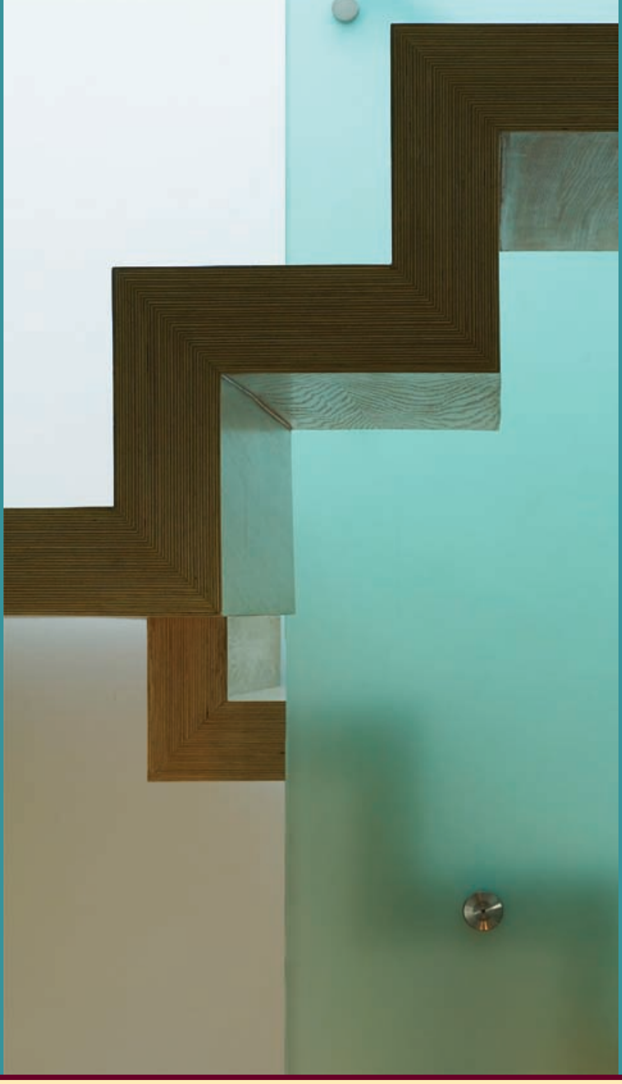
IN THIS CHAPTER YOU WILL LEARN:

1. The idea of present value and why it is critical in making financial decisions.
2. About the most popular investments: stocks, bonds, and mutual funds.
3. How investment returns compensate for being patient and for bearing risk.
4. About portfolio diversification and why it implies that investors can focus on nondiversifiable risk when evaluating an investment opportunity.
5. Why higher levels of nondiversifiable risk are associated with higher rates of return.
6. Why even professionals have a hard time trying to "beat the market."



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Financial Economics

Financial economics studies investor preferences and how they affect the trading and pricing of financial assets like stocks, bonds, and real estate. The two most important investor preferences are a desire for high rates of return and a dislike of risk and uncertainty. This chapter will explain how these preferences interact to produce a strong positive relationship between risk and return: the riskier an investment, the higher its rate of return. This positive relationship compensates investors for bearing risk. And it is enforced by a powerful set of buying and selling pressures known as arbitrage, which ensures consistency across investments so that assets with identical levels of risk generate identical rates of return. As we will demonstrate, this consistency makes it extremely difficult for anyone to "beat the market" by finding a set of investments that can generate high rates of return at low levels of risk. Instead, investors are stuck with a trade-off: If they want higher rates of return, they must accept higher levels of risk. On average, higher risk results in higher returns. But it can also result in large losses, as it did for investors in subprime mortgage loans in late 2007 and in 2008.

Financial Investment

Financial economics focuses its attention on the investments that individuals and firms make in the wide variety of assets available to them in our modern economy. But before proceeding, it is important for you to recall the difference between economic investment and financial investment.

Economic investment refers either to paying for *new* additions to the capital stock or *new* replacements for capital stock that has worn out. Thus, *new* factories, houses, retail stores, construction equipment, and wireless networks are all good examples of economic investments. And so are purchases of office computers to replace computers that have become obsolete as well as purchases of new commercial airplanes to replace planes that have served out their useful lives.

