Capital Markets Overview

Objectives

- Calculate returns
- Calculate mean, variance, and standard deviation of returns
- Describe the average return and standard deviation of returns across different asset classes in the U.S.
- Suggested Exercises:
  - 10th edition, chapter 10: 1-3, 7-8, 12, 14, 24-27
  - 11th edition, chapter 10: 1-3, 7-8, 12, 14, 24-27
  - 12th edition, chapter 10: 1-3, 7-8, 12, 14, 24-27

A question from the 2006 High School Financial Literacy Survey

- Kelly and Pete just had a baby. They received money as baby gifts and want to put it away for the baby's education. Which of the following tends to have the highest growth over periods of time as long as 18 years?

  - a) A U.S. Govt. savings bond
  - b) A savings account
  - c) A checking account
  - d) Stocks

A question from the 2006 High School Financial Literacy Survey

- Kelly and Pete just had a baby. They received money as baby gifts and want to put it away for the baby's education. Which of the following tends to have the highest growth over periods of time as long as 18 years?
  - 44.8% a) A U.S. Govt. savings bond
  - 34.8% b) A savings account
  - 6.3% c) A checking account
  - *14.2% d) Stocks

    ↑ % of Students who picked each answer.

* Correct Answer

How are risk and expected return related?

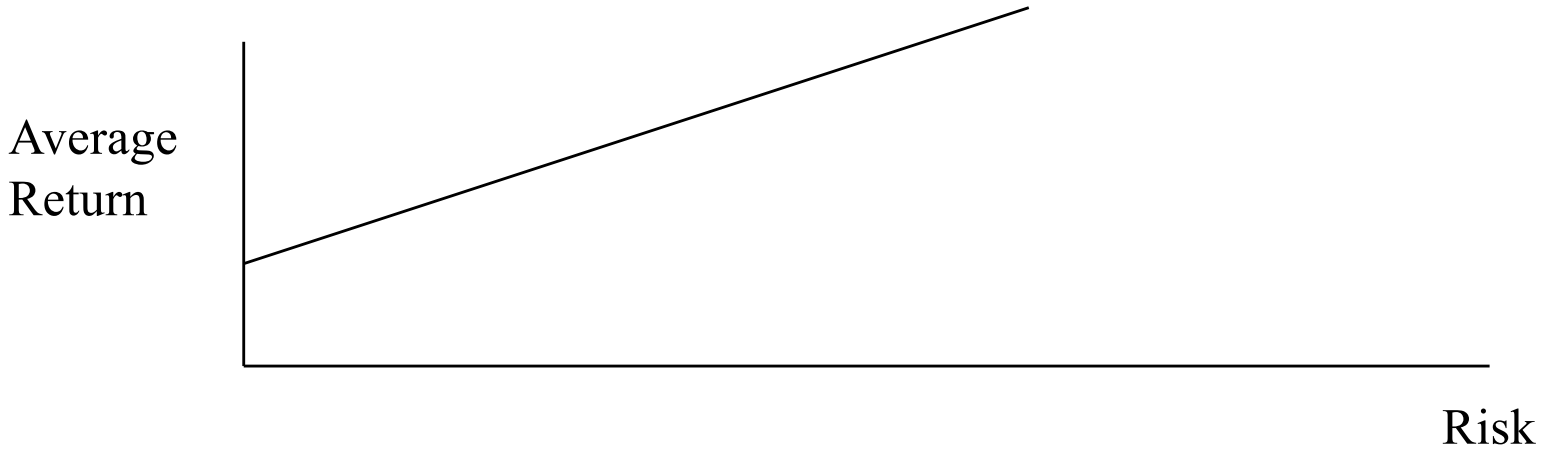
- There are two main reasons to be concerned with this question.

  (1) When conducting discounted cash flow analysis, how should we adjust discount rates to allow for riskiness in the cash flow projections?

  (2) When saving/investing, what is the tradeoff between taking risks and our expected future wealth?

The risk-return relationship

- There is general agreement that the average return should increase with risk



  - But how should risk be measured?
  - At what rate does the line slope up?
  - Is the relation linear?
- Let's look at some historical evidence

Stock returns

- We will start our discussion of risk and return by looking at the performance of returns for different asset classes over almost 100 years.

- But first, it is helpful to know how to calculate returns.

The Beardstown Ladies Investment Club

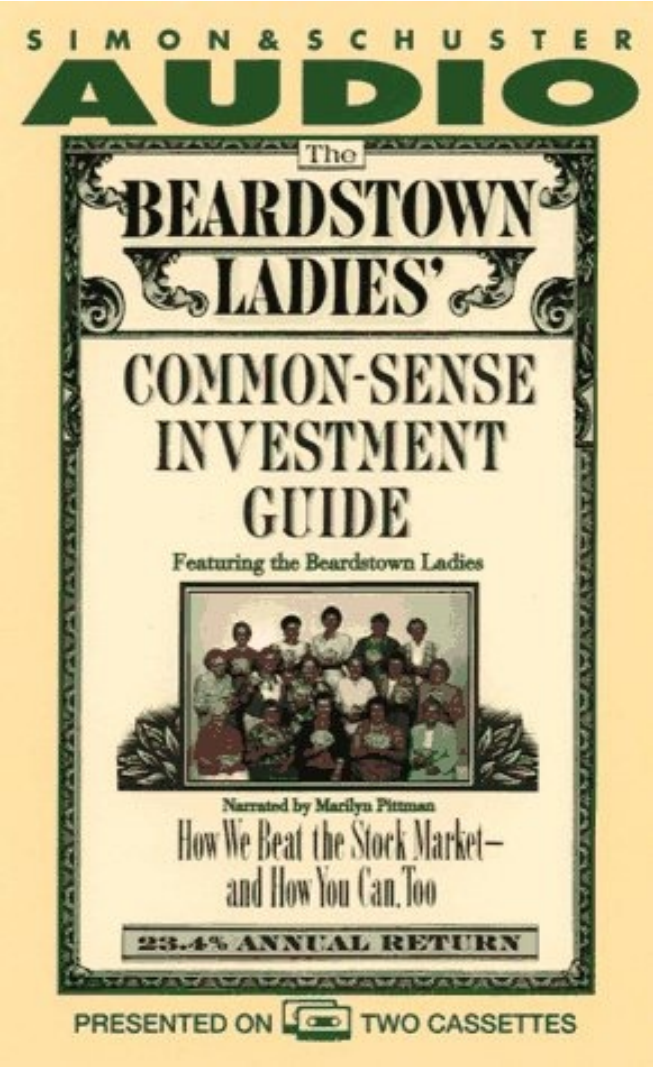
- What are investment clubs?
  - Not a new idea, they have been around since the 1900s
  - From the Wall Street Journal (8/27/84)
  - “Some people have found that pooling investments with neighbors and friends can be financially rewarding. "I've seen individuals come in and start buying $300 or $400 worth of stock, and now they are retiring with several hundred thousand dollars," says Mr. O'Hara, who joined his first investment club in the 1940s.”
- Ladies in this club were:
  - 16 Illinois women: average age was 63 ½ years
  - Met the first Thursday of every month in the basement of a Church in Beardstown, Ill.
  - Each member contributed $25 every month

Their investment strategy

- An easy, common sense-way to beat the market
- An example:

  “One of our tricks is that we might ask for the last two or three annual reports and read the oldest ones first,” notes Sinnock. “We’ll look at what the chief executive officer promised, and then see in subsequent reports if he or she kept those promises.”
- Seemed to be very successful

Their book…



- Released in 1996
  - Advertised their 23.4% annual return
  - Mixed investment tips with recipes
  - Sold 800,000 copies
- What followed?
  - Dozens of TV Appearances
  - Hundreds of Speeches
  - Five more books

There was only one problem

- Chicago Magazine challenged their claim
  - Ladies claimed the return was 23.4% for the 10 years ending in 1993
- The club allowed Price Waterhouse to conduct an audit
  - Found that the actual return was 9.1%
  - Far less than the S&P 500 figure of 14.9% for the same period
- They were calculating returns incorrectly
  - They were making incorrect entries into their computer
  - Nobody double-check the math
- Lost their mystique overnight

How do we calculate returns?

