UNIVERSITY OF MICHIGAN

SCHOOL OF PUBLIC HEALTH

DEPARTMENT OF HEALTH MANAGEMENT AND POLICY

HMP 607

CORPORATE FINANCE FOR HEALTH CARE ADMINISTRATORS

2008

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Proximate Course Objectives

- Understand Corporate Finance Theory
  - Investing Decision-Making
  - Financing Decision-Making
- Apply Corporate Finance Methods
  - Practical analyses, rooted in theory
  - Use of analyses to inform decisions
  - Health care firm
  - Health care financial and other markets

Course Methods

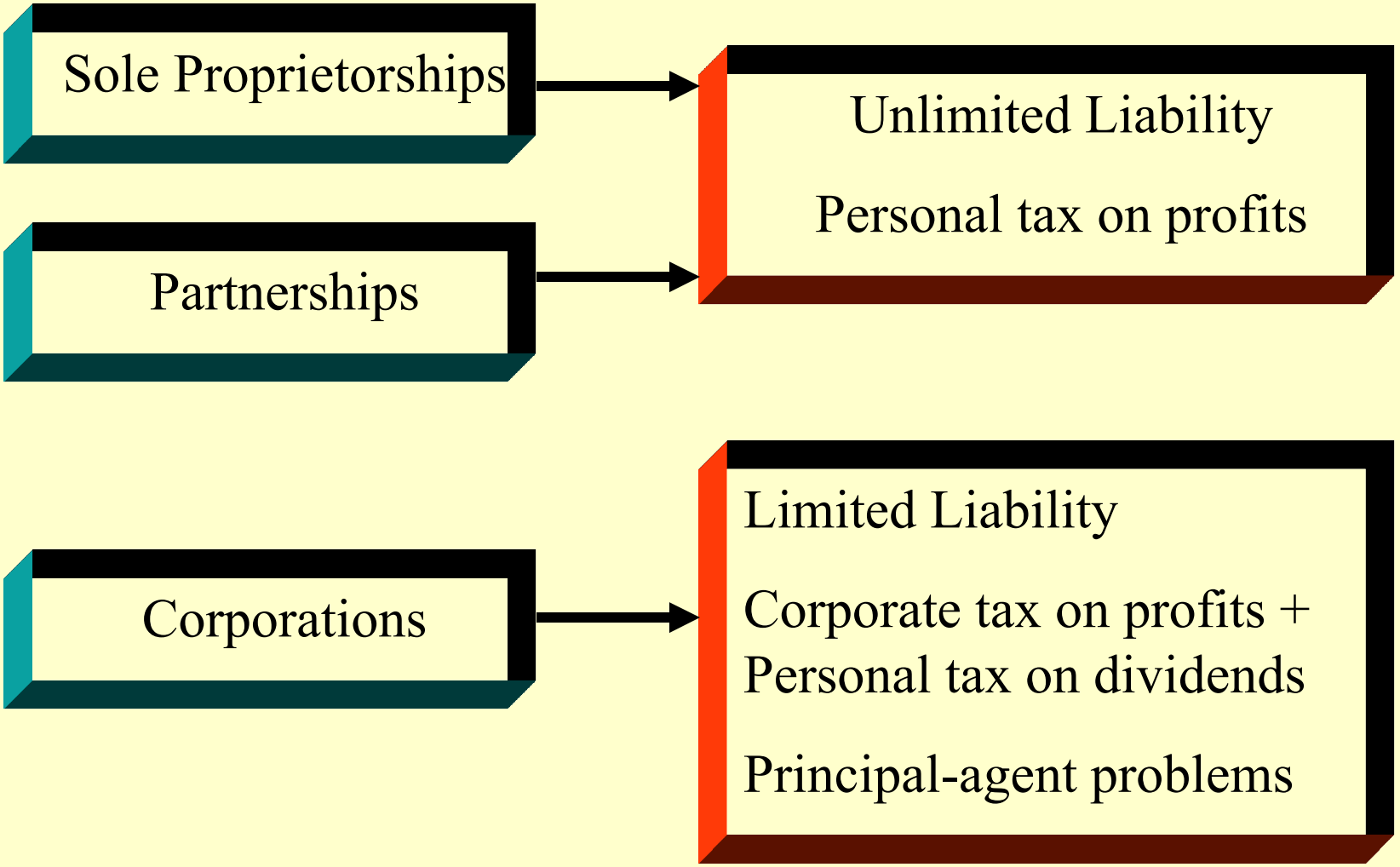
- 40 hours of theory, math, applications
- Readings in text (BMA) and other
- Review of videos
- CTools discussion
- Deliverables
  - 7 exercises
  - 2 cases
- Grading
  - 30% case analyses
  - 20% exercise analyses
  - 40% examinations
  - 20% miscellaneous information
- Schedule (attached)

Finance and the Financial Manager

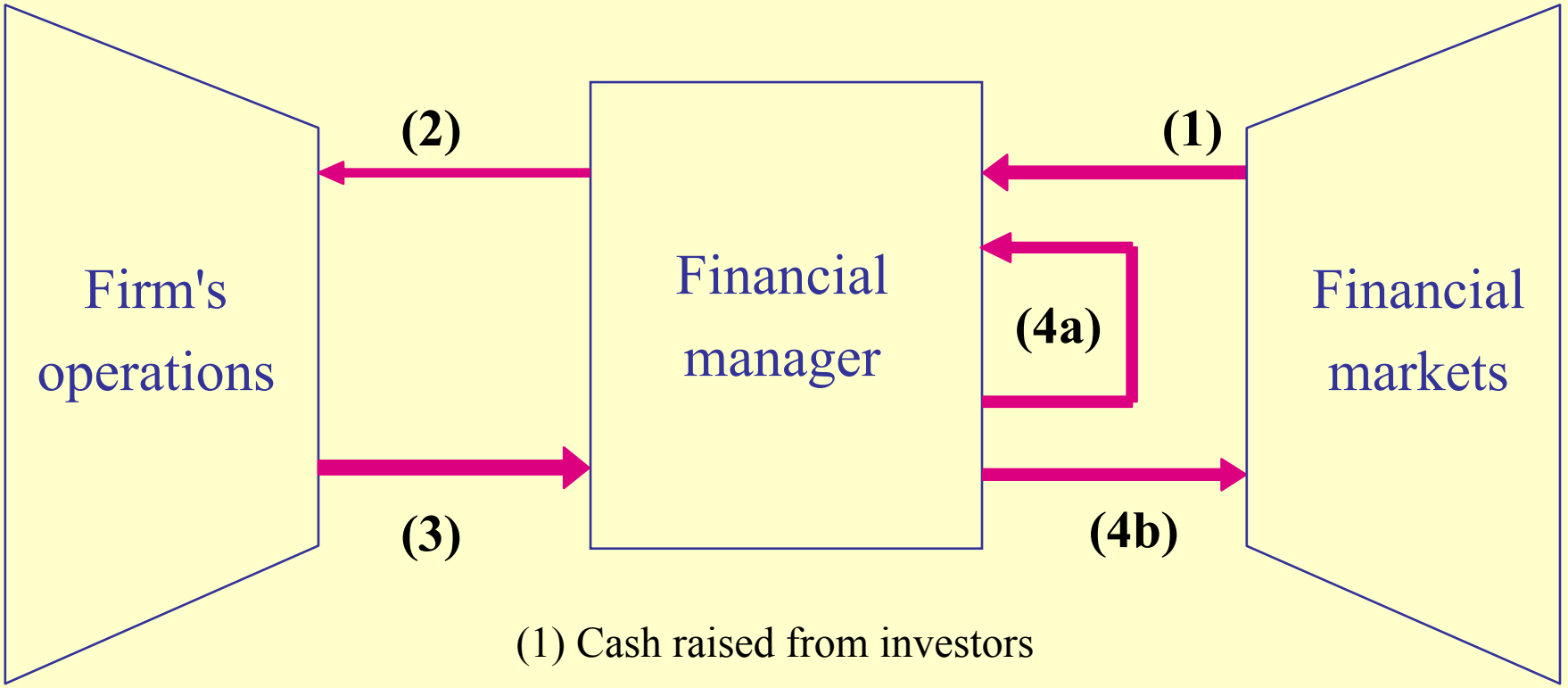
BMA Ch 1

- Organizational structures
- The role of the financial manager
- Common finance terminology
- Financial analyses and decisions

Organizational Structures



Role of The Financial Manager



(1) Cash raised from investors

(2) Cash invested in firm

(3) Cash generated by operations

(4a) Cash reinvested

(4b) Cash returned to investors

Role of The Financial Manager

- Prepare Financial Statements
- Develop Strategic Financial Plan
- Analyze Capital Expenditure Proposals
- Determine Optimal Capital Structure
- Secure Capital Financing
- Manage Cash
  - Accounts receivable
  - Financial investments
- Control to Achieve Financial Plan
  - Cost Management Systems
  - Revenue Maximization

Introduction to Health Care Finance

Let's begin at the end

- Financial statements
  - Results of decisions show up here
  - Terminology
- Financial challenges - key themes
  - Equity the key to success (capital structure)
  - Pressure on operating profits
  - Reliance on investments
  - Increasing business risk

Potential Solutions

- Control Costs (or cash outflows)
  - Administrative Efficiency
    - Technical efficiency
    - Economic efficiency
    - Scale economies
  - Clinical efficiency
  - Financing efficiency
- Enhance Revenues (or cash inflows)
  - Net price increases
  - Volume increases (and effect on costs)
  - New lines of business
  - Fund development (philanthropy)
  - More investment games?

Financial Analyses and Decisions

Basic finance problems

- Investment decision - How much should we invest and what assets should we invest in?
- Financing decision - How should the cash required for the operation of the firm be raised?
- Criterion - To make the owners of the firm as well off as possible, i.e., to maximize value.

Financial Analyses and Decisions
Important characteristics of decisions

- Focus on cash flows, instead of accruals
  - Expenses v. Cash Outflows
    - Purchase of capital asset
      - is not expense
      - is cash outflow
    - Recognition of depreciation expense
      - is expense
      - is not cash outflow
  - Revenues v. Cash Inflows
    - Borrowing funds
      - is not revenue
      - is cash inflow

Financial Analyses and Decisions
Important characteristics of decisions

- Consequences last several years
- Risk of future cash flows
- Non-cash values (?)

Financial Math I

BMA Ch 2

- Time value of money (and anything)
- Future value and interest accumulation
- Present value and discounting

Time Value of Money

Value of money (and everything) depends on timing

- Inflation (?)
- Opportunity for investment
- Time preference for consumption

Present and Future Values

Future Value

Amount to which an investment will grow after earning interest

◄Interest accumulation

Present Value

Value today of a future cash flow

◄Discounting

Future Value
and
Interest Accumulation

$$FV = PV * (1+r)^t$$

where r = interest rate

Future Value
and
Interest Accumulation

Example: What is the value in one year of $3000 invested at 8%?