In contrast, financial investment is a far broader, much more inclusive concept. It includes economic investment and a whole lot more. **Financial investment** refers to either buying an asset or building an asset in the expectation of financial gain. It does not distinguish between *new* assets and *old* assets. Purchasing an old house or an old factory is just as much a financial investment as purchasing a new house or a new factory. For financial investment, it does not matter if the purchase of an asset adds to the capital stock, replaces the capital stock, or does neither. Investing in old comic books is just as much a financial investment as building a new refinery. Finally, unlike economic investment, financial investment can involve either *financial assets* (such as stocks, bonds, and futures contracts) or *real assets* (such as land, factories, and retail stores).

When bankers, entrepreneurs, corporate executives, retirement planners, and ordinary people use the word "investment," they almost always mean financial investment. In fact, the ordinary meaning of the word investment *is* financial investment. So for this chapter, we will use the word investment in its ordinary sense of "financial investment" rather than in the far narrower sense of "economic investment," which is used throughout the rest of this book.

Present Value

One of the fundamental ideas in financial economics is **present value**—the present-day value, or worth, of returns or costs that are expected to arrive in the future. The ability to calculate present values is especially useful when investors wish to determine the proper current price to pay for an asset. In fact, the proper current price for any risk-free investment *is* the present value of its expected future returns. And while some adjustments have to be made when determining the proper price of a risky investment, the process is entirely based upon the logic of present value. So we begin our study of finance by explaining present value and how it can be used to price risk-free assets. Once that is accomplished, we will turn our attention to risk and how the financial markets determine the prices of risky assets by taking into account investor preferences regarding the trade-off between potential return and potential risks.

TABLE 34.1 **Compounding: $100 at 8 Percent Interest**

(1) Years of Compounding	(2) Compounding Computation	(3) Value at Year's End
1	$100 (1.08)	$108.00
2	100 $(1.08)^2$	116.64
3	100 $(1.08)^3$	125.97
4	100 $(1.08)^4$	136.05
5	100 $(1.08)^5$	146.93
17	100 $(1.08)^{17}$	370.00

Compound Interest

The best way to understand present value is by first understanding compound interest. **Compound interest** describes how quickly an investment increases in value when interest is paid, or compounded, not only on the original amount invested but also on all interest payments that have been previously made.

As an example of compound interest in action, consider Table 34.1, which shows the amount of money that $100 invested today becomes if it increases, or compounds, at an 8 percent annual interest rate, i, for various numbers of years. To make things simple, let's express the 8 percent annual interest rate as a decimal so that it becomes $i = .08$. The key to understanding compound interest is to realize that 1 year's worth of growth at interest rate i will always result in $(1 + i)$ times as much money at the end of a year as there was at the beginning of the year. Consequently, if the first year begins with $100 and if $i = .08$, then $(1 + .08)$ or 1.08 times as much money—$108—will be available at the end of the year. We show the computation for the first year in column 2 of Table 34.1 and display the $108 outcome in column 3. The same logic would also apply with other initial amounts. If a year begins with $500, there will be 1.08 times more money after 1 year, or $540. Algebraically, for any given number of dollars X at the beginning of a particular year, there will be $(1 + i)\,X$ dollars, or, alternatively, $X(1 + i)$ dollars, after 1 year's worth of growth.

We can use this formula to consider what happens if the initial investment of $100 that grew into $108 after 1 year continues to grow at 8 percent interest for a second year. The $108 available at the beginning of the second year will grow into an amount of money that is 1.08 times larger by the end of the second year. That amount, as shown in Table 34.1, is \$116.64. Notice that the computation in the table is made by multiplying the initial \$100 by $(1.08)^2$. That is because the original \$100 is compounded by 1.08 into \$108 and then the \$108 is again compounded by 1.08. More generally, since the second year begins with $(1 + i)X$ dollars, it will grow to $(1 + i)(1 + i)X = (1 + i)^2X$ dollars by the end of the second year.

Similar reasoning shows that the amount of money at the end of 3 years has to be $(1 + i)^3X$ since the amount of money at the beginning of the third year, $(1 + i)^2X$, gets multiplied by $(1 + i)$ to convert it into the amount of money at the end of the third year. In terms of Table 34.1, that amount is \$125.97, which is $(1.08)^3$\$100.

