Chapter 12
Risk, Return, and Capital Budgeting

Financial Management (MGCM10018)

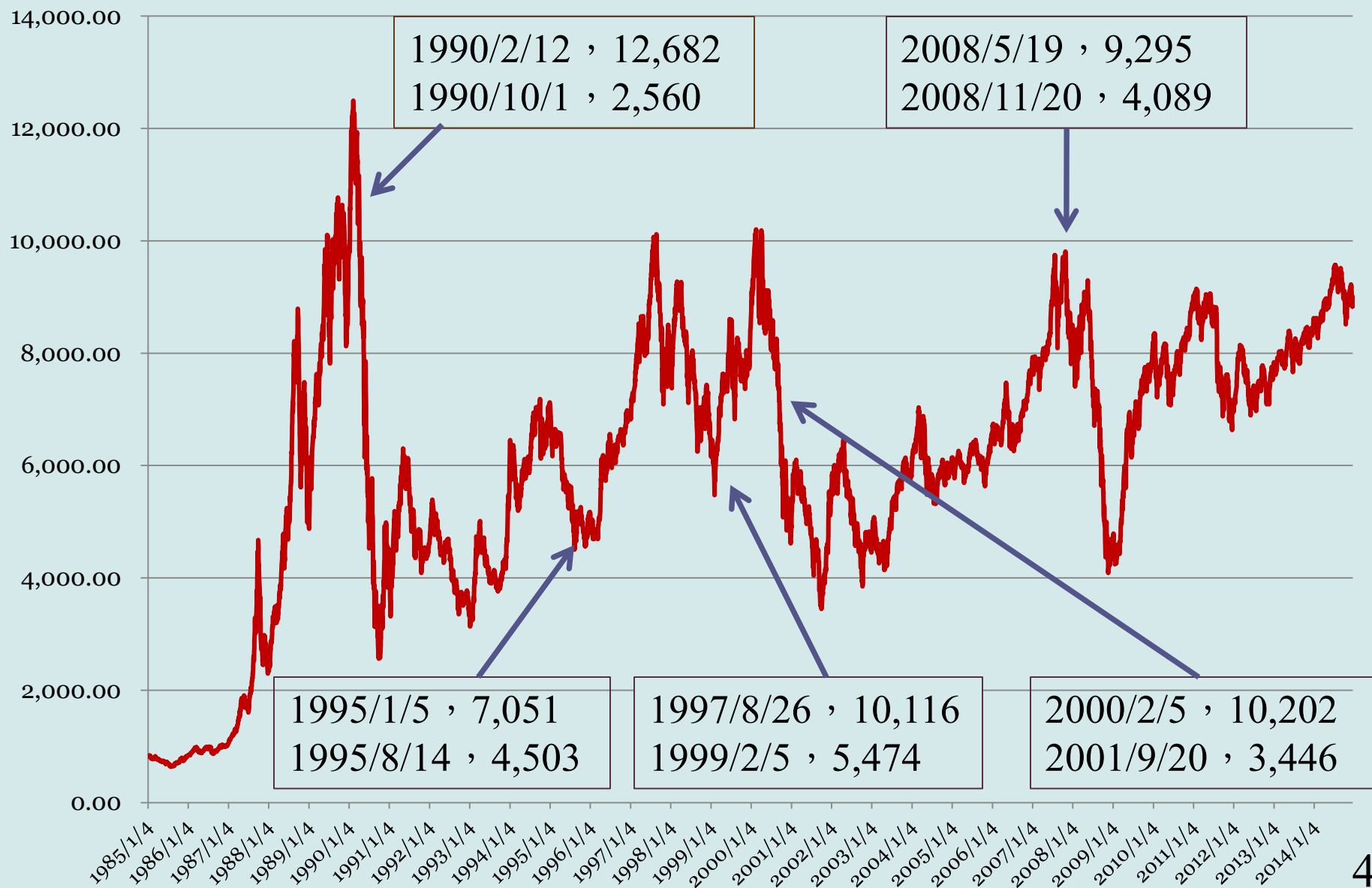# Preview

- This chapter introduces the quantitative techniques used to estimate the required returns on equity.
- It also establishes the relationship between market risk and the relative riskiness of the firm.

Outline

- Measuring Market Risk
- What Can You Learn from Beta?
- Risk and Return
- The CAPM and the Opportunity Cost of Capital

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台灣加權指數，1984/1/4 ~ 2014/12/19

1990/2/12，12,682
1990/10/1，2,560

2008/5/19，9,295
2008/11/20，4,089

1995/1/5，7,051
1995/8/14，4,503

1997/8/26，10,116
1999/2/5，5,474

2000/2/5，10,202
2001/9/20，3,446

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Measuring Market Risk (12.1)

- Changes in interest rate, government spending, oil prices, foreign exchange rate, and other macroeconomic events affect all companies and returns of almost all stocks.
- We can assess the impact of macro news by tracking the rate of return on a market portfolio.
  - Market portfolio: Portfolio of all assets in the economy.
  - Performance of market reflects only macro events because firm-specific events average out.

Measuring Market Risk (continued)

- Our goal is to define and measure the risk of individual common stocks.
- Risk depends on exposure to macroeconomic events and can be measured as the sensitivity of a stock's returns to fluctuations in returns on the market portfolio.
  - This is called the stock's Beta.
    - Beta: Sensitivity of a stock's return to the return on the market portfolio.

Measuring Market Risk (continued)

- Diversification eliminates the risk that is unique to individual stocks.
  - An investor with diversified portfolio would be interested in the effect each stock has on the risk of the entire portfolio.
- Some stocks are less affected than others.
  - Defensive stocks are not very sensitive to market fluctuations and have low betas.
  - Aggressive stocks amplify market movements and have higher betas.

Measuring Beta: Example

The Fosterhouse Gourmet Foods corporation has the following % returns on its stock, relative to the listed changes in the % return on the market portfolio. Its beta (β) can be derived from this information.

Month *	Market Return %	Fosterhouse Return %
1	+1	+1.8
2	-1	+1.6
3	+1	+0.2
4	+1	-0.8
5	-1	+0.0
6	-1	-2.8

Measuring Beta: Example

- When the market was up 1%, Fosterhouse Corporation's average percent change was +.4%.
- When the market was down 1%, Fosterhouse Corporation's average percent change was -.4%.
- The change of .8% (-.4% to .4%) divided by the 2% (-1.0% to 1.0%) change in the market produces a beta of .4.

