

CHAPTER 1

An Overview of the
Investment Process

1.2 MEASURES OF RETURN AND RISK

The purpose of this book is to help you understand how to choose among alternative investment assets. This selection process requires that you estimate and evaluate the expected risk-return trade-offs for the alternative investments available. Therefore, you must understand how to measure the rate of return and the risk involved in an investment accurately. To meet this need, in this section we examine ways to quantify return and risk. The presentation will consider how to measure both *historical* and *expected* rates of return and risk.

We consider historical measures of return and risk because this book and other publications provide numerous examples of historical average rates of return and risk measures for various assets, and understanding these presentations is important. In addition, these historical results are often used by investors when attempting to estimate the *expected* rates of return and risk for an asset class.

The first measure is the historical rate of return on an individual investment over the time period the investment is held (that is, its holding period). Next, we consider how to measure the *average* historical rate of return for an individual investment over a number of time periods. The third subsection considers the average rate of return for a *portfolio* of investments.

Given the measures of historical rates of return, we will present the traditional measures of risk for a historical time series of returns (that is, the variance and standard deviation).

Following the presentation of measures of historical rates of return and risk, we turn to estimating the *expected* rate of return for an investment. Obviously, such an estimate contains a great deal of uncertainty, and we present measures of this uncertainty or risk.

1.2.1 Measures of Historical Rates of Return

When you are evaluating alternative investments for inclusion in your portfolio, you will often be comparing investments with widely different prices or lives. As an example, you might want to compare a \$10 stock that pays no dividends to a stock selling for \$150 that pays dividends of \$5 a year. To properly evaluate these two investments, you must accurately compare their historical rates of returns. A proper measurement of the rates of return is the purpose of this section.

When we invest, we defer current consumption in order to add to our wealth so that we can consume more in the future. Therefore, when we talk about a return on an investment, we are concerned with the *change in wealth* resulting from this investment. This change in wealth can be either due to cash inflows, such as interest or dividends, or caused by a change in the price of the asset (positive or negative).

If you commit \$200 to an investment at the beginning of the year and you get back \$220 at the end of the year, what is your return for the period? The period during which you own an

这种财富变化可能归因于诸如利息、股息等现金流入，也可能归因于资产价格的变化（正的或负的）。

持有投资的期间称为投资的持有期，这段时期的回报称为持有期回报率（HPR）。

investment is called its *holding period*, and the return for that period is the **holding period return (HPR)**. In this example, the HPR is 1.10, calculated as follows:

$$\begin{aligned} 1.1 \quad HPR &= \frac{\text{Ending Value of Investment}}{\text{Beginning Value of Investment}} \\ &= \frac{\$220}{\$200} = 1.10 \end{aligned}$$

This HPR value will always be zero or greater—that is, it can never be a negative value. A value greater than 1.0 reflects an increase in your wealth, which means that you received a positive rate of return during the period. A value less than 1.0 means that you suffered a decline in wealth, which indicates that you had a negative return during the period. An HPR of zero indicates that you lost all your money (wealth) invested in this asset.

Although HPR helps us express the change in value of an investment, investors generally evaluate returns in *percentage terms on an annual basis*. This conversion to annual percentage rates makes it easier to directly compare alternative investments that have markedly different characteristics. The first step in converting an HPR to an annual percentage rate is to derive a percentage return, referred to as the **holding period yield (HPY)**. The HPY is equal to the HPR minus 1.

将持有期回报率（HPR）转化为年百分比，首先需要计算回报的百分比，即持有期收益率（HPY）。

$$1.2 \quad HPY = HPR - 1$$

In our example:

$$\begin{aligned} HPY &= 1.10 - 1 = 0.10 \\ &= 10\% \end{aligned}$$

To derive an *annual HPY*, you compute an *annual HPR* and subtract 1. Annual HPR is found by:

$$1.3 \quad \text{Annual HPR} = HPR^{1/n}$$

where:

$$n = \text{number of years the investment is held}$$

Consider an investment that cost \$250 and is worth \$350 after being held for two years:

$$\begin{aligned} HPR &= \frac{\text{Ending Value of Investment}}{\text{Beginning Value of Investment}} = \frac{\$350}{\$250} \\ &= 1.40 \\ \text{Annual HPR} &= 1.40^{1/n} \\ &= 1.40^{1/2} \\ &= 1.1832 \\ \text{Annual HPY} &= 1.1832 - 1 = 0.1832 \\ &= 18.32\% \end{aligned}$$

If you experience a decline in your wealth value, the computation is as follows:

$$\begin{aligned} HPR &= \frac{\text{Ending Value}}{\text{Beginning Value}} = \frac{\$400}{\$500} = 0.80 \\ HPY &= 0.80 - 1.00 = -0.20 = -20\% \end{aligned}$$

A multiple-year loss over two years would be computed as follows:

$$\begin{aligned} HPR &= \frac{\text{Ending Value}}{\text{Beginning Value}} = \frac{\$750}{\$1,000} = 0.75 \\ \text{Annual } HPR &= (0.75)^{1/n} = 0.75^{1/2} \\ &= 0.866 \\ \text{Annual } HPY &= 0.866 - 1.00 = -0.134 = -13.4\% \end{aligned}$$

In contrast, consider an investment of \$100 held for only six months that earned a return of 12%:

$$\begin{aligned} HPR &= \frac{\$112}{100} = 1.12 \quad (n=0.5) \\ \text{Annual } HPR &= 1.12^{1/.5} \\ &= 1.12^2 \\ &= 1.2544 \\ \text{Annual } HPY &= 1.2544 - 1 = 0.2544 \\ &= 25.44\% \end{aligned}$$

Note that we made some implicit assumptions when converting the six-month *HPY* to an annual basis. This annualized holding period yield computation assumes a constant annual yield for each year. In the two-year investment, we assumed an 18.32 percent rate of return each year, compounded. In the partial year *HPR* that was annualized, we assumed that the return is compounded for the whole year. That is, we assumed that the rate of return earned during the first half of the year is likewise earned on the value at the end of the first six months. The 12 percent rate of return for the initial six months compounds to 25.44 percent for the full year.² Because of the uncertainty of being able to earn the same return in the future six months, institutions will typically *not* compound partial year results.

Remember one final point: The ending value of the investment can be the result of a positive or negative change in price for the investment alone (for example, a stock going from \$20 a share to \$22 a share), income from the investment alone, or a combination of price change and income. Ending value includes the value of everything related to the investment.

1.2.2 Computing Mean Historical Returns

Now that we have calculated the *HPY* for a single investment for a single year, we want to consider **mean rates of return** for a single investment and for a portfolio of investments. Over a number of years, a single investment will likely give high rates of return during some years and low rates of return, or possibly negative rates of return, during others. Your analysis should consider each of these returns, but you also want a summary figure that indicates this investment's typical experience, or the rate of return you might expect to receive if you owned this investment over an extended period of time. You can derive such a summary figure by computing the mean annual rate of return (its *HPY*) for this investment over some period of time.

Alternatively, you might want to evaluate a portfolio of investments that might include similar investments (for example, all stocks or all bonds) or a combination of investments (for example, stocks, bonds, and real estate). In this instance, you would calculate the mean rate of return for this portfolio of investments for an individual year or for a number of years.

Single Investment Given a set of annual rates of return (*HPYs*) for an individual investment, there are two summary measures of return performance. The first is the arithmetic mean return, the second is the geometric mean return. To find the **arithmetic mean (AM)**, the sum (Σ) of annual *HPYs* is divided by the number of years (n) as follows:

²To check that you understand the calculations, determine the annual *HPY* for a three-year *HPR* of 1.50. (Answer: 14.47 percent.) Compute the annual *HPY* for a three-month *HPR* of 1.06. (Answer: 26.25 percent.)