As you can see, we now have a fixed pattern. The \$100 that is invested at the beginning of the first year becomes $(1 + i)$\$100 after 1 year, $(1 + i)^2$\$100 after 2 years, $(1 + i)^3$\$100 after 3 years, and so on. It therefore is clear that the amount of money after t years will be $(1 + i)^t$\$100. This pattern always holds true, regardless of the size of the initial investment. Thus, investors know that if X dollars is invested today and earns compound interest at the rate i, it will grow into exactly $(1 + i)^tX$ dollars after t years. Economists express this fact by writing

$$X \text{ dollars today} = (1 + i)^t X \text{ dollars in } t \text{ years} \qquad (1)$$

Equation 1 captures the idea that if investors have the opportunity to invest X dollars today at interest rate i, then they have the ability to transform X dollars today into $(1 + i)^tX$ dollars in t years.

But notice that the logic of the equality also works in reverse, so that it can also be thought of as showing that $(1 + i)^tX$ dollars in t years can be transformed into X dollars today. That may seem very odd, but it is exactly what happens when people take out loans. For instance, consider a situation where an investor named Roberto takes out a loan for \$100 dollars today, a loan that will accumulate interest at 8 percent per year for 5 years. Under such an arrangement, the amount Roberto owes will grow with compound interest into $(1.08)^5$\$100 = \$146.93 dollars in 5 years. This means that Roberto can convert \$146.93 dollars in 5 years (the amount required to pay off the loan) into \$100 dollars today (the amount he borrows.)

Consequently, the compound interest formula given in equation 1 defines not only the rate at which present amounts of money can be converted to future amounts of money but also the rate at which future amounts of money can be converted into present amounts of money. It allows us to measure the so-called *time-value of money*. In the model that follows, we exploit the ability of equation 1 to convert future dollars into present dollars.

The Present Value Model

The present value model simply rearranges equation 1 to make it easier to transform future amounts of money into present amounts of money. To derive the formula used to calculate the present value of a future amount of money, we divide both sides of equation 1 by $(1 + i)^t$ to obtain

$$\frac{X}{(1 + i)^t} \text{ dollars today} = X \text{ dollars in } t \text{ years} \qquad (2)$$

The logic of equation 2 is identical to that of equation 1. Both allow investors to convert present amounts of money into future amounts of money and vice versa. However, equation 2 makes it much more intuitive to convert a given number of dollars in the future into their present-day equivalent. In fact, it says that X dollars in t years converts into exactly $X/(1 + i)^t$ dollars today. This may not seem important, but it is actually very powerful because it allows investors to easily calculate how much they should pay for any given asset.

WORKED PROBLEMS
W 34.1
Present value

To see why this is true, understand that an asset's owner obtains the right to receive one or more future payments. If an investor is considering buying an asset, her problem is to try to determine how much she should pay today to buy the asset and receive those future payments. Equation 2 makes this task very easy. If she knows how large any given payment will be (X dollars), when it will arrive (in t years), and what the interest rate (i) is, then she can apply equation 2 to determine the payment's present value: its value in present-day dollars. If she does this for each of the future payments that the asset in question is expected to make, she will be able to calculate the overall present value of all the asset's future payments by simply summing together the present values of each of the individual payments. This will allow her to determine the price she should pay for the asset. In particular, *the asset's price should exactly equal the total present value of all of the asset's future payments*.

As a simple example, suppose that Cecilia has the chance to buy an asset that is guaranteed to return a single payment of exactly \$370.00 in 17 years. Again let's assume the interest rate is 8 percent per year. Then the present value of that future payment can be determined using equation 2 to equal precisely $\$370.00/(1 + 0.08)^{17} = \$370.00/(1.08)^{17} = \$100$ today. This is confirmed in the row for year 17 in Table 34.1.

To see why Cecilia should be willing to pay a price that is *exactly* equal to the \$100 present value of the asset's single future payment of \$370.00 in 17 years, consider the following thought experiment. What would happen if she were to invest \$100 today in an alternative investment that is guaranteed to compound her money for 17 years at 8 percent per year? How large would her investment in this alternative become? Equation 1 and Table 34.1 tell us that the answer is exactly $370.00 in 17 years.

This is very important because it shows that Cecelia and other investors have two different possible ways of purchasing the right to receive $370.00 in 17 years. They can either:

- Purchase the asset in question for $100.
- Invest $100 in the alternative asset that pays 8 percent per year.

Because either investment will deliver the same future benefit, both investments are in fact identical. Consequently, they should have identical prices—meaning that each will cost precisely $100 today.