PV = 3000

r = .08

t = 1

FV = 3000*(1.08)^1 = 3240

Present Value and Discounting

$$PV = FV * (1/(1+r))^t,$$

where

r = discount rate

$(1/(1+r))^t$ = discount factor

Present Value and Discounting

Example: What is the value today of $100 received in one year, discounted at 12%?

FV = 100

r = .12

t = 1

PV = 100*(1/(1.12))^1 = 89.29

Several Ways to Calculate Present Value

- Long hand
- PV Table
- Calculator with financial functions
- Excel financial function - NPV
- Nerd decoder watch - rare

Future Value
and
Interest Accumulation

Example: What is the value in one year of $89.29 invested at 12% (compounded annually)?

PV = 89.29

r = .12

t = 1

FV = 89.29*(1.12)^1 = 100

Note that interest accumulation is both conceptually and mathematically the inverse of discounting.

Financial Math II

BMA Ch 3

- Compounding
- PV of Cash Flow Stream
- Perpetuities
- Annuities
- Real v. Nominal Interest (and Discount) Rates (inflation)

Present Value

$$PV = C_t * (1/1+r)^t$$

- We have replaced FV with C in PV formula. C_t now designates Cash Flow in year t
- In Session 2,
  - t=1
  - C = 100
  - PV of $100 one year from now is $89.29
- We can calculate the PV of cash flow at any time in future, using compounding

Compounding

- Annual

$$PV\ (1+r)\ (1+r) = FV_2$$

$$PV\ (1+r)^2 = FV_2$$

$$PV\ (1+r)^t = FV_t$$

$$PV = FV_t / (1+r)^t$$

Ex: What is the PV of $100 received two years from now, if r = .12?

Compounding

- Discrete, but more frequently than annual

$$FV_t = PV\,(1 + r/m)^{mt}$$

$$PV = FV_t / (1 + r/m)^{mt}$$

Ex: What is the value in one year of an investment of 100 at 8 percent compounded

annually?

quarterly?

daily?

Note: More frequent compounding results in higher effective annual yield

Present Value of Cash Flow Stream

- General

$$PV = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_T}{(1+r)^T}$$

$$PV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t}$$

Ex: What is the PV of the following stream of cash flows:

yr 1: 100
yr 2: 150
yr 3: 165, if r=.07?

Present Value of Cash Flow Stream

- ***Perpetuity*** – Constant stream of cash flows forever

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

$$r = \frac{C}{PV}$$

$$PV = \frac{C}{r}$$

Applications:
1. Valuation of non-growth stocks
2. Estimation of terminal values in investment decisions

Present Value of Cash Flow Stream

- ***Growing Perpetuity*** – Stream of cash flows that grows at a constant rate forever

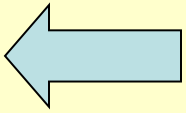
$$PV = \frac{C}{r - g}$$

Application: Valuation of growth stocks

Present Value of Cash Flow Stream

- ***Annuity*** – Constant stream of cash flows for a term

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



Don't memorize!

Applications:
1. Valuation of bonds
2. Valuation of your lottery winnings

Ex: What is the value of winning a $1,000,000 lottery, if payout is in 20 annual installments?

Real v. Nominal Interest (and Discount) Rates

- Nominal rate
  - Rate stated on a financial instrument
  - Known a priori
- Real rate
  - Nominal rate adjusted for inflation
  - Can only be known after the fact
- Exact math relationship

  (1+nom) = (1+real)*(1+inf) 1.1=1.038*1.06
- Common approximation

  nom = real + inf

  .1 ≈ .038 + .06 close enough

Valuing Stocks and Bonds

BMA Ch 4

- Bond Valuation - annuities
- Common Stock Trading
- Stock Valuation
- Estimating the Cost of Equity Capital
- Stock Valuation - perpetuities
- Some Stock Valuation Terminology

Bond Valuation

Parameters of bonds

1. Face value	FV = 1000
2. Coupon rate	coup = .05
3. Frequency of payment	m = 1
4. Interest payment	C = 50
5. Maturity date	T = 5
6. Yield to maturity	r = .06
7. Price	PV = ?

Market price

$$P_B = \sum_{t=1}^{T} \frac{Pmt}{(1+r)^t} + \frac{FaceValue}{(1+r)^T}$$

Bond Valuation

Example: The data on the previous slide refer to 10-year bonds originally sold to the public by Dandy Crowing Company in 2002. At the time of the sale, prevailing interest rates on the debt of firms such as Dandy were at 5%. It is now 2007, and interest rates have risen to 6% on such debt.

1. What is the 2007 price of Dandy's bonds?
2. If interest rates had fallen to 4%, instead of rising, what would be the price of Dandy's bonds?

Common Stock Trading

Common Stock - Ownership shares in a publicly held corporation

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

Dividend - Periodic cash distribution from the firm to the shareholders

P/E Ratio - Price per share divided by earnings per share.

Common Stock Trading

Book Value - Value of the firm according to the balance sheet

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

Market Value - Value of firm in financial markets

Stock Valuation

Parameters of Stocks

1. Current Price
2. Future Price
3. Future dividend stream
4. Market capitalization rate

Cost of Equity Capital

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

$$\text{Expected Return} = r = \frac{Div_1 + P_1 - P_0}{P_0}$$

Cost of Equity Capital

Example: If Red Hen Feathers is selling for $100 per share today and is expected to sell for $110 one year from now, what is the expected return if the dividend one year from now is forecasted to be $5.00?

$$\text{Expected Return} = \frac{5 + 110 - 100}{100} = .15$$

Cost of Equity Capital

The formula can be broken into two parts:

Dividend Yield

\+ Capital Appreciation

$$\text{Expected Return} = r = \frac{Div_1}{P_0} + \frac{P_1 - P_0}{P_0}$$

Stock Valuation

Stock Price using Dividend Discount Model:

Computation of today's stock price, depending on the present value of all expected future dividends.

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

H - Time horizon for your investment.

Stock Valuation

Example

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

$$PV = \frac{3.00}{(1+.12)^1} + \frac{3.24}{(1+.12)^2} + \frac{3.50+94.48}{(1+.12)^3}$$

$$PV = \$75.36$$

Stock Valuation

Stock Price using Perpetuity Model (no growth):

Computation of today's stock price, depending on current (and perpetual) dividends.

$$P_0 = \frac{Div_1}{r} \quad or \quad \frac{EPS_1}{r}$$

Ex: What is the price of a share of no-growth stock that pays $12 per share in perpetuity, if the market capitalization rate is 6%?

Stock Valuation

Stock Price using Perpetuity Model (growth):

Computation of today's stock price, depending on current dividend and growth assumption.

$$P_0 = \frac{Div_1}{r-g} \quad or \quad \frac{EPS_1}{r-g}$$

Ex: What is the price of a share of stock that pays $12 per share and is assumed to grow at 3% per year, if the market capitalization rate is 6%? What happens to share price if g falls to 2%?

Stock Valuation Terminology

Return Measurements

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

$$\text{Return on Equity} = ROE$$

$$ROE = \frac{\text{EPS}}{\text{Book Equity Per Share}}$$

Stock Valuation Terminology

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

Payout Ratio - Fraction of earnings paid out as dividends

Plowback Ratio - Fraction of earnings retained by the firm

Stock Valuation Terminology

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

Sustainable Growth Rate - Steady rate at which a firm can grow: plowback ratio X return on equity

Net Present Value

BMA Ch 6

- NPV and PV
- NPV Rule
- Internal Rate of Return (IRR)
- NPV and IRR
- NPV and PMT
- Payback Period

NPV and PV

PV = sum of discounted future cash flows

$$PV = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_T}{(1+r)^T}$$

$$PV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t}$$

NPV and PV

- NPV = sum of current + disc. future cash flows

$$NPV = C_0 + \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_T}{(1+r)^T}$$

$$NPV = \sum_{t=0}^{T} \frac{C_t}{(1+r)^t}$$

- NPV = C_0 + PV
- NPV = initial investment (negative) + future investment returns (positive)

NPV Rule

- NPV Rule - Accept investments (or financing methods) that have positive NPVs
- Such investments generate enough cash to
  - Cover their operating costs
  - Cover their financing costs
  - Add value to the firm (=NPV)

Ex: What is the NPV of a business opportunity that costs $300 and generates the following stream of cash flows:

yr 1: 100
yr 2: 150
yr 3: 165, if r=.07?

Internal Rate of Return (IRR)

- An investment generates a rate of return that can be compared to the discount rate

$$\sum_{t=0}^{T} \frac{Ct}{(1+IRR)^t} = 0$$

- IRR Rule: Accept investments that offer rates of return in excess of the discount rate (cost of financing)

Ex: What is the rate of return on a business opportunity that costs $300 and generates the following stream of cash flows:

yr 1: 100
yr 2: 150
yr 3: 165

NPV and IRR

If NPV > 0 → IRR > r

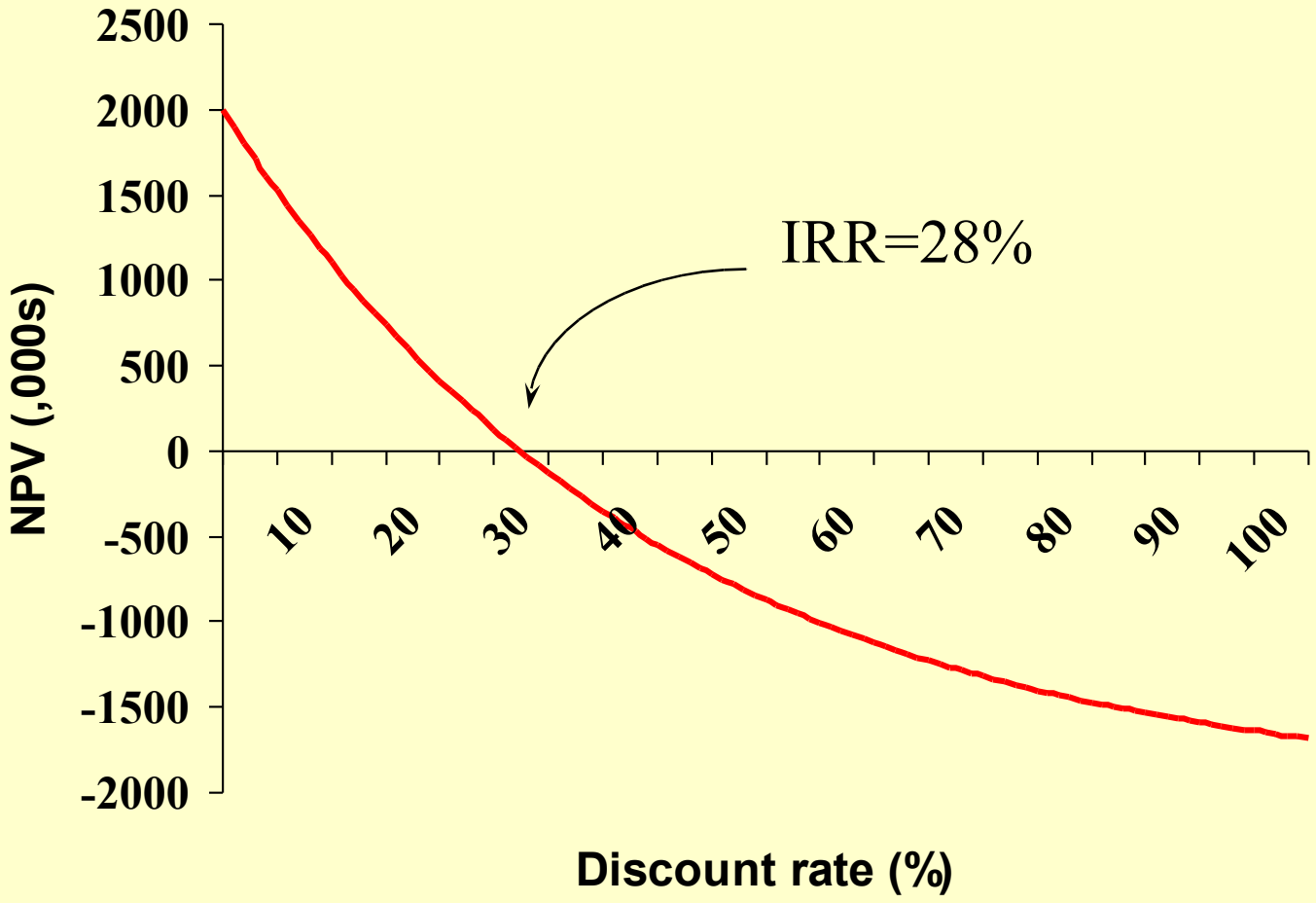
- If NPV < 0 → IRR < r
- If NPV = 0 → IRR = r
- Investment with highest NPV not always the one with the highest IRR

NPV and IRR

Example

Red Hen Proteins can purchase a turbo powered egg carton machine for $4,000. The investment will generate cash flows of $2,000 in year 1 and $4,000 in year two. What is the IRR on this investment?

NPV and IRR


2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
NPV (,000s)
IRR=28%
10
20
30
40
50
60
70
80
90
100
Discount rate (%)

NPV and IRR

- Evaluating independent investments – NPV and IRR will generally imply same decision
- Comparing two (or more) mutually exclusive investments – NPV and IRR can produce different ranking

NPV and IRR

mutually exclusive projects (same lives)

Ex: Argus Enterprises is comparing two retail outlets in the same market, one on Corky St. and one on Beanie Ave.

Best investment depends on what is “appropriate” discount rate (i.e., true cost of financing)

- NPV assumes cash flows can be reinvested at r
- IRR assumes cash flows can be reinvested at IRR

- Investors care about cash (i.e., NPV), not interest rates (i.e., IRR)

NPV and IRR

- Projects with no positive cash flows
  - Often involves comparison of competing technologies
  - Minimize net present value of costs
  - Tax effects

NPV and PMT

mutually exclusive projects (different lives)

- In comparing two or more projects with different economic lives, you must account for the time it takes to achieve a given NPV
- Ex (simple): Wahoo Products is considering two new brands:

Tippy	Casey
NPV=100	NPV=200
T=4	T=10
r=.06	r=.06

- To compare, calculate the NPV created per year
- Annualized NPV = NPV/Annuity Factor

Payback Period

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

Payback Period

Example

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

Project	C_0	C_1	C_2	C_3	Payback Period	NPV@10%
A	-2000	500	500	5000		
B	-2000	500	1800	0		
C	-2000	1800	500	0		

Payback Period

Example

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

Project	C_0	C_1	C_2	C_3	Payback Period	NPV@10%
A	-2000	500	500	5000	3	+2,624
B	-2000	500	1800	0	2	-58
C	-2000	1800	500	0	2	+50

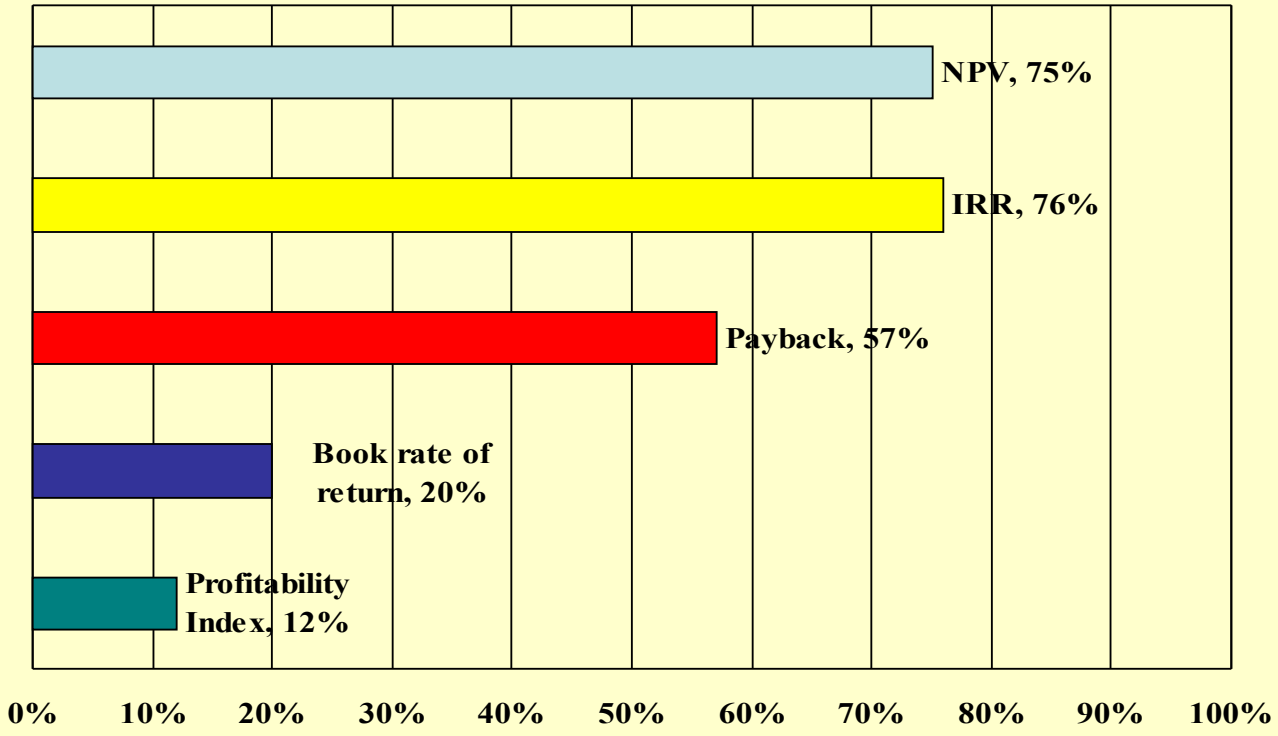
Payback Period

- Sometimes used as supplementary decision criterion to NPV or IRR
  - "We will invest in new business opportunities with positive NPVs and PPs of 5 years or shorter."
  - Risk reduction criterion (more later)
- PP in present value terms

Ex: How many years does project generating $200,000 per year in cash flow take to return an initial investment of $1,000,000, in PV terms, if r=.08?

CFO Decision Tools

Survey Data on CFO Use of Investment Evaluation Techniques



SOURCE: Graham and Harvey, "The Theory and Practice of Finance: Evidence from the Field," Journal of Financial Economics 61 (2001), pp. 187-243.

Capital Expenditure Analysis

BMA Ch 7

- Characterize Project
- Estimate Cash Flows
- Determine the Discount Rate
- Calculate NPV

Characterize Project

- New business (new revenues, new programs) v. No new business (cost reductions, tech. change)
- Independent v. Mutually exclusive
- Investment constraint (artificial)
  - There is always a natural constraint imposed by the financial markets

Estimate Cash Flows

- Expected net cash flow in each time period:

$$C_t = CI_t - CO_t$$

- Measure on **incremental** basis

(All rules of differential cost accounting apply)

1. Forget sunk costs
2. Use opportunity cost as measurement concept
3. Include working capital (cash) requirements
4. Include incidental effects (on other business lines)
5. Beware of allocated overhead

Determine the Discount Rate

- Rule: Use cost of financing (rate of return) imposed by investors in the project
- Process: Start with overall financial structure of the firm (after project adoption) and calculate:

$$WACC: \; r = r_D\left(\frac{D}{D+E}\right) + r_E\left(\frac{E}{D+E}\right)$$

WACC Calculation example

- r_D = .032
- r_E = .07
- D = $60,000,000
- E = $40,000,000
- A = $100,000,000

WACC = (.032 * .6) + (.07 * .4) = .0472

If a project generates a positive NPV at r = .0472, it generates enough cash to pay debt service and grow equity at at least .07 per year.