这种年化的持有期收益率的计算假设每个年度具有相同的收益率。

投资期末的价值可能是投资价格上下波动后的结果(比如,股票价格从每股20美元涨到每股22美元),或者是投资收入变动的结果,或者是以上两者同时变动的结果。

给定一项投资的一组年度收益率,通常可以用两个指标衡量投资的总体回报情况:算术平均收益率和几何平均收益率。

$$1.4 \quad AM = \Sigma HPY/n$$

where:

ΣHPY = the sum of annual holding period yields

An alternative computation, the **geometric mean (GM)**, is the n th root of the product of the $HPRs$ for n years minus one.

$$1.5 \quad GM = [\pi HPR]^{1/n} - 1$$

where:

π = the product of the annual holding period returns as follows:

$$(HPR_1) \times (HPR_2) \dots (HPR_n)$$

To illustrate these alternatives, consider an investment with the following data:

Year	Beginning Value	Ending Value	HPR	HPY
1	100.0	115.0	1.15	0.15
2	115.0	138.0	1.20	0.20
3	138.0	110.4	0.80	-0.20

$$\begin{aligned} AM &= [(0.15) + (0.20) + (-0.20)]/3 \\ &= 0.15/3 \\ &= 0.05 = 5\% \end{aligned}$$

$$\begin{aligned} GM &= [(1.15) \times (1.20) \times (0.80)]^{1/3} - 1 \\ &= (1.104)^{1/3} - 1 \\ &= 1.03353 - 1 \\ &= 0.03353 = 3.353\% \end{aligned}$$

投资者在比较各项投资时通常更加关注长期表现。几何平均收益率(GM)在测度长期平均收益率方面更有优势,因为GM意味着用年收益率复利计算投资末期的价值。

Investors are typically concerned with long-term performance when comparing alternative investments. *GM* is considered a superior measure of the long-term mean rate of return because it indicates *the compound annual rate of return* based on the ending value of the investment versus its beginning value.³ Specifically, using the prior example, if we compounded 3.353 percent for three years, $(1.03353)^3$, we would get an ending wealth value of 1.104.

Although the arithmetic average provides a good indication of the expected rate of return for an investment during a future individual year, it is biased upward if you are attempting to measure an asset's long-term performance. This is obvious for a volatile security. Consider, for example, a security that increases in price from \$50 to \$100 during year 1 and drops back to \$50 during year 2. The annual *HPYs* would be:

Year	Beginning Value	Ending Value	HPR	HPY
1	50	100	2.00	1.00
2	100	50	0.50	-0.50

This would give an *AM* rate of return of:

$$\begin{aligned} [(1.00) + (-0.50)]/2 &= .50/2 \\ &= 0.25 = 25\% \end{aligned}$$

This investment brought no change in wealth and therefore no return, yet the *AM* rate of return is computed to be 25 percent.

³Note that the *GM* is the same whether you compute the geometric mean of the individual annual holding period yields or the annual *HPY* for a three-year period, comparing the ending value to the beginning value, as discussed earlier under annual *HPY* for a multiperiod case.

The GM rate of return would be:

$$(2.00 \times 0.50)^{1/2} - 1 = (1.00)^{1/2} - 1 = 1.00 - 1 = 0\%$$

This answer of a 0 percent rate of return accurately measures the fact that there was no change in wealth from this investment over the two-year period.

When rates of return are the same for all years, the GM will be equal to the AM. If the rates of return vary over the years, the GM will always be lower than the AM. The difference between the two mean values will depend on the year-to-year changes in the rates of return. Larger annual changes in the rates of return—that is, more volatility—will result in a greater difference between the alternative mean values. We will point out examples of this in subsequent chapters.

An awareness of both methods of computing mean rates of return is important because most published accounts of long-run investment performance or descriptions of financial research will use both the AM and the GM as measures of average historical returns. We will also use both throughout this book with the understanding that the AM is best used as an expected value for an individual year, while the GM is the best measure of long-term performance since it measures the compound annual rate of return for the asset being measured.

投资资产组合的平均历史收益率是资产组合中单个投资的历史收益率的加权平均值，或者是该初始资产组合总体价值的变化。

A Portfolio of Investments The mean historical rate of return (HPY) for a portfolio of investments is measured as the weighted average of the HPYs for the individual investments in the portfolio, or the overall percent change in value of the original portfolio. The weights used in computing the averages are the relative *beginning* market values for each investment; this is referred to as *dollar-weighted* or *value-weighted* mean rate of return. This technique is demonstrated by the examples in Exhibit 1.1. As shown, the HPY is the same (9.5 percent) whether you compute the weighted average return using the beginning market value weights or if you compute the overall percent change in the total value of the portfolio.

Although the analysis of historical performance is useful, selecting investments for your portfolio requires you to predict the rates of return you *expect* to prevail. The next section discusses how you would derive such estimates of expected rates of return. We recognize the great uncertainty regarding these future expectations, and we will discuss how one measures this uncertainty, which is referred to as the risk of an investment.

1.2.3 Calculating Expected Rates of Return

风险是投资在获得其预期收益率过程中存在的不确定性。

Risk is the uncertainty that an investment will earn its expected rate of return. In the examples in the prior section, we examined *realized* historical rates of return. In contrast, an investor who is evaluating a future investment alternative expects or anticipates a certain rate of return.

Exhibit 1.1 Computation of Holding Period Yield for a Portfolio

Investment	Number of Shares	Beginning Price	Beginning Market Value	Ending Price	Ending Market Value	HPR	HPY	Market Weight ^a	Weighted HPY
A	100,000	\$10	\$1,000,000	\$12	\$1,200,000	1.20	20%	0.05	0.01
B	200,000	20	4,000,000	21	4,200,000	1.05	5	0.20	0.01
C	500,000	30	15,000,000	33	16,500,000	1.10	10	0.75	0.075
Total			\$20,000,000		\$21,900,000				0.095

$$HPR = \frac{21,900,000}{20,000,000} = 1.095$$

$$HPY = 1.095 - 1 = 0.095 = 9.5\%$$

^aWeights are based on beginning values.

The investor might say that he or she *expects* the investment will provide a rate of return of 10 percent, but this is actually the investor's most likely estimate, also referred to as a *point estimate*. Pressed further, the investor would probably acknowledge the uncertainty of this point estimate return and admit the possibility that, under certain conditions, the annual rate of return on this investment might go as low as -10 percent or as high as 25 percent. The point is, the specification of a larger range of *possible* returns from an investment reflects the investor's uncertainty regarding what the *actual* return will be. Therefore, a larger range of possible returns implies that the investment is riskier.

这里的要点是：可能的投资收益率之所以具有较大的变动范围，反映了投资者对实际收益率的不确定。

为了做这项工作，投资者对所有可能的收益率都赋予概率值。

这些概率值通常是投资者根据该项投资或者类似投资的历史表现，以及投资者对未来的预期加以修正后的主观估计。

An investor determines how certain the expected rate of return on an investment is by analyzing estimates of possible returns. To do this, the investor assigns probability values to all *possible* returns. These probability values range from zero, which means no chance of the return, to one, which indicates complete certainty that the investment will provide the specified rate of return. These probabilities are typically subjective estimates based on the historical performance of the investment or similar investments modified by the investor's expectations for the future. As an example, an investor may know that about 30 percent of the time the rate of return on this particular investment was 10 percent. Using this information along with future expectations regarding the economy, one can derive an estimate of what might happen in the future.

The *expected* return from an investment is defined as:

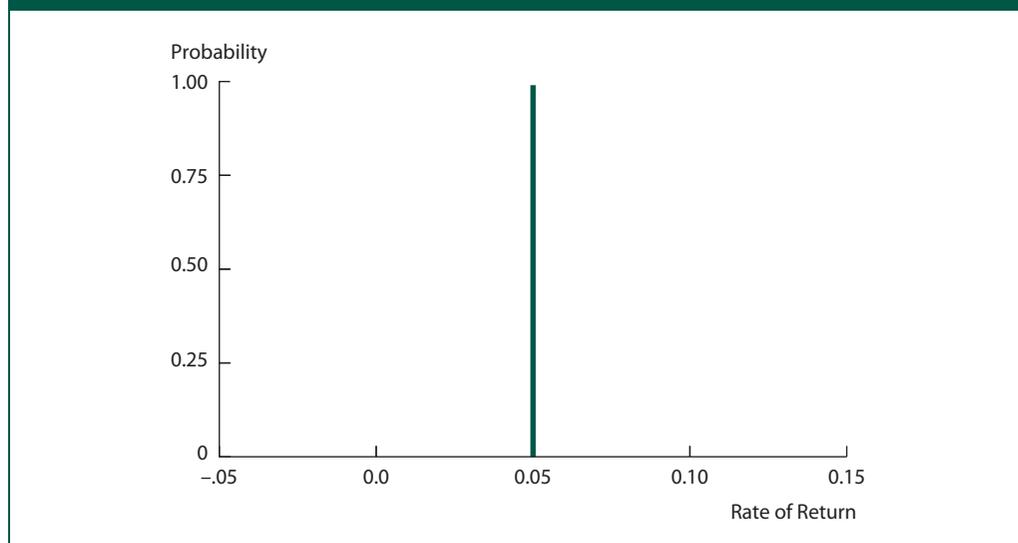
$$\begin{aligned} \text{1.6} \quad \text{Expected Return} &= \sum_{i=1}^n (\text{Probability of Return}) \times (\text{Possible Return}) \\ E(R_i) &= [(P_1)(R_1) + (P_2)(R_2) + (P_3)(R_3) + \cdots + (P_n)R_n] \\ E(R_i) &= \sum_{i=1}^n (P_i)(R_i) \end{aligned}$$

Let us begin our analysis of the effect of risk with an example of perfect certainty wherein the investor is absolutely certain of a return of 5 percent. Exhibit 1.2 illustrates this situation.