Measuring Beta Graphically
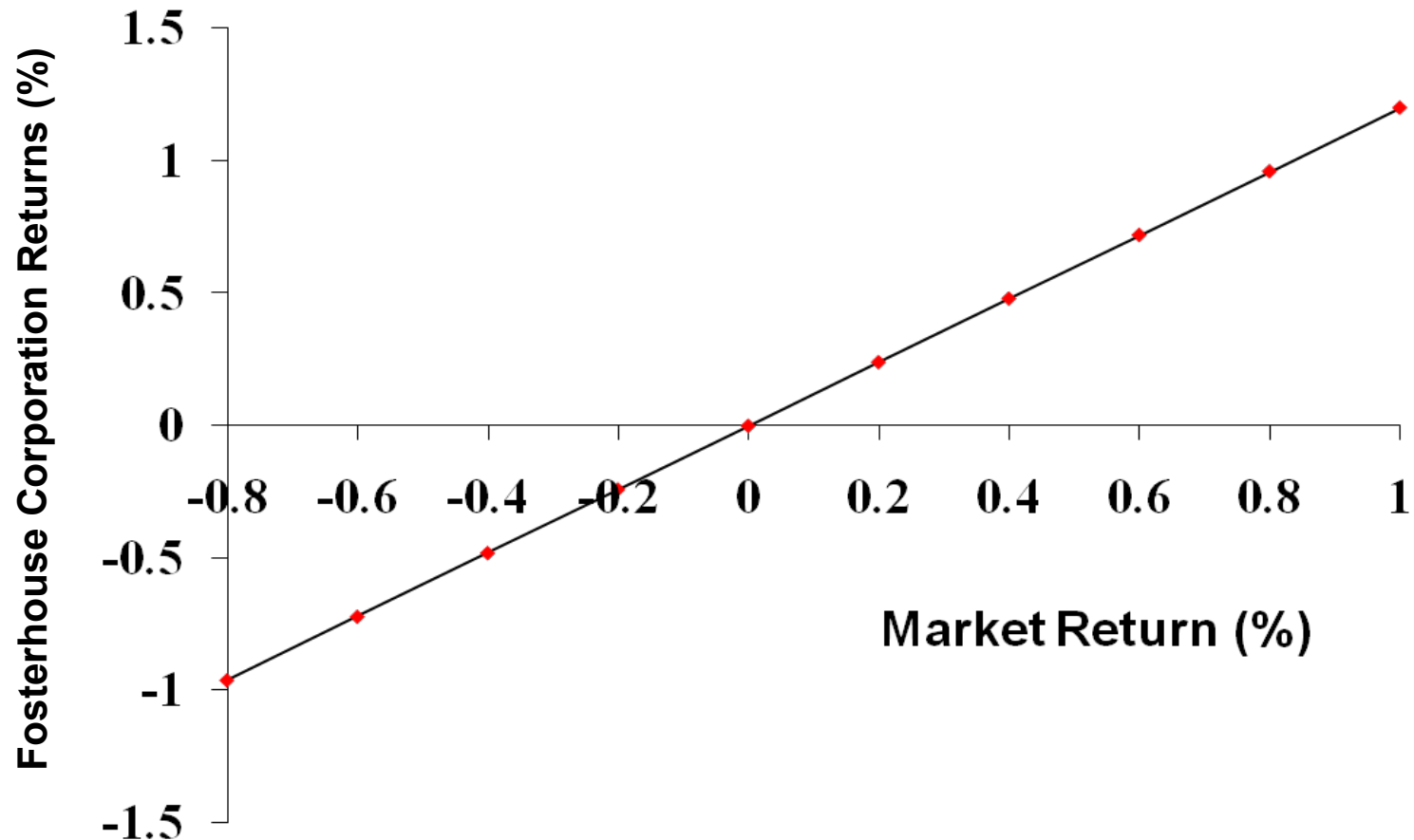
Measuring Beta

- Procedure:
  - First, observe rates of return for the stock and the market (often in monthly frequency).
  - Second, plot the observations in a graph.
  - Third, fit a line showing the average return to the stock at different market returns.
- The slope of the fitted line is the beta.
  - In excel, the SLOPE function can be directly used.

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Dow Chemical, Beta = 2.28
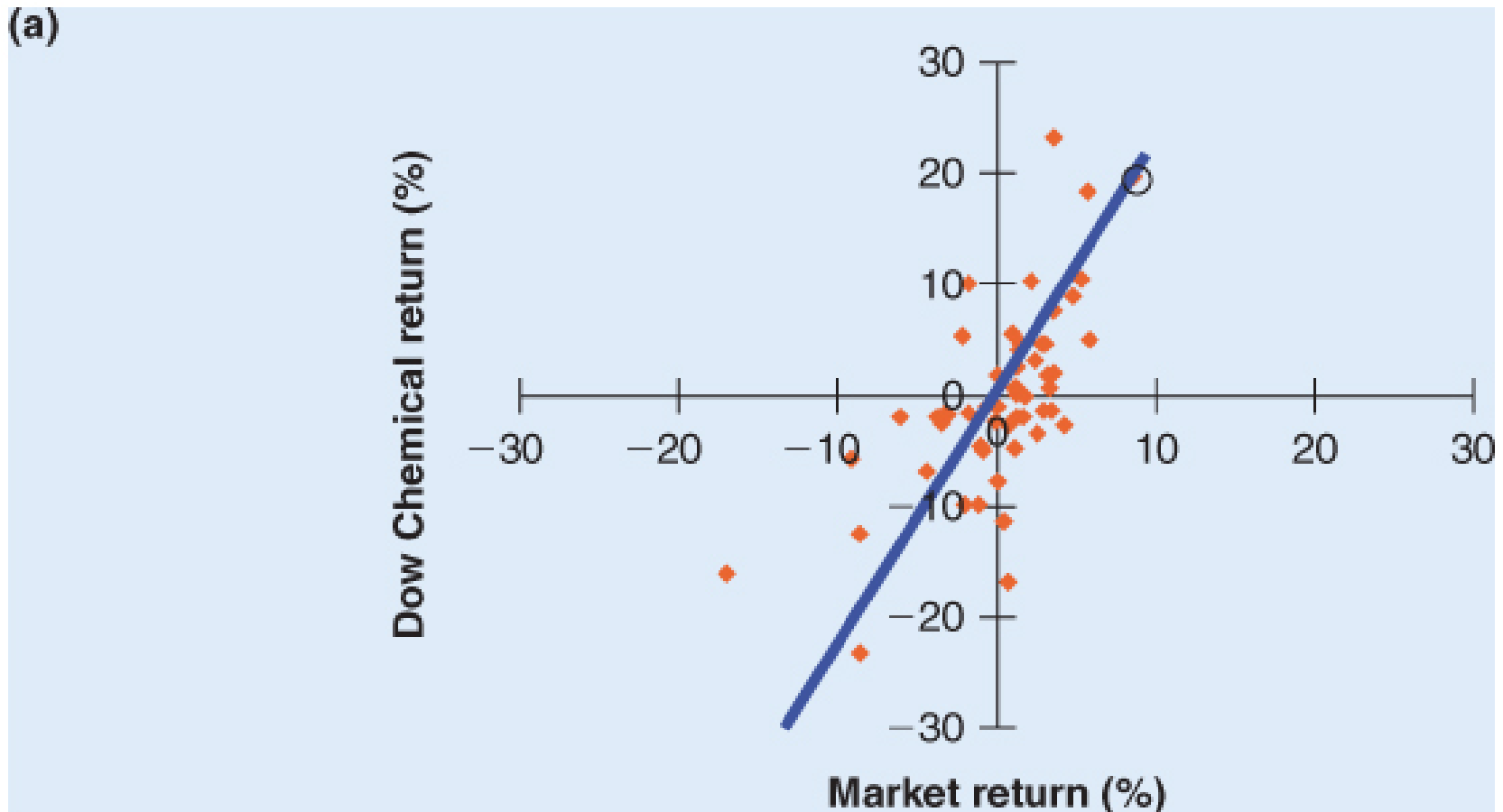
Consolidated Edison, Beta = 0.32
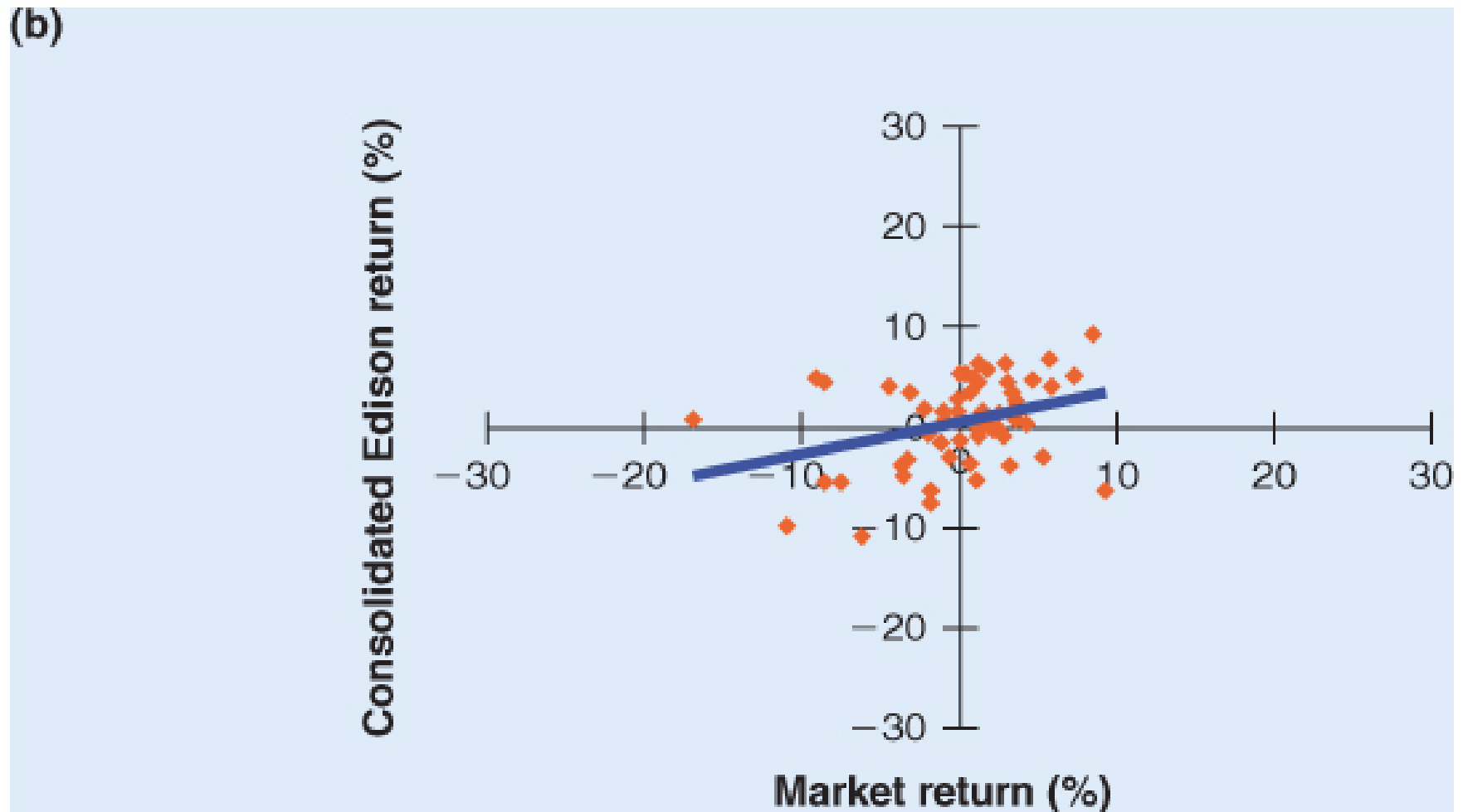
Stock Betas for Common Stocks
(May 2005 - April 2010)

