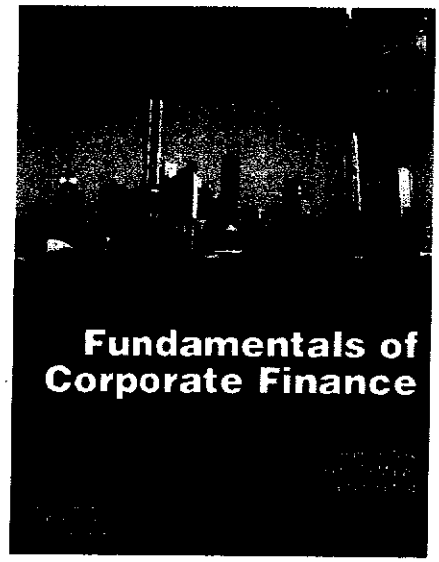
Chapter 11

Risk and Return in Capital Markets



Chapter Outline

18. Types of Risk

Common Versus Independent Risk
Home Insurance

	Theft Insurance	**Earthquake Insurance**
No of policies.	100,000	100,000
Risk of occurrence	1 percent	1 percent
No of homes		
Experience a robbery.	100/year	
If EQ occurs.	All homes will be destroyed Ins comp. can expect 0 or 100,000 Claims	

Example 11-5

Flipping a Coin 100X

HU. UW 1$.
TU. UL. 1$.

Expected outcome = 50% (+1$) + 50% (-1$) = 0$

Flipping the same Coin just once

Same expected outcome= 0$. But there is 50% Chance of loosing your $100

Therefore your risk is far greater in case of one flip than it would be for 100 one dollar bets.

Learning Objectives

- Identify which types of securities have historically had the highest returns and which have been the most volatile
- Compute the average return and volatility of returns from a set of historical asset prices
- Understand the tradeoff between risk and return for large portfolios versus individual stocks
- Describe the difference between common and independent risk
- Explain how diversified portfolios remove independent risk, leaving common risk as the only risk requiring a risk premium

Risk
The variability of returns form an investment
The change that actual outcomes (Returns) may differ from those expected

Return
Is the expected return from an investment

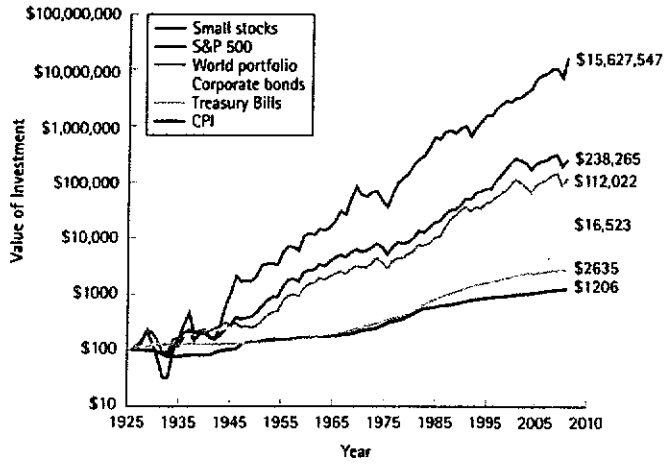
A basic PRIMSE IN MANAGERIAL FINANCE IS THAT a tradeoff exist between return (cash flow) & risk

Risk and return are in fact the key determinates of share price, which represent the wealth of the owners of the firm

11.1 A First Look at Risk and Return

- Consider how an investment would have grown if it were invested in each of the following from the end of 1925 until the beginning of 2010:
  - Standard & Poor's 500 (S&P 500)
  - Small Stocks
  - World Portfolio
  - Corporate Bonds
  - Treasury Bills

Figure 11.1 Value of $100 Invested at the End of 1925 in U.S. Large Stocks (S&P 500), Small Stocks, World Stocks, Corporate Bonds, and Treasury Bills



Source: Global Financial Data.

Table 11.1 Realized Returns, in Percent (%) for Small Stocks, the S&P 500, Corporate Bonds, and Treasury Bills, Year-End 1925–1935

Year	Small Stocks	S&P 500	Corp Bonds	Treasury Bills
1926	1.09	11.14	6.29	3.30
1927	31.37	37.13	6.55	3.15
1928	65.36	43.31	3.38	4.05
1929	−43.08	−8.91	4.32	4.47
1930	−44.70	−25.26	6.34	2.27
1931	−54.68	−43.86	−2.38	1.15
1932	−0.47	−8.85	12.20	0.88
1933	216.14	52.88	5.25	0.52
1934	57.20	−2.34	9.73	0.27
1935	69.11	47.22	6.86	0.17

Source: Global Financial Data.