Perfect certainty allows only one possible return, and the probability of receiving that return is 1.0. Few investments provide certain returns and would be considered risk-free investments. In the case of perfect certainty, there is only one value for $P_i R_i$:

$$E(R_i) = (1.0)(0.05) = 0.05 = 5\%$$

Exhibit 1.2 Probability Distribution for Risk-Free Investment



In an alternative scenario, suppose an investor believed an investment could provide several different rates of return depending on different possible economic conditions. As an example, in a strong economic environment with high corporate profits and little or no inflation, the investor might expect the rate of return on common stocks during the next year to reach as high as 20 percent. In contrast, if there is an economic decline with a higher-than-average rate of inflation, the investor might expect the rate of return on common stocks during the next year to be -20 percent. Finally, with no major change in the economic environment, the rate of return during the next year would probably approach the long-run average of 10 percent.

The investor might estimate probabilities for each of these economic scenarios based on past experience and the current outlook as follows:

Economic Conditions	Probability	Rate of Return
Strong economy, no inflation	0.15	0.20
Weak economy, above-average inflation	0.15	-0.20
No major change in economy	0.70	0.10

This set of potential outcomes can be visualized as shown in Exhibit 1.3.

The computation of the expected rate of return [$E(R_i)$] is as follows:

$$E(R_i) = [(0.15)(0.20)] + [(0.15)(-0.20)] + [(0.70)(0.10)] \\ = 0.07$$

Obviously, the investor is less certain about the expected return from this investment than about the return from the prior investment with its single possible return.

A third example is an investment with 10 possible outcomes ranging from -40 percent to 50 percent with the same probability for each rate of return. A graph of this set of expectations would appear as shown in Exhibit 1.4.

In this case, there are numerous outcomes from a wide range of possibilities. The expected rate of return [$E(R_i)$] for this investment would be:

$$E(R_i) = (0.10)(-0.40) + (0.10)(-0.30) + (0.10)(-0.20) + (0.10)(-0.10) + (0.10)(0.0) \\ + (0.10)(0.10) + (0.10)(0.20) + (0.10)(0.30) + (0.10)(0.40) + (0.10)(0.50) \\ = (-0.04) + (-0.03) + (-0.02) + (-0.01) + (0.00) + (0.01) + (0.02) + (0.03) \\ + (0.04) + (0.05) \\ = 0.05$$

Exhibit 1.3 Probability Distribution for Risky Investment with Three Possible Rates of Return

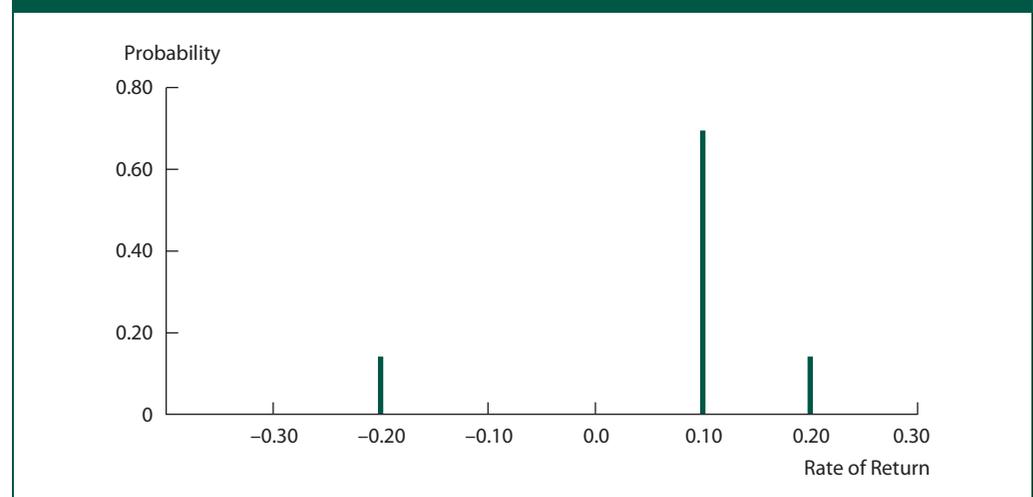
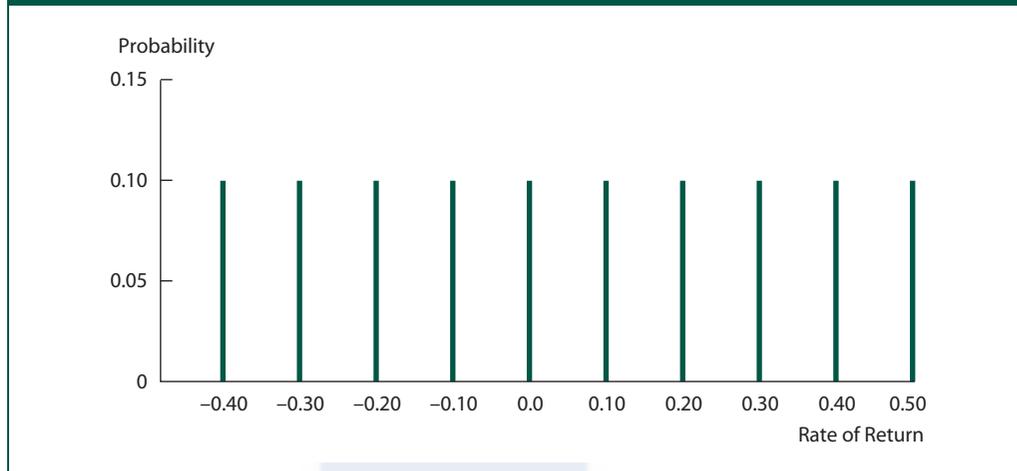


Exhibit 1.4 Probability Distribution for Risky Investment with 10 Possible Rates of Return



The *expected* rate of return for this investment is the same as the certain return discussed in the first example; but, in this case, the investor is highly uncertain about the *actual* rate of return. This would be considered a risky investment because of that uncertainty. We would anticipate that an investor faced with the choice between this risky investment and the certain (risk-free) case would select the certain alternative. This expectation is based on the belief that most investors are **risk averse**, which means that if everything else is the same, they will select the investment that offers greater certainty (i.e., less risk).

这种预期是基于大多数投资者都是**风险规避型**的假设。也就是说，在其他条件相同的情况下，投资者倾向于选择确定性更强（或者说风险更小）的投资。

1.2.4 Measuring the Risk of Expected Rates of Return

We have shown that we can calculate the expected rate of return and evaluate the uncertainty, or risk, of an investment by identifying the range of possible returns from that investment and assigning each possible return a weight based on the probability that it will occur. Although the graphs help us visualize the dispersion of possible returns, most investors want to quantify this dispersion using statistical techniques. These statistical measures allow you to compare the return and risk measures for alternative investments directly. Two possible measures of risk (uncertainty) have received support in theoretical work on portfolio theory: the *variance* and the *standard deviation* of the estimated distribution of expected returns.

在资产组合理论研究中支持了度量风险（不确定的）的两种方法：估计的预期收益率分布的方差和标准差。

In this section, we demonstrate how variance and standard deviation measure the dispersion of possible rates of return around the expected rate of return. We will work with the examples discussed earlier. The formula for variance is as follows:

$$\begin{aligned}
 \text{1.7} \quad \text{Variance } (\sigma^2) &= \sum_{i=1}^n (\text{Probability}) \times \left(\begin{array}{c} \text{Possible} \\ \text{Return} \end{array} - \begin{array}{c} \text{Expected} \\ \text{Return}} \right)^2 \\
 &= \sum_{i=1}^n (P_i) [R_i - E(R_i)]^2
 \end{aligned}$$

Variance The larger the **variance** for an expected rate of return, the greater the dispersion of expected returns and the greater the uncertainty, or risk, of the investment. The variance for the perfect-certainty (risk-free) example would be:

$$\begin{aligned}
 (\sigma^2) &= \sum_{i=1}^n P_i [R_i - E(R_i)]^2 \\
 &= 1.0(0.05 - 0.05)^2 = 1.0(0.0) = 0
 \end{aligned}$$

Note that, in perfect certainty, there is *no variance of return* because there is no deviation from expectations and, therefore, *no risk or uncertainty*. The variance for the second example would be:

$$\begin{aligned}(\sigma^2) &= \sum_{i=1}^n P_i [R_i - E(R_i)]^2 \\ &= [(0.15)(0.20 - 0.07)^2 + (0.15)(-0.20 - 0.07)^2 + (0.70)(0.10 - 0.07)^2] \\ &= [0.010935 + 0.002535 + 0.00063] \\ &= 0.0141\end{aligned}$$

Standard Deviation The **standard deviation** is the square root of the variance:

$$1.8 \quad \text{Standard Deviation} = \sqrt{\sum_{i=1}^n P_i [R_i - E(R_i)]^2}$$

For the second example, the standard deviation would be:

$$\begin{aligned}\sigma &= \sqrt{0.0141} \\ &= 0.11874 = 11.874\%\end{aligned}$$

Therefore, when describing this investment example, you would contend that you expect a return of 7 percent, but the standard deviation of your expectations is 11.87 percent.

