WHY FINANCE MATTERS

TWO FINANCIAL DECISIONS
INVESTMENT OR CAPITAL BUDGETING
WHAT TO INVEST IN
FINANCING
HOW TO PAY FOR IT

SUCCESS IS JUDGED IN TERMS OF VALUE
The flow of cash

FINANCIAL DECISION MAKING

• Theory vs. Cases
  – An example from the pool hall

• Assumptions
  – The building blocks of theories- language
  – Judged by logical consistency- not realism

• Theories
  – Hypotheses, implications ... judged by accuracy of predictions
FINANCIAL DECISION MAKING

- The science vs. the art of finance
- Positive vs. normative economics
  - An example: the minimum wage debate

THE GOAL OF THE FIRM

- MAXIMIZE PROFITS?
  Problem: Ignores timing and uncertainty

MAXIMIZE SHAREHOLDERS’ WEALTH
The concept of wealth

- Who is wealthier?
  Fife: Has $100,000 in bank and expects no future income... or
  Rose: Has nothing in the bank, but expects $150,000 in 3 years
- Is the goal of zero profits for 5 years ever consistent with wealth maximization?
- Need to consider risk and the time value of money

Consider a different question:
- Does the objective of wealth maximization ever conflict with the objective that firms act in a socially responsible manner?
  or...
  Should firms go past the point of wealth maximization in being socially responsible?

A case to consider:
- Should a chemical company voluntarily clean up a local river?
What do managers actually do?
• Managers are rational “utility maximizers”
• Leads to “agency problem”
  – Managers are agents of shareholders’
• Agency problem more severe with advent of corporations
  • 1. Owner-managed firm
  • 2. Single owner-not manager
  • 3. Many owners-single manager
• How are managers kept in line?

THE CONTRACT VIEW OF THE FIRM

STOCKHOLDERS  MANAGERS
BONDHOLDERS  CUSTOMERS
SUPPLIERS  GOVERNMENT

A Nexus of Contracts
Present value, rate of return and opportunity cost of capital

To Build or Not to Build: A Sports Bar

- Lot next to proposed baseball stadium is worth $50,000
- If built, a sports bar would be worth $400,000 in one year
- Will cost $300,000 to build
Plot the relevant cash flows on a timeline:

Should we build?

Build if the present value of $400,000 (delivered next year) is greater than $350,000
PRESENT VALUE

• Basic principle:
  A dollar today is worth more than a dollar tomorrow

Why?
Because, a dollar today can be invested to earn interest and therefore will be worth more than one dollar tomorrow

Present value of cash in period one
• Present value = Discount factor x C₁
  – where C₁ = cash flow in period 1
• Discount factor = 1 / (1+r)
  – where r is the rate of return investors demand for accepting delayed payment
• Rate of return also referred to as the:
  discount rate, hurdle rate, or opportunity cost of capital
What discount rate should we use for the sports bar?

- Assume investment is a sure thing (no risk)
- US T-Bills are also risk-free and currently pay 7%
- Thus, the appropriate discount rate is 7%

How much would you have to invest in US government T-Bills (which pay 7%) to get $400,000 a year from now?
After committing the land and beginning construction, how much could you sell the project for?

More generally, the formula for net present value can be written as:

$$\text{NPV} = C_0 + \frac{C_1}{1+r}$$

Note that $C_0$, the cash flow at time 0, is typically negative and therefore a cash outflow.

$$\text{NPV} = -350,000 + \frac{400,000}{1.07}$$
$$= $23,832$$
Financing the investment: A preview

Suppose you borrow $300,000 to build the bar
What rate would the bondholder demand? How much would you have to repay next period?

\[ 300,000 \times 1.07 = 321,000 \]

Discussion Question

What’s the affect on your NPV?
What is the bondholder’s NPV?

1. Recalculate your net outlay in period 0 and net inflow in period 1 and refigure your NPV.
2. Determine the bondholder’s cash flows in periods 0 and 1 and calculate the bondholder’s NPV?
3. Explain your answers to 1 and 2. (what’s going on?)
NPV = Change in Wealth

- Wealth = PV of current and future income
  - Who is wealthier?
    - Individual A: $0 today; $100,000 next period
    - Individual B: $50,000 today; $0 next period
- Giving up $350,000 today for $400,000 next period increases wealth by $23,832

A few comments on risk

- Unrealistic assumption that sports bar investment is risk-free
- Another basic principle: A safe dollar is worth more than a risky dollar
- Discounting is still appropriate, but investors will use a higher rate
How does risk affect our decision whether to build the sports bar?

- Assume that the risk is equivalent to an investment in the stock market which is currently expected to pay 12%
- Thus, 12% is the appropriate opportunity cost of capital
- \[ \text{PV} = \frac{400,000}{1.12} = 357,143 \]
- \[ \text{NPV} = 357,143 - 350,000 = 7143 \]
- Project still adds value, but smaller than our earlier calculations
Present value and rates of return

- Return = profit / investment
  = (400,000 - 350,000) / 350,000
  = 14.3%

- In both cases, the project was worth taking because the return exceeded the opportunity cost of capital

Two equivalent decision rules for capital investments

Net present value rule:
Accept all investments that have positive net present values

Rate-of-return rule:
Accept all investments that offer rates of return in excess of their opportunity costs of capital
How to calculate present values

Back to the future

Discounted Cash Flow Analysis
(Time Value of Money)

• Discounted Cash Flow (DCF) analysis is the foundation of valuation in corporate finance

• To use DCF we need to know three things
  • The size of the expected cash flows
  • The timing of the cash flows
  • The proper discount (interest) rate

• DCF allows us to compare the values of alternative cash flow streams in dollars today (Present Value)
FUTURE VALUE
(COMPOUNDING):
What will $100 grow to after 1 year at 10% ?

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<td>0</td>
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<tbody>
<tr>
<td>-100</td>
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</table>

interest 10
end of period value 110

FV_1 = PV_0 (1+r) = 100 (1.1) = 110
where FV_1 is the future value in period 1
PV_0 is the present value in period 0 (today)

NOTE: When r=10%, $100 received now (t=0) is equivalent to $110 received in one year (t=1).

What will $100 grow to after 2 years at 10% ?

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<tbody>
<tr>
<td>0</td>
<td>10%</td>
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<tbody>
<tr>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

interest 10 11
end of period value 110 121

FV_2 = PV_0 (1+r) (1+r) = PV_0 (1+r)^2
= 100 (1.1)^2 = 100 (1.21) = 121

NOTE: $100 received now (t=0) is equivalent to $110 received in one year (t=1) which is also equivalent to $121 in 2 years (t=2).
The general formula for future value in year N (FV$_N$)

\[ FV_N = PV_0 (1+r)^N \]

What will $100 grow to after 8 years at 6%?

What is the present value of $159.40 received in 8 years at 6%?

Or

How much would you have to invest today at 6% in order to have $159.40 in 8 years?

<table>
<thead>
<tr>
<th>Year</th>
<th>5%</th>
<th>10%</th>
<th>15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.050</td>
<td>1.100</td>
<td>1.150</td>
</tr>
<tr>
<td>2</td>
<td>1.103</td>
<td>1.210</td>
<td>1.323</td>
</tr>
<tr>
<td>5</td>
<td>1.276</td>
<td>1.331</td>
<td>2.011</td>
</tr>
<tr>
<td>10</td>
<td>1.629</td>
<td>2.594</td>
<td>4.046</td>
</tr>
<tr>
<td>20</td>
<td>2.653</td>
<td>6.727</td>
<td>16.37</td>
</tr>
</tbody>
</table>

Future value of $1
PRESENT VALUE IS THE RECIPROCAL OF FUTURE VALUE:

\[ PV_0 = \frac{FV_N}{(1+r)^N} \]

Note: Brealey & Myers refer to \(1/(1+r)^N\) as a “discount factor”.

The discount factor for 8 years at 6% is

\[ \frac{1}{(1+.06)^8} = 0.627 \]

Thus, the present value of $1.00 in 8 years at 6% is $0.627.

What’s the present value of $50 in 8 years?
PRESENT VALUE PROBLEMS
Which would you prefer at \( r=10\% \)?
$1000 \text{ today vs. }$2000 \text{ in 10 years}

There are 4 variables in the analysis
PV, FV, N, and \( r \)

Given three, you can always solve for the other
Four related questions:

2.1. How much must you deposit today to have $1 million in 25 years? (r=0.12)

2.2. If a $58,820 investment yields $1 million in 25 years, what is the rate of interest?

2.3. How many years will it take $58,820 to grow to $1 million if r=0.12?

2.4. What will $58,820 grow to after 25 years if r=0.12?

Present Value Of An Uneven Cash Flow Stream

• In general, the present value of a stream of cash flows can be found using the following general valuation formula.

\[ PV = \frac{C_1}{(1+r_1)} + \frac{C_2}{(1+r_2)^2} + \frac{C_3}{(1+r_3)^3} + \ldots + \frac{C_N}{(1+r_N)^N} \]

\[ = \sum_{i=1}^{N} \frac{C_i}{(1+r_i)^i} \]

• In other words, discount each cash flow back to the present using the appropriate discount rate and then sum the present values.
Example

<table>
<thead>
<tr>
<th>year</th>
<th>A</th>
<th>PV</th>
<th>B</th>
<th>PV</th>
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<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>92.59259</td>
<td>300</td>
<td>277.7778</td>
</tr>
<tr>
<td>2</td>
<td>400</td>
<td>342.9355</td>
<td>400</td>
<td>342.9355</td>
</tr>
<tr>
<td>3</td>
<td>400</td>
<td>317.5329</td>
<td>400</td>
<td>317.5329</td>
</tr>
<tr>
<td>4</td>
<td>400</td>
<td>294.0119</td>
<td>400</td>
<td>294.0119</td>
</tr>
<tr>
<td>5</td>
<td>300</td>
<td>204.175</td>
<td>100</td>
<td>68.05832</td>
</tr>
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</table>

Present Value 1251.248 1300.316

Who got the better contract? Emmitt or Thurman?

<table>
<thead>
<tr>
<th></th>
<th>93</th>
<th>94</th>
<th>95</th>
<th>96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thurman</td>
<td>4</td>
<td>2.7</td>
<td>2.7</td>
<td>4.1</td>
</tr>
<tr>
<td>Emmitt</td>
<td>7</td>
<td>2.2</td>
<td>2.4</td>
<td>2</td>
</tr>
</tbody>
</table>
PERPETUITIES
Offer a fixed annual payment (C) each year in perpetuity.

\[
\begin{array}{ccc}
C & C & C \\
0 & 1 & 2 & 3 & \ldots
\end{array}
\]

How do you determine present value?

\[
PV = \frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \ldots
\]

Fortunately, a simple formula

\[
PV_0 \text{ of a perpetuity} = \frac{C}{r}
\]

An example

Perpetuity: $100 per period forever discounted at 10% per period

\[
\begin{array}{ccc}
100 & 100 & 100 \\
0 & 1 & 2 & 3 & \ldots
\end{array}
\]

… and some intuition

Consider a $1000 deposit in a bank account that pays 10% per year.
GROWING PERPETUITIES
Annual payment grows at a constant rate, g.

\[
\begin{array}{c|c|c|c}
0 & 1 & 2 & 3 \\
C & C(1+g) & C(1+g)^2 & \ldots
\end{array}
\]

How do you determine present value?

\[
PV = \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \ldots
\]

Fortunately, a simple formula

\[
PV_0 \text{ of a growing perpetuity} = \frac{C_1}{(r-g)}
\]

An example

Growing perpetuity: $100 received at time t = 1,
growing at 2% per period with a discount rate of 10%
An example

An investment in a growing perpetuity costs $5000 and is expected to pay $200 next year. If the interest rate is 10%, what is the growth rate of the annual payment?

Annuities

- An annuity is a series of equal payments (PMT on your calculator) made at fixed intervals for a specified number of periods
  - e.g., $100 at the end of each of the next three years
- If payments occur at the end of each period it is an ordinary annuity--(This is most common)
- If payments occur at the beginning of each period it is an annuity due
Annuitities

• The present value of an ordinary annuity that pays a cash flow of \( C \) per period for \( T \) periods when the discount rate is \( r \) is

\[
PV = C\left(\frac{1}{r} - \frac{1}{r(1+r)^T}\right)
\]

Annuites

■ A \( T \)-period annuity is equivalent to the difference between two perpetuities. One beginning at time zero, and one with first payment at time \( T+1 \).

\[
PV = C \left( \frac{1}{r} - \frac{1}{r} \right) = C \left( \frac{1}{r} - \frac{1}{r(1+r)^T} \right)
\]
Example

• Compute the present value of a 3 year ordinary annuity with payments of $100 at r=10%
• Answer:

\[
PVA_3 = 100 \frac{1}{1.1} + 100 \frac{1}{1.1^2} + 100 \frac{1}{1.1^3} = $248.68
\]

Or

\[
PVA_3 = 100 \left( \frac{1}{0.1} - \frac{1}{0.1(1.1)^3} \right) = $248.68
\]

What is the relation between a lump sum cash flow and an annuity?

• What is the present value of an annuity that promises $2000 per year for 5 years at r=5%?