11.2 Historical Risks and Returns of Stocks

- Computing Historical Returns
  - Realized Returns
  - Individual Investment Realized Returns
    - The realized return from your investment in the stock from t to t+1 is:

$$R_{t+1} = \frac{Div_{t+1} + P_{t+1} - P_t}{P_t} = \frac{Div_{t+1}}{P_t} + \frac{P_{t+1} - P_t}{P_t} \qquad \text{(Eq. 11.1)}$$

$$= Dividend\ Yield + Capital\ Gain\ Yield$$

Example 11.1 Realized Return

Problem:

- Microsoft paid a one-time special dividend of $3.08 on November 15, 2004. Suppose you bought Microsoft stock for $28.08 on November 1, 2004 and sold it immediately after the dividend was paid for $27.39. What was your realized return from holding the stock?

Example 11.1 Realized Return

Solution:

Plan:

- We can use Eq 11.1 to calculate the realized return. We need the purchase price ($28.08), the selling price ($27.39), and the dividend ($3.08) and we are ready to proceed.

Example 11.1 Realized Return

Execute:

- Using Eq. 11.1, the return from Nov 1, 2004 until Nov 15, 2004 is equal to

$$R_{t+1} = \frac{Div_{t+1} + P_{t+1} - P_t}{P_t} = \frac{3.08 + (27.39 - 28.08)}{28.08} = 0.0851, \text{ or } 8.51\%$$

- This 8.51% can be broken down into the dividend yield and the capital gain yield:

$$\text{Dividend Yield} = \frac{Div_{t+1}}{P_t} = \frac{3.08}{28.08} = .1097, \text{ or } 10.97\%$$

$$\text{Capital Gain Yield} = \frac{P_{t+1} - P_t}{P_t} = \frac{(27.39 - 28.08)}{28.08} = -0.0246, \text{ or } -2.46\%$$

11.2 Historical Risks and Returns of Stocks

- Computing Historical Returns
  - Individual Investment Realized Returns
    - For quarterly returns (or any four compounding periods that make up an entire year) the annual realized return, R_{annual}, is found by compounding:

$$1 + R_{annual} = (1 + R_1)(1 + R_2)(1 + R_3)(1 + R_4) \quad \text{(Eq. 11.2)}$$

Example 11.2 Compounding Realized Returns

Problem:

- Suppose you purchased Microsoft stock (MSFT) on Nov 1, 2004 and held it for one year, selling on Oct 31, 2005. What was your annual realized return?

Example 11.2 Compounding Realized Returns

Solution:

Plan:

- We need to analyze the cash flows from holding MSFT stock for each quarter. In order to get the cash flows, we must look up MSFT stock price data at the purchase date and selling date, as well as at any dividend dates. From the data we can construct the following table to fill out our cash flow timeline:

Example 11.2 Compounding Realized Returns

Plan (cont'd):

Date	Price	Dividend
Nov 01 04	28.08	
Nov 15 04	27.39	3.08
Feb 15 05	25.93	0.08
May 16 05	25.49	0.08
Aug 15 05	27.13	0.08
Oct 31 05	25.70	

- Next, compute the realized return between each set of dates using Eq. 11.1. Then determine the annual realized return similarly to Eq. 11.2 by compounding the returns for all of the periods in the year.

Example 11.2 Compounding Realized Returns

Execute:

- In Example 11.1, we already computed the realized return for Nov 1, 2004 to Nov 15, 2004 as 8.51%. We continue as in that example, using Eq. 11.1 for each period until we have a series of realized returns. For example, from Nov 15, 2004 to Feb 15, 2005, the realized return is

$$R_{t+1} = \frac{Div_{t+1} + P_{t+1} - P_t}{P_t} = \frac{0.08 + (25.93 - 27.39)}{27.39} = -0.0504, \text{ or } -5.04\%$$

Example 11.2 Compounding Realized Returns

Execute (cont'd):

- The table below includes the realized return at each period.