- The general expression for a return over a period t is:

$$r_t = \frac{p_t f_t + d_t}{p_{t-1}} - 1$$

- p_t is price at end of period t
- p_{t-1} is price at end of period t-1
- f_t is the price adjustment for period t
  - This term is used to adjust for stock splits
- d_t is the dividend paid in period t
- Can you decompose the total return into the dividend yield and the capital gain?

Some sample data for a stock

	Price	Dividends	Stock Splits	Returns
June 2020	$364.80	-	-	
July 2020	$425.04	-	-	
August 2020	$129.04	$0.82	4 for 1	
September 2020	$115.81	-	-	

What are the monthly total returns?

How would you do this in R? See the file

“coding-exercise-AAPL-total-returns-handout.R”

A note on stock splits

- Stock splits are—for the most part—cosmetic events
- Example
  - Suppose a company does a 2 for 1 split
  - Current shares outstanding = 1000 and current price =$20.00
  - Market value = $20,000.00
  - After the split: 2000 shares outstanding and price = $10.00
  - Market value = $20,000.00

Holding-Period Returns

- The holding period return is the return that an investor would get when holding an investment over period of *n* years (or months, days), when the return during year *i* is given as r_i:

$$holding\ period\ return = (1 + r_1) \times (1 + r_2) \times \cdots \times (1 + r_n) - 1$$

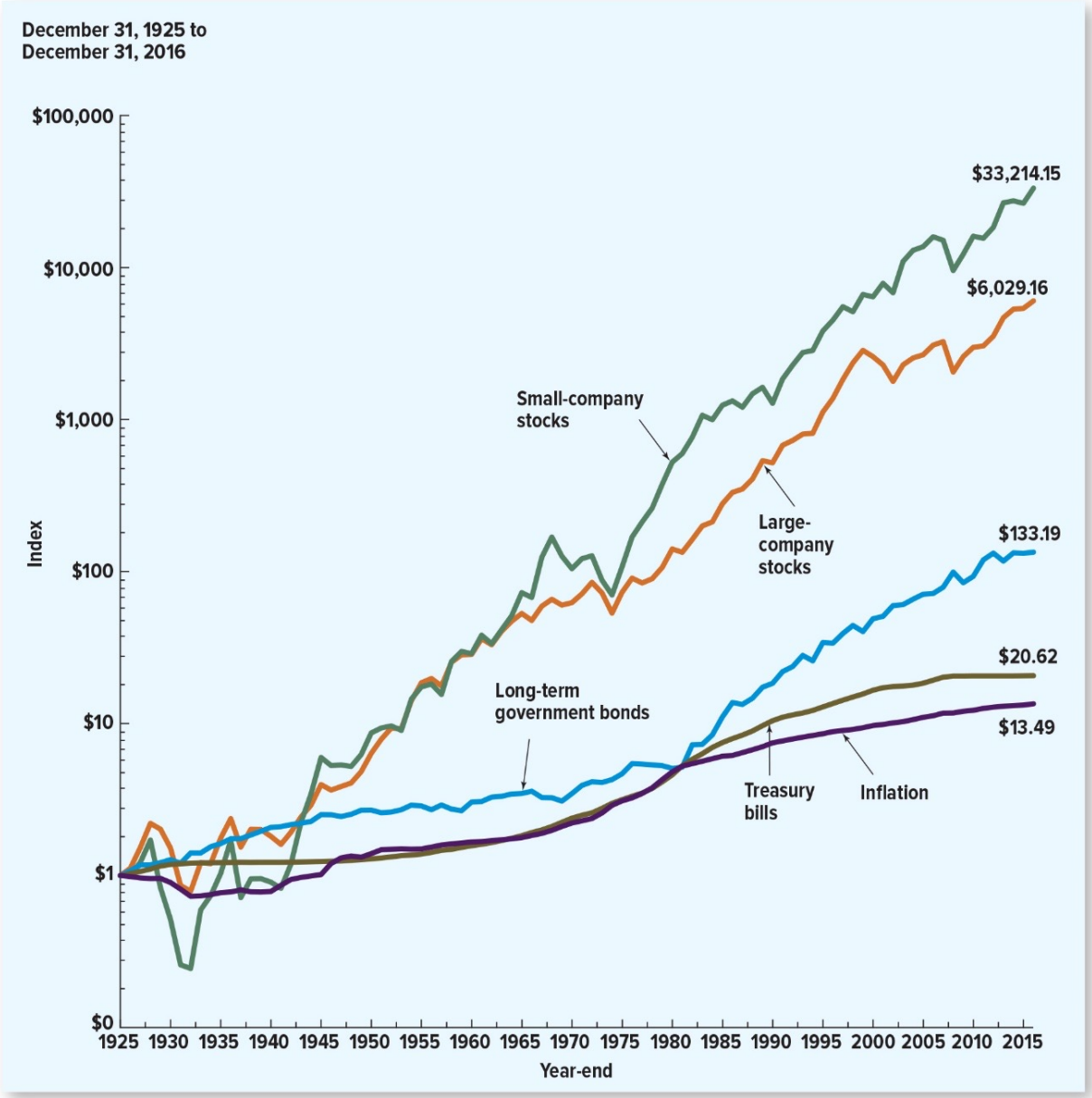
Holding Period Return for Apple

- Given the returns previously calculated, what's the holding period return for Apple from June through September 2020?