More on this topic later (lots)

Inflation

Remember the INFLATION RULE

- Be consistent in how you handle inflation!!
- Use nominal interest rates to discount nominal cash flows.
- Use real interest rates to discount real cash flows.
- You will get the about the same results, whether you use nominal or real figures

Capital Expenditure Risk Analysis

BMA Ch 11

- Sensitivity Analysis
- Break Even Analysis
- Scenario Analysis
- Monte Carlo Simulation
- Real Options and Decision Trees
- Risk-Adjusted Discount Rate

Sensitivity Analysis
one variable changes at a time

- Determine most likely values for variables
  - Calculate NPV
- Identify sources of variability in CI, CO
- Check sensitivity of NPV to changes in each individually
  - Single spreadsheet
  - Data Table function
  - Line plots
- Identify breakeven value for each variable

Sensitivity Analysis
Ex: Obotai Company's Motor Scooter project

- Base case NPV
- Sources of variability
  - Volume, as determined by
    - Market size
    - Market share
  - Price
  - Cost function
    - Average variable cost
    - Fixed cost

Scenario Analysis
multiple variables change at once

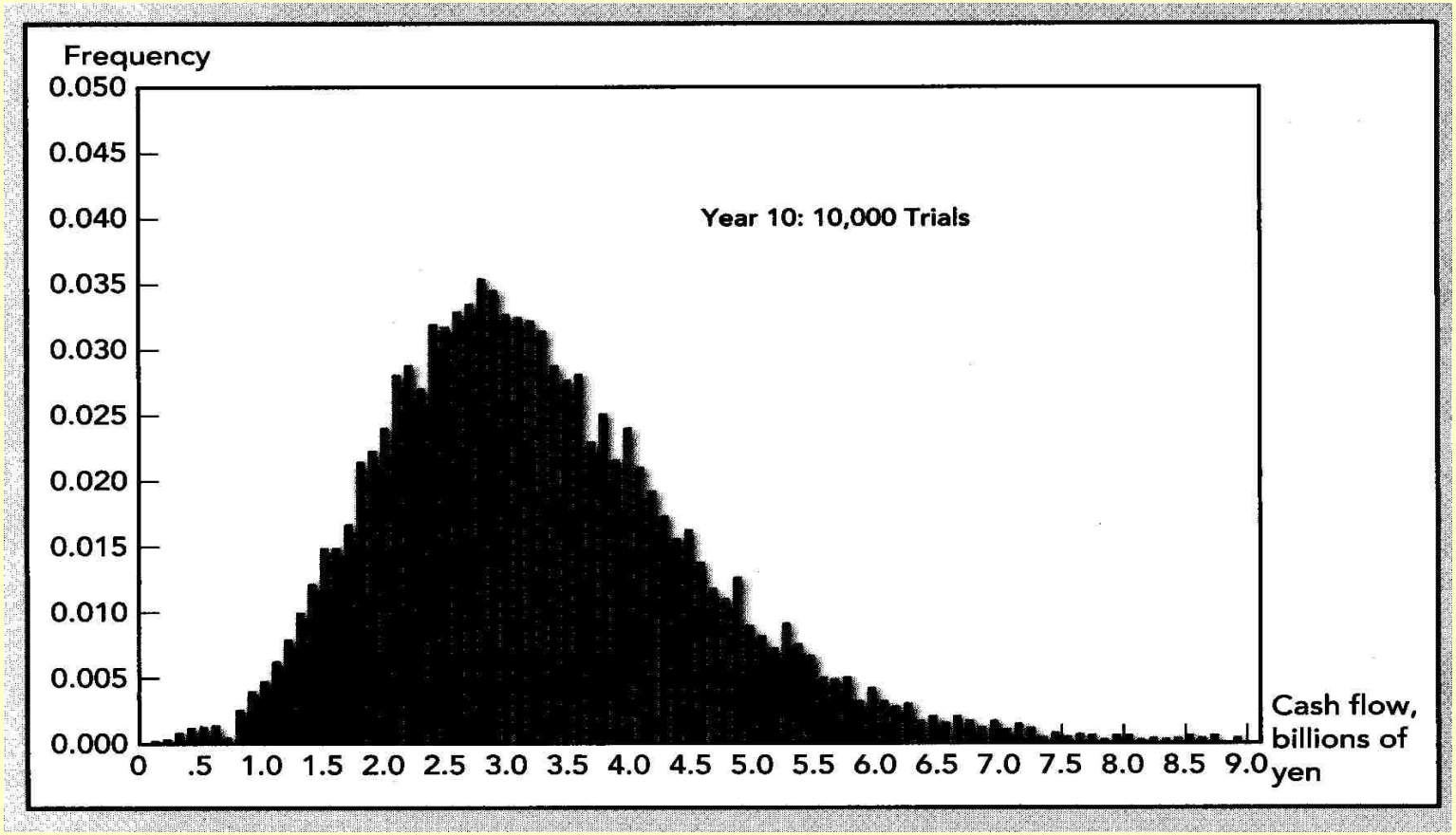
- Identify sources of variability in CI, CO
- Develop likely case, bad case, and good case scenarios for cash flows
  - Separate spread sheets
- Check sensitivity of NPV to scenarios
- Assign probabilities to scenarios and calculate
  - Exp (NPV)
  - Std Dev (NPV)
  - CV (NPV)
- Adjust r for relative CV

Monte Carlo Simulation

Modeling Process

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

Monte Carlo Simulation



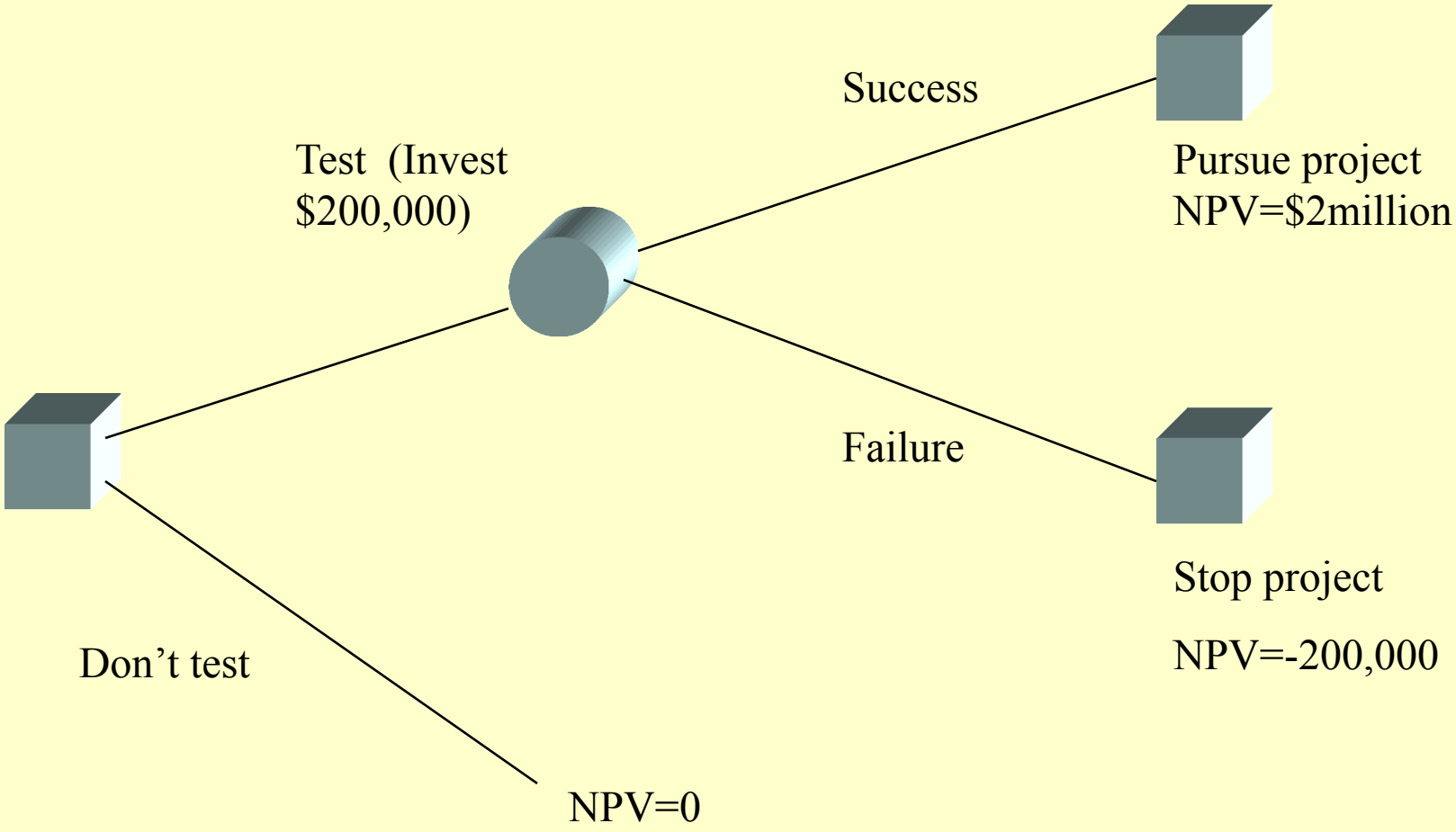
Source: Undetermined

Real Options and Decision Trees

Decision Tree - Diagram of sequential decisions and possible outcomes

- Decision trees help companies determine their Options by showing the various choices and outcomes.
- The Option to avoid a loss or produce extra profit has value.
- The ability to create an Option thus has value that can be bought or sold.

Decision Trees



Capital Expenditure and Strategy

BMA Ch 12

Where does positive NPV come from?

- Start with Market Values
- Economic Rents and Competitive Advantage

Market Values

- **Positive NPVs stem from a comparative advantage**
- **Strategic decision-making identifies this comparative advantage; it does *not* identify growth areas**
- **Start with the market price of the asset and ask whether it is worth more to you than to others**

Market Values

- ***Don't* assume that other firms will watch passively**
- **Ask**
  - **How long a lead do I have over my rivals?**
  - **What will happen to prices when that lead disappears?**
- **In the meantime, how will rivals react to my move? Will they cut prices or imitate my product?**

Economic Rents and Comparative Advantage

- Rents = profits that more than cover the cost of capital
- Sources of rents
  - better product
  - lower costs
  - location advantage
  - some other competitive edge
- Sooner or later competition is likely to eliminate rents