<table>
<thead>
<tr>
<th>year</th>
<th>PMT</th>
<th>PV (t=0)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>2,000.00</td>
<td>1,904.76</td>
</tr>
<tr>
<td>2</td>
<td>2,000.00</td>
<td>1,814.06</td>
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<tr>
<td>3</td>
<td>2,000.00</td>
<td>1,727.68</td>
</tr>
<tr>
<td>4</td>
<td>2,000.00</td>
<td>1,645.40</td>
</tr>
<tr>
<td>5</td>
<td>2,000.00</td>
<td>1,567.05</td>
</tr>
</tbody>
</table>

\[
PVA_3 = 2000 \left( \frac{1}{0.05} - \frac{1}{0.05(1.05)^3} \right) = $8658.95
\]
• Alternatively, suppose you were given $8,658.95 today instead of the annuity

<table>
<thead>
<tr>
<th>year</th>
<th>principal</th>
<th>interest</th>
<th>PMT</th>
<th>Ending Bal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$8,658.95</td>
<td>$432.95</td>
<td>$(2,000.00)</td>
<td>$7,091.90</td>
</tr>
<tr>
<td>2</td>
<td>$7,091.90</td>
<td>$354.60</td>
<td>$(2,000.00)</td>
<td>$5,446.50</td>
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<tr>
<td>3</td>
<td>$5,446.50</td>
<td>$272.32</td>
<td>$(2,000.00)</td>
<td>$3,718.82</td>
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<tr>
<td>4</td>
<td>$3,718.82</td>
<td>$185.94</td>
<td>$(2,000.00)</td>
<td>$1,904.76</td>
</tr>
<tr>
<td>5</td>
<td>$1,904.76</td>
<td>$95.24</td>
<td>$(2,000.00)</td>
<td>$0.00</td>
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</table>

• Notice that you can duplicate the cash flows from the annuity by investing your money from the lump sum to earn the required rate of return (5% in this example).

A Net Present Value Problem
What is the value today of a 10-year annuity that pays $300 a year (at year-end) if the annuity’s first cash flow starts at the end of year 6 and the interest rate is 10%?
Other Compounding Intervals

Cash flows are often compounded over periods other than annually

- Consumer loans are compounded monthly
- Bond coupons are received semiannually

<table>
<thead>
<tr>
<th>Compounding Interval</th>
<th>Annual Factor</th>
<th>Semi-Annual Factor</th>
<th>Quarterly Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual:</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>110.00</td>
<td></td>
</tr>
<tr>
<td>Semi-Annual:</td>
<td>.5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Quarterly:</td>
<td>.25 .5 .75</td>
<td>1</td>
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Compounding
Example

- Find the PV of $500 received in the future under the following conditions.
- 12% nominal rate, semiannual compounding, 5 years

\[
PV = \frac{500}{\left(1 + \frac{0.12}{2}\right)^{10}} = \$279.20
\]

- 12% nominal rate, quarterly compounding, 5 years

\[
PV = \frac{500}{\left(1 + \frac{0.12}{4}\right)^{20}} = \$276.84
\]

Future value of $1.00 in N years when interest is compounded M times per year

\[
FV_N = (1 + \frac{r}{M})^{MN}
\]

*Continuous compounding:*

As M approaches infinity...

\[
\ldots (1 + \frac{r}{M})^{MN} \text{ approaches } e^{rN}
\]

where \( e = 2.718 \)

**Example:** The future value of $100 continuously compounded at 10% for one year is

\[
100 \times e^{0.10} = 110.52
\]
Summary

• Discounted cash flow analysis is the foundation for valuing assets
• To use DCF you need to know three things
  – Size of expected cash flows
  – Timing of cash flows
  – Discount rate (reflects the risk of cash flows)
• When valuing a stream of cash flows, search for components such as annuities that can be easily valued
• Compare different streams of cash flows in common units using present value

Valuing Stocks and Bonds

An application of discounted cash flow analysis
Valuing an 8% 4-year Treasury bond

- The bond has a coupon rate of 8%, a face value of $1000 and a maturity of 4 years.
- Each year you receive an interest payment of $0.08 \times 1000 = $80.
- In the year the bond matures you receive the final $80 interest payment and the $1000 face value.

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<td>3</td>
<td>4</td>
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</table>

Determine PV of bond’s cash flows

Suppose that similar risk investments offer a 9% return.

PV =

- Note that the bond can be valued in two pieces:
  - Annuity of $80 per year for four years.
  - Lump sum of $1000 at the end of 4 years

Alternative question: If the bond sells for $967.60, what return do investors expect? Yield to maturity and internal rate of return.
Valuing a semiannual coupon bond

In practice Treasuries make semi-annual payments.

- Two Pieces:
  - Annuity of C/2 for 2N periods where C is total annual coupon payment.
  - Lump sum of F (face value) received at the end of 2N periods.

\[
P_0 = \frac{C}{2} \left[ \frac{1}{r/2} - \frac{1}{(r/2)(1 + r/2)^{2N}} \right] + \frac{F}{(1 + r/2)^{2N}}
\]

Valuing a semiannual coupon bond:
An example

- Dupont issued 30 year maturity bonds with a coupon rate of 7.95%. These bonds currently have 28 years remaining to maturity and are rated AA.
- Newly issued AA bonds with maturities greater than 10 years are currently yielding 7.73%. The bonds have a par value of $1000.
- What is the value of a Dupont bond today?
Dupont example (continued)

• Annual coupon payment=0.0795*$1000=$79.50
• Semiannual coupon payment=$39.75
• Semiannual discount rate=0.0773/2=0.03865
• Number of semiannual periods=28*2=56

\[ P_0 = 39.75 \left[ \frac{1}{0.03865} - \frac{1}{(0.03865)(1+0.03865)^{56}} \right] + \frac{1000}{(1+0.03865)^{56}} = $1025.06 \]

The effect of changes in interest rates on bond prices

• Consider two identical 8% coupon bonds except that one matures in 4 years, the other matures in 10 years.
• Calculate the change in the price of each bond if interest rates fall from 8% to 6%.
• Compare and discuss the relative price changes.
Stock valuation terminology

- $D_t$ or $\text{Div}_t$ = expected dividend at time $t$
- $P_0$ = market price of stock today (time 0)
- $P_t$ = expected price of stock at time $t$
- $g$ = expected growth rate of dividends
- $r_s$ = required rate of return
- $D_1 / P_0$ = expected one-year dividend yield
- $(P_1 - P_0) / P_0$ = expected one-year capital gain

Valuing common stock

- As noted previously, the return on a share of stock is given by:
  \[ r_s = \frac{\text{Div}_1 + P_1 - P_0}{P_0} \]
- Suppose that investors require a rate of return of $r_s$ to hold the stock. The price an investor would be willing to pay is:
  \[ P_0 = \frac{\text{Div}_1 + P_1}{1 + r_s} \]
  where $\text{Div}_1$ is the expected dividend and $P_1$ is the expected price of the stock in period 1.
Common stock valuation (continued)

• What determines $P_1$?
• An investor purchasing the stock at time 1 and holding it until time 2 would be willing to pay:

$$P_1 = \frac{\text{Div}_2 + P_2}{1 + r_s}$$

• Substituting into the equation for $P_0$, the price at time zero is:

$$P_0 = \frac{\text{Div}_1}{1 + r_s} + \frac{1}{1 + r_s} \cdot \frac{\text{Div}_2 + P_2}{1 + r_s}$$

Common stock valuation (continued)

• This process can be repeated into the future, for example, to period $H$, so that:

$$P_0 = \frac{\text{Div}_1}{(1 + r_s)^1} + \frac{\text{Div}_2}{(1 + r_s)^2} + \frac{\text{Div}_3}{(1 + r_s)^3} + \cdots + \frac{\text{Div}_H + P_H}{(1 + r_s)^H}$$

$$= \sum_{t=1}^{H} \frac{\text{Div}_t}{(1 + r_s)^t} + \frac{P_H}{(1 + r_s)^H}$$

• What happens to the last term as the time horizon gets long ($H$ approaches infinity)?
Dividend valuation model

• As $H$ approaches infinity the last term goes to zero…

$$P_0 = \frac{\text{Div}_1}{(1 + r_s)} + \frac{\text{Div}_2}{(1 + r_s)^2} + \frac{\text{Div}_3}{(1 + r_s)^3} + \cdots + \frac{\text{Div}_H + X}{(1 + r_s)^H}$$

$$= \sum_{t=1}^{H} \frac{D_{iv_1}}{(1 + r_s)^t}$$

• The resulting Dividend Valuation Model posits that the price of a stock is equal to the present value of the stream of expected future dividends.

Constant dividend growth

• If the dividend payments on a stock are expected to grow at a constant rate, $g$, and the discount rate is $r_s$, the value of the stock at time 0 is:

$$P_0 = \frac{\text{Div}_1}{r_s - g}$$

• $g$ must be less than $r_s$ to use this formula
• If $g = 0$, the formula reduces to the perpetuity formula
Dividend valuation example

• Geneva steel just paid a dividend of $2.10. Geneva’s dividend payments are expected to grow at a constant rate of 6%. The appropriate discount rate is 12%. What is the price of Geneva Stock?
• Div$_0$ = $2.10  \quad$ Div$_1$ = $2.10(1.06) = $2.226

\[ P_0 = \frac{\text{Div}_1}{r_s - g} = \frac{$2.226}{0.12 - 0.06} = $37.10 \]

Estimating the capitalization rate

The growing perpetuity formula that explains price...

\[ P_0 = \frac{\text{Div}_1}{r_s - g} \]

… can be rearranged to get an estimate of $r$

\[ r_s = \frac{\text{Div}_1}{P_0} + g \]

The market capitalization rate equals the dividend yield (Div$_1/P_0$) plus the expected rate of growth on dividends (g).
Estimating the capitalization rate of Sears

- In early 1986 Sears stock was selling for $45 per share. Dividend payments for 1986 were expected to be $1.76. This implies a dividend yield of .039 or 3.9%.
- Estimating g is trickier. One approach is to start with the payout ratio, the ratio of dividends paid to earnings per share. The payout ratio for Sears has been around 45% of earnings per share (EPS).
- This means that each year the company plows back 55% of EPS into the business
- Plowback ratio = 1 - payout ratio

Capitalization rate of Sears (cont)

- In addition Sears’ return on equity (ROE) has been stable at 13%. ROE is the ratio of earnings per share to book equity per share.
- If the company earns 13% of book equity and reinvests 55% of that, then book equity will increase by .55 x .13 = .072 or 7.2%.
- Earnings and dividends per share will also increase by 7.2%.
- Dividend growth rate = g = plowback ratio x ROE
- Assuming these relationships hold in the future, the equity capitalization rate for Sears is:

\[
r_s = \frac{\text{Div}_t}{P_0} + g = \frac{1.76}{45} + 0.072 = 0.111 = 11.1\%
\]
Caveats on estimating rates of return

- It is difficult to estimate $r_s$ using only a single stock. Use a large sample of equivalent risk securities.
- Do not apply the technique to firms with high current rates of growth. It is unlikely that supernormal growth can be sustained.
  - Why might this be the case?

Valuation of stocks with variable dividend growth

- Firms go through lifecycles
  - Fast growth
  - Growth that matches the economy
  - Decline

- A supernormal growth stock is one that is going through a period of rapid growth in dividends. This supernormal growth is generally only temporary.
Valuation of stocks with variable dividend growth

• Find the PV of dividends during the period of nonconstant growth.

• Find the price of the stock at the end of the nonconstant growth period. Using, for example, the constant growth model. Discount this price back to the present.

• Add these two present values to find the intrinsic value (price) of the stock.

Valuation of stocks with variable dividend growth: An example

• Batesco Inc. just paid a dividend of $1. The dividends of Batesco are expected to grow at 50% the next year (year 1) and 25% in the year after that (year 2). Batesco’s dividends are expected to grow at 6% per year in perpetuity beginning in year 3.

• The proper discount rate for Batesco is 13%.

• What price would you pay for a share of Batesco stock?
Example (continued)

- First, determine the dividends using \( g \)
  - \( D_0 = \$1 \quad g_1 = 50\% \)
  - \( D_1 = \$1(1.50) = \$1.50 \quad g_2 = 25\% \)
  - \( D_2 = \$1.50(1.25) = \$1.875 \quad g_3 = 6\% \)
  - \( D_3 = \$1.875(1.06) = \$1.9875 \)

<table>
<thead>
<tr>
<th>( t )</th>
<th>( g )</th>
<th>( D_t )</th>
<th>( \text{Value at time } t )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>50%</td>
<td>$1</td>
<td>$1</td>
</tr>
<tr>
<td>1</td>
<td>25%</td>
<td>$1.50</td>
<td>$1.50</td>
</tr>
<tr>
<td>2</td>
<td>6%</td>
<td>$1.875</td>
<td>$1.875</td>
</tr>
<tr>
<td>3</td>
<td>6%</td>
<td>$1.9875</td>
<td>$1.9875</td>
</tr>
<tr>
<td>4</td>
<td>6%</td>
<td>$2.107</td>
<td>$2.107</td>
</tr>
</tbody>
</table>

Example (continued)

- Supernormal growth period:
  \[
P_s = \frac{D_1}{(1+r_s)} + \frac{D_2}{(1+r_s)^2} = \frac{1.50}{1.13} + \frac{1.875}{1.13^2} = \$2.796
\]

- Constant growth period. Value at time 2:
  \[
P_c = \frac{D_3}{r_s - g_3} = \frac{1.9875}{0.13 - 0.06} = \$28.393
\]

- Discount to time 0 and add to \( P_s \):
  \[
P_0 = P_s + \frac{P_c}{(1+r_s)^3} = 2.796 + \frac{28.393}{1.13^3} = \$25.03
\]
Link between stock prices and earnings

- Consider a firm with a 100% payout ratio, where DIV = EPS in each period.
- A new valuation model:

\[ P_0 = \sum_{t=1}^{H} \frac{E P S_t}{(1 + r_s)^t} \]

- Example: \( r = .10 \), EPS = $10 in perpetuity
  \[ P = \frac{10}{.10} = $100 \]
- What is the P-E ratio?
- What is the E-P ratio?
- Rationale for use as multiplier, capitalization rate.