Real world example: Microsoft and Apple

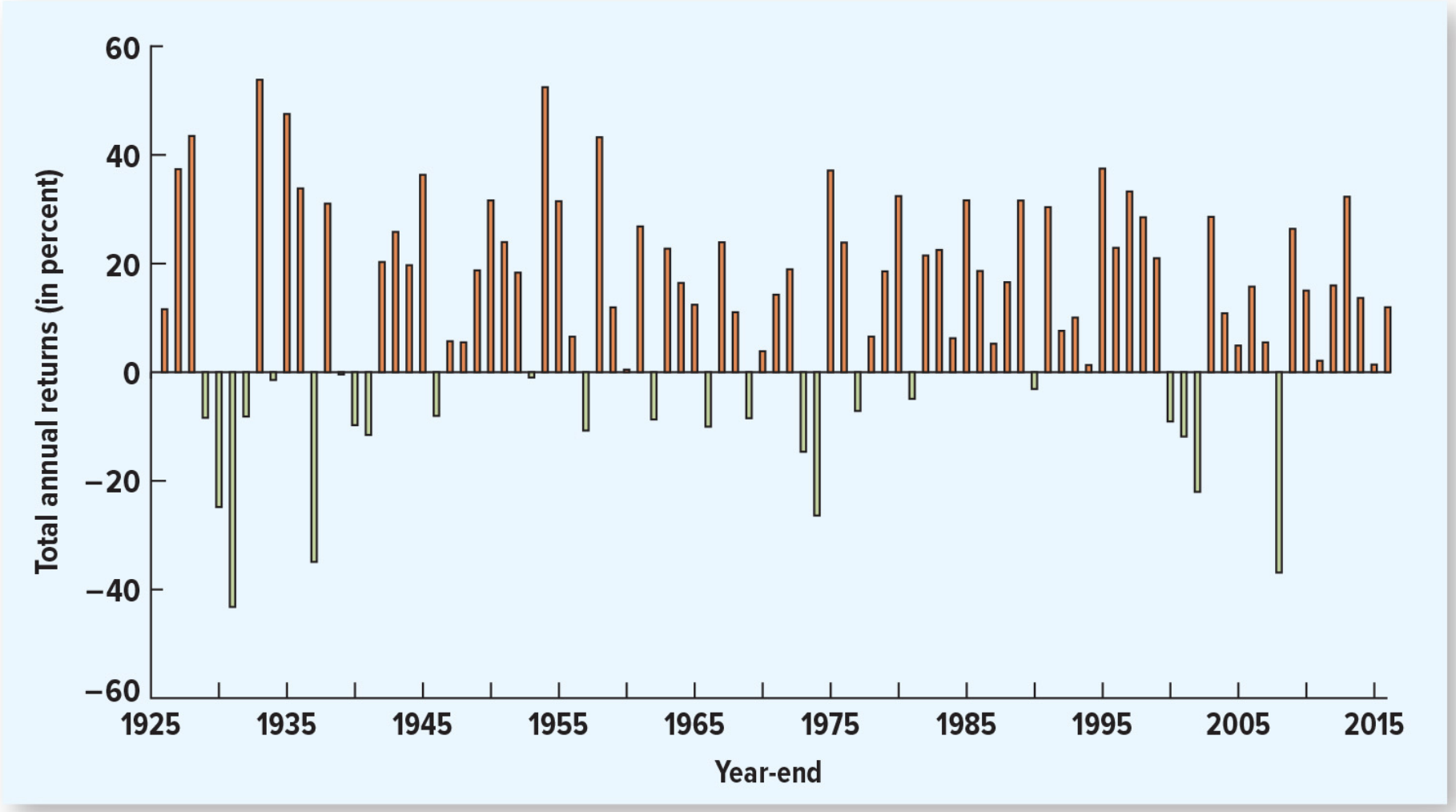
- Calculate the monthly total return for MSFT and AAPL over the past 30+ years
- For each stock, what would be your final wealth in 2021 if you invested $1 in 1987?
- How would this number change if you ignored dividends?
- Use the Excel spreadsheet for this exercise, which contains price data from 1987/01/30 to 2021/09/30
  - Source: Yahoo Finance
- Alternatively, download the code file
  - “coding-exercise-AAPL-holding-period-returns-handout.R”

Historical performance of different asset classes



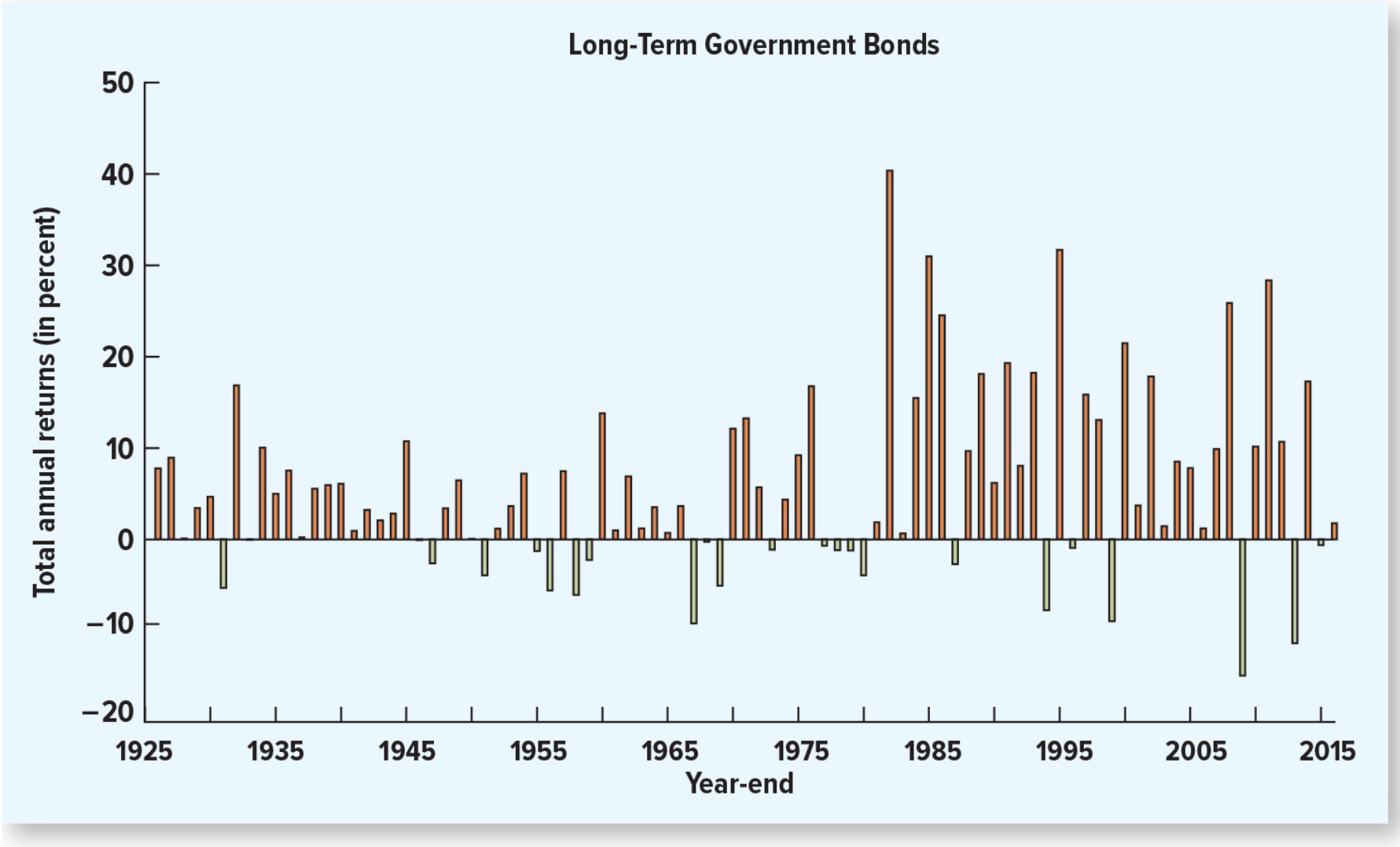
SOURCE: Morningstar, 2017, author calculations.