Date	Price	Dividend	Return
Nov 01 04	28.08		
Nov 15 04	27.39	3.08	8.51%
Feb 15 05	25.93	0.08	–5.04%
May 16 05	25.49	0.08	–1.39%
Aug 15 05	27.13	0.08	6.75%
Oct 31 05	25.70		–5.27%

Example 11.2 Compounding Realized Returns

Execute (cont'd):

- We then determine the one-year return by compounding.

$$1 + R_{annual} = (1 + R_1)(1 + R_2)(1 + R_3)(1 + R_4)(1 + R_5)$$

$$1 + R_{annual} = (1.0851)(0.9496)(0.9861)(1.0675)(0.9473) = 1.0275$$

$$R_{annual} = 1.0275 - 1 = .0275 \text{ or } 2.75\%$$

11.2 Historical Risks and Returns of Stocks

$$\bar{R} = \frac{1}{T}(R_1 + R_2 + \ldots + R_T) \qquad \text{(Eq. 11.3)}$$

Figure 11.2 The Distribution of Annual Returns for U.S. Large Company Stocks (S&P 500), Small Stocks, Corporate Bonds, and Treasury Bills, 1926–2009

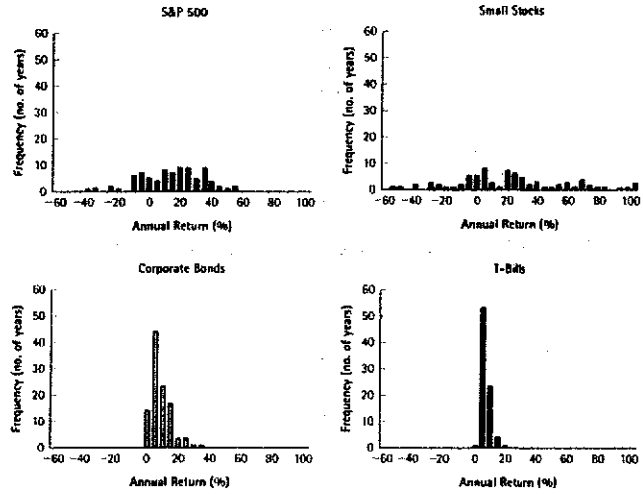
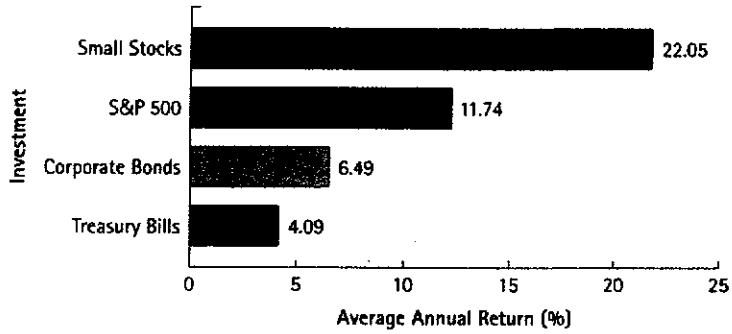


Figure 11.3 Average Annual Returns in the U.S. for Small Stocks, Large Stocks (S&P 500), Corporate Bonds, and Treasury Bills, 1926–2009



11.2 Historical Risks and Returns of Stocks

- The Variance and Volatility of Returns:
  - Variance

$$Var(R) = \frac{1}{T-1}\left((R_1 - \bar{R})^2 + (R_2 - \bar{R})^2 + \ldots + (R_T - \bar{R})^2\right) \qquad \text{(Eq. 11.4)}$$

  - Standard Deviation

$$SD(R) = \sqrt{Var(R)} \qquad \text{(Eq. 11.5)}$$

Example 11.3 Computing Historical Volatility

Problem:

- Using the data from Table 11.1, what is the standard deviation of the S&P 500's returns for the years 2005-2009?

Example 11.3 Computing Historical Volatility

Solution:

Plan:

2005	2006	2007	2008	2009
4.9%	15.8%	5.5%	–37.0%	26.5%

- First, compute the average return using Eq. 11.3 because it is an input to the variance equation. Next, compute the variance using Eq. 11.4 and then take its square root to determine the standard deviation as shown in Eq. 11.5.