Suppose at time 0, the firm discovers a future investment opportunity...

... which it plans to finance with earnings.

The opportunity:
- Invest: $10.00 per share at \( t = 1 \).
- Returns: $1.50 per share per year in perpetuity starting in year 2.

What is the effect of the discovery of this new project on TODAY’s stock price?
Present value of all future growth opportunities (PVGO)

\[ PVGO = \sum_{t=1}^{H} \frac{NPV_t}{(1 + r)^t} \]

Thus, another valuation model:

\[ P_0 = \frac{EPS}{r} + PVGO \]

\[ \uparrow \quad \uparrow \]

capitalized PV of
growth opportunities

$100 \quad $4.55

What affect does the new investment opportunity have on the E/P ratio?

E/P ratio goes from .10 (=10/100)…
… to .0956 (= 10/104.55).

Is the E/P ratio the capitalization rate?

The E/P ratio underestimates the capitalization rate when the stock price (P) reflects the present value of future growth opportunities.
What affect does the new investment opportunity have on the P/E ratio?

P/E ratio goes from $10 \ (= 100/10)$…
… to $10.455 \ (= 104.55/10)$.

So what do high P/E ratios signify?
(1) Growth opportunities
(2) Safe earnings
or (3) Some combination of the two!

WARNINGS:
• Price is forward looking…EPS is historical.
• BE CAREFUL WITH ACCOUNTING NUMBERS

WHY NET PRESENT VALUE LEADS TO BETTER INVESTMENT DECISIONS THAN OTHER CRITERIA
THE NET PRESENT VALUE RULE

\[ NPV = C_0 + \frac{C_1}{1 + r} + \frac{C_2}{(1 + r)^2} + \ldots \]

WHERE

- \( C_i \) = Change in cash flow in period \( i \) due to project,
- \( r \) = discount rate that reflects time value and risk of project

RULE:

ACCEPT PROJECT if \( NPV \geq 0 \) otherwise, REJECT.

3 COMPETITORS OF NPV

- Payback
- Average Return on Book
- Internal Rate of Return
## PAYBACK

- The PAYBACK PERIOD is the number of years before cumulated forecasted cash flow equals initial investment.

### EXAMPLE:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Payback period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proj. A</td>
<td>-2</td>
<td>+2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proj. B</td>
<td>-2</td>
<td>+1</td>
<td>+1</td>
<td>+5</td>
<td>2 years</td>
</tr>
</tbody>
</table>

initial outlay

---

Let’s calculate the net present value of these two projects assuming a discount rate of 10%

### EXAMPLE:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Payback</th>
<th>NPV  At 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proj. A</td>
<td>-2</td>
<td>+2</td>
<td></td>
<td></td>
<td>1</td>
<td>-$0.20</td>
</tr>
<tr>
<td>Proj. B</td>
<td>-2</td>
<td>+1</td>
<td>+1</td>
<td>+5</td>
<td>2</td>
<td>$3.50</td>
</tr>
</tbody>
</table>

The problem: Better project has a longer payback.
Problems with PAYBACK

1. **NO DISCOUNTING**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project A</td>
<td>-100</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Project B</td>
<td>-100</td>
<td>99</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Payback rule implies projects A & B are equal. Which would you rather have?

2. **IGNORES CASH FLOWS AFTER PAYBACK PERIOD**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project A</td>
<td>-100</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>10,000</td>
</tr>
<tr>
<td>Project B</td>
<td>-100</td>
<td>50</td>
<td>50</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Payback rule implies project B is better.

Problems (continued)

3. **PAYBACK IGNORES SCALE**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project A</td>
<td>-10</td>
<td>5</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Project B</td>
<td>-1000</td>
<td>500</td>
<td>500</td>
<td>10,000</td>
</tr>
</tbody>
</table>

Payback implies that A and B are the same ...but, if mutually exclusive Project B is better.

4. **THERE IS NO NATURAL CUTOFF POINT!**
AVERAGE RETURN ON BOOK

\[
\frac{\text{AVERAGE ANNUAL INCOME}}{\text{AVERAGE ANNUAL INVESTMENT}}
\]

**EXAMPLE:** Investment in $9,000 3-yr. project

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Book</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Gross Profit (= cash flow)</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Depreciation (non-cash expense)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Net Profit</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Average Return on Book = \( \frac{2}{4.5} = 44\% \)

PROBLEMS WITH AVERAGE RETURN ON BOOK

1. **IGNORES TIMING:**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Book</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Gross Profit (= cash flow)</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Depreciation (non-cash expense)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Net Profit</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Average Return on Book = \( \frac{2}{4.5} = 44\% \)

Same average return on book, but cash flows come later and NPV IS LESS
Problems (continued)

2. BASED ON ACCOUNTING INCOME, NOT CASH FLOWS
   ➤ Affected by deprectiation method

3. NO LOGICAL BENCHMARK
   ➤ RATE OF RETURN ON EXISTING PROJECTS
      NOT NECESSARILY A GOOD YARDSTICK.

INTERNAL RATE OF RETURN RULE (IRR)
The IRR is the discount rate that sets \( NPV = 0 \).

\[
NPV = C_0 + \frac{C_1}{1 + IRR} + \frac{C_2}{(1 + IRR)^2} + \ldots = 0
\]

EXAMPLE: \( C_0 = -1000 \); \( C_1 = 1100 \)

\[
NPV = -1000 + \frac{1100}{1 + IRR} = 0 \quad \rightarrow \quad IRR = .10 \text{ or } 10\%
\]

RULE:
ACCEPT PROJECT IF
\( IRR \geq \) opportunity cost of capital
Otherwise, REJECT.
INTERNAL RATE OF RETURN (IRR)

To obtain return on a long-lived project find the discount rate at which NPV = 0, e.g.

$$NPV = 4 + \frac{2}{1 + IRR} + \frac{4}{(1 + IRR)^2} = 0$$

$$NPV = 4 + \frac{2}{1.28} + \frac{4}{(1.28)^2} = 0$$

Find by Trial and Error . . .

OR

by computer or calculator.

IRR (continued)

NOTE: IRR and NPV give the same result . . .
**PROBLEMS WITH IRR**

1. **LENDING OR BORROWING?**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>IRR</th>
<th>NPV @ 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project A</td>
<td>-100</td>
<td>60</td>
<td>72</td>
<td>20%</td>
<td>$14.05</td>
</tr>
<tr>
<td>Project B</td>
<td>100</td>
<td>-60</td>
<td>-72</td>
<td>20%</td>
<td>-$14.05</td>
</tr>
</tbody>
</table>

![Diagram showing NPV vs. Discount rate for Project A and B]

**PROBLEMS WITH IRR (continued)**

2. **MULTIPLE ROOTS**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-72,727</td>
<td>170,909</td>
<td>-100,000</td>
</tr>
</tbody>
</table>

![Diagram showing NPV vs. Discount rate for multiple roots]

**NOTE:** NPV at 10% is negative.
3. **NO ROOTS**

![Graph of NPV vs Discount Rate](image)

<table>
<thead>
<tr>
<th>Discount Rate</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>-2</td>
<td>2</td>
</tr>
</tbody>
</table>

**MORE PROBLEMS WITH IRR**

4. **IRR IS SCALE FREE**

<table>
<thead>
<tr>
<th>Project</th>
<th>IRR</th>
<th>NPV @ 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>50%</td>
<td>$0.36</td>
</tr>
<tr>
<td>B</td>
<td>20%</td>
<td>$91.00</td>
</tr>
</tbody>
</table>

For independent projects this is not a problem

TAKE BOTH.

But obviously a problem if projects are mutually exclusive.
MORE PROBLEMS WITH IRR (continued)

5. IRR ASSUMES A FLAT TERM STRUCTURE
   i.e., \( r_1 = r_2 = \ldots = r \)

Not a problem for NPV since

\[
NPV = C_0 + \frac{C_1}{1 + r_1} + \frac{C_2}{(1 + r_2)^2} + \frac{C_3}{(1 + r_3)^3} + \ldots = 0
\]

The problem is that it is not clear which \( r \) we should compare IRR with.

VERDICT ON IRR

Gives the same result as NPV if:

1. Flat Term Structure

2. Conventional Cash Flows
   [ i.e., outflow followed by inflows.]

3. Independent Projects

Otherwise may lead to incorrect decision.
MAKING INVESTMENT DECISIONS
WITH THE
NET PRESENT VALUE RULE

WHAT TO DISCOUNT
1. Only cash flow is relevant
2. Estimate incremental cash flows
3. Be consistent in treatment of inflation
4. Recognize project interactions
1. **ONLY CASH FLOW IS RELEVANT**

1. Remember investment in working capital

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SALES</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>INVEST IN RECEIVABLES</td>
<td>-60</td>
<td>+60</td>
</tr>
<tr>
<td>CASH FLOW</td>
<td>40</td>
<td>60</td>
</tr>
</tbody>
</table>

2. Depreciation is not a cash flow

3. Discount flows after tax

---

**EXAMPLE**: A $20,000 machine, with a 5-year life and no salvage value will save your firm $7,000 per year for 5 years.

1. What is the incremental after tax cash flow in year 0?

   ![Cash Flow Timeline](chart)

   - Year 0: Investment - $20,000
   - Years 1-5: Cash Flow + $7,000 per year

   **Note**: Cash flows are discounted after tax.
EXAMPLE: A $20,000 machine, with a 5-year life and no salvage value will save your firm $7,000 per year for 5 years.

1. What is the incremental after tax cash flow in year 0?

<table>
<thead>
<tr>
<th>Year</th>
<th>Book Account</th>
<th>Cash Account</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-20,000</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5,920</td>
<td>5,920</td>
</tr>
<tr>
<td>2</td>
<td>5,920</td>
<td>5,920</td>
</tr>
<tr>
<td>3</td>
<td>5,920</td>
<td>5,920</td>
</tr>
<tr>
<td>4</td>
<td>5,920</td>
<td>5,920</td>
</tr>
<tr>
<td>5</td>
<td>5,920</td>
<td>5,920</td>
</tr>
</tbody>
</table>

2. What is the IATCF in years 1 - 5?

Savings
Incr. deprec.
Incr. tax. income
Taxes @ 36%
After Tax profit

Incremental cash flow

Thus, the incremental after tax cash flows from buying the machine are:

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-20,000</td>
<td>5,920</td>
<td>5,920</td>
<td>5,920</td>
<td>5,920</td>
<td>5,920</td>
</tr>
</tbody>
</table>

Assuming a cost of capital of 10%, what is the NPV of this investment?
Replacement Problem:

\( P_{\text{new}} = \$14,000; \) 4-year life; salvage value year 4 = \$2,000.  
\( P_{\text{old}} = BV_{\text{old}} = \$3,000; \) 4 years left.  
Cash savings with replacement: 
\$7,000 per year for 4 years.  
Corporate tax rate = 40%  

1. What is the initial cash outlay?  

What if book value of old machine was \$2,000?  

2. What is the IATCF in years 1 - 4?  

Book Account  
Cash Account
INFLATION AND CAPITAL BUDGETING

What is Inflation?

\[
\frac{CPI_2}{CPI_1} = \frac{CPI_1}{CPI_1}
\]

Nominal vs. Real Wages

EXAMPLE:
$1,000 investment promises 9% nominal return in one year.

\[
\begin{array}{c}
0 \\
1000 \\
1 \\
1090
\end{array}
\quad X \ (1.09)
\]

Suppose inflation is expected to be 7%.

e.g., the price of apples go from $1.00 to $1.07.

How many apples can you expect to buy?

\[
1090 / 1.07 = 1018.69
\]

What's the real (apple) rate of return?

\[
\frac{1018.69}{1000} = 1.869\%
\]
The general relation is:

\[ 1 + r = (1 + R) (1 + \Delta) \quad \text{where} \]

\[ r = \text{nominal rate}, \quad R = \text{Real rate}, \quad \Delta = \text{inflation rate}. \]

Multiplying out and rearranging yields

\[ r = R + \Delta + R \Delta \]

which is often approximated as

\[ r = R + \Delta \]

What happens to nominal interest rates as expectations of inflation increase?

---

**THE MORAL**

Interest rates stated in nominal terms so discount nominal cash flows.

**Example**

If electricity rates expected to rise at 7% then nominal savings will increase:

<table>
<thead>
<tr>
<th>Year</th>
<th>Real savings</th>
<th>Nominal savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7000</td>
<td>7490</td>
</tr>
<tr>
<td>2</td>
<td>7000</td>
<td>8014</td>
</tr>
<tr>
<td>3</td>
<td>7000</td>
<td>8575</td>
</tr>
<tr>
<td>4</td>
<td>7000</td>
<td>9176</td>
</tr>
<tr>
<td>5</td>
<td>7000</td>
<td>9818</td>
</tr>
</tbody>
</table>

NOTE: Could also discount real flows at real rate.