	Beta
Ford	2.53
Dow Chemical	2.28
Starbucks	1.36
Dell	1.33
Boeing	1.28
Disney	1.16
Microsoft	.97
IBM	.76
Pfizer	.68
McDonald's	.62
Heinz	.61
Newmont Mining	.59
Johnson & Johnson	.57
ExxonMobil	.42
Campbell Soup	.37
Consolidated Edison	.32
Walmart	.24

Measuring Beta

- We can break down common stock returns into two parts:
  - The part explained by market returns and the firm's beta,
  - And the part due to news that is specific to the firm.
  - Fluctuations in the first part reflect market risk, and fluctuations in the second part reflect specific risk.
    - Diversification can get rid of the specific risks.

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Total Risk and Market Risk

- Note that total risk is not the same as market risk.
  - Some of most variable stocks have below average betas, and vice versa.
  - Recall that total risk is a combination of unique risk and market risk.
  - For example, Newmont Mining, the largest gold producer, has above average volatility but relatively low beta.

What Can You Learn from Beta? (12.2)

- Is a stock defensive or aggressive?
- Portfolio betas
  - Portfolio diversification

Portfolio Betas

- Diversification decreases variability from specific risk but not from market risk.
- The beta of a portfolio is an average of the betas of the securities in the portfolio, weighted by the investment in each security.

Portfolio Beta = (fraction of portfolio in first stock) ×
(beta of first stock) +
(fraction of portfolio in second stock) ×
(beta of second stock)

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Portfolio Beta: Example

Calculate the beta of a portfolio that consists of 25% Ford, 25% Boeing, and 50% McDonald's.

| Company	Beta	Weight	
Ford	2.53	.25	.63
Boeing	1.28	.25	.32
McDonald's	.62	.50	<u>.31</u>

Portfolio Betas

- Portfolios with betas between 0 and 1 tend to move in the same direction as the market but not as far.
  - Thus, on average stocks have a beta of 1. A well-diversified portfolio including all kinds of stocks have a beta of 1.

Vanguard Explorer mutual fund, Beta = 1.15

Vanguard 500 Portfolio, Beta = 1

(b)