A good way to see why this must be the case is by considering how the presence of the alternative investment affects the behavior of both the potential buyers and the potential sellers of the asset in question. First, notice that Cecelia and other potential buyers would never pay more than $100 for the asset in question because they know that they could get the same future return of $370.00 in 17 years by investing $100 in the alternative investment. At the same time, people selling the asset in question would not sell it to Cecelia or other potential buyers for anything less than $100 since they know that the only other way for Cecelia and other potential buyers to get a future return of $370.00 in 17 years is by paying $100 for the alternative investment. Since Cecelia and the other potential buyers will not pay more than $100 for the asset in question and its sellers will not accept less than $100 for the asset in question, the result will be that the asset in question and the alternative investment will have the exact same price of $100 today.

QUICK REVIEW 34.1

- Financial investment refers to buying an asset with the hope of financial gain.
- Compound interest is the payment of interest not only on the original amount invested but also on any interest payments previously made; X dollars today growing at interest rate i will become $(1 + i)^t X$ dollars in t years.
- The present value formula facilitates transforming future amounts of money into present-day amounts of money; X dollars in t years converts into exactly $X/(1 + i)^t$ dollars today.
- An investment's proper current price is equal to the sum of the present values of all the future payments that it is expected to make.

Applications

Present value is not only an important idea for understanding investment, but it has many everyday applications. Let's examine two of them.

Take the Money and Run?

The winners of state lotteries are typically paid their winnings in equal installments spread out over 20 years. For instance, suppose that Zoe gets lucky one week and wins a $100 million jackpot. She will not be paid $100 million all at once. Rather, she will receive $5 million per year for 20 years, for a total of $100 million.

Zoe may object to this installment payment system for a variety of reasons. For one thing, she may be very old, so that she is not likely to live long enough to collect all of the payments. Alternatively, she might prefer to receive her winnings immediately so that she could make large immediate donations to her favorite charities or large immediate investments in a business project that she would like to get started. And, of course, she may just be impatient and want to buy a lot of really expensive consumption goods sooner rather than later.

Fortunately for Zoe, if she does have a desire to receive her winnings sooner rather than later, several private financial companies are ready and willing to help her. They do this by arranging swaps. Lottery winners sell the right to receive their installment payments in exchange for a single lump sum that they get immediately. The people who hand over the lump sum receive the right to collect the installment payments.

Present value is crucial to arranging these swaps since it is used to determine the value of the lump sum that lottery winners like Zoe will receive in exchange for giving up their installment payments. The lump sum in any case is simply equal to the sum of the present values of each of the future payments. Assuming an interest rate of 5 percent per year, the sum of the present values of each of Zoe's 20 installment payments of $5 million is $62,311,051.71. So, depending on her preferences, Zoe can either receive that amount immediately or $100 million spread out over 20 years.

Salary Caps and Deferred Compensation

Another example of present value comes directly from the sporting news. Many professional sports leagues worry that richer teams, if not held in check, would outbid poorer teams for the best players. The result would be a situation in which only the richer teams have any real chance of doing well and winning championships.

To prevent this from happening, many leagues have instituted salary caps. These are upper limits on the total amount of money that each team can spend on salaries during a given season. For instance, one popular basketball league has a salary cap of about $50 million per season, so that the combined value of the salaries that each team pays its players can be no more than $50 million.

Typically, however, the salary contracts that are negotiated between individual players and their teams are for multiple seasons. This means that during negotiations, players are often asked to help their team stay under the current season's salary cap by agreeing to receive more compensation in later years. For instance, suppose that a team's current payroll is $45 million but that it would like to sign a superstar nicknamed HiTop to a two-year contract. HiTop, however, is used to earning $10 million per year. This is a major problem for the team because the $50 million salary cap means that the most that the team can pay HiTop for the current season is $5 million.

A common solution is for HiTop to agree to receive only $5 million the first season in order to help the team stay under the salary cap. In exchange for this concession, the team agrees to pay HiTop more than the $10 million he would normally demand for the second season. The present value formula is used to figure out how large his second-season salary should be. In particular, the player can use the present value formula to figure out that if the interest rate is 8 percent per year, he should be paid a total of $15,400,000 during his second season, since this amount will equal the $10 million he wants for the second season plus $5.4 million to make up for the $5 million reduction in his salary during the first season. That is, the present value of the $5.4 million that he will receive during the second season precisely equals the $5 million that he agrees to give up during the first season.

