05
0.067
0.10
Questions

¬ Is there an overall economic gain to the merger?
¬ Do the terms of the merger make the company and its shareholders better off?

\[ \text{PV(AB)} > \text{PV(A)} + \text{PV(B)} \]
Estimating Merger Gains

- Economic Gain

\[
\text{Economic Gain} = \text{PV(}\text{increased earnings}) \\
= \frac{\text{New cash flows from synergies}}{\text{discount rate}}
\]
**Takeover Defenses**

**White Knight** - Friendly potential acquirer sought by a target company threatened by an unwelcome suitor.

**Shark Repellent** - Amendments to a company charter made to forestall takeover attempts.

**Poison Pill** - Measure taken by a target firm to avoid acquisition; for example, the right for existing shareholders to buy additional shares at an attractive price if a bidder acquires a large holding.
Control, Governance, and Financial Architecture

Chapter 34
Topics Covered

- Leveraged Buyouts
- Spin-offs and Restructuring
- Conglomerates
- Private Equity Partnership
- Control and Governance
Definitions

- **Corporate control** -- the power to make investment and financing decisions.
- **Corporate governance** -- the role of the Board of Directors, shareholder voting, proxy fights, etc. and the actions taken by shareholders to influence corporate decisions.
- **Financial architecture** -- the financial organization of the business.
Leveraged Buyouts

- The difference between leveraged buyouts and ordinary acquisitions:

1. A large fraction of the purchase price is debt financed.
2. The LBO goes private, and its share is no longer trade on the open market.
Leveraged Buyouts

- The three main characteristics of LBOs:

1. High debt
2. Incentives
3. Private ownership
## Leveraged Buyouts

### 10 Largest LBOs in 1980s and 1997/98 examples

<table>
<thead>
<tr>
<th>Acquirer</th>
<th>Target</th>
<th>Year</th>
<th>Price ($bil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KKR</td>
<td>RJR Nabisco</td>
<td>1989</td>
<td>$24.72</td>
</tr>
<tr>
<td>KKR</td>
<td>Beatrice</td>
<td>1986</td>
<td>$6.25</td>
</tr>
<tr>
<td>KKR</td>
<td>Safeway</td>
<td>1986</td>
<td>$4.24</td>
</tr>
<tr>
<td>Thompson Co.</td>
<td>Southland</td>
<td>1987</td>
<td>$4.00</td>
</tr>
<tr>
<td>AV Holdings</td>
<td>Borg-Warner</td>
<td>1987</td>
<td>$3.76</td>
</tr>
<tr>
<td>Wing Holdings</td>
<td>NWA, Inc.</td>
<td>1989</td>
<td>$3.69</td>
</tr>
<tr>
<td>KKR</td>
<td>Owens-Illinois</td>
<td>1987</td>
<td>$3.69</td>
</tr>
<tr>
<td>TF Investments</td>
<td>Hospital Corp of America</td>
<td>1989</td>
<td>$3.69</td>
</tr>
<tr>
<td>FH Acquisitions</td>
<td>For Howard Corp.</td>
<td>1988</td>
<td>$3.59</td>
</tr>
<tr>
<td>Macy Acquisition Corp.</td>
<td>RH Macy &amp; Co</td>
<td>1986</td>
<td>$3.50</td>
</tr>
<tr>
<td>Bain Capital</td>
<td>Sealy Corp.</td>
<td>1997</td>
<td>$811.20</td>
</tr>
<tr>
<td>Citicorp Venture Capital</td>
<td>Neenah Corp.</td>
<td>1997</td>
<td>$250.00</td>
</tr>
<tr>
<td>Cyprus Group (w/mgmt)</td>
<td>WESCO Distribution Inc.</td>
<td>1998</td>
<td>$1,100.00</td>
</tr>
<tr>
<td>Clayton, Dublier &amp; Rice</td>
<td>North Maerican Van Lines</td>
<td>1998</td>
<td>$200.00</td>
</tr>
<tr>
<td>Clayton, Dublier &amp; Rice</td>
<td>Dynatech Corp.</td>
<td>1998</td>
<td>$762.90</td>
</tr>
<tr>
<td>Kohlberg &amp; Co. (w/mgmt)</td>
<td>Helley Performance Products</td>
<td>1998</td>
<td>$100.00</td>
</tr>
</tbody>
</table>
Spin-offs, etc.