Vanguard 500 Portfolio return (%)
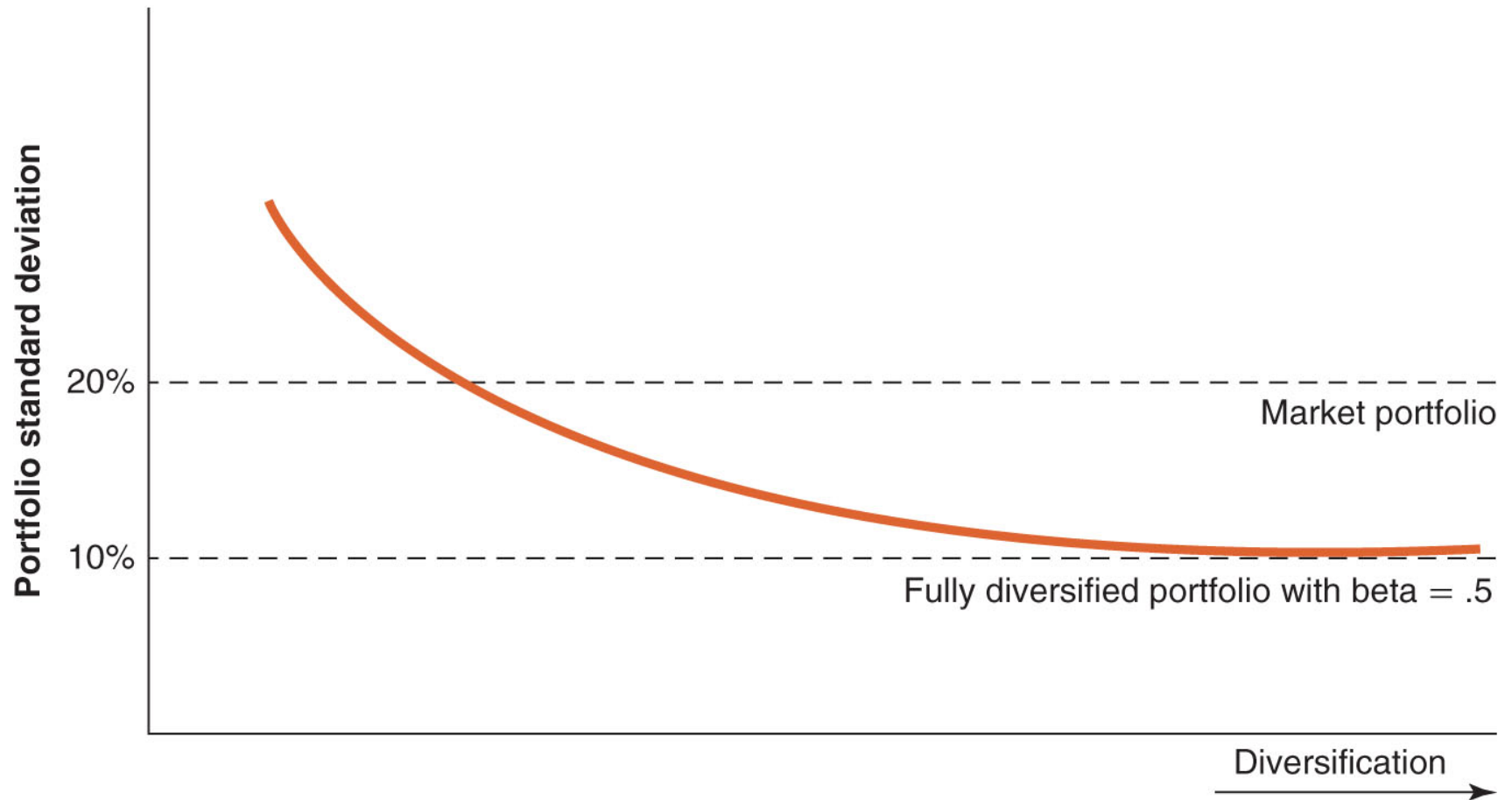
Market return (%)
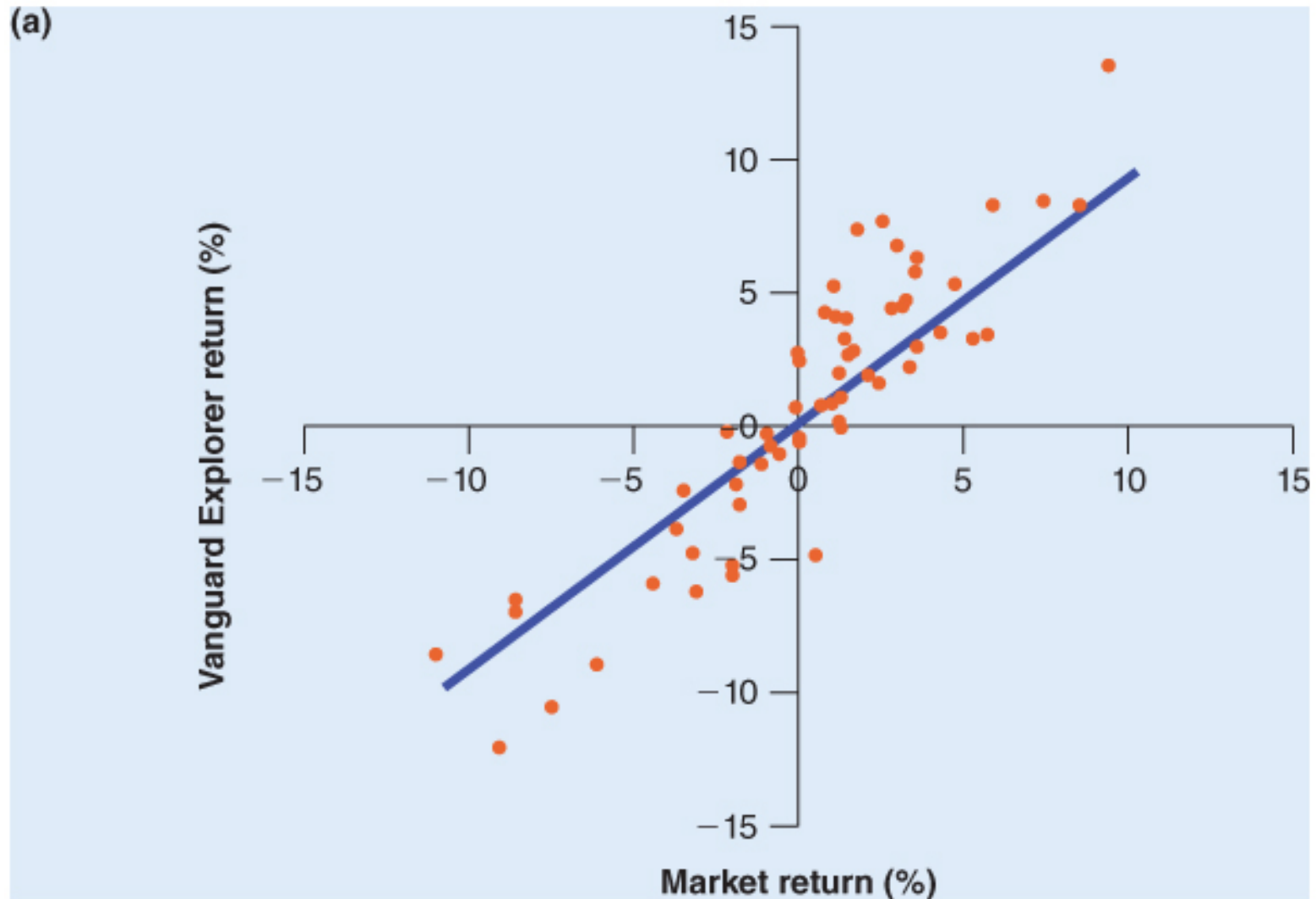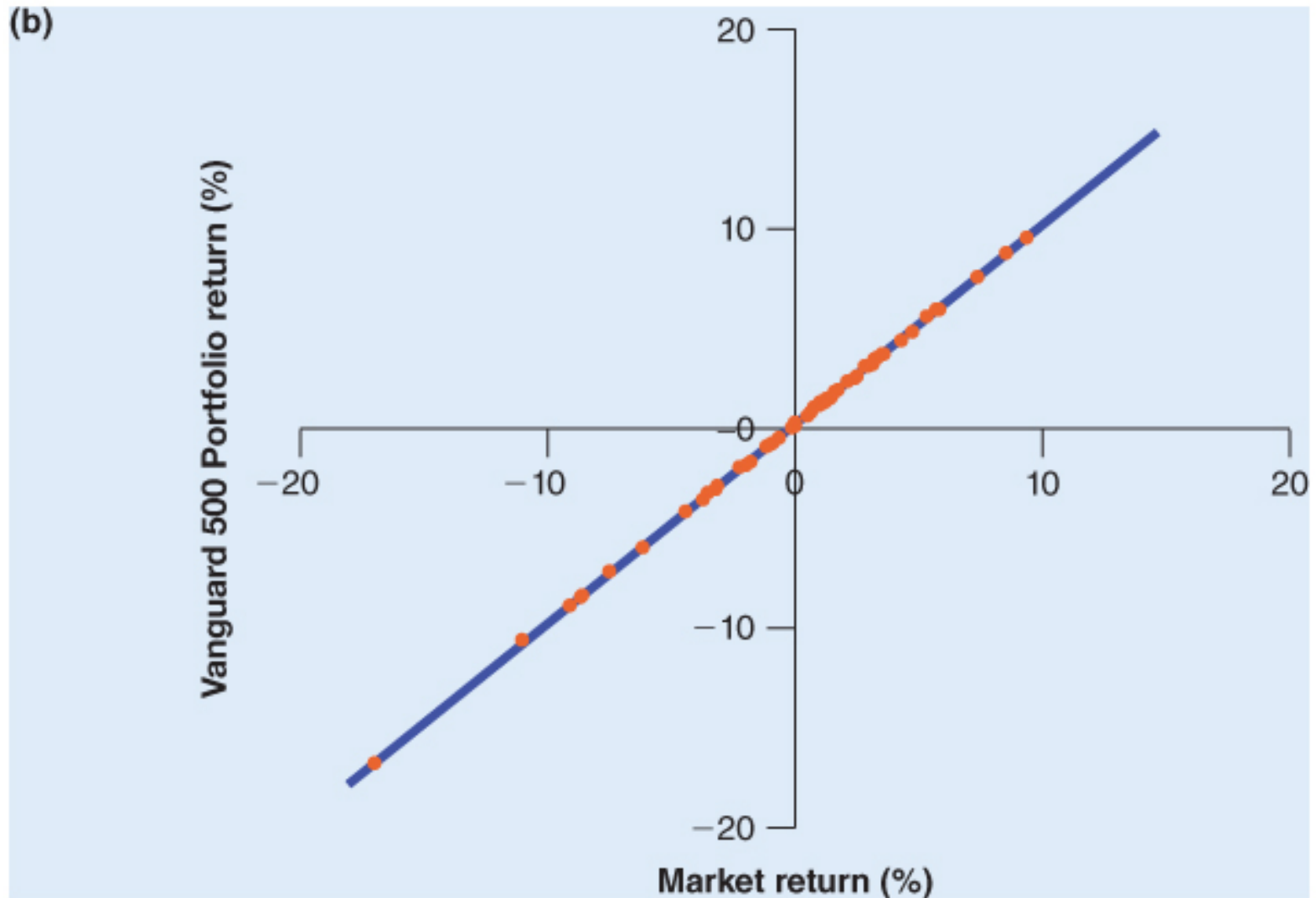
Portfolio Betas (continued)