SomeP opularIn vestments

The number and types of financial "instruments" in which one can invest are very numerous, amazingly creative, and highly varied. Most are much more complicated than the investments we used to explain compounding and present value. But, fortunately, all investments share three features:

- They require that investors pay some price—determined in the market—to acquire them.
- They give their owners the chance to receive future payments.
- The future payments are typically risky.

These features allow us to treat all assets in a unified way. Three of the more popular investments are stocks, bonds, and mutual funds. In 2004, the median value of stock holdings for U.S. families that held stocks was $15,000; the median value for bonds, $65,000; and the median value for "pooled funds" (mainly mutual funds) was $40,400.[1]

[1]Federal Reserve, "Recent Changes in U.S. Family Finances: Evidence from the 2001 and 2004 Survey of Consumer Finances," p. A14.

Stocks

Recall that **stocks** are ownership shares in a corporation. If an investor owns 1 percent of a corporation's shares, she gets 1 percent of the votes at the shareholder meetings that select the company's managers and she is also entitled to 1 percent of any future profit distributions. There is no guarantee, however, that a company will be profitable.

Firms often lose money and sometimes even go **bankrupt,** meaning that they are unable to make timely payments on their debts. In the event of a bankruptcy, control of a corporation's assets is given to a bankruptcy judge, whose job is to enforce the legal rights of the people who lent the company money by doing what he can to see that they are repaid. Typically, this involves selling off the corporation's assets (factories, real estate patents, etc.) to raise the money necessary to pay off the company's debts. The money raised by selling the assets may be greater than or less than what is needed to fully pay off the firm's debts. If it is more than what is necessary, any remaining money is divided equally among shareholders. If it is less than what is necessary, then the lenders do not get repaid in full and have to suffer a loss.

A key point, however, is that the maximum amount of money that shareholders can lose is what they pay for their shares. If the company goes bankrupt owing more than the value of the firm's assets, shareholders do not have to make up the difference. This **limited liability rule** limits the risks involved in investing in corporations and encourages investors to invest in stocks by capping their potential losses at the amount that they paid for their shares.

When firms are profitable, however, investors can look forward to gaining financially in either or both of two possible ways. The first is through **capital gains,** meaning that they sell their shares in the corporation for more money than they paid for them. The second is by receiving **dividends,** which are equal shares of the corporation's profits. As we will soon explain, a corporation's current share price is determined by the size of the capital gains and dividends that investors expect the corporation to generate in the future.

Bonds

Bonds are debt contracts that are issued most frequently by governments and corporations. They typically work as follows: An initial investor lends the government or the corporation a certain amount of money, say $1000, for a certain period of time, say 10 years. In exchange, the government or corporation promises to make a series of semiannual payments in addition to returning the $1000 at the end of the 10 years. The semiannual payments constitute interest on the loan. For instance, the bond agreement may specify that the borrower will pay $30 every six months. This means that the bond will pay $60 per year in payments, which is equivalent to a 6 percent rate of interest on the initial $1000 loan.

The initial investor is free, however, to sell the bond at any time to other investors, who then gain the right to receive any of the remaining semiannual payments as well as the final $1000 payment when the bond expires after 10 years. As we will soon demonstrate, the price at which the bond will sell if it is indeed sold to another investor will depend on the current rates of return available on other investments offering a similar stream of future payments and facing a similar level of risk.

The primary risk a bondholder faces is the possibility that the corporation or government that issues his bond will **default** on, or fail to make, the bond's promised payments. This risk is much greater for corporations, but it also faces local and state governments in situations where they cannot raise enough tax revenue to make their bond payments or where defaulting on bond payments is politically easier than reducing spending on other items in the government's budget to raise the money needed to keep making bond payments. The U.S. Federal government, however, has never defaulted on its bond payments and is very unlikely to ever default for the simple reason that it has the right to print money and can therefore just print whatever money it needs to make its bond payments on time.

A key difference between bonds and stocks is that bonds are much more predictable. Unless a bond goes into default, its owner knows both how big its future payments will be and exactly when they will arrive. By contrast, stock prices and dividends are highly volatile because they depend on profits, which vary greatly depending on the overall business cycle and on factors specific to individual firms and industries—things such as changing consumer preferences, variations in the costs of inputs, and changes in the tax code. As we will demonstrate later, the fact that bonds are typically more predictable (thus less risky) than stocks explains why they generate lower average rates of return than stocks. Indeed, this difference in rates of return has been very large historically. From 1926 to 2007, stocks on average returned just over 11 percent per year worldwide while bonds on average returned only a bit over 6 percent per year worldwide.