Ex: Marvin Enterprises

See also Warren Buffett on
Growth and Profitability

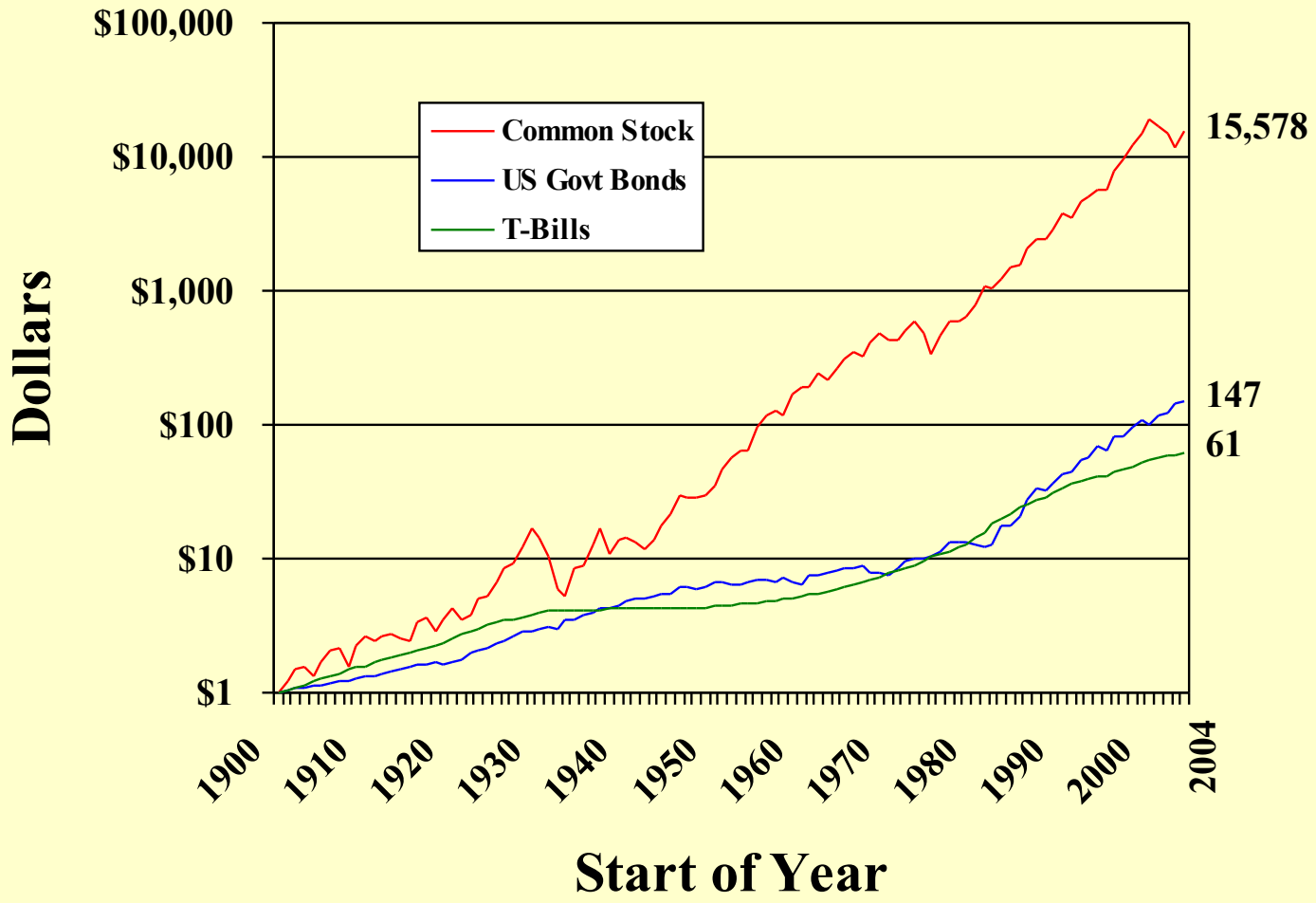
Discount Rate Determination: CAPM and WACC

BMA Ch 10

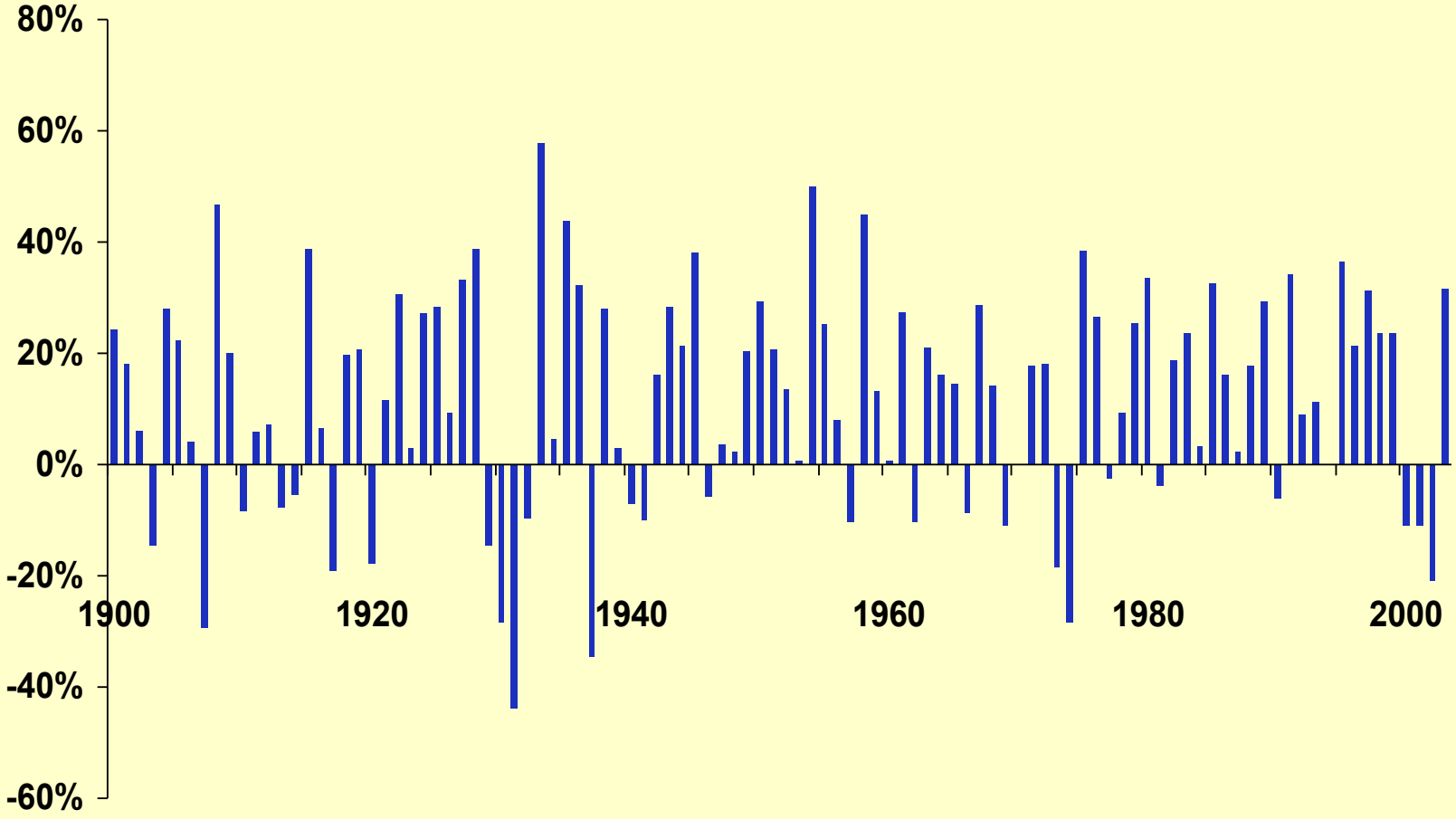
- Capital Market History
  - Market Risk and Return
- Capital Asset Pricing Model
- Company Cost of Capital
  - Capital Asset Pricing Model
  - Risk of Businesses
  - Weighted Average Cost of Capital
- Measuring Beta and the Cost of Equity
- Project Cost of Capital

Capital Market History

future value of $1 invested in 1900 (nominal)