- Knowing a mutual fund's beta will help you understand the relative performance of the fund.
  - For example, a manager of mutual fund delivered a 35% return in 2014.
  - This is 3 percentage points above the 32% return on S&P500.
  - Suppose the fund specialized in high-beta stocks with average beta of 1.5, it should earn $32\% \times 1.5 = 48\%$. Thus, the fund actually underperformed by about 13%.

Portfolio Betas (continued)

- The portfolio beta determines the risk of a diversified portfolio.
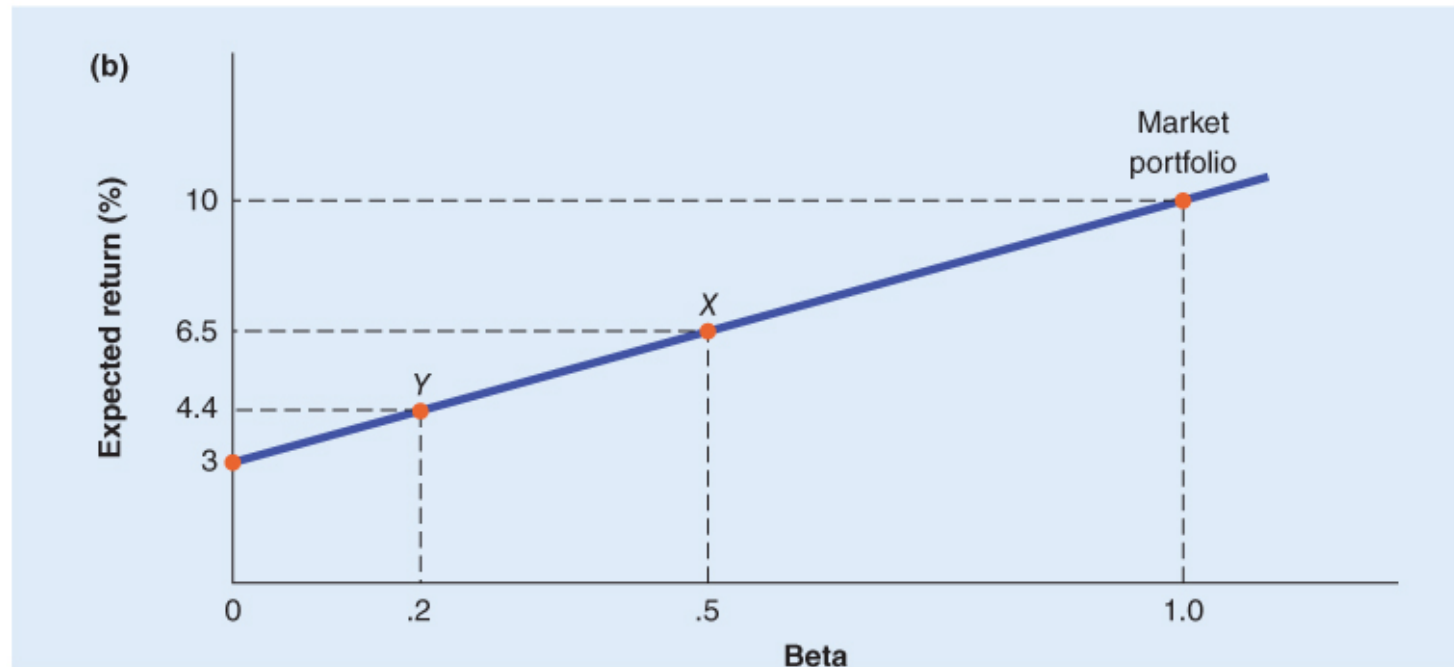- On the other hand, it shows how much market risk remains.

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Risk and Return (12.3)

- From Chapter 11, we see the least risky investment was U.S. Treasury bills.
  - Since return on Treasury bills is fixed (assume that the U.S. government does not default), it is unaffected by market condition.
  - Thus, the beta of Treasury bills is zero.
  - The most risky investment is common stocks, whose portfolio has average market risk as beta of 1.

Risk and Return (continued)

- The difference between market return and the return on risk-free Treasury bills is termed as market risk premium.
  - Over the past century, the average market risk premium in the U.S. has been 7.4% a year.
  - We often naturally assume a 7% additional return from investing in the stock market rather than Treasury bills.