MutualFu nds

A **mutual fund** is a company that maintains a professionally managed **portfolio,** or collection, of either stocks or bonds. The portfolio is purchased by pooling the money of many investors. Since these investors provide the money to purchase the portfolio, they own it and any gains or losses generated by the portfolio flow directly to them. Table 34.2 lists the 10 largest U.S. mutual funds based on their assets.

TABLE 34.2 The 10 Largest Mutual Funds, February 2008

Fund Name	Assets under Management, Billions
American Funds Growth Fund of America A	$96.7
American Funds Capital World Growth and Income A	85.4
American Funds Capital Income Builder A	83.5
Fidelity Contrafund	80.3
American Funds Investment Company of America A	78.1
American Funds Washington Mutual A	70.9
American Funds Fund of America A	69.8
PIMCO Total Returns Institutional	69.4
American Funds Euro Pacific Growth A	67.4
Dodge & Cox Stock Fund	65.7

Source: Morningstar, **www.morningstar.com.**

Most of the more than 8000 mutual funds currently operating in the United States choose to maintain portfolios that invest in specific categories of bonds or stocks. For instance, some fill their portfolios exclusively with the stocks of small tech companies, while others buy only bonds issued by certain state or local governments. In addition, there are **index funds,** whose portfolios are selected to exactly match a stock or bond index. Indexes follow the performance of a particular group of stocks or bonds in order to gauge how well a particular category of investments is doing. For instance, the Standard & Poor's 500 Index contains the 500 largest stocks trading in the United States in order to capture how the stocks of large corporations vary over time, while the Lehman 10-Year Corporate Bond Index follows a representative collection of 10-year corporate bonds to see how well corporate bonds do over time.

An important distinction must be drawn between actively managed and passively managed mutual funds. **Actively managed funds** have portfolio managers who constantly buy and sell assets in an attempt to generate high returns. By contrast, index funds are **passively managed funds** because the assets in their portfolios are chosen to exactly match whatever stocks or bonds are contained in their respective underlying indexes.

Later in the chapter, we will discuss the relative merits of actively managed funds and index funds, but for now we merely point out that both types are very popular and that, overall, investors had placed about $12 trillion into mutual funds by the end of 2007. By way of comparison, U.S. GDP in 2007 was $13.8 trillion and the estimated value of all the financial assets held by households in 2007 (including everything from real estate to checking account deposits) was about $46 trillion.

CalculatingIn vestmentRe turns

Investors buy assets in order to obtain one or more future payments. The simplest case is purchasing an asset for resale. For instance, an investor may buy a house for $300,000 with the hope of selling it for $360,000 in one year. On the other hand, he could also rent out the house for $3000 per month and thereby receive a stream of future payments. And he, of course, could do a little of both, paying $300,000 for the house now in order to rent it out for five years and then sell it. In that case, he is expecting a stream of smaller payments followed by a large one.

Economists have developed a common framework for evaluating the gains or losses of assets that only make one future payment as well as those that make many future payments. They state the gain or loss as a **percentage rate of return,** by which they mean the percentage gain or loss (relative to the buying price) over a given period of time, typically a year. For instance, if a person buys a rare comic book today for $100 and sells it in 1 year for $125, she is said to make a 25 percent per year rate of return because she would divide the gain of $25 by the purchase price of $100. By contrast, if she were only able to sell it for $92, then she would be said to have made a loss of 8 percent per year since she would divide the $8 loss by the purchase price of $100.

A similar calculation is made for assets that deliver a series of payments. For instance, an investor who buys a house for $300,000 and expects to rent it out for $3000 per month would be expecting to make a 12 percent per year rate of return because he would divide his $36,000 per year in rent by the $300,000 purchase price of the house.

Asset Prices and Rates of Return

A very fundamental concept in financial economics is that *an investment's rate of return is inversely related to its price*. That is, the higher the price, the lower the rate of return.

To see why this is true, consider a house that is rented out for $2000 per month. If an investor pays $100,000 for the house, he will earn a 24 percent per year rate of return because the $24,000 in annual rent payments will be divided by the $100,000 purchase price of the house. But suppose that the purchase price of the house rises to $200,000. In that case, he would earn only a 12 percent per year rate of return since the $24,000 in annual rent payments would be divided by the much larger purchase price of $200,000. Consequently, as the price of the house goes up, the rate of return from renting it goes down.