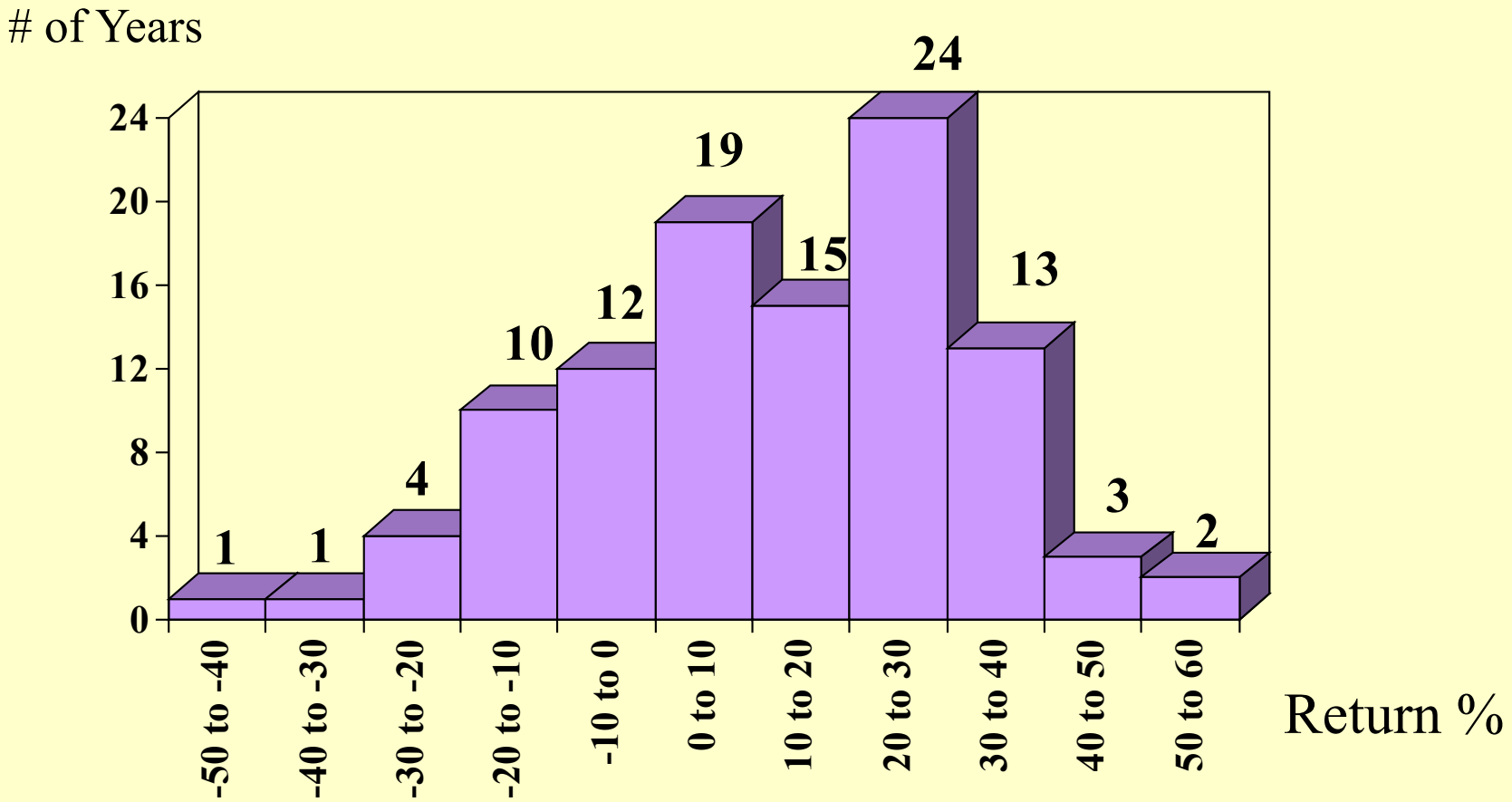


Capital Market History
Risk and Return



Market Risk and Return

Histogram of Annual Stock Market Returns



Market Risk and Return

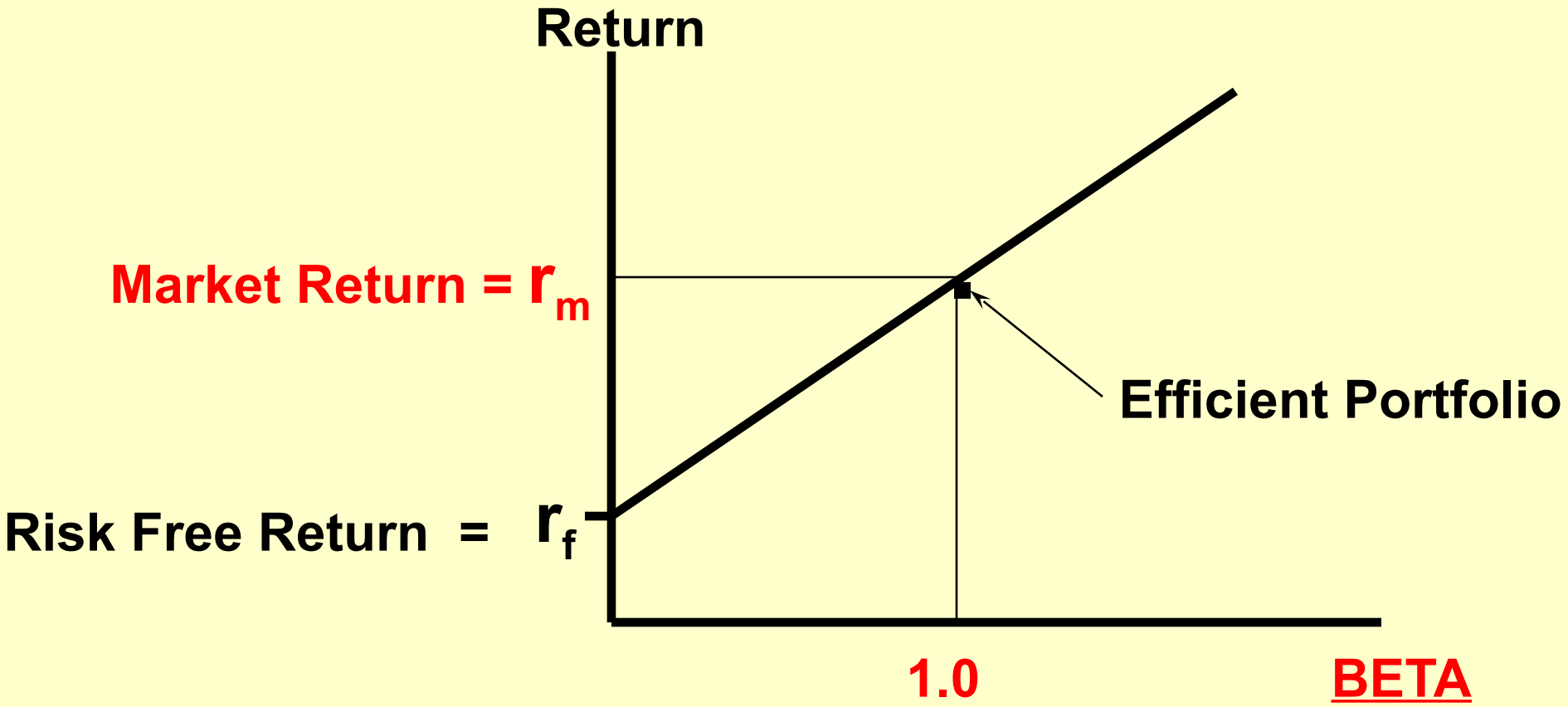
- r_f risk-free rate (on t-bills)
- r_m (stock) market rate
- $(r_m - r_f)$ market risk premium

Long Run Investment Returns

Security	Average Annual Rate of Return		Average Risk Premium
	Nominal	Real	
T bills	4.1	1.1	0
Gov't bonds	5.2	2.3	1.2
Common stocks	11.7	8.5	7.6

Capital Asset Pricing Model

Security Market Line



SML Equation = $r_f + \beta (r_m - r_f)$

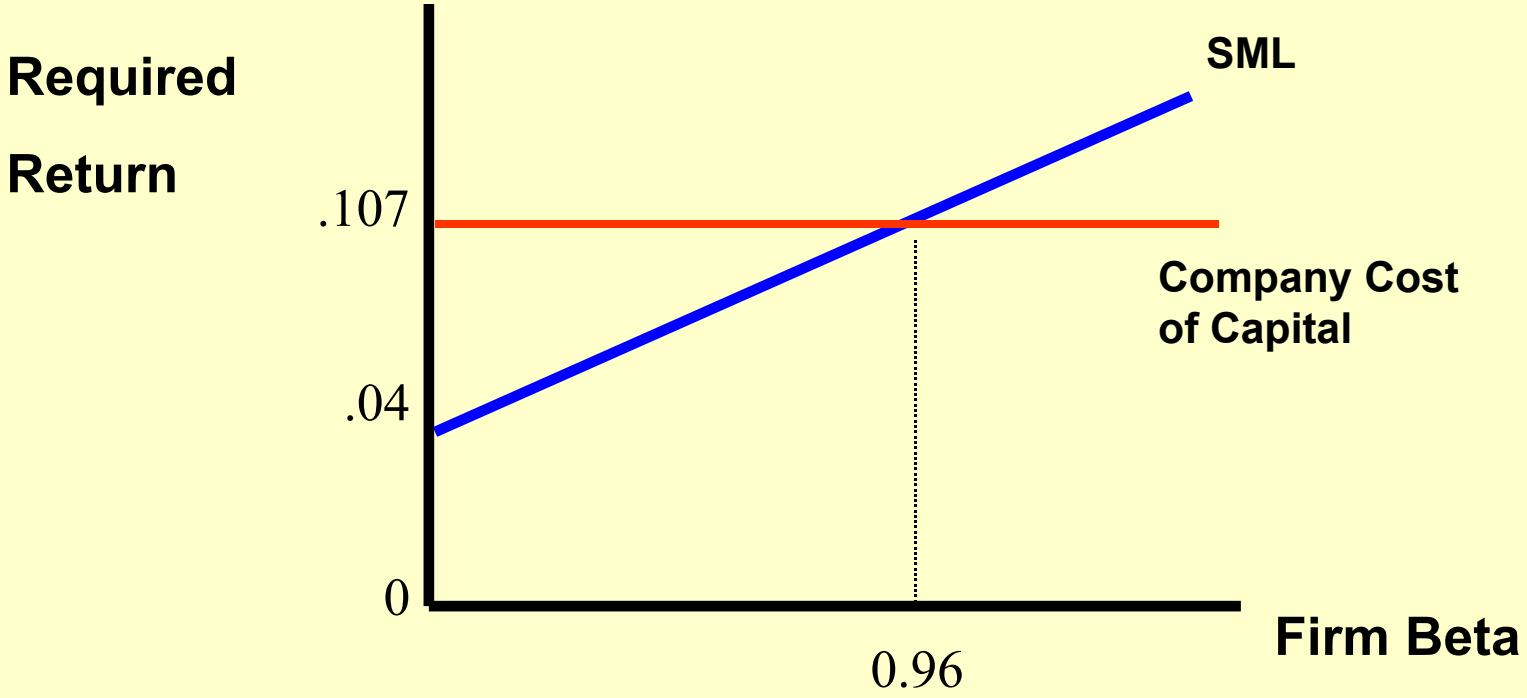
Capital Asset Pricing Model

$$r = r_f + \beta (r_m - r_f)$$

CAPM

Company Cost of Capital and CAPM

- Expected return on firm's businesses
- Cost of funds invested in firm's assets (businesses)
- Depends on average risk of firm's businesses (Beta)
- Discount rate for firm's average risk projects



$$r = r_f + \beta (r_m - r_f)$$

Company Cost of Capital and Business Risk

Company Cost of Capital is based on the average beta of its businesses (or assets)

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

Example

1/3 Risky ventures	β=1.4
1/3 Moderate risk businesses	β=0.96
1/3 Low risk assets	β=0.58

Average β of assets = 0.96

Company Cost of Capital and WACC

$$WACC: \; r = r_D\left(\frac{D}{D+E}\right) + r_E\left(\frac{E}{D+E}\right)$$

$r_E = r_f + \beta_{equity} (r_m - r_f)$

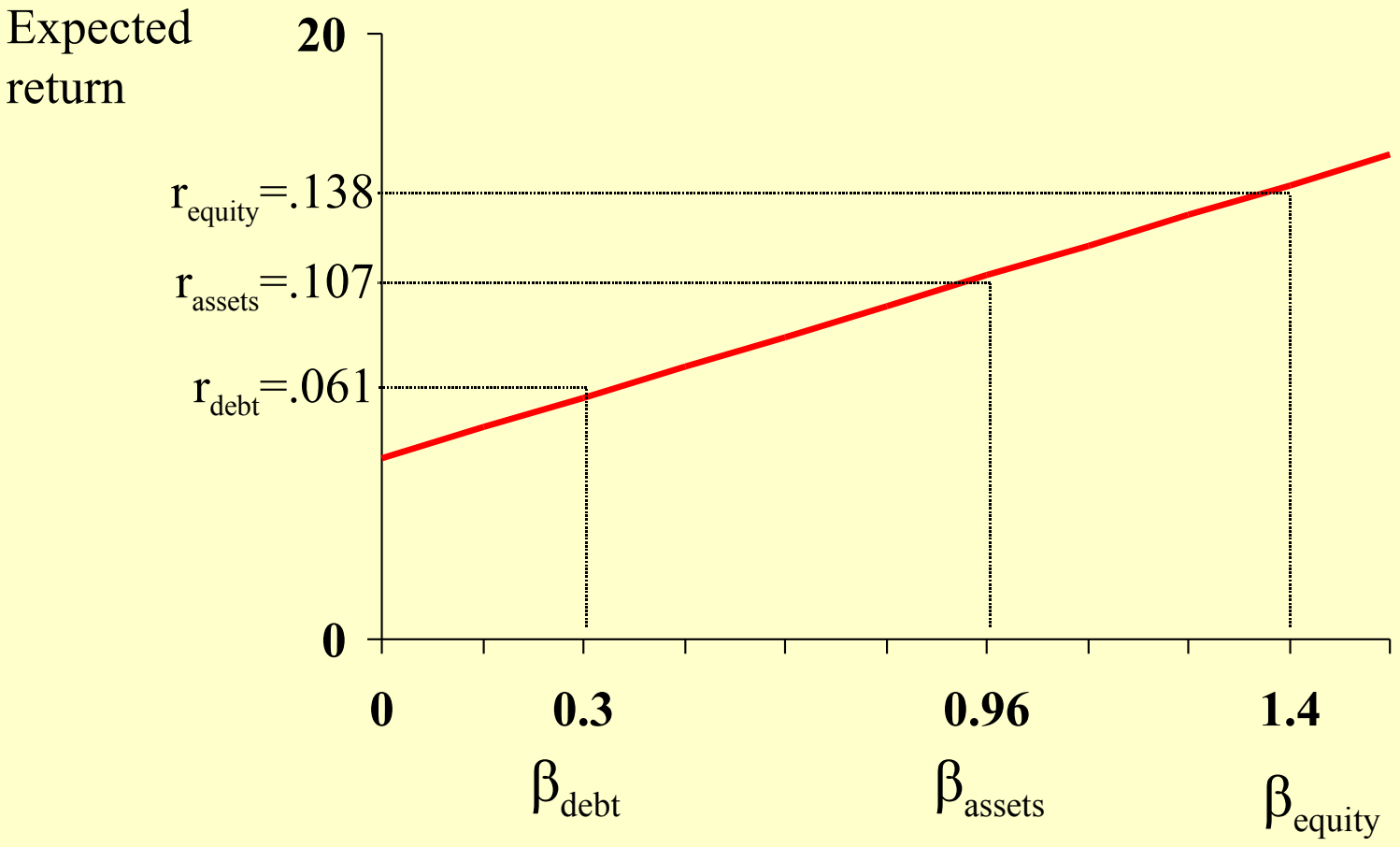
$r_D = r_f + \beta_{debt} (r_m - r_f)$

IMPORTANT

E and D are market (not book) values

Company Cost of Capital and WACC

$$\beta_A = \beta_D\left(\frac{D}{D+E}\right) + \beta_E\left(\frac{E}{D+E}\right)$$