Stock vs. Treasury Bills

(a)

Expected return (%)

10 — Market portfolio

7% = market risk premium

3 — Treasury bills

0 — Beta — 1.0

(b)

Expected return (%)

Market portfolio

10

6.5 — X

4.4 — Y

3

0 — .2 — .5 — 1.0 — Beta

The Market Risk Premium

Let,

$r_f = $ Risk-free rate of return

$r_m = $ Market Return

Market Risk Premium $= r_m - r_f$

Market Risk Premium: Example

Let,

$r_f = 4\%$

$r_m = 12\%$

Market Risk Premium = 8%

Example:

market risk premium $= 8\%$

Market Portfolio
(market return = 12%)

$r_f = 4\%$

Expected Return (%)

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12

10

8

6

4

2

0

0   0.2   0.4   0.6   0.8   1

Beta
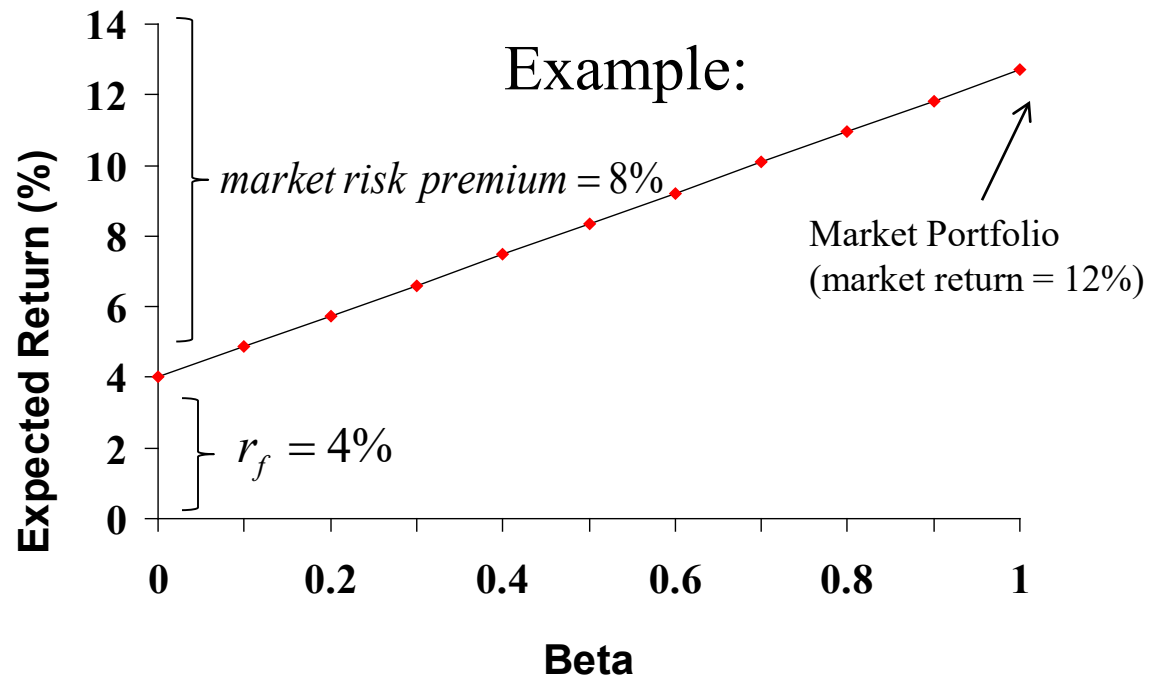
Capital Asset Pricing Model (CAPM)

- One popular tool to formally establish the relation between risk and return is the Capital Asset Pricing Model (CAPM).
  - The expected rates of return demanded by investors depend on two things:
    - (1) compensation for the time value of money (the risk-free rate)
    - (2) a risk premium, which depends on beta and the market risk premium.

Capital Asset Pricing Model (CAPM)

Let r = expected return on any asset

Market risk premium = $r_m - r_f$

Risk premium on any asset = $r - r_f$

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

or,*

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

CAPM: Example

Let:

$r_f = 4\%$

$r_m = 12\%$

Thus, the Market Risk Premium = 8%

Suppose $\beta = 1.2$

CAPM

- By investing some proportion of our money in the market portfolio and lending the balance, we can obtain any combination of risk and expected return along a sloping line.
- This line is known as the security market line.
- The line sets a standard for other investments.
  - Investors will be willing to hold other investments only if they offer equally good prospects.
 - Thus, the required risk premium for any investment is given by the security market line.

Graphic Representation of CAPM

Security Market Line: The relationship between expected return and beta.
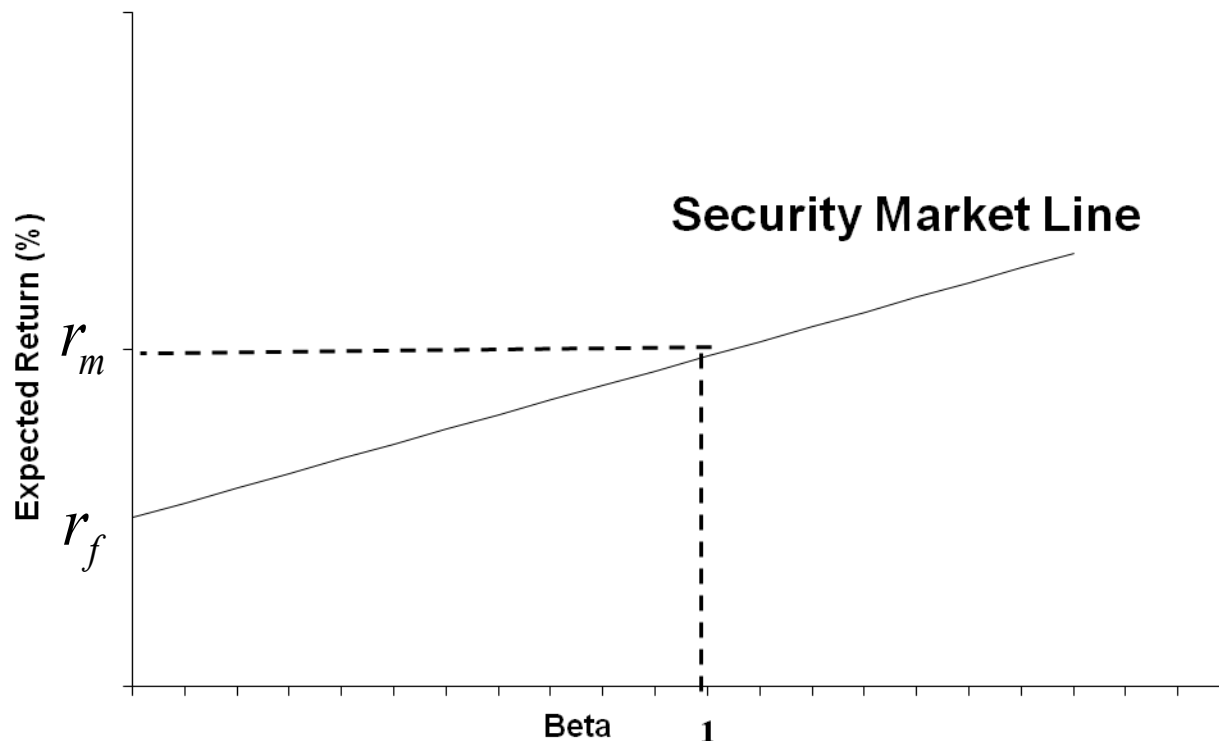
CAPM Tested