Year-by-Year Total Returns on Large-Company Common Stocks

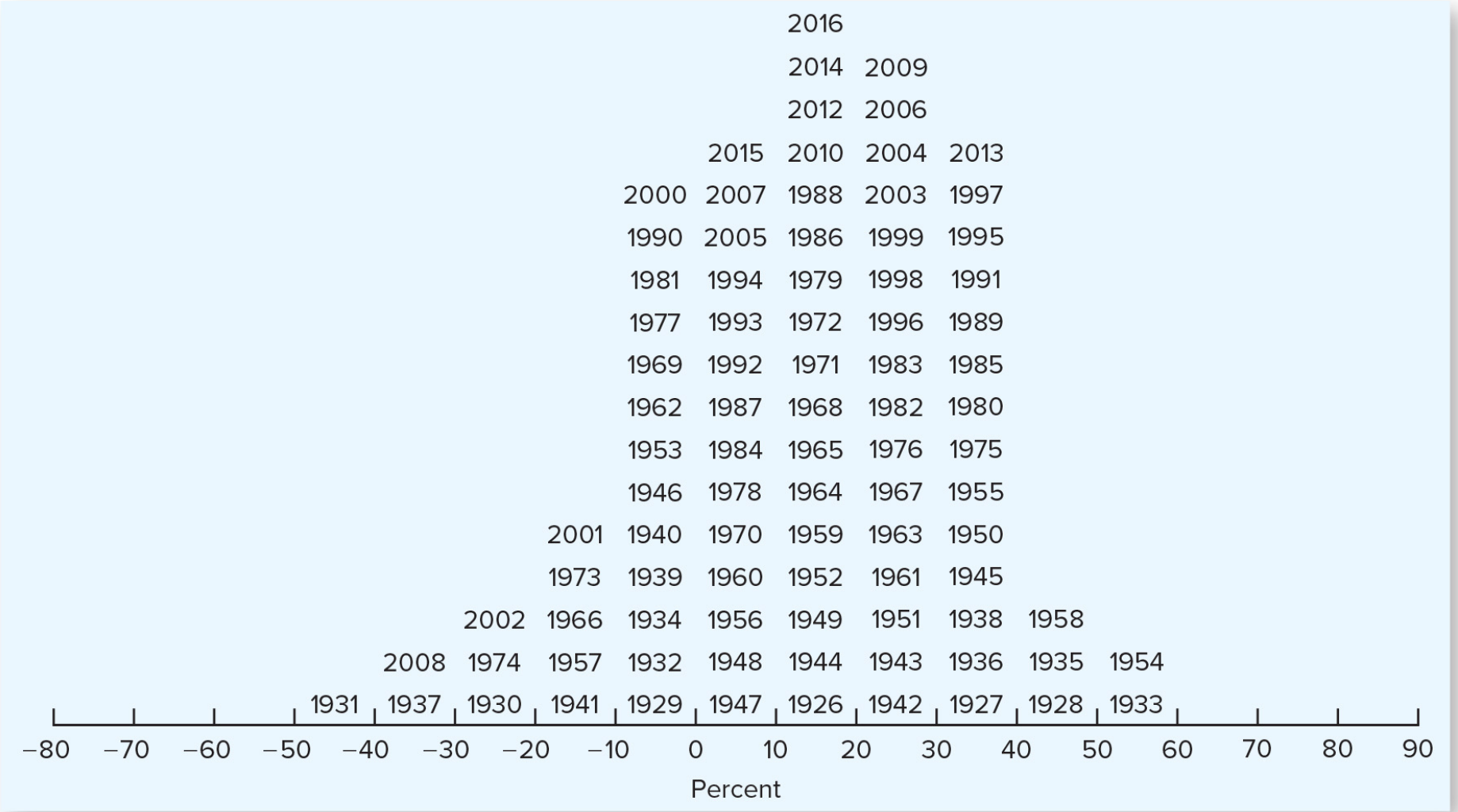


SOURCE: Morningstar, 2017

Year-by-Year Total Returns of Long-Term Government Bonds

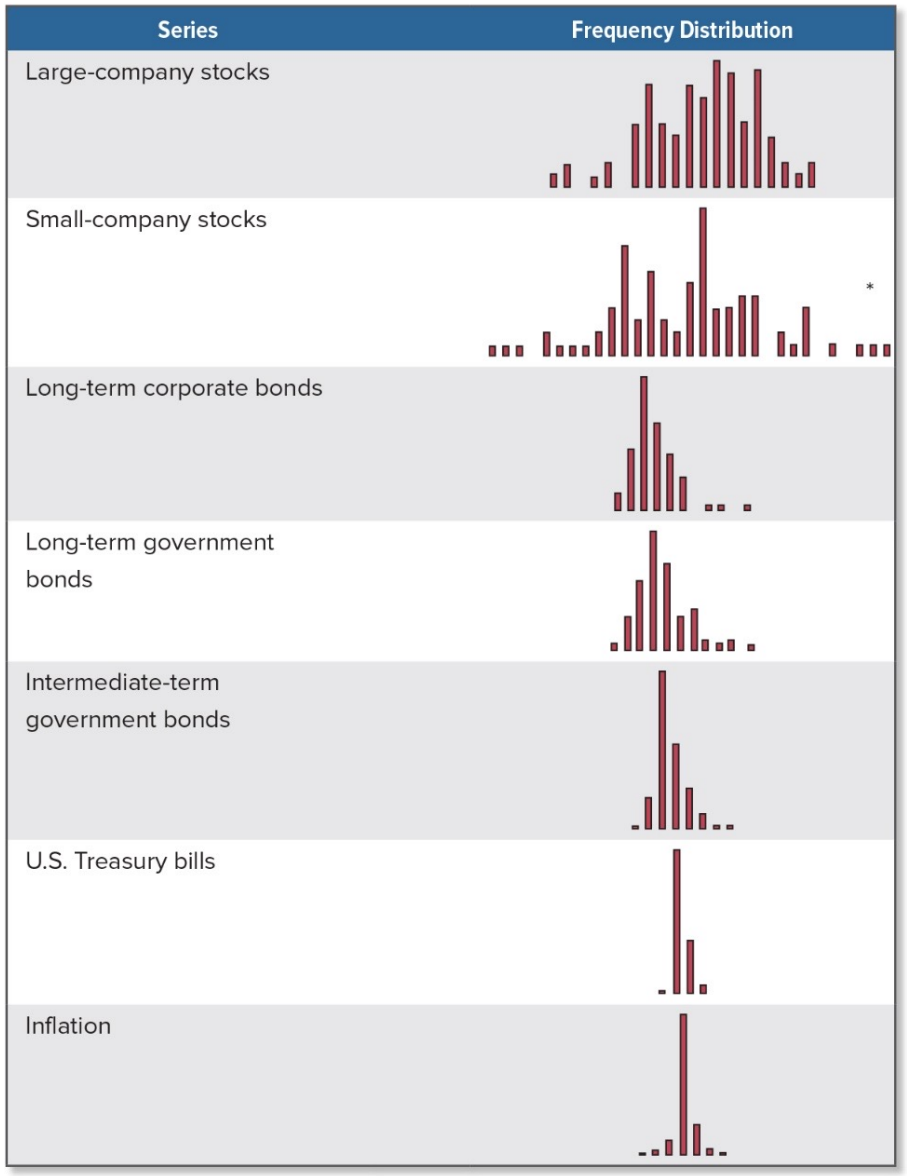


Count how many times a particular return has occurred: The Histogram



SOURCE: Morningstar, 2017, author calculations.