Company Cost of Capital and WACC

- r_D – typically given by debt markets (interest rate)
- r_E – determined by stock market

Regression analysis of stock market data to determine β and thereby to measure the cost of equity

$$r_{equity} = r_f + \beta_{equity} (r_m - r_f)$$

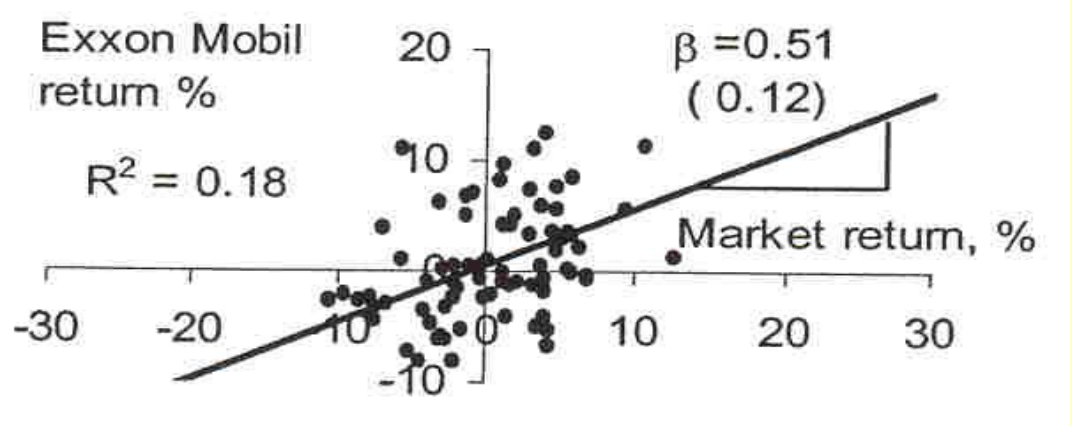
Measuring Beta and the Cost of Equity

Exxon Mobil

Price data: Dec 97 - Apr 04

$R^2 = .18$

$\beta = 0.51$



Exxon Mobil return (%)

Slope determined from plotting the line of best fit.

Market return (%)

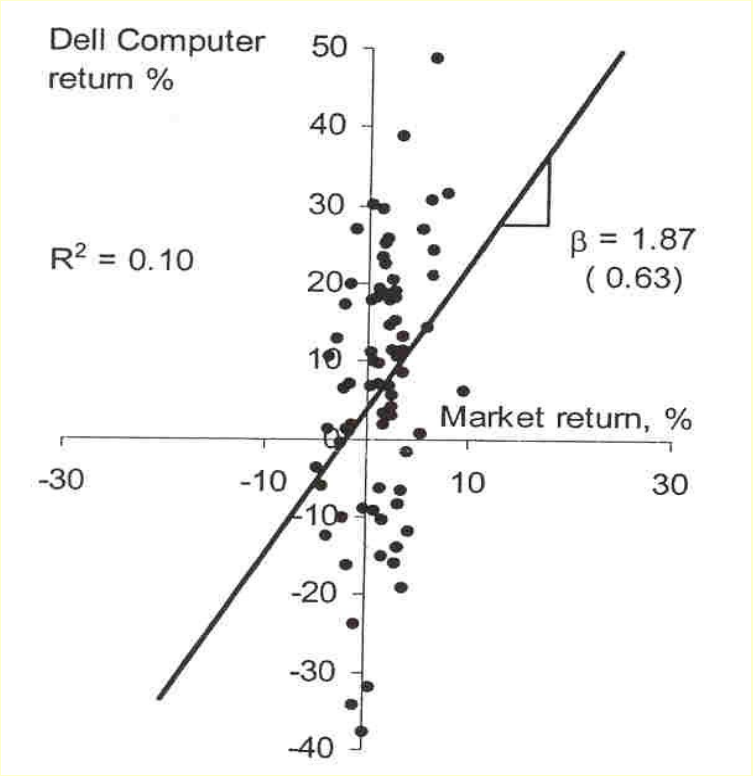
Measuring Beta and the Cost of Equity

Dell Computer

Price data: May 91- Nov 97

$R^2 = .10$

$\beta = 1.87$



Dell return (%)

Market return (%)

Slope determined from plotting the line of best fit.

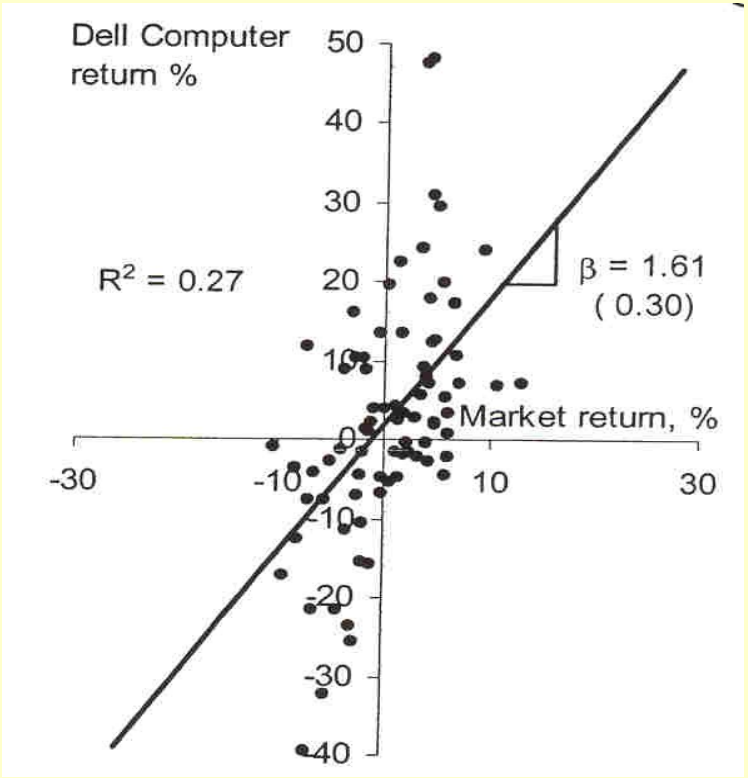
Measuring Beta and the Cost of Equity

Dell Computer

Price data: Dec 97 - Apr 04

$R^2 = .27$

$\beta = 1.61$



Dell return (%)

Market return (%)

Slope determined from plotting the line of best fit.

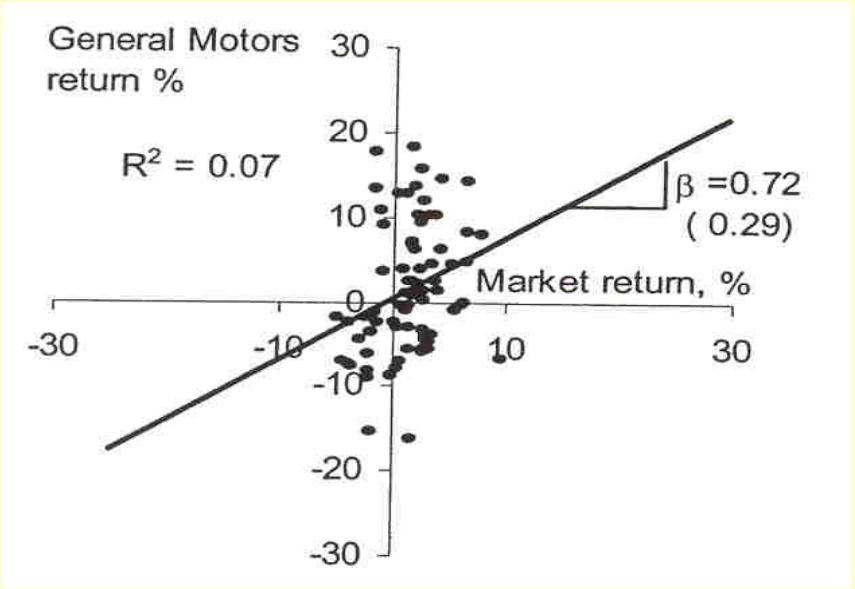
Measuring Beta and the Cost of Equity

General Motors

Price data: May 91- Nov 97

$R^2 = .07$

$\beta = 0.72$



GM return (%)

Market return (%)

Slope determined from plotting the line of best fit.

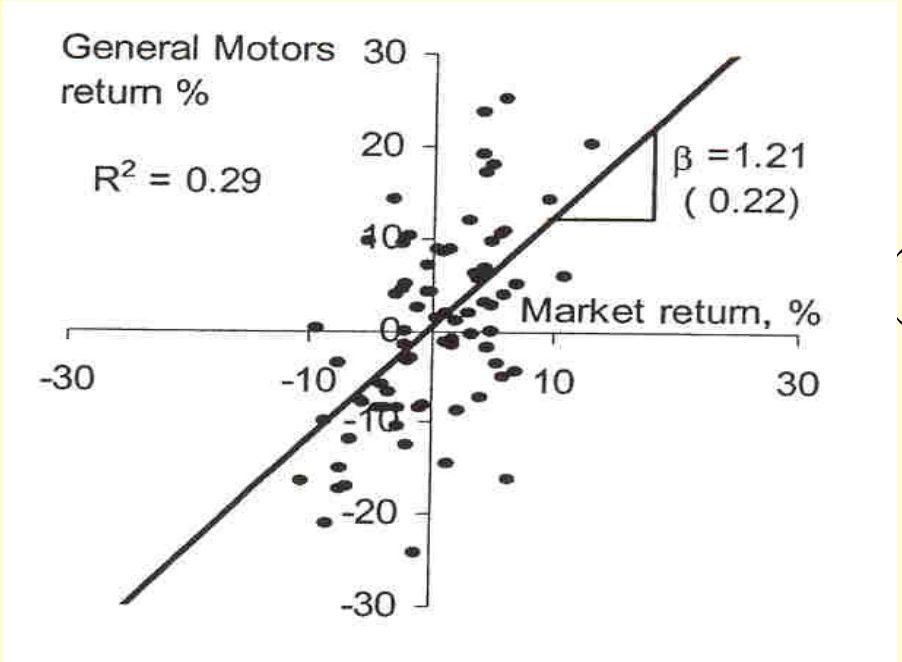
Measuring Beta and the Cost of Equity

General Motors

Price data: Dec 97 - Apr 04

$R^2 = .29$

$\beta = 1.21$



Slope determined from plotting the line of best fit.