The underlying cause of this inverse relationship is the fact that the rent payments are fixed in value so that there is an upper limit to the financial rewards of owning the house. As a result, the more an investor pays for the house, the lower his rate of return will be.

Arbitrage

Arbitrage happens when investors try to take advantage and profit from situations where two identical or nearly identical assets have different rates of return. They do so by simultaneously selling the asset with the lower rate of return and buying the asset with the higher rate of return. For instance, consider what would happen in a case where two very similar T-shirt companies start with different rates of return despite the fact that they are equally profitable and have equally good future prospects. To make things concrete, suppose that a company called T4me starts out with a rate of return of 10 percent per year while TSTG (T-Shirts to Go) starts out with a rate of return of 15 percent per year.

Since both companies are basically identical and have equally good prospects, investors in T4me will want to shift over to TSTG, which offers higher rates of return for the same amount of risk. As they begin to shift over, however, the prices of the two companies will change—and with them, the rates of return on the two companies. In particular, since so many investors will be selling the shares of the lower-return company, T4me, the supply of its shares trading on the stock market will rise so that its share price will fall. But since asset prices and rates of return are inversely related, this will cause its rate of return to rise.

At the same time, however, the rate of return on the higher-return company, TSTG, will begin to fall. This has to be the case because, as investors switch from T4me to TSTG, the increased demand for TSTG's shares will drive up their price. And as the price of TSTG goes up, its rate of return must fall.

The interesting thing is that this arbitrage process will continue—with the rate of return on the higher-return company falling and the rate of return on the lower-return company rising—until both companies have the same rate of return. This convergence must happen because as long as the rates of return on the two companies are not identical, there will always be some investors who will want to sell the shares of the lower-return company in order to buy the shares of the higher-return company. As a result, arbitrage will continue until the rates of return are equal.

What is even more impressive, however, is that generally only a very short while is needed for prices to equalize. In fact, for highly traded assets like stocks and bonds, arbitrage will often force the rates of return on identical or nearly identical investments to converge within a matter of minutes or sometimes even within a matter of seconds. This is very helpful to small investors who do not have a large amount of time to study the thousands of potential investment opportunities available in the financial markets. Thanks to arbitrage, they can invest with the confidence that assets with similar characteristics will have similar rates of return. As we discuss in the next section, this is especially important when it comes to risk—a characteristic that financial economists believe investors care about very deeply. **(Key Question 6)**

QUICK REVIEW 34.2

- Three popular forms of financial investments are stocks (ownership shares in corporations that give their owners a share in any future profits), bonds (debt contracts that promise to pay a fixed series of payments in the future), and mutual funds (pools of investor money used to buy a portfolio of stocks or bonds).
- Investment gains or losses are typically expressed as a percentage rate of return: the percentage gain or loss (relative to the investment's purchase price) over a given period of time, typically a year.
- Asset prices and percentage rates of return are inversely related.
- Arbitrage refers to the buying and selling that takes place to equalize the rates of return on identical or nearly identical assets.

Risk

Investors purchase assets in order to obtain one or more future payments. As used by financial economists, the word **risk** refers to the fact that investors never know with total certainty what those future payments will turn out to be.

The underlying problem is that the future is uncertain. Many factors affect an investment's future payments, and each of these may turn out better or worse than expected. As a simple example, consider buying a farm. Suppose that in an average year, the farm will generate a profit of $100,000. But if a freak hailstorm damages the crops, the profit will fall to only $60,000. On the other hand, if weather conditions turn out to be perfect, the profit will rise to $120,000. Since there is no way to tell in advance what will happen, investing in the farm is risky.

Also notice that when financial economists use the word *risk*, they do not use it in the normal way in which people think of risk as meaning that something bad may potentially happen (as in, "There is a risk that this experimental medicine may kill you"). Instead, the way the word risk is used in financial economics, it only means that an outcome (good or bad) lacks certainty. For instance, suppose that you are gifted a raffle ticket that will pay you either $100 or $200 when a drawing is made in one month. There are no bad outcomes in this situation, only good ones. But because you do not know with certainty which outcome you will receive, the situation is, by definition, risky.