Compare different asset classes' returns



Differences in returns across asset classes

- We see big differences in average realized returns across assets.
- But risk also differed.
- A useful construct for thinking rigorously about risk is a probability distribution
- More specifically, we are going to assume that stock returns are normally distributed
  - The history of capital market returns can be summarized by describing the average return and the standard deviation of returns

Calculating sample statistics

- We can *estimate* the variance and expected return using the arithmetic mean of past returns and the sample variance.
  - Mean = $\overline{R}$ = (R_1 + R_2 + R_3 + ... + R_T)/T
  - Sample variance = σ^2 = "Average" of $(R - \bar{R})^2$

$$Var = \sigma^2 = \frac{1}{T-1}\sum_{t=1}^{T}\left(R_t - \overline{R}\right)^2$$

  - Sample standard deviation:

$$STD = \sqrt{Var} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(R_t - \bar{R})^2}$$

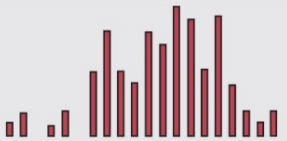
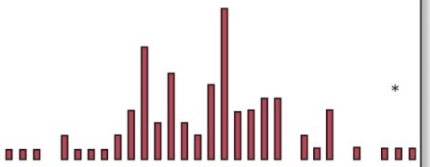
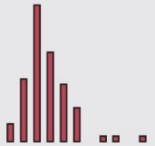
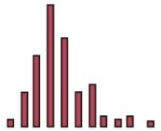
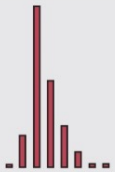
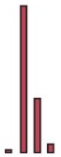
Example: Mean and variance across time

- Calculate the arithmetic mean and sample standard deviation of returns on stocks A & B.

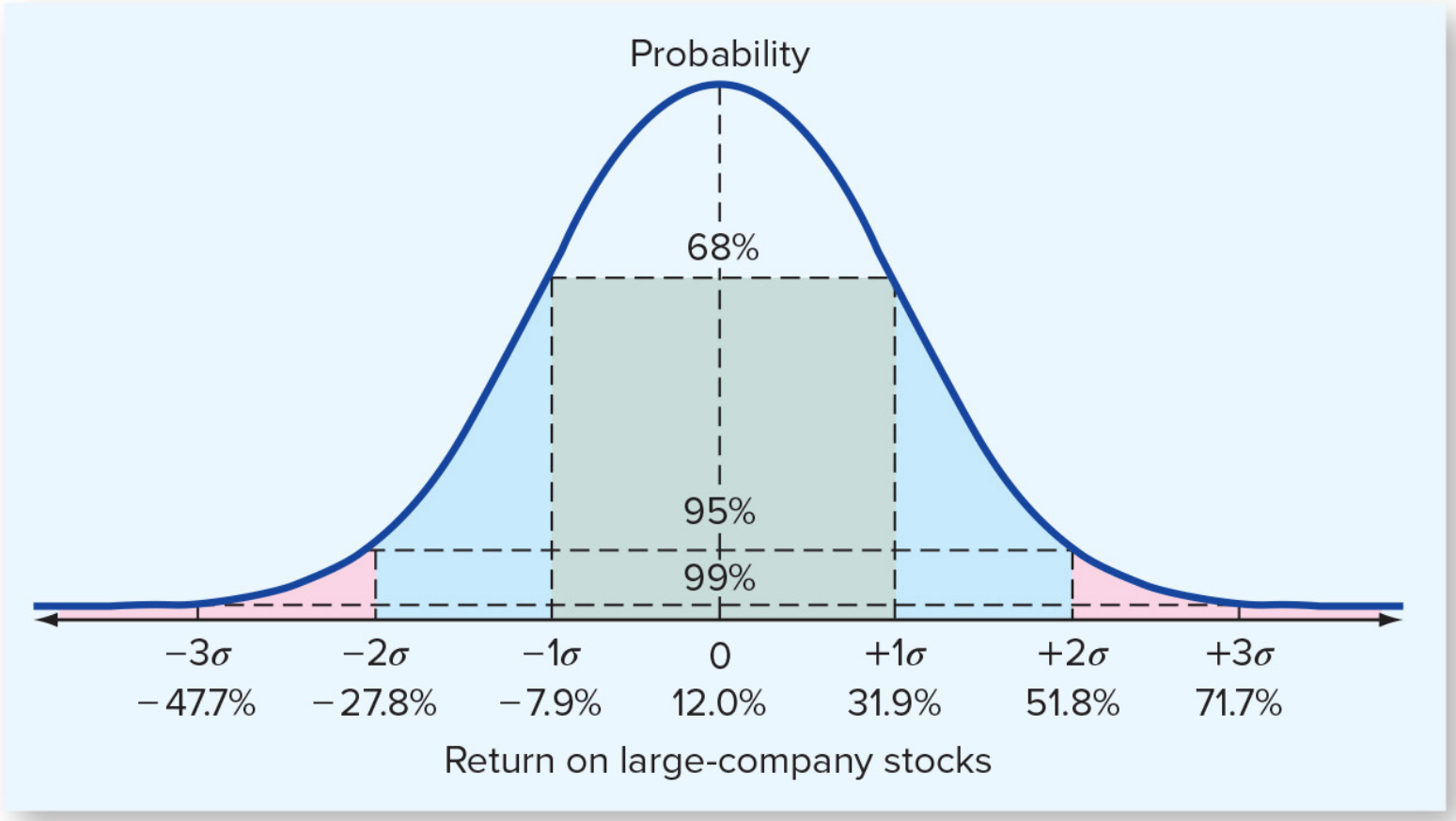
Year	Stock A	Stock B
2018	15%	30%
2019	0%	-20%
2020	5%	20%
2021	20%	50%

- $\bar{R}_A$ =
- $\bar{R}_B$ =
- VAR_A = STD_A =
- VAR_B = STD_B =

Historical means and standard deviations

Series	Average Return	Standard Deviation	Frequency Distribution
Large-company stocks	12.0%	19.9%	
Small-company stocks	16.6	31.9	
Long-term corporate bonds	6.3	8.4	
Long-term government bonds	6.0	9.9	
Intermediate-term government bonds	5.3	5.6	
U.S. Treasury bills	3.4	3.1	
Inflation	3.0	4.1	

Normal distribution: Example with large stock returns (mean 12.0%, sd 19.9%)



NOTE: Illustrated returns are based on the historical return and standard deviation for a portfolio of large-company common stocks.