A Relative Measure of Risk In some cases, an unadjusted variance or standard deviation can be misleading. If conditions for two or more investment alternatives are not similar—that is, if there are major differences in the expected rates of return—it is necessary to use a measure of *relative variability* to indicate risk per unit of expected return. A widely used relative measure of risk is the **coefficient of variation (CV)**, calculated as follows:

$$1.9 \quad \text{Coefficient of Variation (CV)} = \frac{\text{Standard Deviation of Returns}}{\text{Expected Rate of Return}} = \frac{\sigma_i}{E(R)}$$

The CV for the preceding example would be:

$$\begin{aligned}CV &= \frac{0.11874}{0.07000} \\ &= 1.696\end{aligned}$$

This measure of relative variability and risk is used by financial analysts to compare alternative investments with widely different rates of return and standard deviations of returns. As an illustration, consider the following two investments:

	Investment A	Investment B
Expected return	0.07	0.12
Standard deviation	0.05	0.07

Comparing absolute measures of risk, investment B appears to be riskier because it has a standard deviation of 7 percent versus 5 percent for investment A. In contrast, the CV figures show that investment B has less *relative variability* or lower risk per unit of expected return because it has a substantially higher expected rate of return:

$$\begin{aligned}CV_A &= \frac{0.05}{0.07} = 0.714 \\ CV_B &= \frac{0.07}{0.12} = 0.583\end{aligned}$$

如果两项或者多项投资的条件不同——也就是说，如果预期收益率存在较大的差异——有必要运用相对变动量来表示每单位预期收益率的风险。一种运用广泛的相对风险测度指标是变异系数。

1.2.5 Risk Measures for Historical Returns

To measure the risk for a series of historical rates of returns, we use the same measures as for expected returns (variance and standard deviation) except that we consider the historical holding period yields (*HPYs*) as follows:

$$1.10 \quad \sigma^2 = \left[\sum_{i=1}^n [HPY_i - E(HPY)]^2 \right] / n$$

where:

σ^2 = the variance of the series

HPY_i = the holding period yield during period i

$E(HPY)$ = the expected value of the holding period yield that is equal to the arithmetic mean (*AM*) of the series

n = the number of observations

The standard deviation is the square root of the variance. Both measures indicate how much the individual *HPYs* over time deviated from the expected value of the series. An example computation is contained in the appendix to this chapter found at the end of the text. As is shown in subsequent chapters where we present historical rates of return for alternative asset classes, presenting the standard deviation as a measure of risk (uncertainty) for the series or asset class is fairly common.

1.3 DETERMINANTS OF REQUIRED RATES OF RETURN

In this section, we continue our discussion of factors that you must consider when selecting securities for an investment portfolio. You will recall that this selection process involves finding securities that provide a rate of return that compensates you for: (1) the time value of money during the period of investment, (2) the expected rate of inflation during the period, and (3) the risk involved.

The summation of these three components is called the *required rate of return*. This is the minimum rate of return that you should accept from an investment to compensate you for deferring consumption. Because of the importance of the required rate of return to the total investment selection process, this section contains a discussion of the three components and what influences each of them.

The analysis and estimation of the required rate of return are complicated by the behavior of market rates over time. First, a wide range of rates is available for alternative investments at any time. Second, the rates of return on specific assets change dramatically over time. Third, the difference between the rates available (that is, the spread) on different assets changes over time.

The yield data in Exhibit 1.5 for alternative bonds demonstrate these three characteristics. First, even though all these securities have promised returns based upon bond contracts, the promised annual yields during any year differ substantially. As an example, during 2009 the average yields on alternative assets ranged from 0.15 percent on T-bills to 7.29 percent for Baa corporate bonds. Second, the changes in yields for a specific asset are shown by the three-month Treasury bill rate that went from 4.48 percent in 2007 to 0.15 percent in 2009. Third, an example of a change in the difference between yields over time (referred to as a spread) is shown by the Baa–Aaa spread.⁴ The yield spread in 2007 was 91 basis points (6.47–5.56), but the spread in 2009 increased to 198 basis points (7.29–5.31). (A basis point is 0.01 percent.)

⁴Bonds are rated by rating agencies based upon the credit risk of the securities, that is, the probability of default. Aaa is the top rating Moody's (a prominent rating service) gives to bonds with almost no probability of default. (Only U.S. Treasury bonds are considered to be of higher quality.) Baa is a lower rating Moody's gives to bonds of generally high quality that have some possibility of default under adverse economic conditions.

以上三部分的总和称为必要收益率。这是为补偿延期消费而需要从投资中获得的最小收益率。

Exhibit 1.5 Promised Yields on Alternative Bonds

Type of Bond	2004	2005	2006	2007	2008	2009	2010
U.S. government 3-month Treasury bills	1.37%	3.16%	4.73%	4.48%	1.37%	0.15%	0.14%
U.S. government 10-year bonds	2.79	3.93	4.77	4.94	3.66	3.26	3.22
Aaa corporate bonds	5.63	5.24	5.59	5.56	5.63	5.31	4.94
Baa corporate bonds	6.39	6.06	6.48	6.47	7.44	7.29	6.04

Source: Federal Reserve Bulletin, various issues.

Because differences in yields result from the riskiness of each investment, you must understand the risk factors that affect the required rates of return and include them in your assessment of investment opportunities. Because the required returns on all investments change over time, and because large differences separate individual investments, you need to be aware of the several components that determine the required rate of return, starting with the risk-free rate. In this chapter we consider the three components of the required rate of return and briefly discuss what affects these components. The presentation in Chapter 11 on valuation theory will discuss the factors that affect these components in greater detail.

1.3.1 The Real Risk-Free Rate

The **real risk-free rate (RRFR)** is the basic interest rate, assuming no inflation and no uncertainty about future flows. An investor in an inflation-free economy who knew with certainty what cash flows he or she would receive at what time would demand the *RRFR* on an investment. Earlier, we called this the *pure time value of money*, because the only sacrifice the investor made was deferring the use of the money for a period of time. This *RRFR* of interest is the price charged for the risk-free exchange between current goods and future goods.

Two factors, one subjective and one objective, influence this exchange price. The subjective factor is the time preference of individuals for the consumption of income. When individuals give up \$100 of consumption this year, how much consumption do they want a year from now to compensate for that sacrifice? The strength of the human desire for current consumption influences the rate of compensation required. Time preferences vary among individuals, and the market creates a composite rate that includes the preferences of all investors. This composite rate changes gradually over time because it is influenced by all the investors in the economy, whose changes in preferences may offset one another.

The objective factor that influences the *RRFR* is the set of investment opportunities available in the economy. The investment opportunities available are determined in turn by the *long-run real growth rate of the economy*. A rapidly growing economy produces more and better opportunities to invest funds and experience positive rates of return. A change in the economy's long-run real growth rate causes a change in all investment opportunities and a change in the required rates of return on all investments. Just as investors supplying capital should demand a higher rate of return when growth is higher, those looking to borrow funds to invest should be willing and able to pay a higher rate of return to use the funds for investment because of the higher growth rate and better opportunities. Thus, a *positive* relationship exists between the real growth rate in the economy and the *RRFR*.

1.3.2 Factors Influencing the Nominal Risk-Free Rate (NRFR)

Earlier, we observed that an investor would be willing to forgo current consumption in order to increase future consumption at a rate of exchange called the *risk-free rate of interest*. This rate of exchange was measured in real terms because we assume that investors want to

实际无风险收益率假设不存在通货膨胀和关于未来现金流的不确定性,是基础利率。在一个没有通货膨胀的经济中,如果投资者确切地知道什么时间将获得多少现金流,他从投资中要求获得的收益率就是实际无风险收益率。

也就是说，名义市场利率不仅取决于实际利率，而且取决于影响名义利率的因素，比如预期通货膨胀率和货币环境。

increase the consumption of actual goods and services rather than consuming the same amount that had come to cost more money. Therefore, when we discuss rates of interest, we need to differentiate between *real* rates of interest that adjust for changes in the general price level, as opposed to *nominal* rates of interest that are stated in money terms. That is, nominal rates of interest that prevail in the market are determined by real rates of interest, *plus* factors that will affect the nominal rate of interest, such as the expected rate of inflation and the monetary environment. It is important to understand these factors.