Consider Year 2:

\[
\frac{7000}{(1.01869)^2} = \frac{8014}{(1.09)^2} = 6745
\]

HOWEVER, TYPICALLY NOMINAL FLOWS AND RATES ARE USED.
ESTIMATE INCREMENTAL CASH FLOW (WITH VS. WITHOUT)

1. Incremental not average flows, e.g., railway bridge
2. Incidental effects, e.g., General Foods
3. Ignore sunk costs, e.g., Lockheed
4. Include opportunity costs, e.g., land, V.P.
5. Beware of allocated overheads

Does project add to overhead?

SHOULD WE INCLUDE DIVIDEND AND INTEREST PAYMENTS

Consider example of BOB’s Sports Bar

\[
\text{NPV} = -350,000 + \frac{400,000}{1.07} = 23,831.77
\]

Suppose we issue a 1-year bond to pay for this project.

HOW WILL BOND ISSUE AFFECT CASH FLOWS?
CHOOSING BETWEEN LONG- AND SHORT-LIVED EQUIPMENT

Two machines produce same output. Which has lower costs?

<table>
<thead>
<tr>
<th>COSTS</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>PV@10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine A</td>
<td>20</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>34.92</td>
</tr>
<tr>
<td>Machine B</td>
<td>15</td>
<td>8</td>
<td>8</td>
<td></td>
<td>28.89</td>
</tr>
</tbody>
</table>

*Machine B has lower P.V. of costs, but needs to be replaced sooner.*

To compare, calculate “Equivalent Annual Cost” per year

Equivalent Annual Cost of Machine A:

\[
\frac{34.92}{(3\text{-year annuity factor})} = \frac{34.92}{2.487} = 14.04
\]

Equivalent Annual Cost of Machine B:

\[
\frac{28.89}{(2\text{-year annuity factor})} = \frac{28.89}{1.736} = 16.64
\]

**MORAL:** Annual cost of A (14.04) is less than B (16.14).

**NOTE:** An assumption of the analysis is that machines will be replaced by same machine with same costs

<table>
<thead>
<tr>
<th>Costs</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine A</td>
<td>20</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>


| Machine B | 15 | 8  | 8  | 8  | 8  | 8  | .  | .   |
|           |    |    |    |    |    |    |    | .   |
|           |    |    |    |    |    |    |    | .   |
|           |    |    |    |    |    |    |    | .   |

Equivalent Annual Cost 16.64 16.64 16.64 16.64 16.64 16.64


**WHEN TO REPLACE AN EXISTING MACHINE**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>NPV@10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Operating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of old machine</td>
<td>9</td>
<td>12</td>
<td>15</td>
<td></td>
<td>29.37</td>
</tr>
<tr>
<td>Cost of new machine</td>
<td>15</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>27.4</td>
</tr>
<tr>
<td>Equivalent Annual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of new machine*</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td></td>
<td>27.4</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 exceed 11.

---

**PROJECT INTERACTIONS**

**COST OF EXCESS CAPACITY**

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

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

\[
P V_{extra\ cost} = \frac{11.7}{(1.1)^5} + \frac{11.7}{(1.1)^7} + \cdots + \frac{11.7}{(1.1)^{10}} = 27.6
\]

\[
0 \ldots 5 \quad 6 \ldots 10 \quad 11 \ldots
\]

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>0</th>
<th>11.7</th>
<th>11.7</th>
<th>11.7</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>
</tr>
<tr>
<td>Without project</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>11.7</td>
</tr>
<tr>
<td>Difference</td>
<td>0</td>
<td>0</td>
<td>11.7</td>
<td>11.7</td>
<td>0</td>
</tr>
</tbody>
</table>
INTRODUCTION TO RISK AND RETURN IN CAPITAL BUDGETING

WE ALL KNOW: THE GREATER THE RISK THE GREATER THE REQUIRED (OR EXPECTED) RETURN...

...BUT HOW DO WE MEASURE **RISK**?
An Historical Look at Risk and Return

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Nominal</th>
<th>Real</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Cap</td>
<td>$2,843</td>
<td>$340</td>
</tr>
<tr>
<td>S &amp; P 500</td>
<td>$ 811</td>
<td>$ 97</td>
</tr>
<tr>
<td>Corporate Bonds</td>
<td>$ 38</td>
<td>$ 4.5</td>
</tr>
<tr>
<td>Treasury Bonds</td>
<td>$ 26</td>
<td>$ 3.1</td>
</tr>
<tr>
<td>T-Bills</td>
<td>$ 12</td>
<td>$ 1.5</td>
</tr>
<tr>
<td>Inflation</td>
<td>$ 7</td>
<td>---</td>
</tr>
</tbody>
</table>

$7 AT THE END OF 1994 HAD THE SAME PURCHASING POWER AS $1 AT THE BEGINNING OF 1926

Next slide shows returns

Source: Ibbotson Associates
THE U.S. STOCK MARKET HAS BEEN A PROFITABLE BUT VARIABLE INVESTMENT


ANNUAL MARKET RETURNS IN THE USA 1926 - 1992

STANDARD DEVIATION AND NORMAL DISTRIBUTION: A REVIEW

Normal distribution is completely defined by its mean and standard deviation.

How much of the area of the curve lies within one standard deviation of the mean?

Within two standard deviations? ...within three?

MEAN AND STANDARD DEVIATION

- mean measures average (or expected return)
- standard deviation (or variance) measures the spread or variability of returns
- risk averse investors prefer high mean & low standard deviation
## AVERAGE RETURNS AND STANDARD DEVIATIONS
### 1926 - 1994

<table>
<thead>
<tr>
<th>PORTFOLIO</th>
<th>Average nominal return</th>
<th>Average real return</th>
<th>Average risk premium</th>
<th>Standard deviation of returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treasury bills</td>
<td>3.7%</td>
<td>0.6%</td>
<td>0%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Government bonds</td>
<td>5.2</td>
<td>2.1</td>
<td>1.4</td>
<td>8.7</td>
</tr>
<tr>
<td>Corporate bonds</td>
<td>5.7</td>
<td>2.7</td>
<td>2.0</td>
<td>8.3</td>
</tr>
<tr>
<td>Common stocks</td>
<td>12.2</td>
<td>8.9</td>
<td>8.4</td>
<td>20.2</td>
</tr>
<tr>
<td>Small-firm stocks</td>
<td>17.4</td>
<td>13.9</td>
<td>13.7</td>
<td>34.3</td>
</tr>
</tbody>
</table>


## EXPECTED RETURN ON MARKET PORTFOLIO
(= expected return on average-risk US stock)

Expected market return = current interest rate + expected market risk premium

If expected risk premium = long-run average, then

Expected market return = interest rate + 8.4%

Copyright 1996 by The McGraw-Hill Companies, Inc.
### TOTAL RISK (STANDARD DEVIATION)
FOR COMMON STOCKS, 1988 - 1992

<table>
<thead>
<tr>
<th>Stock</th>
<th>Standard deviation</th>
<th>Stock</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T</td>
<td>21.5%</td>
<td>Ford Motor</td>
<td>27.7%</td>
</tr>
<tr>
<td>Bristol-Myers Squibb</td>
<td>18.0</td>
<td>Genentech</td>
<td>33.9</td>
</tr>
<tr>
<td>Delta Airlines</td>
<td>27.7</td>
<td>Microsoft</td>
<td>48.5</td>
</tr>
<tr>
<td>Digital Equipment</td>
<td>35.7</td>
<td>Polaroid</td>
<td>33.6</td>
</tr>
<tr>
<td>Exxon</td>
<td>12.1</td>
<td>Tandem Computer</td>
<td>44.3</td>
</tr>
</tbody>
</table>

Do these seem high? (The standard deviation of the S&P 500 over the same period was 15%.)

### HOW DOES DIVERSIFICATION REDUCE RISK?

<table>
<thead>
<tr>
<th>Return on Security A:</th>
<th>Time</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Return on Security B:</th>
<th>Time</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Return on Portfolio of A &amp; B</th>
<th>Time</th>
</tr>
</thead>
</table>
DIVERSIFICATION REDUCES RISK

Individual stocks have two kinds of risk:

**MARKET RISK**

(OR SYSTEMATIC OR UNDIVERSIFIABLE RISK)  
AFFECTS ALL STOCKS

**UNIQUE RISK**

(OR UNSYSTEMATIC OR DIVERSIFIABLE RISK)  
AFFECTS INDIVIDUAL STOCKS OR SMALL GROUPS OF STOCKS (INDUSTRIES)

- UNIQUE RISK OF DIFFERENT FIRMS UNRELATED
- ELIMINATED BY DIVERSIFICATION
ADVANTAGE OF DIVERSIFICATION

SINGLE STOCK
- EXPOSED TO MARKET RISK AND UNIQUE RISK

DIVERSIFIED PORTFOLIO
- ONLY EXPOSED TO MARKET RISK
- MAJOR UNCERTAINTY IS WHETHER MARKET WILL RISE OR FALL
- MOST OF BENEFITS OF DIVERSIFICATION ACHIEVED WITH 10 - 20 STOCKS

REturns

<table>
<thead>
<tr>
<th></th>
<th>Recession Prob = .50</th>
<th>Boom Prob = .50</th>
<th>E (R)</th>
<th>o(R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security J</td>
<td>.06</td>
<td>.12</td>
<td>.09</td>
<td>.03</td>
</tr>
<tr>
<td>Security K</td>
<td>.15</td>
<td>.03</td>
<td>.09</td>
<td>.06</td>
</tr>
</tbody>
</table>
Expected return of a portfolio is the weighted sum of the expected returns of the individual stocks in the portfolio.

**EXAMPLE:**
- 60% of portfolio is in Bristol-Myers-Squibb, with an expected return of 15%
- 40% in Ford, with an expected return of 21%
- Expected portfolio return = \(0.60 \times 0.15 + 0.40 \times 0.21\) = 0.174 or 17.4%

The variance of a two-stock portfolio is the sum of these four boxes:

\[
\begin{array}{ccc}
X_1^2 \delta_1^2 & X_1 X_2 \rho_{12} \delta_1 \delta_2 & X_2^2 \delta_2^2 \\
X_1 X_2 \rho_{12} \delta_1 \delta_2 & = X_1 X_2 \delta_{12} & \end{array}
\]

\(\delta_{12}\) = covariance of returns
\(\rho\) = correlation of returns
Portfolio Variance: Example

Std dev: Gen Mills 20%; Citicorp 30%. Correlation = 0.3
60% invested in Gen Mills; 40% in Citicorp.

<table>
<thead>
<tr>
<th>Security</th>
<th>Variance</th>
<th>Std dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen Mills</td>
<td>.6² x 20² - 144</td>
<td>- 19.3%</td>
</tr>
<tr>
<td>Citicorp</td>
<td>.6 x .4 x .3 x 20 x 30 - 43.2</td>
<td>- 43.2</td>
</tr>
</tbody>
</table>

Variance = 144 + 144 + (2 x 43.2) = 374.4
Std dev = \sqrt{374.4} = - 19.3%

PORTFOLIO VARIANCE
TWO SECURITIES

- PORTFOLIO VARIANCE = \( \sigma_1^2 \delta_1^2 + \sigma_2^2 \delta_2^2 + 2\sigma_1\sigma_2 \rho_{12} \delta_1 \delta_2 \)
- where \( \sigma_i^2 \) is the variance of security 1, \( \delta_i \) is the variance of security 2, \( \delta_1 \) is the standard deviation of security 1, \( \delta_2 \) is the standard deviation of security 2, and \( \rho_{12} \) is the correlation between security 1 and security 2.
- Note: -1 ≤ \( \rho_{12} \) ≤ 1

EXAMPLE:

\( \sigma_1 = .6 \)
\( \delta_1 = 18.6\% \)
\( \sigma_2 = .4 \)
\( \delta_2 = 28.0\% \)

- IF \( \rho_{12} = 1 \), \( \delta_p = 22.4\% \)
  - WHICH IS THE WEIGHTED AVERAGE OF \( \delta_1 \) AND \( \delta_2 \)

- IF \( \rho_{12} = 0.2 \), \( \delta_p = 17.3\% \)
  - WHICH IS LESS THAN THE WEIGHTED AVERAGE OF \( \delta_1 \) AND \( \delta_2 \)

- IF \( \rho_{12} = -1 \), \( \delta_p = 0 \)
  - WITH PERFECT NEGATIVE CORRELATION, THERE IS ALWAYS A PORTFOLIO WHICH HAS NO RISK
The matrix for an N-stock portfolio

The shaded boxes contain variance terms; the remainder contain covariance terms.

Preview of CAPM: How individual securities affect portfolio risk

The risk of a well-diversified portfolio depends on the market risk of the securities in that portfolio.

WHAT IS MARKET RISK?

BETA: MEASURES SENSITIVITY TO MARKET MOVEMENT

The average stock has a beta = 1.0

▲ Stocks with betas > 1.0 tend to amplify market movement
▲ Beta < 1.0 move in same direction as the market but not as much

Stocks with betas of 2.0 are twice as volatile as the market...
...stocks with betas of 0.5 are half as volatile.