Market return (%)

Measuring Beta and the Cost of Equity

GM's cost of equity (hypothetical example)

$$r_E = r_f + \beta_E (r_m - r_f)$$

β_E=1.21

r_f=.033

$(r_m - r_f)$=.08

r_E= .033+1.21(.08) = .13

Company Cost of Capital

GM's cost of capital (hypothetical example)

$$WACC: \; r = r_D\left(\frac{D}{D+E}\right) + r_E\left(\frac{E}{D+E}\right)$$

r_E =.13

r_D =.08

E = 60

D = 40

r = .08*(40/100) + .13*(60/100)

= .11

Company Cost of Capital

GM evaluates investing in a new green car division

Assumptions:

1. Project Green costs $300 mil to start
2. PG is expected to produce CF = $100 mil for each of five years
3. PG has the same risk as GM's overall business (β_E=1.21)

What is the NPV of the project?

$69,701,295

Project Cost of Capital

- Depends on project risk
- Starting point is company cost of capital
  - Correct if project has same level of risk as firm
- Methods of adjustment for risk differences
- Determining risk-adjusted discount rate (radr)

Project Cost of Capital

adjusting Beta

1. GM's Project Green is determined to be 50% riskier than current business lines
   - Adjust both r_D and r_E
   - r = .1483
   - NPV = $36,553,225
2. GM's Project Green is determined to be 30% less risky than current business lines
   - r = .0868
   - NPV = $92,199,918

Project Discount Rate

BMA Ch 20

- Company Cost of Capital
- WACC and Taxes
- Risk-Adjusted Discount Rate
- Cost of Equity Capital – Pure Play
- Project Discount Rate – Pure Play
- Project Discount Rate – Simulation

Company Cost of Capital

$$WACC: \; r = r_D\left(\frac{D}{D+E}\right) + r_E\left(\frac{E}{D+E}\right)$$

Example: Crow Hardwoods takes harvested trees and creates dimensional boards, which it sells to cabinet makers. Here are relevant financial data regarding Crow:

- Crow's stock has a beta of 1.2
- Crow's bonds pay an interest rate of 4.8%
- The TBill rate is 3%
- The market risk premium is 6%
- Crow is financed with 50% equity and 50% debt

What is Crow's cost of capital?

WACC and Taxes

- Income tax deductibility of interest expense lowers the net cost of debt (net interest rate on debt) to the borrower.

$$WACC = r_D \times (1 - t) \times \left(\frac{D}{A} \right) + \left(r_E \times \frac{E}{A} \right)$$

- If Crow's marginal tax rate is 35%, what is the WACC?

Risk-Adjusted Discount Rate

Crow Hardwoods is considering integrating vertically by creating a division that will manufacture cabinets. What is the correct discount rate to use to evaluate this project?

- If cabinet manufacturing
  - Has same business risk
  - Has same financial risk

  then the project discount rate is .067
- If cabinet manufacturing
  - Has different business risk
  - Has different financial risk

  then project discount rate is not .067
- Project discount rate depends on project business and financial risk

Risk-Adjusted Discount Rate

- Business risk
  - Risk inherent in the project or business
  - Risk associated with the project's assets
    - Market conditions
    - Production processes
  - Reflected in asset beta
- Financial risk
  - Risk due to the capital structure
  - Reflected in difference between asset beta and equity beta

Risk-Adjusted Discount Rate

$$WACC = r_D \times (1-t) \times \left(\frac{D}{A}\right) + \left(r_E \times \frac{E}{A}\right)$$

- D/A, E/A – target capital structure of the firm, after project adoption
- t – marginal tax rate of firm
- r_D – interest rate lenders charge to finance the project
  - Depends on
    - Business risk
    - Financial risk
  - Can often be determined in the market

Risk-Adjusted Discount Rate

$$WACC = r_D \times (1-t) \times \left(\frac{D}{A}\right) + \left(r_E \times \frac{E}{A}\right)$$

- r_E – return required by equity investors in project
  - Depends on
    - Business risk
    - Financial risk
  - Sometimes can be estimated by
    - Reference to comparable firms (pure play)
    - Simulation or scenario analysis
    - Rules of thumb

Cost of Equity Capital
Pure Play Approach

- Individual firms pure play
  - Find firms operating only in project's industry
  - Obtain equity betas for these comp firms
  - Unlever each comp firm's equity beta to get asset beta

$$\beta_A = \beta_D \left(\frac{D}{D+E} \right) * (1-t) + \beta_E \left(\frac{E}{D+E} \right)$$

  - Take average of comps' asset betas to get project's estimated asset beta

Business Valuation

BMA Ch 20

- Business (Project) Valuation Equation
- Business (Project) Discount Rate
- Business (Project) Cash Flows
  - Components
  - To valuation horizon
  - Horizon valuation
- Total Business Value
- Business (Project) Valuation Rules

Business Valuation Equation

- The value of a business or project is usually computed as the discounted value of CF out to a ***valuation horizon (H)***
- The ***horizon value*** is sometimes called the terminal value or salvage value

$$PV = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \ldots + \frac{CF_H}{(1+r)^H} + \frac{PV_H}{(1+r)^H}$$

PV (cash flows)

PV (horizon value)

r = radr

Business Discount Rate

Example: Sangria Corporation evaluates Rio Corporation

Project Discount Rate – because Rio and Sangria are in same business, can use Sangria's discount rate of 9%

Business Cash Flows

Components

- Cash Flow v. Net Income
  - Interest expense
    - NI is after interest expense is subtracted
    - CF is before interest expense is subtracted
  - Non-cash (depreciation and amortization) expense
    - NI is after depreciation expense is subtracted
    - CF is before depreciation expense is subtracted
  - Asset (real capital and working capital) increases
    - NI is before asset increases
    - CF is after asset increases

Business Cash Flows

Components

CF =

- \+ EBITDA (earnings before int, tax, depreciation, amort)
- \- Depreciation and amortization
- = Profit before taxes (EBIT)
- \- Taxes
- = Profit after taxes (EBIAT)
- \+ Depreciation and amortization
- \- Investment in capital assets
- \- Investment in working capital
- = Cash flow

Note: Profit and taxes figured as if business is all-equity financed

Ex: Rio $CF_1 = 3.5$

Business Cash Flows

To Valuation Horizon

- Determine the value of the business to a valuation horizon
- Valuation horizon might depend on time to get a business stabilized
- Ex: Rio horizon is 6 years

$$PV(CF) = \frac{3.5}{1.09} + \frac{3.2}{(1.09)^2} + \frac{3.4}{(1.09)^3} + \frac{5.9}{(1.09)^4} + \frac{6.1}{(1.09)^5} + \frac{6.0}{(1.09)^6} = 20.3$$

- Business value of Rio to horizon is $20.3 million

Business Cash Flows

Horizon Valuation

- Determine value of business at horizon
- Business often assumed to be either stable going concern or steadily growing business
- Stable (no growth) future: use perpetuity formula

  PV_H at horizon = $(CF_{H+1})/r$

  Horizon Value
- Constant growth future: use growing perpetuity formula

  PV_H at horizon = $(CF_{H+1})/(r-g)$

  Horizon Value
- Discount horizon value to determine PV

  PV_H at year 0 = $(CF_{H+1})/(r-g) * (1/1+r)^H$

  PV(Horizon Value)

Business Cash Flows

Horizon Valuation

Ex: Rio Horizon Valuation

$$\text{Horizon Value} = PV_H = \frac{CF_{H+1}}{r-g} = \left(\frac{6.8}{.09-.03}\right) = 113.3$$

$$PV(\text{Horizon Value}) = 113.3 \times \frac{1}{(1.09)^6} = \$67.6$$

Total Business Value

PV (business) = PV(CF)+PV(Horizon Value)

Ex: Rio Corporation

$$\begin{aligned} \text{PV(business)} &= \text{PV(CF)} + \text{PV(Horizon Value)} \\ &= 20.3 + 67.6 \\ &= \$87.9 \text{ million} \end{aligned}$$

Business (Project) Valuation Rules

- Discount Rate - use rate required by investors in project
  - Company cost of capital
  - Adjust for income taxes
  - Adjust for risk differential
- Cash flow determination
  - Adjust Net Income
  - Do not deduct interest
  - Calculate taxes as if the company were all-equity financed
  - Add back depreciation expense
  - Adjust for changes in capital assets and working capital
- Horizon or terminal value
  - Forecast to end of project *or* to a horizon year
  - Be careful in estimating terminal value, because it often accounts for the majority of the value of the company or project

Investments and the Health Care Firm

(Wheeler and Clement)

IO health care firms v. NFP health care firms

- Maximize cash NPV?
- Theory of NFP behavior
  1. Provision of public goods
  2. Articulation of public wants
- Investment behavior
  1. Importance of non-cash values
  2. Need for cross-subsidization

Investments and the Health Care Firm

An investment decision methodology:

As part of the annual capital budgeting process, each project j consistent with the mission of the firm should be evaluated according to the following criteria:

subject to:

$$Sum_t C_t/(1+r)^t + Sum_t S0_t/(1+k)^t \geq 0$$
$$or\ NPV_j + NPSV_j \geq 0,$$

$$Sum_j NPV_j + UD = 0,$$
$$NPSV \geq 0\ of\ each\ j,$$

where

C_t = net cash flow of by proj j in pd t,

r = firm's commercial proj disc rate,

$S0_t$ = social output of proj j in period t,

k = rate of time pref for soc proj,

UD = unrest dons and charity care dons recd in yr 0

Investments and the Health Care Firm

General rules regarding NPV
(extended for social value)

- If NPV>0, accept the project
  - As long as not negative social value
- If NPV<0, do not accept the project, unless
  - Sufficient social value (more than cash cost)
  - Opportunity to subsidize

Investments and the Health Care Firm
Social Valuation

- Cost-benefit analysis
  - Valuation of services – willingness to pay
  - Valuation of health outcomes
    - Human capital approach
    - Willingness to pay approach
    - Quality-adjusted life years (QALYs)
- Cost-effectiveness analysis
  - Net cost per unit of output (in PV terms)
  - Finding a single measure of output