Notably, the variables that determine the *RRFR* change only gradually because we are concerned with *long-run* real growth. Therefore, you might expect the required rate on a risk-free investment to be quite stable over time. As discussed in connection with Exhibit 1.5, rates on three-month T-bills were *not* stable over the period from 2004 to 2010. This is demonstrated with additional observations in Exhibit 1.6, which contains yields on T-bills for the period 1987–2010.

Investors view T-bills as a prime example of a default-free investment because the government has unlimited ability to derive income from taxes or to create money from which to pay interest. Therefore, one could expect that rates on T-bills should change only gradually. In fact, the data in Exhibit 1.6 show a highly erratic pattern. Specifically, there was an increase in yields from 4.64 percent in 1999 to 5.82 percent in 2000 before declining by over 80 percent in three years to 1.01 percent in 2003, followed by an increase to 4.73 percent in 2006, and concluding at 0.14 percent in 2010. Clearly, the *nominal* rate of interest on a default-free investment is *not* stable in the long run or the short run, even though the underlying determinants of the *RRFR* are quite stable. As noted, two other factors influence the *nominal risk-free rate (NRFR)*: (1) the relative ease or tightness in the capital markets, and (2) the expected rate of inflation.

资本市场的相对宽松或相对紧张的变动是一种短期现象，它是由资金供给与需求暂时不平衡引起的。

Conditions in the Capital Market You will recall from prior courses in economics and finance that the purpose of capital markets is to bring together investors who want to invest savings with companies or governments who need capital to expand or to finance budget deficits. The cost of funds at any time (the interest rate) is the price that equates the current supply and demand for capital. Beyond this long-run equilibrium, change in the relative ease or tightness in the capital market is a short-run phenomenon caused by a temporary disequilibrium in the supply and demand of capital.

As an example, disequilibrium could be caused by an unexpected change in monetary policy (for example, a change in the target federal funds rate) or fiscal policy (for example, a change in the federal deficit). Such a change in monetary policy or fiscal policy will produce a change in the *NRFR* of interest, but the change should be short-lived because, in the longer

Exhibit 1.6 Three-Month Treasury Bill Yields and Rates of Inflation

Year	3-Month T-bills	Rate of Inflation	Year	3-Month T-bills	Rate of Inflation
1987	5.78%	4.40%	1999	4.64%	2.70%
1988	6.67	4.40	2000	5.82	3.40
1989	8.11	4.65	2001	3.40	1.55
1990	7.50	6.11	2002	1.61	2.49
1991	5.38	3.06	2003	1.01	1.87
1992	3.43	2.90	2004	1.37	3.26
1993	3.33	2.75	2005	3.16	3.42
1994	4.25	2.67	2006	4.73	2.54
1995	5.49	2.54	2007	4.48	4.08
1996	5.01	3.32	2008	1.37	0.91
1997	5.06	1.70	2009	0.15	2.72
1998	4.78	1.61	2010	0.14	1.49

Source: Federal Reserve Bulletin, various issues; Economic Report of the President, various issues.

run, the higher or lower interest rates will affect capital supply and demand. As an example, an increase in the federal deficit caused by an increase in government spending (easy fiscal policy) will increase the demand for capital and increase interest rates. In turn, this increase in interest rates should cause an increase in savings and a decrease in the demand for capital by corporations or individuals. These changes in market conditions should bring rates back to the long-run equilibrium, which is based on the long-run growth rate of the economy.

Expected Rate of Inflation Previously, it was noted that if investors expected the price level to increase (an increase in the inflation rate) during the investment period, they would require the rate of return to include compensation for the expected rate of inflation. Assume that you require a 4 percent real rate of return on a risk-free investment but you expect prices to increase by 3 percent during the investment period. In this case, you should increase your required rate of return by this expected rate of inflation to about 7 percent $[(1.04 \times 1.03) - 1]$. If you do not increase your required return, the \$104 you receive at the end of the year will represent a real return of about 1 percent, not 4 percent. Because prices have increased by 3 percent during the year, what previously cost \$100 now costs \$103, so you can consume only about 1 percent more at the end of the year $[(\$104/103) - 1]$. If you had required a 7.12 percent nominal return, your real consumption could have increased by 4 percent $[(\$107.12/103) - 1]$. Therefore, an investor's nominal required rate of return on a risk-free investment should be:

$$1.11 \quad NRFR = [(1 + RFR) \times (1 + \text{Expected Rate of Inflation})] - 1$$

Rearranging the formula, you can calculate the *RRFR* of return on an investment as follows:

$$1.12 \quad RFR = \frac{[(1 + NRFR \text{ of Return})]}{[1 + \text{Rate of Inflation}]} - 1$$

To see how this works, assume that the nominal return on U.S. government T-bills was 9 percent during a given year, when the rate of inflation was 5 percent. In this instance, the *RRFR* of return on these T-bills was 3.8 percent, as follows:

$$\begin{aligned} RFR &= [(1 + 0.09)/(1 + 0.05)] - 1 \\ &= 1.038 - 1 \\ &= 0.038 = 3.8\% \end{aligned}$$

This discussion makes it clear that the nominal rate of interest on a risk-free investment is not a good estimate of the *RRFR*, because the nominal rate can change dramatically in the short run in reaction to temporary ease or tightness in the capital market or because of changes in the expected rate of inflation. As indicated by the data in Exhibit 1.6, the significant changes in the average yield on T-bills typically were related to large changes in the rates of inflation. Notably, 2009–2010 were different due to the quantitative easing by the Federal Reserve.

The Common Effect All the factors discussed thus far regarding the required rate of return affect all investments equally. Whether the investment is in stocks, bonds, real estate, or machine tools, if the expected rate of inflation increases from 2 percent to 6 percent, the investor's required rate of return for *all* investments should increase by 4 percent. Similarly, if a decline in the expected real growth rate of the economy causes a decline in the *RRFR* of 1 percent, the required return on all investments should decline by 1 percent.

1.3.3 Risk Premium

A risk-free investment was defined as one for which the investor is certain of the amount and timing of the expected returns. The returns from most investments do not fit this pattern. An

investor typically is not completely certain of the income to be received or when it will be received. Investments can range in uncertainty from basically risk-free securities, such as T-bills, to highly speculative investments, such as the common stock of small companies engaged in high-risk enterprises.

必要收益率中高出名
义无风险收益率的部分就
是风险溢价。

Most investors require higher rates of return on investments if they perceive that there is any uncertainty about the expected rate of return. This increase in the required rate of return over the *NRRFR* is the **risk premium (RP)**. Although the required risk premium represents a composite of all uncertainty, it is possible to consider several fundamental sources of uncertainty. In this section, we identify and discuss briefly the major sources of uncertainty, including: (1) business risk, (2) financial risk (leverage), (3) liquidity risk, (4) exchange rate risk, and (5) country (political) risk.

商业风险是由企业经
营性质引起的收入流的不
确定性。

Business risk is the uncertainty of income flows caused by the nature of a firm's business. The less certain the income flows of the firm, the less certain the income flows to the investor. Therefore, the investor will demand a risk premium that is based on the uncertainty caused by the basic business of the firm. As an example, a retail food company would typically experience stable sales and earnings growth over time and would have low business risk compared to a firm in the auto or airline industry, where sales and earnings fluctuate substantially over the business cycle, implying high business risk.

财务风险是由企业筹
资方式所引入的不确定性。

Financial risk is the uncertainty introduced by the method by which the firm finances its investments. If a firm uses only common stock to finance investments, it incurs only business risk. If a firm borrows money to finance investments, it must pay fixed financing charges (in the form of interest to creditors) prior to providing income to the common stockholders, so the uncertainty of returns to the equity investor increases. This increase in uncertainty because of fixed-cost financing is called *financial risk* or *financial leverage*, and it causes an increase in the stock's risk premium. For an extended discussion on this, see Brigham (2010).

流动性风险是投资的
二级市场所引入的不确
定性。

Liquidity risk is the uncertainty introduced by the secondary market for an investment. When an investor acquires an asset, he or she expects that the investment will mature (as with a bond) or that it will be salable to someone else. In either case, the investor expects to be able to convert the security into cash and use the proceeds for current consumption or other investments. The more difficult it is to make this conversion to cash, the greater the liquidity risk. An investor must consider two questions when assessing the liquidity risk of an investment: How long will it take to convert the investment into cash? How certain is the price to be received? Similar uncertainty faces an investor who wants to acquire an asset: How long will it take to acquire the asset? How uncertain is the price to be paid?⁵

投资买卖快慢的不确
定性, 或者投资价格不确
定性的存在, 都会增加流
动性风险。

Uncertainty regarding how fast an investment can be bought or sold, or the existence of uncertainty about its price, increases liquidity risk. A U.S. government Treasury bill has almost no liquidity risk because it can be bought or sold in seconds at a price almost identical to the quoted price. In contrast, examples of illiquid investments include a work of art, an antique, or a parcel of real estate in a remote area. For such investments, it may require a long time to find a buyer and the selling prices could vary substantially from expectations. Investors will increase their required rates of return to compensate for this uncertainty regarding timing and price. Liquidity risk can be a significant consideration when investing in foreign securities depending on the country and the liquidity of its stock and bond markets.