An investor in a high beta stock will expect a higher return than an investor in a low beta stock
RISK OF A WELL-DIVERSIFIED PORTFOLIO IS PROPORTIONAL TO THE PORTFOLIO BETA

- Randomly selected 500-stock portfolio has $\beta = 1$ and standard deviation $\delta_p = \delta_M$
- Randomly selected 500-stock portfolio made up of stocks with average $\beta = 1.5$ has standard deviation $\delta_p = 1.5 \delta_M$
- Randomly selected 500-stock portfolio made up of stocks with average $\beta = 0.5$ has standard deviation $\delta_p = 0.5 \delta_M$

FIGURE 7-9
(a) A randomly selected 500-stock portfolio ends up with $\beta = 1$ and a standard deviation equal to the market’s—in this case 20 percent.
(b) A 500-stock portfolio constructed with stocks with average $\beta = 1.5$ has a standard deviation of about 30 percent—150 percent of the market’s.
(c) A 500-stock portfolio constructed with stocks with average $\beta = 0.5$ has a standard deviation of about 10 percent—half the market’s.
THE STANDARD DEVIATION OF A PORTFOLIO HAS NO SIMPLE RELATIONSHIP TO THE STANDARD DEVIATIONS OF THE INDIVIDUAL STOCKS IN THE PORTFOLIO.

But the beta of a portfolio is the simple weighted average of the betas of the stocks in the portfolio

$$p = \sum_{i=1}^{n} X_i \sigma_i$$

MAJOR INVESTORS HOLD DIVERSIFIED PORTFOLIOS, WITH LITTLE OR NO DIVERSIFIABLE OR UNIQUE RISK

THE RETURN ON A PORTFOLIO, DIVERISIFIED OR NOT, DEPENDS ONLY ON THE MARKET RISK OF THE PORTFOLIO

• The market doesn’t reward us for taking unique risks we can avoid at very little cost by diversification
MEAN & STANDARD DEVIATION: PORTFOLIO OF MERCK & MCDONALD’S

EFFECT OF CHANGING CORRELATIONS: PORTFOLIO OF MERCK & MCDONALD’S
The set of portfolios when there are 2 risky assets

The set of portfolios when there are many (N) risky assets

The set of portfolios between A and B are efficient portfolios
By investing in portfolio S and lending or borrowing at \( r_f \), an investor can achieve any point along the straight line.

\[
r = r_f + \beta (r_m - r_f)
\]
COST OF CAPITAL

WHAT DISCOUNT RATE TO USE?

ONE VIEW: “TURN VALUATION ON ITS HEAD”

EXAMPLE: FIRM “A” PRODUCES SAFETY PINS.
STOCK PRICE = $22.22
CURRENT DIVIDEND = $2.00
EXPECTED GROWTH RATE = 0

• What is the market capitalization rate?
• What discount rate should we use for safety pin capital budgeting?

COST OF CAPITAL

ANOTHER VIEW: “USE THE CAPM”

Example (continued):
Let \( r_f = .07 \) and \( E(R_m) = .11 \)
Suppose we estimate \( B_a \) and find it equal to .5

Then
\[
\text{COST OF CAPITAL} = R_a = r_f + B_a (r_m - r_f) \\
= .07 + .5 (.04) \\
= .09
\]

Note: BOTH APPROACHES SHOULD YIELD SAME RESULT.
NOW CONSIDER A SECOND COMPANY
FIRM “B” THAT PRODUCES HULA HOOPS

SAY THAT: \( B_b = 1.5 \)

WHAT IS FIRM B’s COST OF CAPITAL?
WHAT DISCOUNT SHOULD BE USED ON HOOP PROJECTS?

NEXT CONSIDER: A MERGER OF FIRMS A & B

IF VALUE OF FIRM A = VALUE OF FIRM B THEN:

• WHAT IS THE MERGED FIRM’S BETA?
• WHAT IS THE COMPANY COST OF CAPITAL?
• WHAT WILL THE COMPANY COST OF CAPITAL BE USED FOR?

LESSONS...

• BETA OF THE FIRM IS A WEIGHTED AVERAGE OF THE BETAS OF THE INDIVIDUAL PROJECTS

• EACH PROJECT SHOULD BE JUDGED ACCORDING TO ITS OWN RISK.

...& QUESTIONS

• Is diversification “good” for firms?

• How do we find individual project betas?
How Capital Structure Affects the Cost of Capital

Company Cost of Capital = \( \frac{\text{Weighted Avg Cost of Capital}}{\text{debt} \cdot \text{equity}} \) + \( \frac{\text{equity}}{\text{debt} \cdot \text{equity}} \)

Rationale for WACC - Example
Firm is 50% debt, 50% equity \( r_d = .04 \) \( r_e = .10 \)
WACC = .50 (.04) + .50 (.10) = .07 = 7%

Consider 3 Investment Scenarios:

<table>
<thead>
<tr>
<th></th>
<th>CF₀</th>
<th>CF₁</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100</td>
<td>108</td>
<td>NPV&gt;0</td>
</tr>
<tr>
<td>B</td>
<td>100</td>
<td>107</td>
<td>NPV = 0</td>
</tr>
<tr>
<td>C</td>
<td>100</td>
<td>106</td>
<td>NPV&lt;0</td>
</tr>
</tbody>
</table>

A) 108
52 \( \rightarrow \) Bondholders (4%)
56 \( \rightarrow \) Stockholders (12%)

B) 107
52 \( \rightarrow \) Bondholders (4%)
55 \( \rightarrow \) Stockholders (10%)

C) 106
52 \( \rightarrow \) Bondholders (4%)
54 \( \rightarrow \) Stockholders (8%)

How Capital Structure Affects Beta

\( \text{assets} = \frac{D}{V} \text{debt} + \frac{E}{V} \text{equity} \)

From previous example, suppose \( \text{debt} = .2 \) and \( \text{equity} = 1.4 \)
\( \text{assets} = .5 \times 2 + .5 \times 1.4 = 0.8 \)
What discount rate would you use if you owned all the debt and equity of the firm?

OR,

What should an, otherwise similar, all-equity firm use as the appropriate discount rate?

Since investors in the levered firm require a total return of 7% on the package of debt and equity, you should also use 7% as the discount rate.

*** The appropriate discount rate depends on the riskiness of the firm’s investment projects, not on the method of financing. *****

HOW WOULD YOU RESPOND TO THE FOLLOWING:

“Our firm is all-equity and currently stockholders require a 7% rate of return. Since prospective bondholders only require a 4% return, we should issue debt. This will increase firm value since our hurdle rate on new investments (capital budgeting projects) will fall from 7% to 4.”
POINT: Can not simply look at equity betas

EXAMPLE: RJR Nabisco wants to figure the appropriate discount rate for capital budgeting decisions in its cereal division.

They see that Kellogg company has an equity beta equal to .95 . . .

. . . but Kellogg also has debt in its capital structure (D/V = .20) with a beta of .30.

Thus, the beta of Kellogg’s assets
\[ \text{Beta}_\text{assets} = (.80)(.95) + (.20)(.30) = .82 \]

Assuming a risk-free rate of 3% and a market risk premium of 8%, the CAPM implies that the required return on Kellogg assets equals

\[ .03 + .82 (.08) = .0956, \text{ or } 9.56\% \]

Thus, RJR should use this rate for its capital budgeting decisions in the cereal division.

WHAT TO DO IF YOU CAN’T FIND BETA

1. Avoid fudge factors
2. Consider determinants of asset betas
A FEW OBSERVATIONS ON LEVERAGE, RISK AND THE COST OF CAPITAL

- The company cost of capital is the relevant discount rate for capital budgeting decisions, not the expected return on the common stock.

- The company cost of capital is a weighted average of the returns that investors expect from the various debt and equity securities issued by the firm.

- The company cost of capital is related to the firm’s asset beta, not to the beta of the common stock.

A FEW OBSERVATIONS ON LEVERAGE, RISK AND THE COST OF CAPITAL

- The asset beta can be calculated as a weighted average of the betas of the various securities.

- When the firm changes its financial leverage, the risk and expected returns of the individual securities change. The asset beta and the company cost of capital do NOT change.
CHAPTER 13
CORPORATE FINANCING
and MARKET EFFICIENCY

FINANCING STRATEGY

• WE NOW MOVE FROM LEFT-HAND SIDE TO RIGHT HAND SIDE OF THE BALANCE SHEET
• GIVEN THE FIRM’S CURRENT PORTFOLIO OF REAL ASSETS AND ITS FUTURE INVESTMENT STRATEGY, WHAT IS THE BEST FINANCING STRATEGY?

THE DIVIDEND POLICY QUESTION (CH. 16)
  – SHOULD THE FIRM REINVEST EARNINGS OR PAY THEM OUT AS DIVIDENDS?

THE CAPITAL STRUCTURE QUESTION (CH. 17)
  – IF THE FIRM NEEDS TO RAISE ADDITIONAL CAPITAL, SHOULD IT ISSUE STOCK OR BORROW MORE?
WE ALWAYS COME BACK TO NPV

- NPV = AMOUNT BORROWED - PV OF AMT REPAID
- EXAMPLE: GOVERNMENT OFFERS TO LEND YOUR FIRM $100,000 FOR 10 YEARS AT 3% (PREVAILING RATE IS 10%)

\[
\text{NPV} = +100,000 - \left[ \sum_{t=1}^{10} \frac{3,000}{(1.10)^t} \right] - \frac{100,000}{(1.10)^{10}} \\
= +100,000 - 56988 = +$43,012
\]

SHOULD YOUR FIRM TAKE THIS DEAL? WHAT IS THE COST TO THE GOVERNMENT? WHERE ELSE CAN FIRMS FIND SUCH DEALS?

EFFECTIVE CAPITAL MARKETS:
IF CAPITAL MARKETS ARE EFFECTIVE, THEN THE PURCHASE OR SALE OF ANY SECURITY AT THE PREVAILING MARKET PRICE IS NEVER A POSITIVE NPV TRANSACTION...OR,

THE PRICE IS RIGHT!

STOCK PRICES CHANGES ARE RANDOM

EXAMPLE OF A RANDOM WALK PROCESS:
COIN FLIP EACH DAY DETERMINES THE VALUE OF YOUR INVESTMENT:
- HEADS, YOUR INVESTMENT INCREASES BY 3%
- TAILS, YOUR INVESTMENT DECLINES BY 2.5%

THUS, SUCCESSIVE CHANGES IN VALUE ARE INDEPENDENT


CAN YOU TELL WHICH IS WHICH?
TESTS OF RANDOM WALK

• “STARTLING DISCOVERY” IN THE 1950’S LED TO ADDITIONAL TESTS OF WHETHER PRICE CHANGES TEND TO PERSIST OVER TIME:
  – SCATTER DIAGRAMS
  – CORRELATION COEFFICIENTS
  – RUNS TESTS
  – TESTS OF FILTER RULES
• RESEARCHERS HAVE LOOKED AT MANY STOCKS
  – DIFFERENT COUNTRIES, VARIOUS TIME PERIODS

BOTTOM LINE:

THERE IS A LARGE QUANTITY OF EVIDENCE THAT THERE IS NO USEFUL INFORMATION CONTAINED IN PAST PRICES

WEYERHAEUSER DAILY PRICE CHANGES ON SUCCESSIVE DAYS BETWEEN 1963 AND 1993

T. CRACK AND O. LEDOIT
Filter rule tests

Chartists (technical analysts) claim that simple correlation tests are unable to capture the “art” of charting. They can see patterns, e.g., heads and shoulders.

FILTER RULE TESTS:

- A filter rule: If price moves up by X%, then buy and hold...until price moves down by Y%, then sell and go short.
- Lots of different buy and sell filters were investigated.

Findings:
- Filter rules can’t beat a buy and hold strategy.
- When commissions are included they do worse.

What is the basis for technical analysis?

Price changes are not independent due to the slow dissemination of information

- For example, consider the following scenario:
  - A firm is expected to pay a $2.00 per share dividend in perpetuity. Investors require 10%.
  - Announcement indicates that dividends will increase to $3.00 per share in perpetuity.

- Compare the change in stock price over time if information dissemination is rapid versus slow.
  - What are the implications for serial correlation?
  - What causes the randomness in stock prices?
**Reactivity of Stock Price to New Information in Efficient and Inefficient Markets**

![Diagram](image)

**THREE FORMS OF MARKET EFFICIENCY**

- **WEAK FORM EFFICIENCY**
  - PRICES REFLECT ALL INFORMATION CONTAINED IN PAST PRICES
  - RESEARCH ON RANDOM WALKS SHOWS MARKET IS AT LEAST WEAK FORM EFFICIENT

- **SEMI-STRONG FORM EFFICIENCY**
  - MARKET REFLECTS ALL PUBLIC INFORMATION, INCLUDING INFORMATION CONTAINED IN PAST PRICES
  - TESTED BY LOOKING AT STOCK PRICE RESPONSE TO SPECIFIC ITEMS OF NEWS, E.G., EARNINGS, DIVIDENDS, MERGERS, STOCK SPLITS, ETC.
  - EVIDENCE SHOWS THAT PUBLIC INFORMATION IS RAPIDLY IMPONDED IN STOCK PRICES
THREE FORMS OF MARKET EFFICIENCY

• STRONG FORM EFFICIENCY
  – PRICES REFLECT ALL INFORMATION ABOUT THE COMPANY INCLUDING INFORMATION THAT CAN BE ACQUIRED BY ANALYSIS OF THE COMPANY (AS WELL AS INSIDE INFO)
  – WITH STRONG FORM EFFICIENCY, WE WOULDN’T FIND SUPERIOR INVESTMENT MANAGERS WHO CONSISTENTLY BEAT THE MARKET...NOR WOULD INSIDERS BE ABLE TO EARN ABNORMAL PROFITS

• Evidence indicates that, on average, professional money managers do not earn above average returns. (Does this mean you should avoid mutual funds?)