- How well does the CAPM work?
- The basic idea behind the CAPM is that investors expect a reward for both waiting and worrying.
  - The greater the worry, greater the expected return.
  - If we invest in Treasury bills, we just receive the rate of interest; that's the reward of waiting.
- Do the stocks with betas of 0.5 on average lie halfway between the return on the market portfolio and the risk-free interest rate?
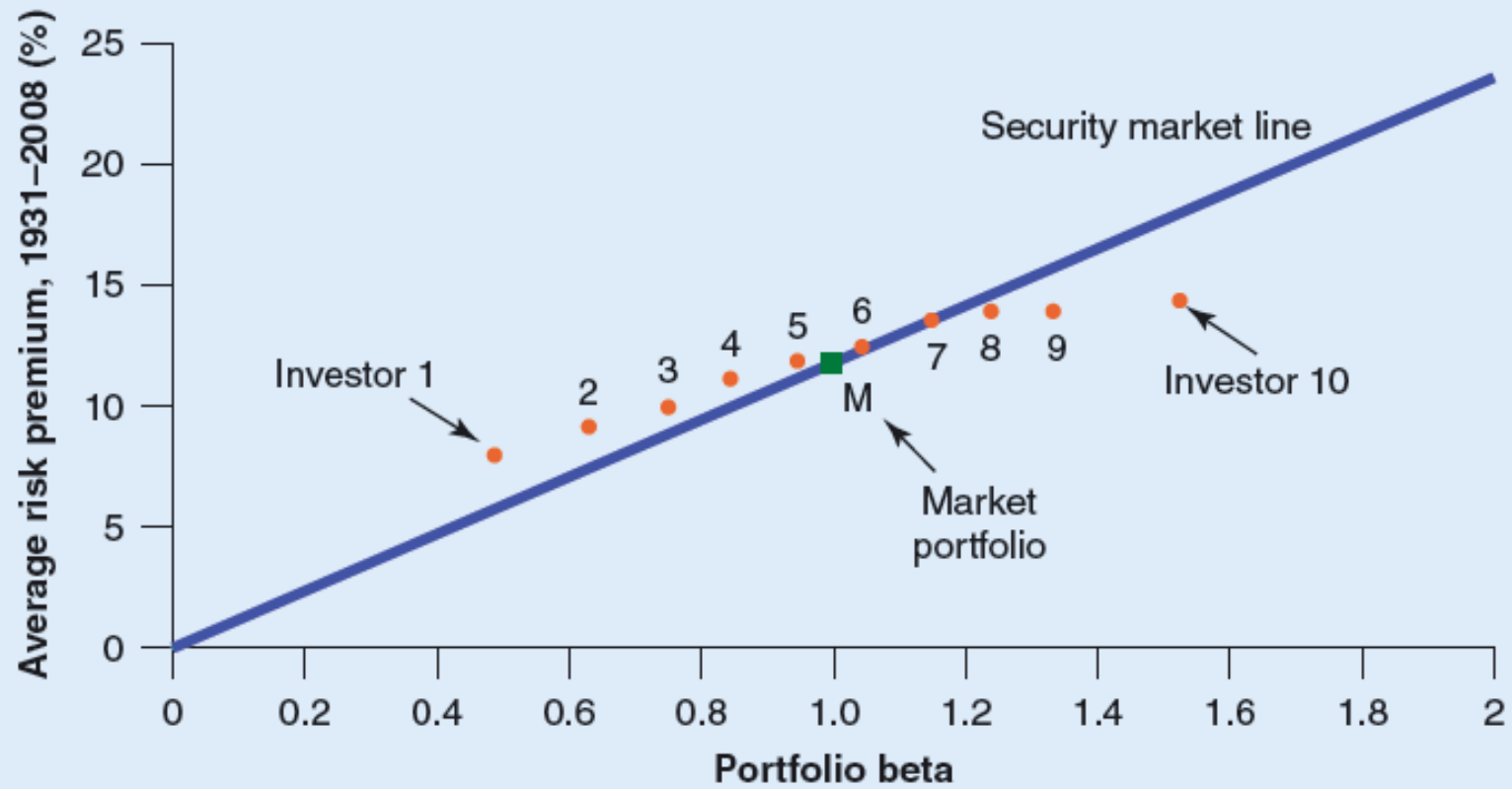
CAPM Tested

- The figure in previous slide shows 77 years (b/w 1931 and 2009) of empirical comparison.
- It provides broad support of the CAPM,
  - though it suggests that the line relating return to beta has been too flat.
- If more recent data are used,
  - for example, data from 1966, very little relation between the portfolio returns and beta will be observed.

Alternative Explanations

- In addition to CAPM, scholars keep looking for more systematic patterns of stocks.
- Small-firm stocks have, in average, higher returns than large-firm stocks.
  - A small minus big strategy.
- Value stocks have, in average, higher returns than growth stocks.
  - Value stocks are those with high ratios of book value to market value.
  - A high minus low strategy.

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Alternative Explanations Tested
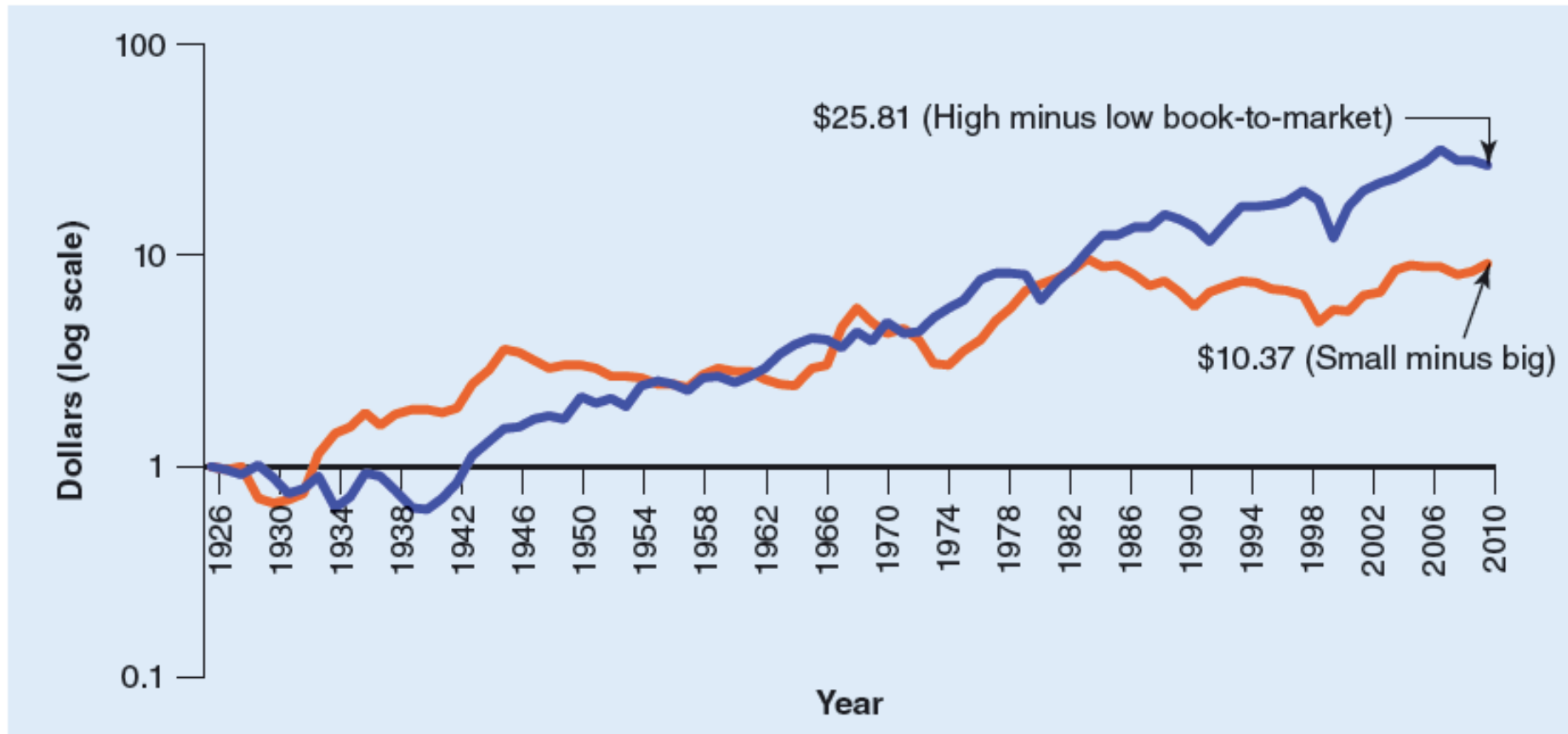
Alternative Explanations (continued)

- Is Beta Dead?
- Some argue that CAPM concerns with expected returns, whereas we can observe only actual return.
  - Actual returns reflect expectations, but they also embody lots of noises.
- Nonetheless, CAPM remains the leading model for estimating required returns.