汇率风险是指投资者
购买用外国货币标价的证
券而造成的收益率的不确
定性。

Exchange rate risk is the uncertainty of returns to an investor who acquires securities denominated in a currency different from his or her own. The likelihood of incurring this risk is becoming greater as investors buy and sell assets around the world, as opposed to only assets within their own countries. A U.S. investor who buys Japanese stock denominated in yen must

⁵You will recall from prior courses that the overall capital market is composed of the primary market and the secondary market. Securities are initially sold in the primary market, and all subsequent transactions take place in the secondary market. These concepts are discussed in Chapter 4.

consider not only the uncertainty of the return in yen but also any change in the exchange value of the yen relative to the U.S. dollar. That is, in addition to the foreign firm's business and financial risk and the security's liquidity risk, the investor must consider the additional uncertainty of the return on this Japanese stock when it is converted from yen to U.S. dollars.

As an example of exchange rate risk, assume that you buy 100 shares of Mitsubishi Electric at 1,050 yen when the exchange rate is 105 yen to the dollar. The dollar cost of this investment would be about \$10.00 per share (1,050/105). A year later you sell the 100 shares at 1,200 yen when the exchange rate is 115 yen to the dollar. When you calculate the *HPY* in yen, you find the stock has increased in value by about 14 percent (1,200/1,050) - 1, but this is the *HPY* for a Japanese investor. A U.S. investor receives a much lower rate of return, because during this period the yen has weakened relative to the dollar by about 9.5 percent (that is, it requires more yen to buy a dollar—115 versus 105). At the new exchange rate, the stock is worth \$10.43 per share (1,200/115). Therefore, the return to you as a U.S. investor would be only about 4 percent (\$10.43/\$10.00) versus 14 percent for the Japanese investor. The difference in return for the Japanese investor and U.S. investor is caused by exchange rate risk—that is, the decline in the value of the yen relative to the dollar. Clearly, the exchange rate could have gone in the other direction, the dollar weakening against the yen. In this case, as a U.S. investor, you would have experienced the 14 percent return measured in yen, as well as a currency gain from the exchange rate change.

The more volatile the exchange rate between two countries, the less certain you would be regarding the exchange rate, the greater the exchange rate risk, and the larger the exchange rate risk premium you would require. For an analysis of pricing this risk, see Jorion (1991).

There can also be exchange rate risk for a U.S. firm that is extensively multinational in terms of sales and expenses. In this case, the firm's foreign earnings can be affected by changes in the exchange rate. As will be discussed, this risk can generally be hedged at a cost.

Country risk, also called *political risk*, is the uncertainty of returns caused by the possibility of a major change in the political or economic environment of a country. The United States is acknowledged to have the smallest country risk in the world because its political and economic systems are the most stable. During the spring of 2011, prevailing examples include the deadly rebellion in Libya against Moammar Gadhafi; a major uprising in Syria against President Bashar al-Assad; and significant protests in Yemen against President Ali Abdullah Saleh. In addition, there has been a recent deadly earthquake and tsunami in Japan that is disturbing numerous global corporations and the currency markets. Individuals who invest in countries that have unstable political or economic systems must add a country risk premium when determining their required rates of return.

When investing globally (which is emphasized throughout the book, based on a discussion in Chapter 3), investors must consider these additional uncertainties. How liquid are the secondary markets for stocks and bonds in the country? Are any of the country's securities traded on major stock exchanges in the United States, London, Tokyo, or Germany? What will happen to exchange rates during the investment period? What is the probability of a political or economic change that will adversely affect your rate of return? Exchange rate risk and country risk differ among countries. A good measure of exchange rate risk would be the absolute variability of the exchange rate relative to a composite exchange rate. The analysis of country risk is much more subjective and must be based on the history and current political environment of the country.

This discussion of risk components can be considered a security's *fundamental risk* because it deals with the intrinsic factors that should affect a security's volatility of returns over time. In subsequent discussion, the standard deviation of returns for a security is referred to as a measure of the security's *total risk*, which considers only the individual stock—that is, the stock is not considered as part of a portfolio.

Risk Premium = f (Business Risk, Financial Risk, Liquidity Risk, Exchange Rate Risk, Country Risk)

国家风险，也称为政治风险，是一国政治或经济环境有可能发生重大变化造成的收益的不确定性。

1.3.4 Risk Premium and Portfolio Theory

An alternative view of risk has been derived from extensive work in portfolio theory and capital market theory by Markowitz (1952, 1959) and Sharpe (1964). These theories are dealt with in greater detail in Chapter 7 and Chapter 8 but their impact on a stock's risk premium should be mentioned briefly at this point. These prior works by Markowitz and Sharpe indicated that investors should use an *external market* measure of risk. Under a specified set of assumptions, all rational, profit-maximizing investors want to hold a completely diversified market portfolio of risky assets, and they borrow or lend to arrive at a risk level that is consistent with their risk preferences. Under these conditions, they showed that the relevant risk measure for an individual asset is its *comovement with the market portfolio*. This comovement, which is measured by an asset's covariance with the market portfolio, is referred to as an asset's **systematic risk**, the portion of an individual asset's total variance that is attributable to the variability of the total market portfolio. In addition, individual assets have variance that is unrelated to the market portfolio (the asset's nonmarket variance) that is due to the asset's unique features. This non-market variance is called *unsystematic risk*, and it is generally considered unimportant because it is eliminated in a large, diversified portfolio. Therefore, under these assumptions, *the risk premium for an individual earning asset is a function of the asset's systematic risk with the aggregate market portfolio of risky assets*. The measure of an asset's systematic risk is referred to as its *beta*:

$$\text{Risk Premium} = f(\text{Systematic Market Risk})$$

1.3.5 Fundamental Risk versus Systematic Risk

Some might expect a conflict between the market measure of risk (systematic risk) and the fundamental determinants of risk (business risk, and so on). A number of studies have examined the relationship between the market measure of risk (systematic risk) and accounting variables used to measure the fundamental risk factors, such as business risk, financial risk, and liquidity risk. The authors of these studies (especially Thompson, 1976) have generally concluded that *a significant relationship exists between the market measure of risk and the fundamental measures of risk*. Therefore, the two measures of risk can be complementary. This consistency seems reasonable because one might expect the market measure of risk to reflect the fundamental risk characteristics of the asset. For example, you might expect a firm that has high business risk and financial risk to have an above-average beta. At the same time, as we discuss in Chapter 8, a firm that has a high level of fundamental risk and a large standard deviation of returns can have a lower level of systematic risk simply because the variability of its earnings and its stock price is not related to the aggregate economy or the aggregate market, i.e., a large component of its total risk is due to unique unsystematic risk. Therefore, one can specify the risk premium for an asset as either:

$$\text{Risk Premium} = f(\text{Business Risk, Financial Risk, Liquidity Risk, Exchange Rate Risk, Country Risk})$$

or

$$\text{Risk Premium} = f(\text{Systematic Market Risk})$$

1.3.6 Summary of Required Rate of Return

The overall required rate of return on alternative investments is determined by three variables: (1) the economy's *RRFR*, which is influenced by the investment opportunities in the economy (that is, the long-run real growth rate); (2) variables that influence the *NRRFR*, which include short-run ease or tightness in the capital market and the expected rate of inflation. Notably, these variables, which determine the *NRRFR*, are the same for all investments; and (3) the risk premium on the investment. In turn, this risk premium can be related to fundamental factors, including business risk, financial risk, liquidity risk, exchange rate risk, and country risk, or it can be a function of an asset's systematic market risk (*beta*).