• However, there is evidence that insiders can earn superior returns.

MUTUAL FUND & MARKET RETURNS 1962-1992
(Figure 13-4)

M. M. CARHART, UNPUBLISHED PAPER, UNIVERSITY OF CHICAGO, DECEMBER 1994
Semi-strong form tests

Event studies:
Measure the effect of some event (e.g., stock split) on the value of the firm. First, need to control for changes in stock price due to normal relation with the overall market.

Calculating abnormal returns:

<table>
<thead>
<tr>
<th>Event Time</th>
<th>Actual Return</th>
<th>Normal Return</th>
<th>Abnormal Return</th>
<th>Cumulative Abnormal Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>15%</td>
<td>12%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>-1</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>14</td>
<td>-2</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>-3</td>
<td>-5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>-9</td>
<td>-8</td>
<td>-1</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>15</td>
<td>9</td>
<td>15</td>
</tr>
</tbody>
</table>

Note: Event period 0 is the period in which the event is announced.

Stock splits

• What are they? Why are they interesting?
• Fama, Fisher, Jensen and Roll study (1969)
  – Looked at 940 splits between 1926 and 1960
  – Defined “month 0” as the month of stock split
  – For each month calculated abnormal return (-29 to +30)
  – Calculated average abnormal return for each month across the 940 splits
  – Examined the average cumulative abnormal returns over the 60 months surrounding the split
• What explains the pre-split price run up?
• What explains the announcement price reaction?
• What does the post-split performance imply?
Abnormal Returns for Companies
Announcing Stock Splits

Cumulative abnormal returns rise prior to month of split. Very likely this occurs because splits take place in good times, that is, they take place following a rise in stock price. Abnormal returns are flat after month of split, a finding consistent with efficient capital markets.


---

Do perfect substitutes exist for securities?

Elasticity of demand = \[
\frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}
\]

- If close substitutes exist → demand is elastic
- If no close substitutes → demand is inelastic

Example: Demand for coffee vs. Demand for Maxwell House

- **Stocks should be almost perfect substitutes for each other**
  - What does this imply about selling large blocks of stock?
  - Do you have to lower your price more to sell larger blocks?
Scholes’ study of secondary distributions

- **Price pressure hypothesis:** To sell a large block of stock you have to offer a discount (sweetener)...to entice investors. Assumes firm’s securities are unique, do not have perfect substitutes thereby resulting in a downward sloping demand curve for the firm’s stock.

- **Perfect substitute hypothesis:** Do not need to offer a discount to sell block. There are perfect substitutes for the firm’s stock so that the demand curve is horizontal. If a discount is offered, the buyer earns an abnormal return.

- **Information hypothesis:** Seller may have to offer a discount if the buyer believes the sale is based on inside information.

---

**Figure 11.5**
Competing hypotheses of price behavior around the sale of a large block.
Scholes’ study of secondary distributions

- Using daily data found slight (permanent) reduction in stock price, which was independent of the amount sold.
- Also partitioned by identity of the seller:

<table>
<thead>
<tr>
<th>Category</th>
<th>CAR (-10, +10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment companies and mutual funds</td>
<td>-2.5%</td>
</tr>
<tr>
<td>Banks and insurance companies</td>
<td>-0.3</td>
</tr>
<tr>
<td>Individuals</td>
<td>-1.1</td>
</tr>
<tr>
<td>Corporations and officers</td>
<td>-2.9</td>
</tr>
<tr>
<td>Estates and trusts</td>
<td>-0.7</td>
</tr>
</tbody>
</table>

- What do these results suggest?

Stock prices and the publication of second hand information (Davies and Canes, 1978)

- Can analysts information be used to earn abnormal returns?
  - Do prices adjust when analysts revise stock recommendations?
  - Does rate of price adjustment depend on how recommendation is disseminated?
  - Do buy recommendations have different effects then sell recommendations?
  - Are analysts’ recommendations self-fulfilling prophesies?
- Tests focus on recommendations in the “Heard on the street” column in the Wall Street Journal.
  1. Analyst has information which is old to the firm’s clients.
  2. Later, published in WST (one or two week lag.)
- Necessary conditions for a stock price response to the column:
  1. Readers believe analyst has information.
  2. Analysts clients haven’t captured all the profits?
Capital market anomalies

- Stock price performance of small firms
- The January effect
- The “week-end” effect
- The October 87’ crash

VERDICT:
- CAPITAL MARKETS FUNCTION WELL
- OPPORTUNITIES FOR EASY PROFITS ARE RARE
- FINANCIAL MANAGERS SHOULD ASSUME, AT LEAST AS A STARTING POINT, THAT SECURITY PRICES ARE FAIR AND THAT IT IS DIFFICULT TO OUTGUESS THE MARKET
Dividend Policy
Chapter 16

If all the economists in the world were laid end to end, they would never reach a conclusion.
- George Bernard Shaw

What is the “Dividend Policy” Question

Often mixed up with other financing/investment decisions
• Dividends as a by-product of the capital budgeting decision
• Dividends as a by-product of the borrowing decision

The precise question:

What is the effect of a change in cash dividends paid, given the firm’s capital budgeting and borrowing decisions?

But, if capital budgeting and borrowing decisions are fixed, how do we get the cash to increase dividends?

By issuing stock.
The Dividend Policy Question

The tradeoff: Retaining earnings vs. 
Paying out cash dividends and issuing new shares

Another way to see the tradeoff is to recognize that “sources” and “uses” of cash in any period must equal each other:

• What are the firm’s sources of cash?
  – Net earnings from the firm’s operations (X)
  – Proceeds from new security issues (F)

• What are the firm’s uses of cash?
  – Dividends paid to shareholders (D)
  – Outlays from capital budgeting decisions (I)

• Sources = Uses implies
  \[ X + F = D + I \]

If borrowing/investment decisions are fixed, how do we change dividends?

The irrelevance of dividend policy: 
An example

Case I: No new financing:
Assume for a particular firm:
1. Net earnings from operations expected to be $1200 per year in perpetuity (X=1200).
2. Investment outlays for capital budgeting projects expected to be $200 per year in perpetuity (I=200).
3. The appropriate discount rate is 10 percent.
4. There are 1000 common shares outstanding.
Applying the “free cash flow” valuation model, what is the value of the firm and the price per share?

[Note: Free cash flow is expected to be $1000 (1200-200) per period in perpetuity]

Firm value =

What is the total dividend paid and the dividend per share?

Sources = Uses

\[ X + F = I + D \]

\[ 1200 + 0 = 200 + 1000 \]

What does the future stream of dividends look like?

Case II: Firm issues $200 of new stock (at t=1):

What will be the total dividend paid at t=1?

Sources = Uses

\[ X + F = I + D \]

\[ 1200 + = 200 + \]

What will be the dividend per share to old shareholders at t=1? (Note: new shareholders don’t receive first dividend until t=2.)

What happens to price per share and what does the future stream of dividends look like?

To answer this we need to know:

• How many new shares were issued (m₁) and
• The price at which new shares were issued (p₁)
Calculating share price and number of shares

We can represent the total proceeds from the issue as:

\[ 200 = m_1 \times p_1 \]  \hspace{1cm} (1)

The value of the firm at \( t=1 \) (\( V_1 \)) can be expressed as:

\[ V_1 = n_1 \times p_1 = (n_0 + m_1) \times p_1 \]  \hspace{1cm} (2)

where \( n_0 \) and \( n_1 \) are the shares outstanding at \( t=0 \) and \( t=1 \), respectively.

Recognizing that the value of the firm at time 1 is \( V_1 = 10,000 \) and that \( n_0 = 1000 \), we can rewrite (2) as

\[ V_1 = (1000 + m_1) \times p_1 = 1000 \times p_1 + m_1 \times p_1 \]

Substituting for \( m_1 \times p_1 \) from expression (1) yields:

\[ 1000 \times p_1 + 200 = 10,000 \]

implying that

\[ p_1 = 9.80 \text{ and } m_1 = 20.41 \text{ new shares} \]

So, what will the future stream of dividends look like?

Dividend per share = Total dividend / no. of shares

\[
= \]

Do new investors pay the right price?

Price =

What is the effect of the increased dividend on the wealth of existing (old) shareholders?

Increase in dividend offset the decline in share price so that there is no change in wealth

What is the return to old shareholders?

Return = \( \frac{(\text{div}_1 + \text{price}_1 - \text{price}_0)}{\text{price}_0} \)
Are old shareholders indifferent between cases I and II?

Consider an investor who holds 100 shares:

<table>
<thead>
<tr>
<th>Case I</th>
<th>100</th>
<th>100</th>
<th>100</th>
<th>100</th>
<th>100</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case II</td>
<td>120</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>II - I</td>
<td>20</td>
<td>-2</td>
<td>-2</td>
<td>-2</td>
<td>-2</td>
<td>-2</td>
</tr>
</tbody>
</table>

NPV = 20 - (2 / 0.10) = 0 ; no change in wealth.

Both streams have the same present value, but there is a difference in timing. Investors may prefer one time pattern to the other.

---

Suppose the firm did not increase the current dividend (financed by equity issue). How could our investor achieve the stream of cash flows associated with case II?

Create a “homemade dividend”

How can investor achieve the pattern associated with case I, if the firm adopts case II?

Undo the dividend

If it is costly for investors to make homemade dividends (or undo dividends) then it may pay firms to offer different time patterns of payouts; so dividend policy may matter. BUT, ... (to be discussed later.)
Share repurchases are the same as dividends

Use $1000 to repurchase shares rather than pay dividend:

This implies that $m_1p_1 = -1000$

Sources = Uses

$X + F = I + D$

$1200 -1000 = 200 + 0$

Firm value can be expressed as:

$V_1 = (1000 + m_1)p_1 = 10,000$

$= 1000 p_1 + m_1p_1 = 10,000$

Substituting for $m_1p_1$ and solving yields:

$P_1 = $11.00 and $m_1 = -90.91$ (90.91 shares are repurchased)

What does the future stream of dividends look like?

$1000/909.09 = 1.10$ per share

What is the effect on shareholder wealth?

Consider an investor who holds 100 shares:

<table>
<thead>
<tr>
<th>Case I</th>
<th>100</th>
<th>100</th>
<th>100</th>
<th>100</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repurchase</td>
<td>0</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td>Difference</td>
<td>-100</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

NPV = $-100 + (10 / 0.10) = 0$; no change in wealth.

How can you “undo” a repurchase?
How can you do a homemade repurchase?
Relax Perfect World Assumptions

1. Uncertainty and the case for larger dividends (rightists)
   Bird in the hand argument
   Bird in the hand fallacy
2. Taxes ... favor lower dividends
   Tax on capital gains less than tax on dividend
3. Allowing for transactions costs
   • Floatation costs of new equity
     - lower optimal payout, but ...
     - issuance process may have “monitoring” benefits
   • Investor transactions costs
     - Makes homemade dividends costly. Therefore, it may be cheaper for firms to create the preferred policy.
     - This leads to a “clientele effect.”
     BUT, ONE CLIENTELE IS AS GOOD AS ANOTHER.

The Clientele Story (middle-of-the-road party)

Suppose
   90% of investors prefer a high dividend payout
   10% of investors prefer a low dividend payout
but...
   50% of firms offer a high dividend payout
   50% of firms offer a low dividend payout

Can any firms increase their value by changing their dividend payout policy?

What happens in equilibrium (when the dividend payout policies that firms offer satisfy investor preferences)?
CHAPTER 17

DOES DEBT POLICY MATTER?