Example 11.3 Computing Historical Volatility

Execute:

- In the previous section we already computed the average annual return of the S&P 500 during this period as 3.1%, so we have all of the necessary inputs for the variance calculation:
- Applying Eq. 11.4, we have:

$$\begin{aligned} Var(R) &= \frac{1}{T-1}\left[(R_1-\bar{R})^2+(R_2-\bar{R})^2+\ldots+(R_T-\bar{R})^2\right] \\ &= \frac{1}{5-1}\left[(.049-.031)^2+(.158-.031)^2+(.055-.031)^2+(-0.370-.031)^2+(.265-.031)^2\right] \\ &= .058 \end{aligned}$$

Example 11.3 Computing Historical Volatility

Execute (cont'd):

- Alternatively, we can break the calculation of this equation out as follows:

	2005	2006	2007	2008	2009
Return	0.049	0.158	0.055	−0.370	0.265
Average	0.031	0.031	0.031	0.031	0.031
Difference	0.018	0.127	0.024	−0.401	0.234
Squared	0.000	0.016	0.001	0.161	0.055

- Summing the squared differences in the last row, we get 0.233.
- Finally, dividing by (5-1=4) gives us 0.233/4 =0.058
- The standard deviation is therefore:

$$SD(R) = \sqrt{Var(R)} = \sqrt{.058} = 0.241, \text{or } 24.1\%$$

Figure 11.4 Volatility (Standard Deviation) of U.S. Small Stocks, Large Stocks (S&P 500), Corporate Bonds, and Treasury Bills, 1926–2009

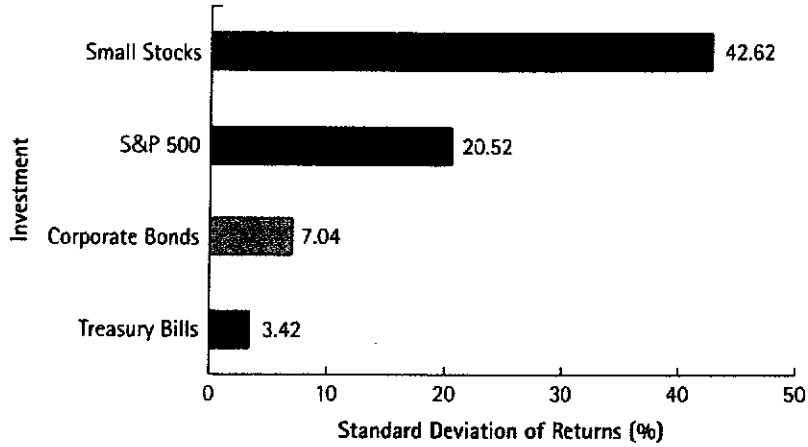


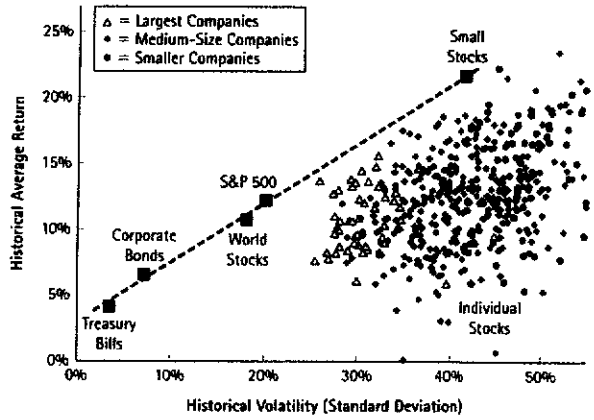
Table 11.2 Summary of Tools for Working with Historical Returns

Concept	Definition	Formula
Realized Returns	Total return earned over a particular period of time	$R_{t+1} = \frac{Div_{t+1} + P_{t+1} - P_t}{P_t}$
Average Annual Return	Average of realized returns for each year	$\bar{R} = \frac{1}{T}(R_1 + R_2 + \ldots + R_T)$
Variance of Returns	A measure of the variability of returns	$Var(R) = \frac{1}{T-1}[(R_1 - \bar{R})^2 + (R_2 - \bar{R})^2 + \ldots + (R_T - \bar{R})^2]$
Standard Deviation or Volatility of Returns	The square root of the variance (which puts it in the same units as the average—namely "%")	$SD(R) = \sqrt{Var(R)}$
95% Prediction Interval	The range of returns within which we are 95% confident that next period's return will lie	$\bar{R} \pm 2 \times SD(R)$

11.3 Historical Tradeoff between Risk and Return

- The Returns of Large Portfolios
  - Investments with higher volatility, as measured by standard deviation, tend to have higher average returns

Figure 11.6 The Historical Tradeoff Between Risk and Return in Large Portfolios, 1926–2010



Source: Global Financial Data and authors' calculations.