Some useful Excel functions

=AVERAGE	Computes arithmetic mean of its arguments
=VAR.S	Computes the variance of a sample
=STDEV.S	Computes the standard deviation of a sample

Risk and Return: The CAPM

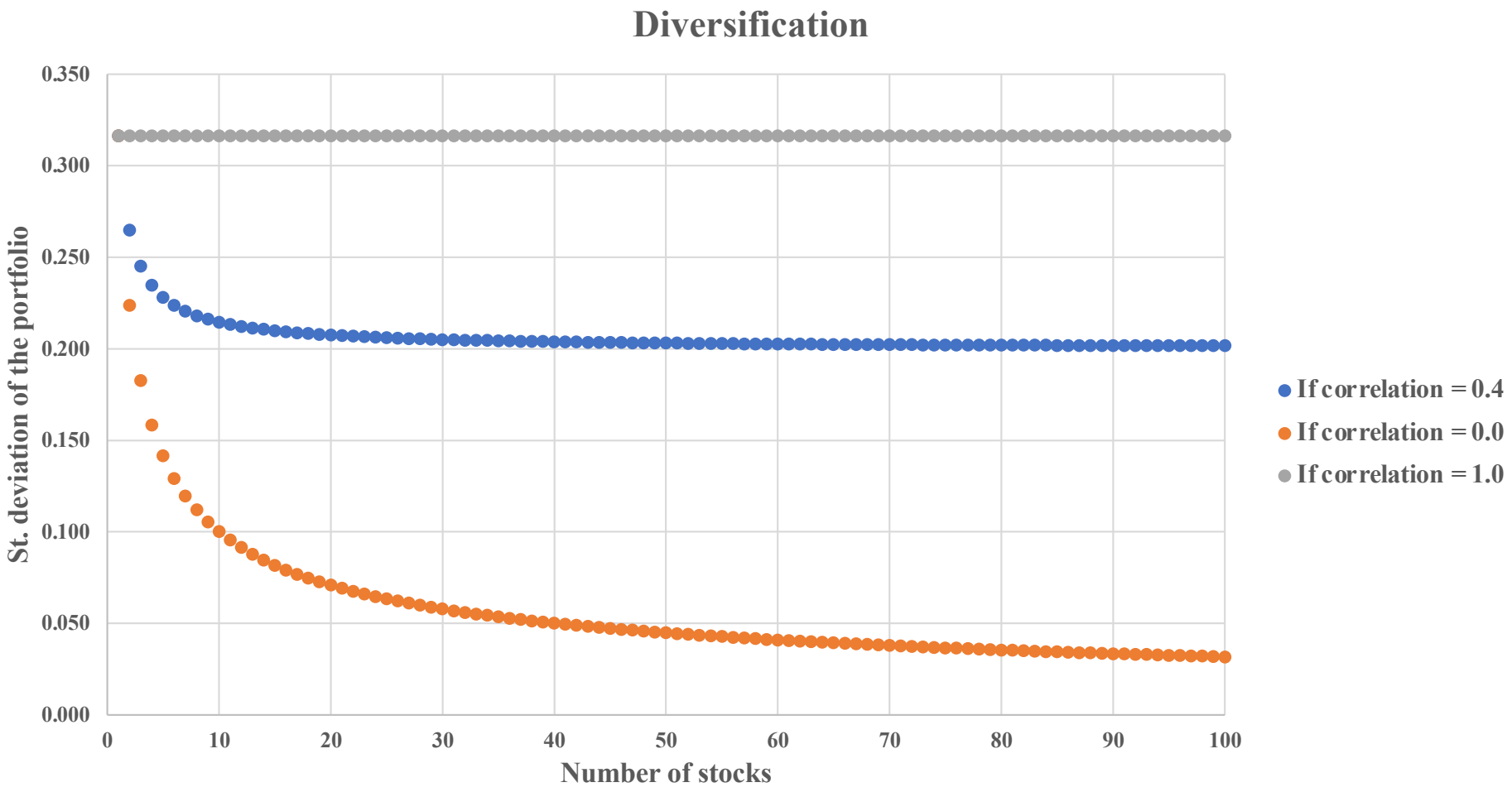
How to compare two risky investments? Example with mutual funds

- Two similar international stock funds:
- Fidelity International Growth Fund
  - Annual return for last 3 years: 8.44%
  - Standard deviation (annualized): 18.36%
- Franklin Templeton Mutual Global Discovery Fund
  - Annual return for last 3 years: 6.89%
  - Standard deviation (annualized): 12.64%
- Which fund is better?
- It's hard to tell!