- **Spin off** -- debut independent company created by detaching part of a parent company's assets and operations.
- **Carve-outs** -- similar to spin offs, except that shares in the new company are not given to existing shareholders but sold in a public offering.
- **Privatization** -- the sale of a government-owned company to private investors.
Privatization

Motives for *Privatization*:

1. Increased efficiency
2. Share ownership
3. Revenue for the government
# Privatization

## Examples of Privatization

<table>
<thead>
<tr>
<th>Country</th>
<th>Company and Date</th>
<th>Amount Issued, $ millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>St. Gobain (1986)</td>
<td>$2,091.40</td>
</tr>
<tr>
<td>France</td>
<td>Paribas (1987)</td>
<td>$2,742.00</td>
</tr>
<tr>
<td>Germany</td>
<td>Volkswagon (1961)</td>
<td>$315.00</td>
</tr>
<tr>
<td>Jamaica</td>
<td>Caribbean Cement (1987)</td>
<td>$45.60</td>
</tr>
<tr>
<td>Japan</td>
<td>Japan Airlines (1987)</td>
<td>$2,600.00</td>
</tr>
<tr>
<td>Mexico</td>
<td>Telefonos de Mexico (1990)</td>
<td>$3,760.00</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Air New Zealand (1989)</td>
<td>$99.10</td>
</tr>
<tr>
<td>Singapore</td>
<td>Neptune Orient Lines (1981-1988)</td>
<td>$308.50</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>British Gas (1986)</td>
<td>$8,012.00</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>BAA (Airports)(1987)</td>
<td>$2,028.00</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>British Steel (1988)</td>
<td>$4,524.00</td>
</tr>
<tr>
<td>United States</td>
<td>Conrail (1987)</td>
<td>$1,650.00</td>
</tr>
</tbody>
</table>
### Conglomerates

The largest US conglomerates in 1979

<table>
<thead>
<tr>
<th>Sales Rank</th>
<th>Company</th>
<th>Number of Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>ITT</td>
<td>38</td>
</tr>
<tr>
<td>15</td>
<td>Tenneco</td>
<td>28</td>
</tr>
<tr>
<td>42</td>
<td>Gulf &amp; Western Industries</td>
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<td>Colt Industries</td>
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Private Equity Partnership

**Investment Phase**
- General Partner put up 1% of capital
- Limited partners put in 99% of capital
- Investment in diversified portfolio of companies
- Mgmt fees

**Payout Phase**
- General Partner get carried interest in 20% of profits
- Limited partners get investment back, then 80% of profits
- Sale or IPO of companies

**Partnership**
- Company 1
- Company 2
- Company N
Conclusion: What We Do and Do Not Know about Finance
Topics Covered

- What We Do Know
- What We Do Not Know
7 Most Important Ideas in Finance

- Net Present Value
- Capital Asset Pricing Model (CAPM)
- Efficient Capital Markets
- Value Additivity & Law Conservation of Value
- Capital Structure Theory
- Option Theory
- Agency Theory
10 Unsolved Problems In Finance

- How major decisions are made?
- What determines project risk and PV?
- Risk and return - What have we missed?
- How important are the exceptions to the Efficient Market Theory?
- Is management an off-balance-sheet liability?
10 Unsolved Problems In Finance

- How can we explain the success of new markets and new securities?
- How can we resolve the dividend controversy?
- What risks should a firm take?
- What is the value of liquidity?