CAPITAL STRUCTURE

• WHEN A FIRM ISSUES DEBT AND EQUITY SECURITIES ITS CASH FLOWS ARE SPLIT INTO TWO STREAMS
  – A SAFE STREAM TO BONDHOLDERS
  – A RISKY STREAM TO STOCKHOLDERS
• CAPITAL STRUCTURE
  – FIRM’S MIX OF DIFFERENT SECURITIES
• FUNDAMENTALLY MARKETING PROBLEM
  – FIND COMBINATION THAT MAXIMIZES OVERALL MARKET VALUE
• IS IT WORTHWHILE TO TRY TO FIND OPTIMAL MIX?
  – PERHAPS MIX DOESN’T MATTER!
CAPITAL STRUCTURE

• NOBEL PRIZE WINNERS MODIGLIANI & MILLER 1958 (MM) SHOWED THAT FINANCING DECISIONS DON’T MATTER IN PERFECT CAPITAL MARKETS
• PROPOSITION 1
  – FIRM CANNOT CHANGE TOTAL VALUE OF ITS SECURITIES BY SPLITTING CASH FLOWS INTO DIFFERENT STREAMS
  – FIRM’S VALUE IS DETERMINED BY ITS REAL ASSETS
  – CAPITAL STRUCTURE IS IRRELEVANT AS LONG AS INVESTMENT DECISIONS ARE FIXED
• ALLOWS COMPLETE SEPARATION OF INVESTMENT AND FINANCING DECISIONS
• IN PRACTICE, FINANCING DECISIONS DO MATTER
  – WE NEED TO UNDERSTAND WHEN MM HOLDS

EFFECT OF LEVERAGE IN A COMPETITIVE TAX-FREE ECONOMY: The Wapshot example

• POLICY THAT MAXIMIZES MARKET VALUE OF FIRM ALSO MAXIMIZES WEALTH OF SHAREHOLDERS
• $D$ AND $E$ ARE MARKET VALUES OF DEBT AND EQUITY OF WAPSHOT MARKETING COMPANY
• 100 SHARES AT $50 A SHARE
• $E = 1,000 \times 50 = 50,000$
• WAPSHOT HAS BORROWED $25,000
• MARKET VALUE OF ALL SECURITIES
  \[ V = D + E = 75,000 \]
• WAPSHOT’S STOCK IS LEVERAGED EQUITY
EFFECT OF LEVERAGE: The Wapshot example (continued)

- WPS “LEVERS UP” AGAIN BY BORROWING ADDITIONAL $10,000
  - PAYING OUT SPECIAL DIVIDEND OF $10 PER SHARE
  - SUBSTITUTES DEBT FOR EQUITY
- NO IMPACT ON WPS ASSETS OR TOTAL CASH FLOWS
  - WHAT IS NEW VALUE OF EQUITY?
- $V = $75,000, UNCHANGED
- $D = $35,000
- $E = 75,000 - 35,000 = $40,000
- STOCKHOLDERS HAVE SUFFERED $10,000 CAPITAL LOSS
  - EXACTLY OFFSET BY $10,000 SPECIAL DIVIDEND

EFFECT OF LEVERAGE: The Wapshot example (continued)

- BUT WHAT HAPPENS IF $V = $80,000
  - BECAUSE OF THE CHANGE IN CAPITAL STRUCTURE?
- THEN $E = 80,000 - 35,000 = $45,000
- ANY INCREASE OR DECREASE IN $V AS A RESULT OF CHANGE IN CAPITAL STRUCTURE
  - ACCRUES TO SHAREHOLDERS
- A POLICY OF MAXIMIZING FIRM’S MARKET VALUE ALSO MAXIMIZES SHAREHOLDER WEALTH
- SO, WHAT’S THE RIGHT COMBINATION OF DEBT AND EQUITY?
MODIGLIANI AND MILLER

• ANY COMBINATION OF SECURITIES IS AS GOOD AS ANY OTHER
• EXAMPLE: TWO FIRMS, SAME OPERATING INCOME
  – DIFFER ONLY IN CAPITAL STRUCTURE
  – FIRM U UNLEVERED, $V_U = E_U$
  – FIRM L IS LEVERED, $E_L = V_L - D_L$

MODIGLIANI AND MILLER

• TWO STRATEGIES:
• STRATEGY 1
  – BUY 1% OF FIRM U’s EQUITY
  – DOLLAR INVESTMENT $0.01 V_U$
  – DOLLAR RETURN $0.01$ PROFITS
• STRATEGY 2
  – BUY 1% OF FIRM L’s EQUITY AND DEBT
  – DOLLAR INVESTMENT
  – DOLLAR RETURN
    FROM OWNING $0.01D_L$
    FROM OWNING $0.01E_L$
    TOTAL
MODIGLIANI AND MILLER

• CONSIDER TWO ALTERNATIVE STRATEGIES:
  • STRATEGY 3
    – BUY 1% OF FIRM L’s EQUITY
    – DOLLAR INVESTMENT
    – DOLLAR RETURN
  • STRATEGY 4
    – BUY 1% OF FIRM U’s EQUITY
    – BORROW ON YOUR OWN ACCOUNT .01D_L
    – DOLLAR INVESTMENT .01(V_U - D_L)
    – DOLLAR RETURN

VALUE ADDITIVITY

• WE CAN SLICE A CASH FLOW INTO AS MANY PARTS AS WE LIKE
  – SUM OF THE PRESENT VALUE OF THE PARTS ALWAYS EQUAL TO
    PRESENT VALUE OF THE ORIGINAL STREAM
  – LAW OF CONSERVATION OF VALUE
• FIRM VALUE IS DETERMINED BY LEFT HAND SIDE OF BALANCE
  SHEET, I.E. BY THE REAL ASSETS
  – REGARDLESS OF CLAIMS AGAINST IT
• SHOULD FIRM ISSUE PREFERRED OR COMMON STOCK?
  – PROPOSITION 1 SAYS CHOICE IS IRRELEVANT
  – IF IT DOESN’T AFFECT INVESTMENT, BORROWING AND
    OPERATING POLICIES
• ALSO APPLIES TO MIX OF DEBT SECURITIES
  – LONG-TERM VS SHORT-TERM
  – SECURED VS UNSECURED
  – CONVERTIBLE VS STRAIGHT
MM PROPOSITION 1

- CORPORATE DEBT CAN BE RISKY
  - ONLY LIMITATION IS THAT FIRMS AND INDIVIDUALS CAN BORROW AT SAME RATE
- BUT SHAREHOLDERS HAVE LIMITED LIABILITY
- MANY INDIVIDUALS WOULD LIKE TO BORROW WITH LIMITED LIABILITY
  - MIGHT BE PREPARED TO PAY SMALL PREMIUM FOR LEVERED SHARES
  - IF SUPPLY OF LEVERED SHARES INSUFFICIENT
    - NO EVIDENCE THAT IS THE CASE

HOW LEVERAGE AFFECTS RETURNS

- EXPECTED RETURN ON THE ASSETS OF A FIRM
  \[ r_A = \frac{\text{EXPECTED OPERATING INCOME}}{\text{MARKET VALUE OF ALL SECURITIES}} \]
- SUPPOSE INVESTOR HOLDS ALL DEBT AND EQUITY OF THE COMPANY
- EXPECTED RETURN ON PORTFOLIO, \( r_A \), IS WEIGHTED AVERAGE OF EXPECTED RETURNS ON INDIVIDUAL SECURITIES:
  \[ r_A = \frac{D}{V}r_D + \frac{E}{V}r_E \]
- REARRANGING YIELDS:
  \[ r_E = r_A + \frac{D}{E}(r_A - r_D) \]
  WHICH IS THE BASIS OF MM PROPOSITION 2
LEVERAGE AND THE EXPECTED RETURN ON EQUITY

As leverage increases, $V_A$ and $r_A$ are unchanged but the expected return on equity increases.

For risky debt, $r_D$ increases as leverage increases.

![Graph showing expected return vs. debt-equity ratio (D/E)]

MM PROPOSITION 2

- Bonds are almost risk-free at low debt levels
  - $r_D$ is independent of leverage
  - $r_E$ increases linearly with debt-equity ratio expressed in market values
  - Increase in expected return reflects increased risk
- As firm borrows more, risk of default increases
  - $r_D$ starts to increase
  - $r_E$ increases more slowly
    - Holders of risky debt bear some of the firm’s business risk
**r_E - THE EXPECTED EQUITY RETURN**

- Increase in expected equity return reflects increased risk.
- Increase in leverage increases amplitude of variations in cash flows available to shareholders.
  - Same change in operating income now distributed among fewer shares.
- We can understand the increased risk in terms of βs.

\[
\beta_A = \frac{D}{V} \beta_D + \frac{E}{V} \beta_E \\
\beta_E = \beta_A + \frac{D}{E} (\beta_A - \beta_D)
\]

**THE TRADITIONAL POSITION**

- What did financial experts think before MM?
- Not much.
- Weighted-average cost of capital:
  - Used in capital budgeting decisions to calculate NPV.
  - Expected return on portfolio of all company’s securities.

\[
r_A = \frac{D}{V} r_D + \frac{E}{V} r_E
\]
WACC: AN EXAMPLE

- EXAMPLE: FIRM HAS $2MM DEBT
  - 100,000 SHARES PRICE $30 PER SHARE
  - CURRENT BORROWING RATE 8%
  - EXPECTED RATE OF RETURN ON COMMON STOCK 15%
- D=$2MM, E=100,000X$3 = $3MM, V = D+E=2+3 = $5MM
- WACC = (D/V)rd + (E/V)rk
  = (2/5).08 + (3/5).15
  =.122 OR 12.2%

WARNING 1

- SOMETIMES OBJECTIVE STATED
  - NOT AS “MAXIMIZE TOTAL MARKET VALUE”
  - BUT “MINIMIZE WACC”
  - EQUIVALENT IF MM PROPOSITION 1 HOLDS
- BUT...IF MM PROPOSITION 1 DOES NOT HOLD,
  - CAPITAL STRUCTURE THAT MINIMIZES WACC ALSO MAXIMIZES VALUE OF FIRM ONLY IF OPERATING INCOME IS INDEPENDENT OF CAPITAL STRUCTURE
WARNING 2

- ATTEMPTS TO MINIMIZE WACC CAN LEAD TO ‘LOGICAL SHORT-CIRCUITS’, e.g.

  “SINCE DEBT IS CHEAPER THAN EQUITY ($D < E$) WE SHOULD BORROW MORE.”

THE PROBLEM: $E$ INCREASES AS WE ADD MORE DEBT (MM PROPOSITION 2)

WHAT HAPPENS IF THE EXPECTED RETURN DOES NOT RISE?

- THIS IMPLIES THAT WACC, $r_A$, DECLINES WITH INCREASING LEVERAGE

- EXAMPLE: NO-GROWTH FIRM
  - SHAREHOLDERS ALWAYS WANT 12% RATE OF RETURN INDEPENDENT OF THE AMOUNT OF DEBT
  - BONDHOLDERS ALWAYS WANT 8%
  - CONSTANT OPERATING INCOME $100,000 A YEAR
  - WITH ALL EQUITY FIRM, WACC IS 12%
    \[ V = \frac{100,000}{0.12} = 833,333 \]
  - WITH “ALL DEBT” FIRM, WACC IS 8%
    \[ V = \frac{100,000}{0.08} = 1,250,000 \]
WHAT HAPPENS IF THE EXPECTED RETURN DOES NOT RISE?

- GAIN OF $416,667 GOES TO SHAREHOLDERS

- FIRM WITH ALMOST 100% DEBT HAS TO BE BANKRUPT
  - OR EQUITY WOULD HAVE SOME VALUE

- BUT IF FIRM IS BANKRUPT, LENDERS ARE ITS NEW SHAREHOLDERS
  - REQUIRE SAME 12% RATE OF RETURN
RATES OF RETURN ON LEVERED EQUITY -
THE TRADITIONALIST POSITION

• TRADITIONALISTS HAVE AN INTERMEDIATE POSITION
• MODERATE DEGREE OF FINANCIAL LEVERAGE MAY INCREASE $r_E$
  – BUT LESS THAN PREDICTED BY MM PROPOSITION 2
• HIGH DEGREE OF FINANCIAL LEVERAGE INCREASES $r_E$
  – BUT MORE THAN PREDICTED BY MM PROPOSITION 2
• WACC, $r_A$, THUS DECLINES AT FIRST, THEN RISES WITH INCREASING LEVERAGE
• ITS MINIMUM POINT IS POINT OF OPTIMAL CAPITAL STRUCTURE

THE TRADITIONALIST POSITION

AS LEVERAGE INCREASES, $r_E$ AT FIRST INCREASES MORE SLOWLY THAN MM PREDICT BUT EVENTUALLY SHOOTS UP WITH “EXCESSIVE” BORROWING

MINIMUM IN WACC IDENTIFIES OPTIMAL D/E RATIO

Expected return

$\begin{align*}
\text{Expected return} & \quad r_E \\
\text{WACC} & \quad r_A \\
\text{Cost of Debt} & \quad r_D \\
\text{Leverage} & \quad (D/E)
\end{align*}$
ARGUMENTS IN FAVOR OF THE TRADITIONALIST POSITION

- ARGUMENT 1
- INVESTORS DON’T NOTICE RISK OF “MODERATE” BORROWING
- THEY WAKE UP WHEN DEBT IS “EXCESSIVE”
- ARGUMENT IS EITHER NAIVE OR REFLECTS CONFUSION BETWEEN DEFAULT RISK AND FINANCIAL RISK
  - DEFAULT MAY NOT BE A SERIOUS RISK FOR MODERATE LEVERAGE
  - FINANCIAL RISK IN TERMS OF INCREASED VOLATILITY OF RETURN AND HIGHER BETA EVEN WITH NO RISK OF DEFAULT

ARGUMENTS IN FAVOR OF THE TRADITIONALIST POSITION

- ARGUMENT 2
- ACCEPTS MM PROPOSITION 2 IN PERFECT CAPITAL MARKETS
  - BUT ARGUES THAT THERE ARE IMPERFECTIONS IN REAL MARKETS
  - FIRMS THAT BORROW PROVIDE SERVICE TO INVESTORS
  - CORPORATIONS CAN BORROW MORE CHEAPLY THAN INDIVIDUALS
  - LEVERED FIRMS TRADE AT PREMIUM TO THEIR VALUES IN PERFECT MARKETS
- IS CORPORATE BORROWING REALLY CHEAPER?
  - MORTGAGE RATES NOT VERY DIFFERENT FROM RATES ON HIGH-GRADE CORPORATE BONDS
- AREN’T THERE ENOUGH LEVERED FIRMS TO SATISFY THIS CLIENTELE?
WHEN DOES MM NOT HOLD?