因此, 在这些假设条件下, 单个收益资产的风险溢价是该资产的系统风险与整个风险资产市场组合的函数。

另类投资的必要回报率由三个变量决定: (1) 受经济体投资机会影响的实际无风险利率 (即长期实际增长率); (2) 影响名义无风险利率的变量, 包括资本市场短期的宽松或紧张环境, 以及预期通货膨胀率。值得注意的是, 这些决定名义无风险利率的变量同样适用于其他所有的投资。(3) 投资的风险溢价。风险溢价与商业风险、财务风险、流动性风险、汇率风险、国家风险等基本因素相关, 或者说, 它是资产系统性市场风险的函数 (即 *beta*)。

Measures and Sources of Risk In this chapter, we have examined both measures and sources of risk arising from an investment. The *measures* of market risk for an investment are:

- Variance of rates of return
- Standard deviation of rates of return
- Coefficient of variation of rates of return (standard deviation/means)
- Covariance of returns with the market portfolio (beta)

The *sources* of fundamental risk are:

- Business risk
- Financial risk
- Liquidity risk
- Exchange rate risk
- Country risk

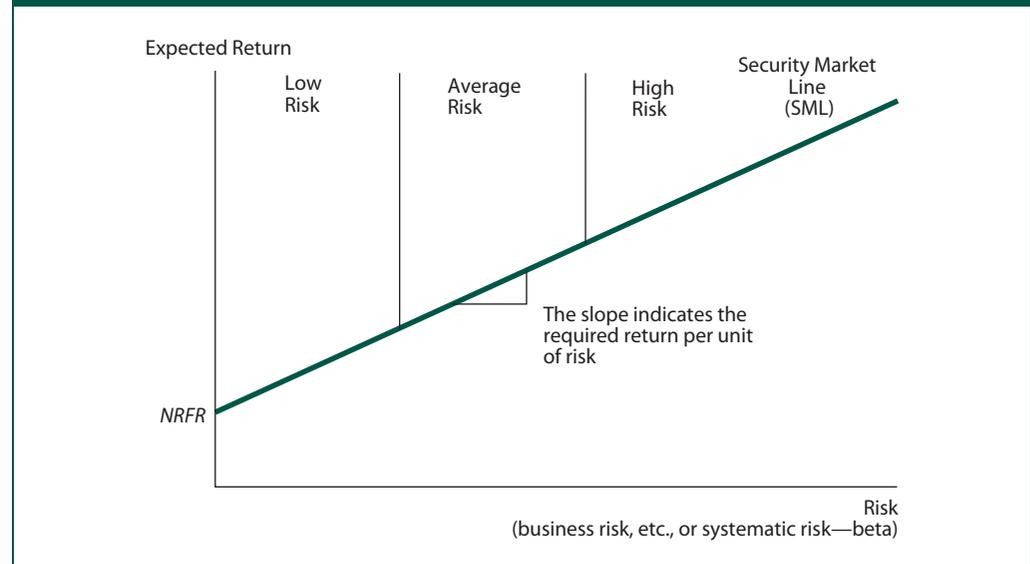
1.4 RELATIONSHIP BETWEEN RISK AND RETURN

Previously, we showed how to measure the risk and rates of return for alternative investments and we discussed what determines the rates of return that investors require. This section discusses the risk-return combinations that might be available at a point in time and illustrates the factors that cause *changes* in these combinations.

Exhibit 1.7 graphs the expected relationship between risk and return. It shows that investors increase their required rates of return as perceived risk (uncertainty) increases. The line that reflects the combination of risk and return available on alternative investments is referred to as the **security market line (SML)**. The SML reflects the risk-return combinations available for all risky assets in the capital market at a given time. Investors would select investments that are consistent with their risk preferences; some would consider only low-risk investments, whereas others welcome high-risk investments.

反映可选投资可实现的
风险和收益组合的那条线
被称为证券市场线 (SML)。

Exhibit 1.7 Relationship between Risk and Return



Beginning with an initial SML, three changes in the SML can occur. First, individual investments can change positions on the SML because of changes in the perceived risk of the investments. Second, the slope of the SML can change because of a change in the attitudes of investors toward risk; that is, investors can change the returns they require per unit of risk. Third, the SML can experience a parallel shift due to a change in the *RRFR* or the expected rate of inflation—i.e., anything that can change in the *NRFR*. These three possibilities are discussed in this section.

1.4.1 Movements along the SML

Investors place alternative investments somewhere along the SML based on their perceptions of the risk of the investment. Obviously, if an investment's risk changes due to a change in one of its fundamental risk sources (business risk, and such), it will move along the SML. For example, if a firm increases its financial risk by selling a large bond issue that increases its financial leverage, investors will perceive its common stock as riskier and the stock will move up the SML to a higher risk position implying that investors will require a higher rate of return. As the common stock becomes riskier, it changes its position on the SML. Any change in an asset that affects its fundamental risk factors or its market risk (that is, its beta) will cause the asset to move *along* the SML as shown in Exhibit 1.8. Note that the SML does not change, only the position of specific assets on the SML.

例如，如果企业通过出售大量债券增加了财务杠杆，将会加大其财务风险，投资者会认为该企业的普通股风险增大，并且该股票在 SML 上的位置将沿 SML 向较高的风险位置移动。

1.4.2 Changes in the Slope of the SML

The slope of the SML indicates the return per unit of risk required by all investors. Assuming a straight line, it is possible to select any point on the SML and compute a risk premium (RP) for an asset through the equation:

$$1.13 \quad RP_i = E(R_i) - NRFR$$

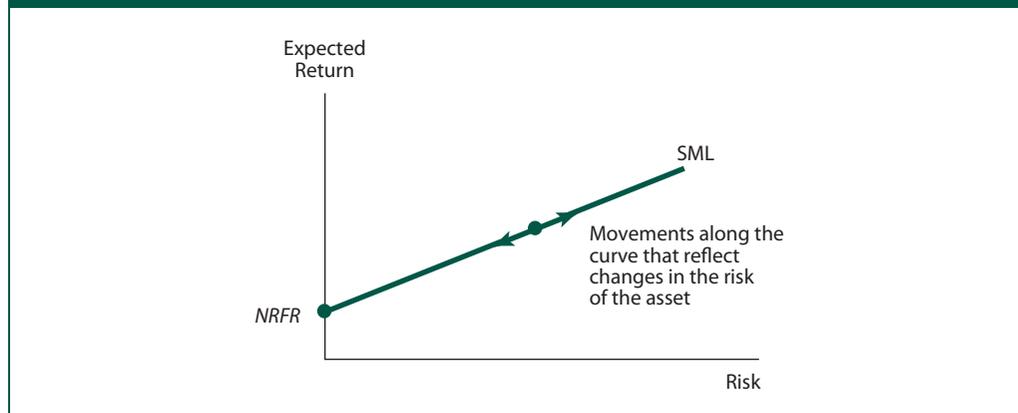
where:

RP_i = risk premium for asset i

$E(R_i)$ = the expected return for asset i

$NRFR$ = the nominal return on a risk-free asset

Exhibit 1.8 Changes in the Required Rate of Return Due to Movements along the SML



If a point on the SML is identified as the portfolio that contains all the risky assets in the market (referred to as the *market portfolio*), it is possible to compute a market RP as follows:

$$1.14 \quad RP_m = E(R_m) - NRFR$$

where:

RP_m = the risk premium on the market portfolio

$E(R_m)$ = the expected return on the market portfolio

$NRFR$ = the nominal return on a risk-free asset

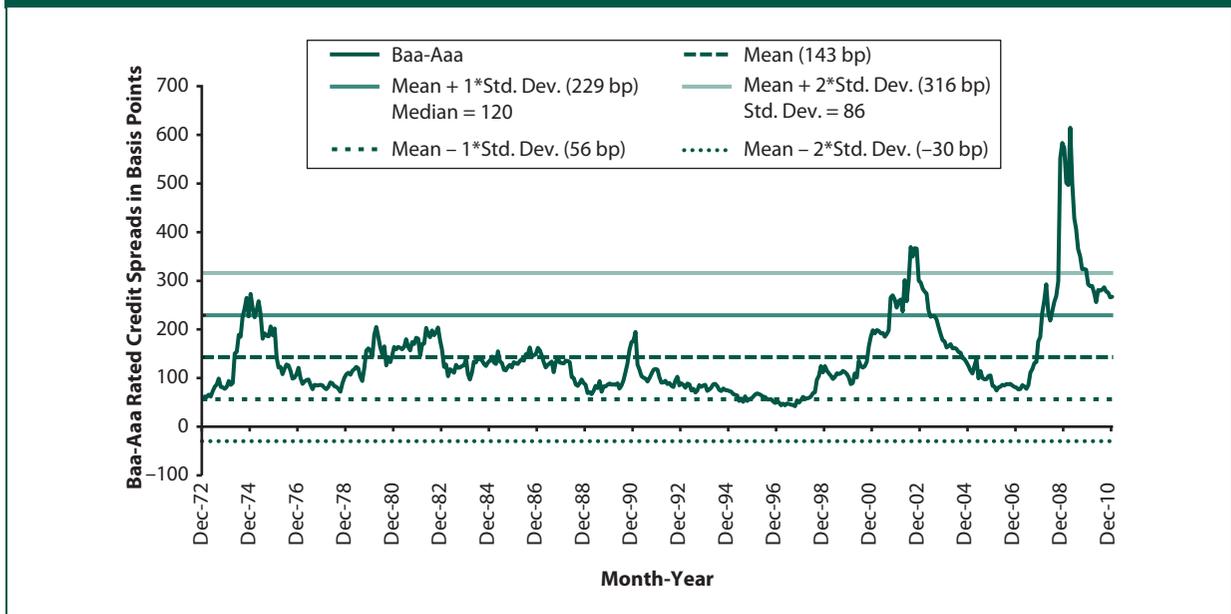
This market RP is *not constant* because the slope of the SML changes over time. Although we do not understand completely what causes these changes in the slope, we do know that there are changes in the *yield* differences between assets with different levels of risk even though the inherent risk differences are relatively constant.