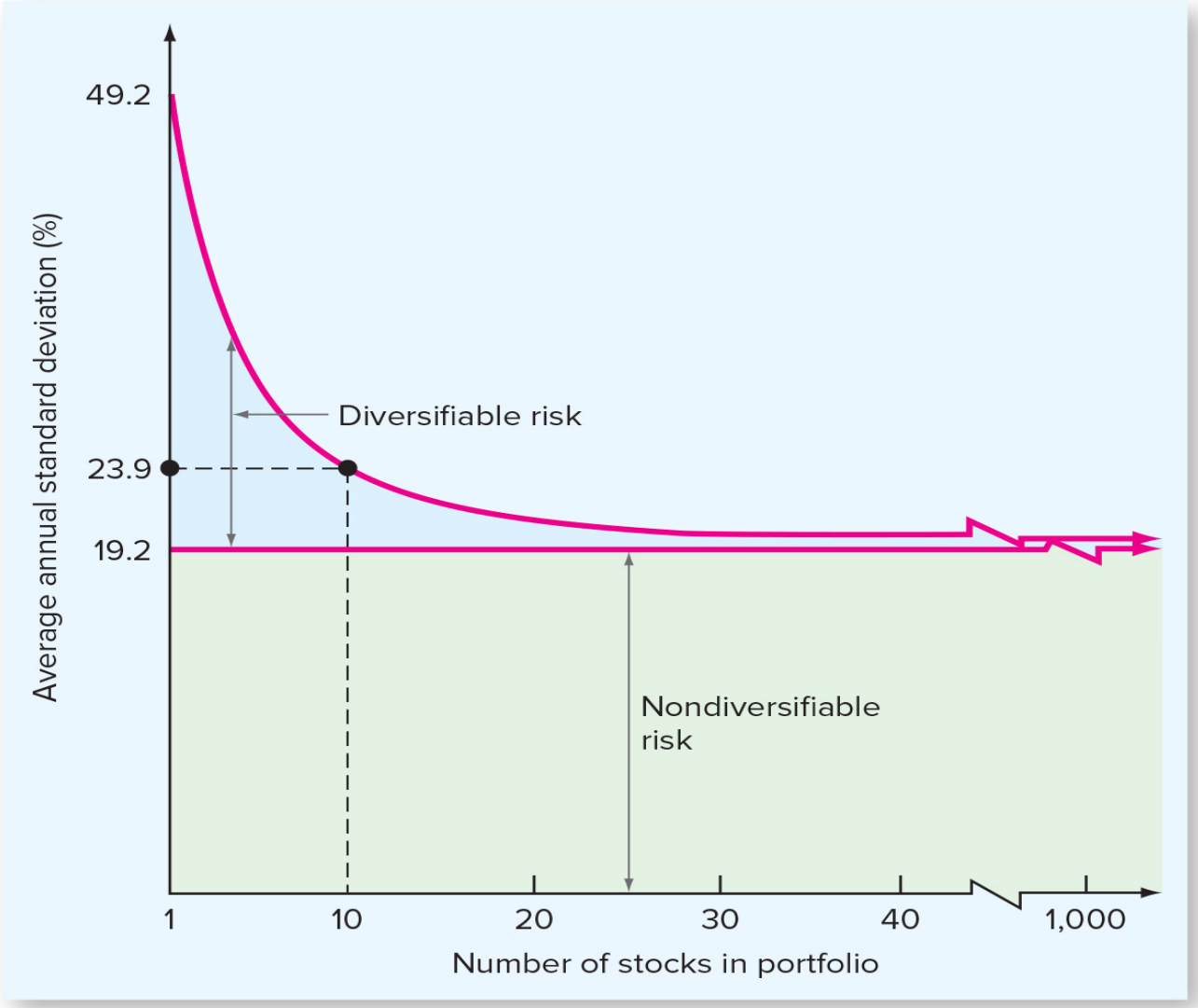
Objectives

- Describe the diversification effect
- Describe the CAPM and beta
- Suggested sample problems:
  - 10th edition, chapter 11: 12-15, 18, 19, 21, 34
  - 11th edition, chapter 11: 12-15, 18, 19, 21, 34
  - 12th edition, chapter 11: 12-15, 18, 19, 21, 34

The Diversification Effect



Limits to Diversification



Main conclusion from diversification

- Firm specific risk (or idiosyncratic risk, unsystematic risk) can be ‘diversified away’ easily
  - **Only systematic risk matters!**

- Two big questions left to tackle:
  - How can we measure systematic risk?
  - Given that diversification is easy and most investors do diversify:
    - What is the equilibrium relation between risk and expected return in the capital markets?

Measuring Systematic Risk

- How can we estimate the amount or proportion of an asset's risk that is diversifiable or non-diversifiable?
- The Beta coefficient :
  - It's the slope coefficient in an OLS regression of stock returns on market returns:

$$\beta_i = \frac{Cov(R_i, R_M)}{Var(R_M)}$$

- As such, Beta is a measures of sensitivity: it describes how strongly the stock return moves with the market.
  - Example: A stock with Beta=2 will on average go up 20% when the market goes up 10%, and vice versa.

Some additional insight: Restate Beta in terms of correlations.

Since $Corr(R_i, R_M) = \frac{Cov(R_i, R_M)}{SD(R_i)SD(R_M)}$

We can restate Beta as $\beta_i = \frac{SD(R_i)Corr(R_i, R_M)}{SD(R_M)}$

- We can interpret the components this way:
  - $SD(R_i)$ is a measure of the total risk of asset i.
  - $CORR(R_i,R_m)$ measures the systematic proportion of asset i's risk.
  - $SD(R_i)CORR(R_i,R_m)$ measures the systematic risk of asset i.
  - $SD(R_m)$ measures the total risk of the market, all of which is systematic.
- So, β_i is the systematic risk of asset i, relative to the systematic risk of the market.
  - This also implies that the average of all betas is 1.0

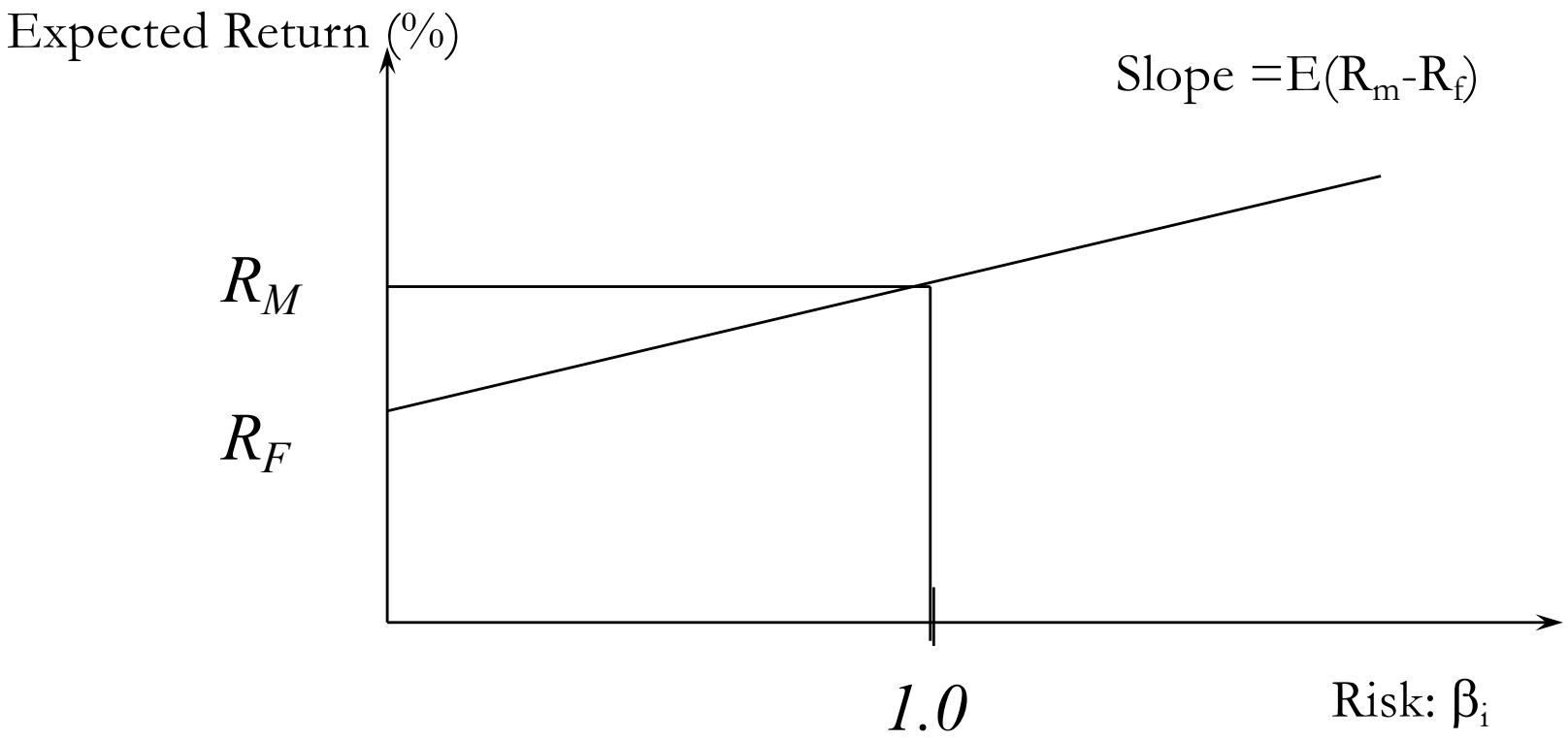
The CAPM (Capital Asset Pricing Model)

- A stock's non-diversifiable or systematic risk is measured by beta
- The expected or required returns on an asset are a linear function of betas

$$E[R_i] = R_f + \beta_i E\left(R_m - R_f\right)$$

- For example, a stock with $\beta = 2$ is twice as risky as the market, so investors require twice the risk premium

CAPM: The Security Market Line



Applications of the CAPM

- Measures and quantifies risk
  - One stock or project is riskier than another stock or project if it has a higher beta
- Valuation:
  - The CAPM provides a way to estimate the firm's cost of capital (a risk-adjusted discount rate)
- It gives us a way to evaluate a stock's or mutual fund's risk-adjusted performance
  - The CAPM provides a benchmark

Example 1: Expected returns of stocks

- Using returns data over the past year, you estimate that Microsoft has a beta of 0.71 and Apple has a beta of 0.74. If these estimates are a reliable guide for their risks going forward, what rate of return is required for an investment in each stock?
  - Assume T-bill (Treasury bill) rate is 1.0%, market risk premium is 6%
  - What are the expected returns for Microsoft and Apple respectively?