- MM DEPENDS ON PERFECT CAPITAL MARKETS
- MARKETS ARE GENERALLY WELL-FUNCTIONING BUT NOT ALWAYS PERFECT
- MM SOMETIMES WRONG
- FINANCIAL MANAGER’S JOB TO KNOW WHEN

CHAPTER 18

HOW MUCH SHOULD A FIRM BORROW?
DEBT POLICY IN THE REAL WORLD

• MM SHOW THAT WITH PERFECT CAPITAL MARKETS DEBT POLICY DOESN'T MATTER
• BUT IT DOES MATTER IN THE REAL WORLD
  – FIRMS IN A GIVEN INDUSTRY HAVE SIMILAR DEBT-RATIOS
  – AIRLINES, UTILITIES, BANKS TYPICALLY RELY HEAVILY ON DEBT
  – DRUG COMPANIES TYPICALLY RELY LESS ON DEBT DESPITE HEAVY REQUIREMENTS FOR CAPITAL

WHAT WE LEFT OUT

• TAXES
• WE ASSUMED BANKRUPTCY WAS CHEAP
• WE IGNORED COSTS OF FINANCIAL DISTRESS EVEN WITHOUT BANKRUPTCY
• WE IGNORED POTENTIAL CONFLICTS OF INTEREST BETWEEN FIRM'S SECURITY HOLDERS
  – WHAT HAPPENS TO OLD BONDHOLDERS WHEN NEW DEBT IS ISSUED
  – WHEN NEW STRATEGY TAKES FIRM INTO RISKIER BUSINESS
WHAT WE LEFT OUT

- WE IGNORED INFORMATION PROBLEMS THAT FAVOR DEBT OVER EQUITY
- WE IGNORED INCENTIVE EFFECTS OF FINANCIAL LEVERAGE ON MANAGEMENT’S INVESTMENT AND PAYOUT DECISIONS
- WE WANT THEORY THAT INCLUDES INSIGHTS OF MM PLUS REAL WORLD EFFECTS OF
  - TAXES
  - COSTS OF BANKRUPTCY AND FINANCIAL DISTRESS

CORPORATE TAXES

- PAYMENTS TO BONDHOLDERS (INTEREST) ARE TAX-DEDUCTIBLE; PAYMENTS TO SHAREHOLDERS (DIVIDENDS) ARE NOT
- HOW DOES THIS AFFECT FIRM VALUE?
- Consider 2 identical firms except one has no debt (Firm U) and one has borrowed $1000 at 8% (Firm L)
  - Both firms have EBIT=$1000; tax rate is 35%
  - Tax for Firm U= 1000 x .35 =$350
  - Tax for Firm L= (1000-80) x .35 = $322
    - Firm L has $28 more to payout to security holders
TAX SHIELDS

- The interest payment to the bondholders provides a valuable tax shield to the levered firm
- How valuable is the tax shield?
- If debt of L is permanent, a continuous stream of $28 per year
- Stream is less risky than operating cash
- Risk depends on:
  - ABILITY OF L TO EARN ENOUGH TO COVER FUTURE INTEREST
  - EVEN IF L DOES NOT COVER INTEREST IN SOME FUTURE YEAR, TAX SHIELD MAY NOT BE LOST
    - L CAN CARRY BACK THE LOSS THREE YEARS
    - IF NECESSARY, CARRY FORWARD LOSS INTO SUBSEQUENT YEARS
- DISCOUNT INTEREST TAX SHIELDS AT LOW RATE

INTEREST TAX SHIELD

- Discount tax shield at rate required by bondholders
- PV (TAX SHIELD) = 28/.08 = $350
- More generally,
  \[ PV (TAX SHIELD) = \frac{(TAX RATE \times INTEREST PAYMENT)}{DISCOUNT RATE} \]
  \[ = \frac{T_C (r_D D)}{r_D} \]
  \[ = T_C D \]

MM PROPOSITION I WITH TAXES
Value of firm=Value if all-equity financed+PV (tax shield)
...or in the special case where debt is permanent and the firm is expected to be able to use all the tax shields in the future...

Value of firm=Value if all-equity financed+T_C D
WHAT ARE WE MISSING?

• MM PROPOSITION I IMPLIES THAT FIRMS SHOULD BE “ALL DEBT”
• HOWEVER, MANY WELL-RUN FIRMS HAVE LOW DEBT LEVELS
• THIS SUGGESTS THAT THERE MUST BE SOME DISADVANTAGES OF DEBT
• WE WILL NEXT CONSIDER
  – PERSONAL TAXES
  – BANKRUPTCY COSTS
  – COSTS OF FINANCIAL

EFFECT OF PERSONAL TAXES

• OBJECTIVE OF THE COMPANY IS NO LONGER TO MINIMIZE CORPORATE TAX BILL BUT MINIMIZE PV OF ALL TAXES PAID ON CORPORATE INCOME

• Some notation
  – $T_p$ PERSONAL TAX RATE ON INTEREST
  – $T_{pe}$ EFFECTIVE PERSONAL RATE ON EQUITY INCOME
  – TWO RATES EQUAL IF EQUITY INCOME RECEIVED AS DIVIDENDS
  – $T_{pe} < T_p$ IF EQUITY INCOME IS CAPITAL GAINS
  – IN 1997, TOP RATE 39.6% ON ORDINARY INCOME, INCLUDING DIVIDENDS
  – TAX RATE ON REALIZED CAPITAL GAINS IS 20%
  – BUT CAPITAL GAINS TAXES CAN BE DEFERRED UNTIL SHARES ARE SOLD
  – TOP EFFECTIVE CAPITAL GAINS RATE LESS THAN 20%
SUPPOSE INTEREST ATTRAITS MORE PERSONAL TAX THAN EQUITY INCOME

\[
\begin{array}{c}
$1$ operating income \\
\text{Paid out as interest} \\
\text{Corporate Tax} \\
\text{Income After Corporate Tax} \\
\text{Personal Tax} \\
\text{Income After All Taxes} \\
\end{array}
\]

\[
\begin{array}{c}
\text{NONE} \\
1 \\
T_p \\
(1 - T_p) \\
1 - T_p \\
\end{array}
\]

\[
\begin{array}{c}
T_C \\
(1 - T_C) \\
T_{pE} (1 - T_C) \\
1 - T_C - T_{pE} (1 - T_C) \\
(1 - T_{pE}) (1 - T_C) \\
\end{array}
\]

If \((1 - T_p)\) is greater than \((1 - T_{pE})(1 - T_C)\), corporate borrowing is still advantageous. But, since \(T_p\) is greater than \(T_{pE}\), the tax advantage is smaller than in the case with no personal taxes.

DEBT AND TAXES: The main points

- Debt provides a corporate tax shield. Most important for firms with high marginal tax rates.
- The more a firm borrows, the less sure it is of being able to use the tax shield. Increasing leverage decreases marginal value of tax shield.
- Equity investors get tax break relative to lenders; may partially offset corporate tax shield.

CONCLUSIONS

a) Some net tax advantage for profitable firms.
b) Firms with tax-loss carry forwards, low marginal tax rates and/or uncertain future prospects should borrow less.
FINANCIAL DISTRESS

- Firm has “difficulty” meeting its financial obligations
  - Suggests firm skating on thin ice; may lead to bankruptcy
- Investor concern about financial distress suggests the following “tradeoff model” of capital structure:

VALUE OF FIRM

\[ \text{VALUE OF FIRM} = \text{VALUE IF ALL EQUITY-FINANCED} + \text{PV(TAX SHIELD)} - \text{PV(COSTS OF FINANCIAL DISTRESS)} \]

- The costs of financial distress depend on:
  - the magnitude of costs encountered if distress occurs
  - the probability of distress
- We will focus on the bankruptcy and agency costs of financial distress

COSTS OF FINANCIAL DISTRESS REDUCE THE OPTIMAL DEBT RATIO

At low debt levels PV of tax shield gradually increases as firm borrows more. At moderate debt levels PV (Financial distress) is small so tax advantage dominates. With more debt, probability of financial distress increases AND tax advantage of debt starts to decline since firm is less certain it will be able to fully utilize tax shield in the future.
Bankruptcy Costs

• Why is bankruptcy bad?
  – Bad financing outcome or bad investment outcome?

  The fact that bondholders are not paid in full is not a cost of bankruptcy, i.e., if creditors could costlessly take the remaining value of the firm, the potential for bankruptcy would not be considered a “disadvantage of debt”.

Direct bankruptcy costs
• Lawyers, accountants and other professional fees
  – optimal contracting technology
• Managerial time administering and settling disputes
  – Costly conflicts between various claimholders

Indirect bankruptcy costs
• Effects on the firm’s operations
  – Loss of sales, weakened assurance of delivery (e.g., warranties,) inability to take profitable projects

EVIDENCE ON BANKRUPTCY COSTS

• Warner (1977) looked at data on 11 railroad bankruptcies; found average direct cost was $2 million.
• Although large, was only 5.3% of RR’s market values just prior to bankruptcy... and only 1.4% of market value 5 years prior to bankruptcy.
• What does this suggest about expected direct costs of bankruptcy? (- Miller’s “Horse and Rabbit Stew”)
• The indirect costs of bankruptcy are hard to measure
  – Anecdotal evidence suggests they are significant, e.g., the Texaco-Pennzoil case
Agency Costs of Debt

• How can stockholders hurt bondholders once the bonds are issued?
  – Asset substitution
  – Dividend payout
  – Underinvestment; *refusing to contribute new capital*
  – Claim dilution
• How do these conflicts affect firm value?
  – Bondholders are rational, they “price protect” themselves
  – Restrictive covenants in debt agreements

Agency Costs

• Agency relationship:
  – Agent is entrusted by principal to act in his or her behalf
  – Incentive problems arise due to conflicts of interest
• Conflicts can arise between:
  – Managers (agent) and shareholders (principal)
  – Shareholders (agent) and bondholders (principal)
• Agency costs:
  – Opportunity losses
  – Monitoring losses
COSTS OF DISTRESS VARY WITH TYPE OF ASSET

- Hotels vs. high tech growth companies
- Assets differ in difficulty to sell off
  - Commercial real estate
  - Technology, brand name capital, human capital
- Difficulty in carrying on as going concern
  - Defections by key employees
  - Assurances to customers that firm will be around to service product (e.g., value of warranties)
  - Continued need for R&D in techs
- May explain why debt-equity ratios are low in the pharmaceutical and high tech industries

TRADE-OFF THEORY OF CAPITAL VALUE

- Target debt ratios should vary from firm to firm
  - Companies with safe assets and plenty of taxable income should have high target debt ratios
  - Marginally profitable companies with risky intangible assets should rely primarily on equity financing, i.e., have low target debt ratios
- Trade-off theory more realistic than MM, but does it agree with the facts?
  - Explains many industry differences in capital structure
    - High techs with risky, intangible assets often use little debt
      - Assets are tangible and relatively safe
  - Explains which firms go private in LBO’s
    - Mature, “cash-cow” businesses with established markets
    - Not high growth companies with more uncertain prospects
TRADE-OFF THEORY OF CAPITAL VALUE

• Some failures of the trade-off theory
  – Why do some of the most successful companies use no debt and thus give up the interest tax shields?
    • For example, Merck is all equity financed
      – True that assets are risky, still large tax bill and very high credit rating...could save millions in taxes
    • Merck is an example of the general rule that in an industry, the most profitable companies borrow the least
      – The trade-off theory predicts the opposite
  – In early 1900’s tax rates low or zeros, but debt ratios just as high as today
  – Firms in countries which do not allow for tax shields have debt ratios similar to firms in the US

PECKING ORDER OF FINANCING CHOICES

• Based on asymmetric information
  – Managers know more about their firm than outsiders
• Managers are reluctant to issue new stock when shares are undervalued. More likely to issue when shares are overvalued- Why?
• Investors realize that managers know more and that they try to “time” issues
• Investors therefore interpret equity issues as bad news
• Firms that “need” external equity may pass up good investment opportunities because shares can’t be sold at a fair price
Some implications

- Firms prefer internally generated funds
  - Adapt dividend payout ratio to investment opportunities
- Financial slack is valuable
- If external capital is required, debt is better
  - Less room for difference of opinion about what debt is worth
- When the capacity to issue debt is exhausted, firms issue equity as a “last resort”
- No well-defined debt-equity ratio
  - Observed debt-equity ratios a function of past profitability and past needs for capital

ASYMMETRIC INFORMATION

- EXPLAINS DOMINANCE OF DEBT FINANCING OVER NEW EQUITY ISSUES
- FIRMS WITH ADEQUATE INTERNALLY GENERATED FUNDS DON’T HAVE TO SELL DEBT
- LESS PROFITABLE FIRMS HAVE TO SELL DEBT
  - NOT ENOUGH INTERNAL FUNDS FOR INVESTMENT NEEDS
- EXPLAINS INVERSE RELATIONSHIP IN AN INDUSTRY BETWEEN PROFITABILITY AND FINANCIAL LEVERAGE
  - FIRMS INVEST TO TRY TO KEEP UP WITH THE GROWTH IN THEIR INDUSTRY
  - LEAST PROFITABLE FIRMS HAVE LESS INTERNAL FUNDS
  - BORROW MORE
FINANCIAL SLACK

• BETTER TO BE AT TOP OF PECKING ORDER THAN AT BOTTOM
  – WON'T HAVE TO PASS UP GOOD INVESTMENTS

• FINANCIAL SLACK VALUABLE
  – CASH, MARKETABLE SECURITIES
  – READY ACCESS TO FINANCIAL MARKETS
  – BANK FINANCING

• NEGATIVE SIDE TO FINANCIAL SLACK
  – MAY ENCOURAGE MANAGERS TO TAKE IT EASY OR INVEST EXTRA CASH IN PET PROJECTS, PERKS, ETC.
  – DEBT IS A WAY TO GET MANAGERS TO PAY OUT CASH RATHER THAN WASTE IT