11.3 Historical Tradeoff between Risk and Return

- The Returns of Individual Stocks
  - Larger stocks have lower volatility overall
  - Even the largest stocks are typically more volatile than a portfolio of large stocks
  - The standard deviation of an individual security doesn't explain the size of its average return
  - All individual stocks have lower returns and/or higher risk than the portfolios in Figure 11.6

11.4 Common Versus Independent Risk

- Types of Risk
  - Common Risk
  - Independent Risk
  - Diversification

Table 11.3 Summary of Types of Risk

Type of Risk	Definition	Example	Risk Diversified in Large Portfolio?
Common Risk	Linked across outcomes	Risk of earthquake	No
Independent Risk	Risks that bear no relation to each other	Risk of theft	Yes

11.5 Diversification in Stock Portfolios

- Unsystematic Versus Systematic Risk
  - Stock prices are impacted by two types of news:
    1. Company or Industry-Specific News
    2. Market-Wide News
  - Unsystematic Risk
  - Systematic Risk

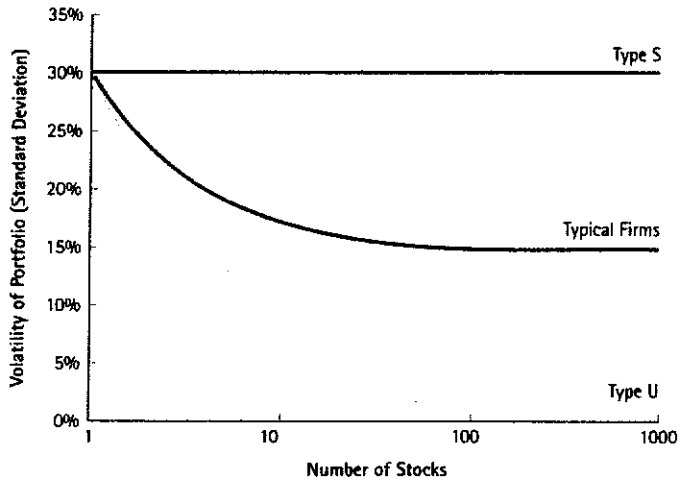
Example

Type S firms are only affected by SYS risk
40% if the economy is strong & negative 20% if the economy is weak
The chance is 50-50
Holding large portfolio will not diversity the risk

Type U firms
Type U firms are affected by unsystematic risk
Returns are equally likely to be 35% Or negative 25%
The chance is 50/50
So the return of the portfolio will be the average return of
50% x 0.35+50%x-20%= .05=5% No matter whether the economy is strong or weak.

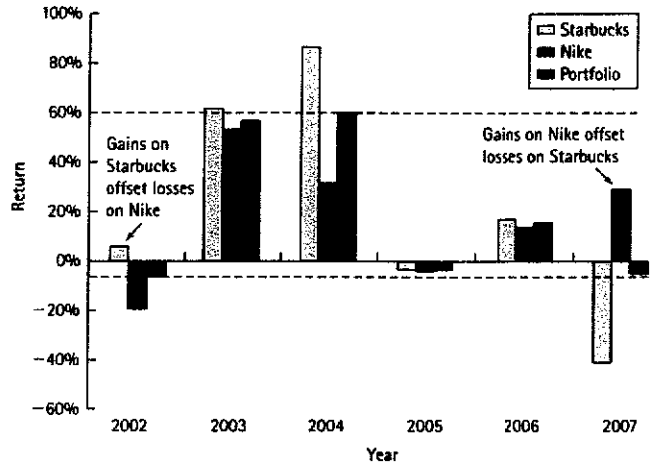
11-37

Figure 11.7 Volatility of Portfolios of Type S and U Stocks



11-38

Figure 11.8 The Effect of Diversification on Portfolio Volatility



11.5 Diversification in Stock Portfolios

- Diversifiable Risk and the Risk Premium
  - The risk premium for diversifiable risk is zero
    - Investors are not compensated for holding unsystematic risk

Table 11.4 Systematic Risk Versus Unsystematic Risk

	Diversifiable?	Requires a Risk Premium?
Systematic Risk	No	Yes
Unsystematic Risk	Yes	No

11.5 Diversification in Stock Portfolios

- The Importance of Systematic Risk
  - The risk premium of a security is determined by its systematic risk and does not depend on its diversifiable risk

Chapter 11 Quiz

1. Historically, which types of investments have had the highest average returns and which have been the most volatile from year to year? Is there a relation?
2. For what purpose do we use the average and standard deviation of historical stock returns?
3. What is the relation between risk and return for large portfolios? How are individual stocks different?
4. What is the difference between common and independent risk?
5. Does systematic or unsystematic risk require a risk premium? Why?