Example 2: Mutual fund selection

- You are choosing between two mutual funds. Over the last 10 years, Blindluck Value Fund had an average return of 12.8% and a beta of 0.9. Easymoney Growth Fund had a return of 17.9% and a beta of 1.3. The market's average return over the same period was 14% and the T-bill rate was 5%.
  - Which fund did better?

- Blindluck: Expected return = 5% + 0.9*(14%-5%) = 13.1%
  - Difference (or Alpha) = 12.8% - 13.1% = - 0.30%

- Easymoney: Expected Return =
  - Difference (or Alpha) =

Sample Problem

- #35 (9th edition). Suppose you observe the following situation:
  - Pete Corp: Beta = 1.4 and Expected Return = 15%
  - RePete Corp: Beta = 0.9 and Expected Return = 11.5%

  Assume these securities are correctly priced. Based on the CAPM, what is the expected return on the market? What is the risk-free rate?

The CAPM is used extensively in practice

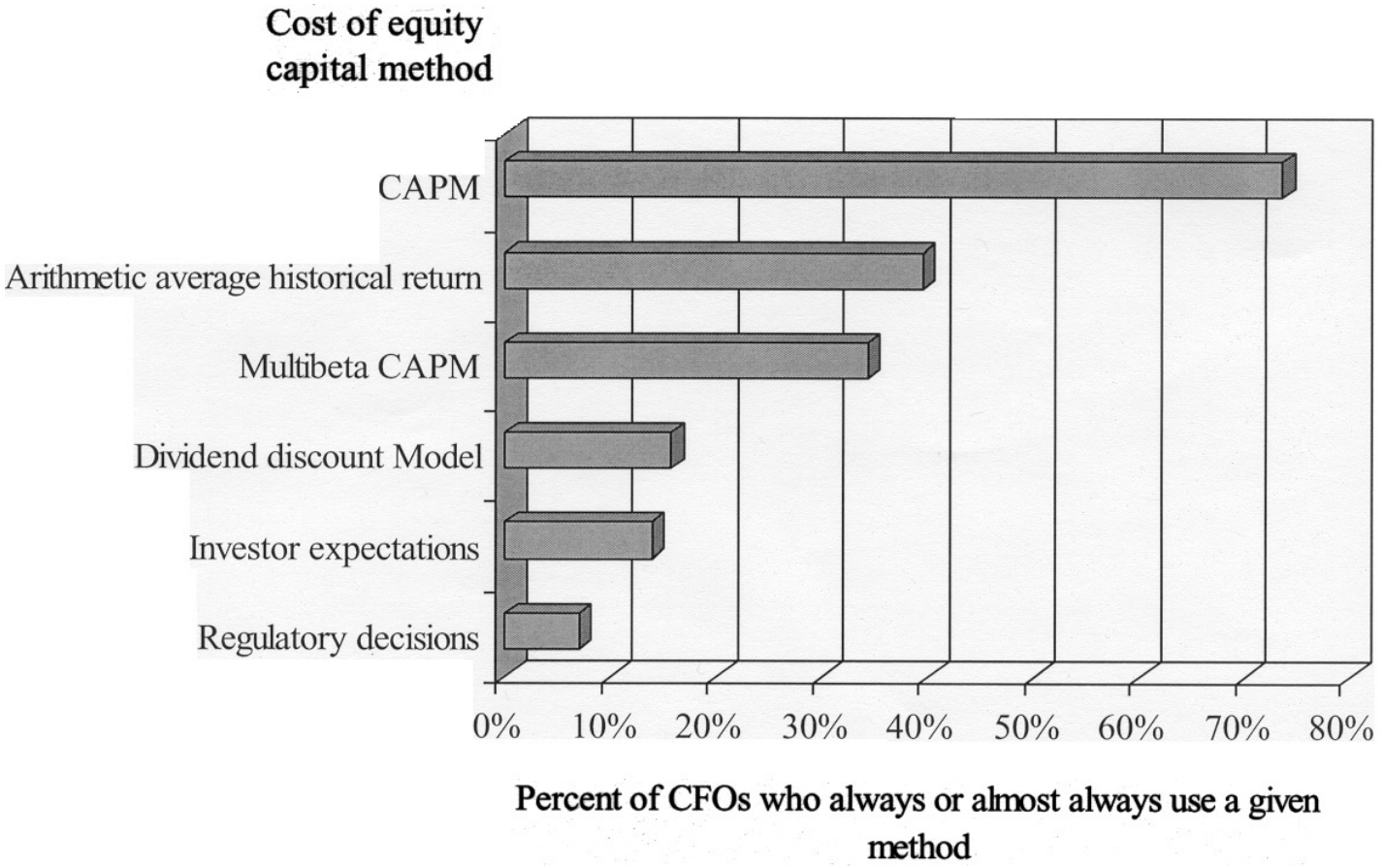


Fig. 3. Survey evidence on the popularity of different methods to calculate the cost of equity capital. We report the percentage of CFOs who always or almost always use a particular technique. CAPM represents the capital asset pricing model. The survey is based on the responses of 392 CFOs.

Concept quiz: Risk and Return

- The *Wall Street Journal* Investment Dartboard
  - A stock picking contest sponsored by the *WSJ*
    - Was held monthly
    - Lasts for 6 months
    - 4 analysts each pick one stock
    - *WSJ* editors pick four stocks by throwing darts at stock listings
  - Originally started to test the Efficient Markets Hypothesis
    - Are we better off throwing darts at a dartboard than listening to professionals when picking stocks?

Competition Results

- Started in 1990
  - 141 total contests
- Competition results as of 3/15/2002
  - Analysts have won 86 earning a 10% return on average
  - Darts have won 55 earning a 3.7% return on average
- Popular conclusion
  - The professional have a significant ability to pick stocks and beat the market!

Is there an alternative explanation?

- Are the risk of the analysts and dartboard picks the same?
  - Average Beta for analysts picks is 1.19
  - Average Beta for dartboard picks 0.73
- Participants in the game tend to pick high risk stocks
  - Why?
  - Higher expected return implies a better chance of winning the game
- Once you adjust for the risks of the picks, the participants have no special stock picking ability
- What happens if you lose to the darts?

Four observations about the CAPM

1. A portfolio's beta is a weighted average of the betas of the individual stocks
2. Two assets can have same total variance, but very different β's
   - Investors should care only about systematic (beta) risk
3. Assets can have negative risk!
   - A stock's β is less than 0 if the stock is negatively correlated with the market portfolio
   - Such a stock contributes negatively to portfolio risk
4. The CAPM implies that the market portfolio will have the highest risk-return trade-off (Sharpe Ratio) of any possible portfolio