Expected Returns

- We can certainly use CAPM to estimate expected return.

- Expected return = risk-free interest rate + (Beta × Expected market risk premium)

- Expected return = $r = r_f + \beta \times (r_m - r_f)$

CAPM and Expected Returns

	Beta	Expected Return
Ford	2.53	20.7%
Dow Chemical	2.28	19.0
Starbucks	1.36	12.5
Dell	1.33	12.3
Boeing	1.28	12.0
Disney	1.16	11.1
Microsoft	.97	9.8
IBM	.76	8.3
Pfizer	.68	7.8
McDonald's	.62	7.3
Heinz	.61	7.3
Newmont Mining	.59	7.1
Johnson & Johnson	.57	7.0
ExxonMobil	.42	5.9
Campbell Soup	.37	5.6
Consolidated Edison	.32	5.2
Walmart	.24	4.7

The CAPM and the Opportunity Cost of Capital (12.4)

- Firms can either buy new plant and equipment or return cash to shareholders.
  - Shareholders can then invest the money for themselves in the capital market.
- The return that shareholders give up by keeping their moneys in the company is called the opportunity cost of capital.
  - Shareholders need the company to earn at least the opportunity cost of capital as return.

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Company versus Project Risk

- Many companies estimate the rate of return required by investors in their securities and use this company cost of capital to discount the cash flows on all new projects.

  ▫ Company cost of capital: Expected rate of return demanded by investors in a company, determined by the average risk of the company's securities.

  ▫ Thus, risky firms will have a higher opportunity cost of capital and set a higher discount rate for their new investment opportunities.

Company vs. Project Risk (continued)

- What about the firm has issued securities other than equity?
- What if a firm's new projects do not have the same risk as its existing business?
  - Example: Dell is considering an expansion of its regular business or branch out into production of pharmaceuticals.
- The project cost of capital thus depends on the risk of investment in alternative business.
  - Project cost of capital: Minimum acceptable expected rate of return on a project given its risk.

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Company vs. Project Risk (continued)

- The project cost of capital also depends on the use to which that capital is put.
  - Therefore, it depends on the risk of project, not the risk of the company.
  - Many companies use the company cost of capital as a measure of the return that they require on a typical capital investment.
  - They then adjust the required return depending on the risk of particular project.

Company vs. Project Risk (continued)

- The security market line provides a standard for project acceptance.
- If the project's expected return lies above the security market line, then it is higher than investors could expect to earn.
  - The project is thus an attractive investment opportunity.

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Project Risk and the Security Market Line
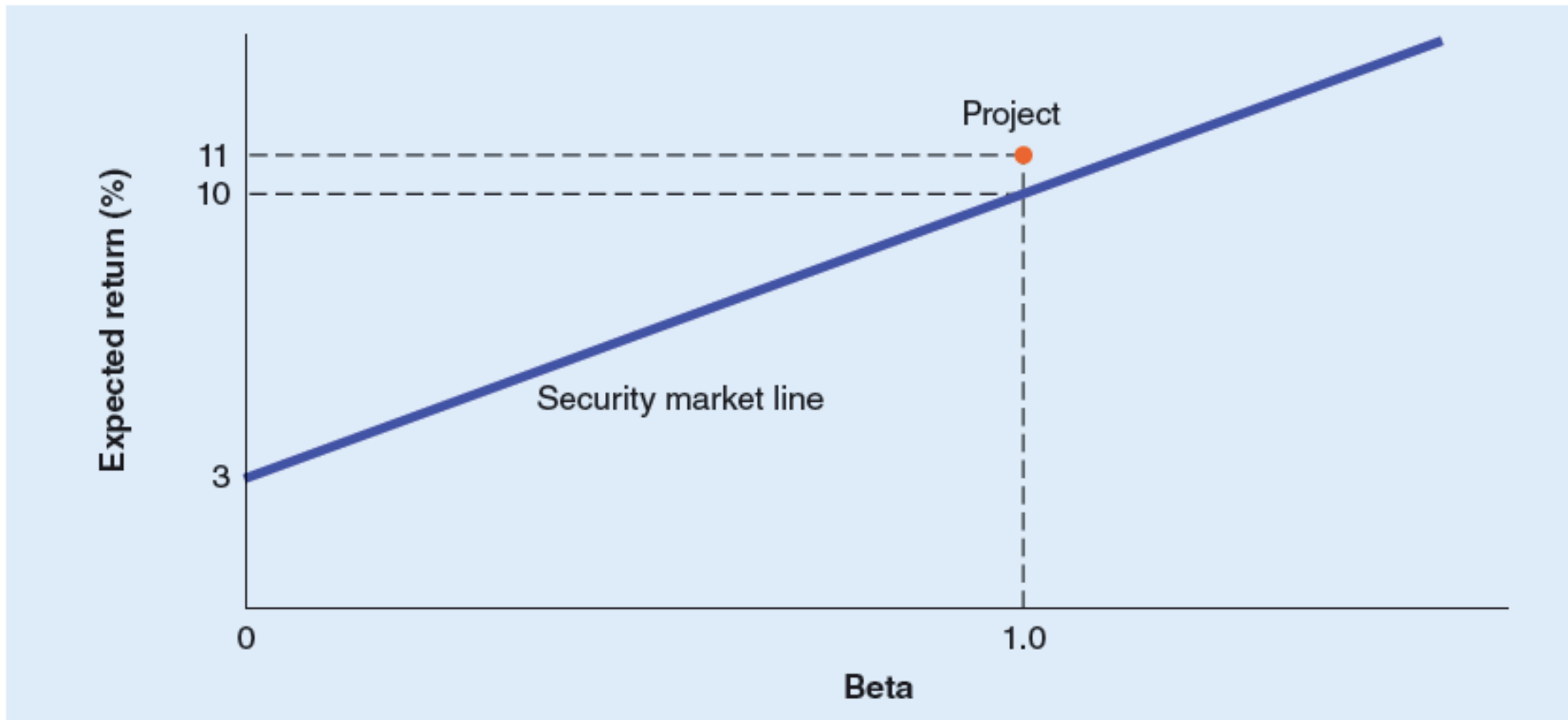
Determinants of Project Risk

- How do we know whether a project is unusually risky?
- Estimating project risk is never going to be an exact science, but there are two things to bear in mind:
  - Operating leverage increases the risk of a project.
    - Projects with high proportion of fixed costs have higher betas.
  - The presence of non-diversifiable risk
    - Variability of earnings reflects diversifiable risk.

Final Notes on Project Risk

- Manager sometimes add fudge factors to discount rates to account for worries about things that can go wrong.
- However, bad outcomes appear to reflect diversifiable risks.
- Most bad outcomes are supposed to be reflected in the cash-flow forecasts.
  - If the cash-flow forecasts are prepared properly, the discount rate should reflect only the market risk of the project.