These differences in yields are referred to as **yield spreads**, and these yield spreads change over time. As an example, if the yield on a portfolio of Aaa-rated bonds is 7.50 percent and the yield on a portfolio of Baa-rated bonds is 9.00 percent, we would say that the yield spread is 1.50 percent. This 1.50 percent is referred to as a credit risk premium because the Baa-rated bond is considered to have higher credit risk—that is, it has a higher probability of default. This Baa–Aaa yield spread is *not* constant over time, as shown by the substantial volatility in the yield spreads shown in Exhibit 1.9.

Although the underlying business and financial risk characteristics for the portfolio of bonds in the Aaa-rated bond index and the Baa-rated bond index would probably not change dramatically over time, it is clear from the time-series plot in Exhibit 1.9 that the difference in yields (i.e., the yield spread) has experienced changes of more than 100 basis points (1 percent) in a short period of time (for example, see the yield spread increases in 1974–1975, 1981–1983, 2001–2002, 2008–2009, and the dramatic declines in yield spread during 1975, 1983–1984, 2003–2004, and the second half of 2009). Such a significant change in the yield spread during a period where there is no major change in the fundamental risk characteristics of Baa bonds

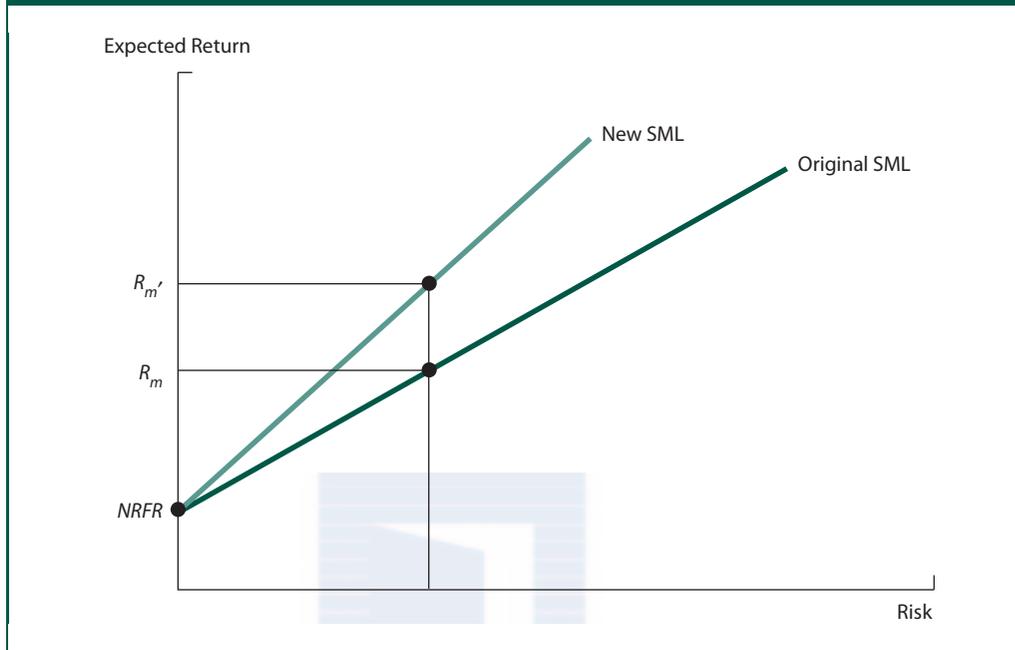
这些收益率的差值称为**收益率差**，这些利差在期间内会发生变化。

Exhibit 1.9 Barclays Capital U.S. Credit Monthly Yield Spreads in Basis Points (U.S. Credit Aaa – U.S. Credit Baa) Jan. 1973–Dec. 2010



Source: Barclays Capital data; computations by authors.

Exhibit 1.10 Change in Market Risk Premium



relative to Aaa bonds would imply a change in the market RP. Specifically, although the intrinsic financial risk characteristics of the bonds remain relatively constant, investors changed the yield spreads (i.e., the credit risk premiums) they demand to accept this difference in financial risk.

This change in the *RP* implies a change in the slope of the SML. Such a change is shown in Exhibit 1.10. The exhibit assumes an increase in the market risk premium, which means an increase in the slope of the market line. Such a change in the slope of the SML (the market risk premium) will affect the required rate of return for all risky assets. Irrespective of where an investment is on the original SML, its required rate of return will increase, although its intrinsic risk characteristics remain unchanged.

不论一项投资位于初始证券市场线 (SML) 的位置如何, 在其个别风险特征保持不变的情况下, 其必要收益率将会增加。

1.4.3 Changes in Capital Market Conditions or Expected Inflation

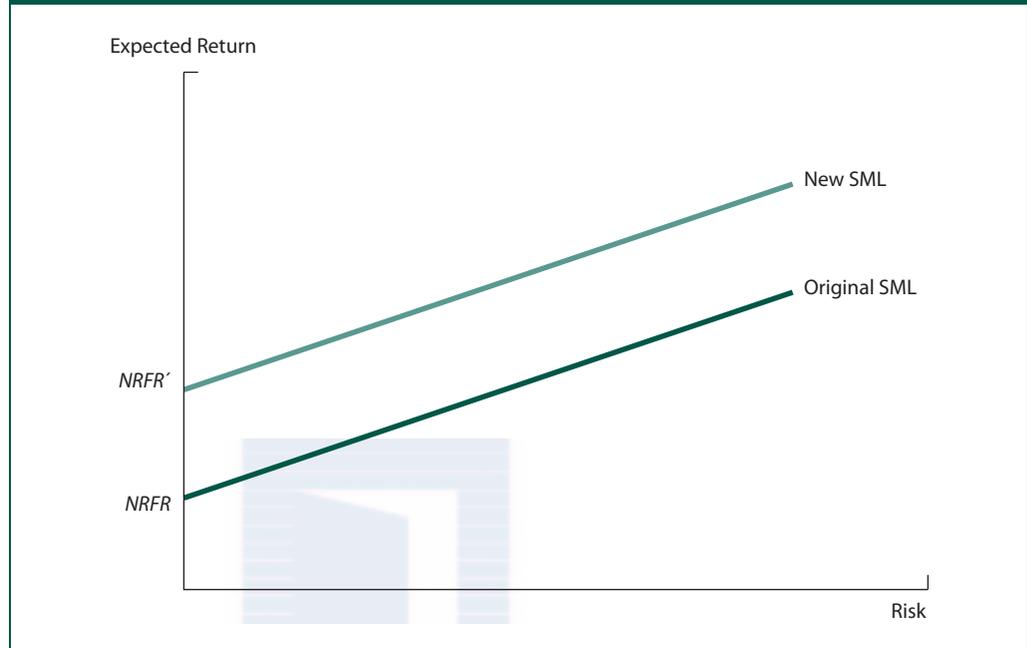
The graph in Exhibit 1.11 shows what happens to the SML when there are changes in one of the following factors: (1) expected real growth in the economy, (2) capital market conditions, or (3) the expected rate of inflation. For example, an increase in expected real growth, temporary tightness in the capital market, or an increase in the expected rate of inflation will cause the SML to experience a parallel shift upward as shown in Exhibit 1.11. The parallel shift occurs because changes in expected real growth or changes in capital market conditions or a change in the expected rate of inflation affect the economy's nominal risk-free rate (*NRFR*) that impacts all investments, irrespective of their risk levels.

1.4.4 Summary of Changes in the Required Rate of Return

The relationship between risk and the required rate of return for an investment can change in three ways:

1. A movement *along* the SML demonstrates a change in the risk characteristics of a specific investment, such as a change in its business risk, its financial risk, or its systematic risk (its beta). This change affects only the individual investment.

Exhibit 1.11 Capital Market Conditions, Expected Inflation, and the Security Market Line



2. A change in the *slope* of the SML occurs in response to a change in the attitudes of investors toward risk. Such a change demonstrates that investors want either higher or lower rates of return for the same intrinsic risk. This is also described as a change in the market risk premium ($R_m - NRFR$). A change in the market risk premium will affect all risky investments.
3. A *shift* in the SML reflects a change in expected real growth, a change in market conditions (such as ease or tightness of money), or a change in the expected rate of inflation. Again, such a change will affect all investments.