Diversification

Investors have many options regarding their portfolios, or collections of investments. Among other things, they can choose to concentrate their wealth in just one or two investments or spread it out over a large number of investments. **Diversification** is the name given to the strategy of investing in a large number of investments in order to reduce the overall risk to the entire portfolio.

The underlying reason that diversification generally succeeds in reducing risk is best summarized by the old saying, "Don't put all your eggs in one basket." If an investor's portfolio consists of only one investment, say one stock, then if anything awful happens to that stock, the investor's entire portfolio will suffer greatly. By contrast, if the investor spreads his wealth over many stocks, then a bad outcome for any one particular stock will cause only a small amount of damage to the overall portfolio. In addition, it will typically be the case that if something bad is happening to one part of the portfolio, something good will be happening to another part of the portfolio and the two effects will tend to offset each other. Thus, the risk to the overall portfolio is reduced by diversification.

It must be stressed, however, that while diversification can reduce a portfolio's risks, it cannot eliminate them entirely. The problem is that even if an investor has placed each of his eggs into a different basket, all of the eggs may still end up broken if all of the different baskets somehow happen to get dropped simultaneously. That is, even if an investor has created a well-diversified portfolio, all of the investments still have a chance to do badly simultaneously. As an example, consider recession: With economic activity declining and consumer spending falling, nearly all companies face reduced sales and lowered profits, a fact that will cause their stock prices to decline simultaneously. Consequently, even if an investor has diversified his portfolio across many different stocks, his overall wealth is likely to decline because nearly all of his many investments will do badly simultaneously.

ORIGIN OF THE IDEA

O 34.1

Portfolio diversification

Financial economists build on the intuition behind the benefits and limits to diversification to divide an individual investment's overall risk into two components, diversifiable risk and nondiversifiable risk. **Diversifiable risk** (or "idiosyncratic risk") is the risk that is specific to a given investment and that can be eliminated by diversification. For instance, a soda pop maker faces the risk that the demand for its product may suddenly decline because people will want to drink mineral water instead of soda pop. But this risk does not matter if an investor has a diversified portfolio that contains stock in the soda pop maker as well as stock in a mineral water maker. This is true because when the stock price of the soda pop maker falls due to the change in consumer preferences, the stock price of the mineral water maker will go up—so that, as far as the overall portfolio is concerned, the two effects will offset each other.

By contrast, **nondiversifiable risk** (or "systemic risk") pushes all investments in the same direction at the same time so that there is no possibility of using good effects to offset bad effects. The best example of a nondiversifiable risk is the business cycle. If the economy does well, then corporate profits rise and nearly every stock does well. But if the economy does badly, then corporate profits fall and nearly every stock does badly. As a result, even if one were to build a well-diversified portfolio, it would still be affected by the business cycle because nearly every asset contained in the portfolio would move in the same direction at the same time whenever the economy improved or worsened.

That being said, creating a diversified portfolio is still an investor's best strategy because doing so at least eliminates diversifiable risk. Indeed, it should be emphasized that for investors who have created diversified portfolios, all diversifiable risks will be eliminated, so that the only remaining source of risk will be nondiversifiable risk.

An extremely important implication of this fact is that when an investor considers whether to add any particular investment to a portfolio that is already diversified, she can ignore the investment's diversifiable risk. She can ignore it because, as part of a diversified portfolio, the investment's diversifiable risk will be "diversified away." Indeed, the only risk left will be the amount of nondiversifiable risk that the investment carries with it. This is very important because it means that she can base her decision about whether to add a potential new investment to her portfolio on a comparison between the potential investment's level of nondiversifiable risk and its potential returns. If she finds this trade-off attractive, she will add the investment, whereas if it seems unattractive, she will not.

The next section shows how investors can measure each asset's level of nondiversifiable risk as well as its potential returns to facilitate such comparisons. **(Key Question 8)**

ComparingRi skyIn vestments

Economists believe that the two most important factors affecting investment decisions are returns and risk—specifically nondiversifiable risk. But for investors to properly compare different investments on the basis of returns and risk, they need ways to measure returns and risk. The two standard measures are, respectively, the average expected rate of return and the beta statistic.

Average Expected Rate of Return

Each investment's **average expected rate of return** is the probability weighted average of the investment's possible future rates of return. The term **probability weighted average** simply means that each of the possible future rates of return is multiplied by its probability expressed as a decimal (so that a 50 percent probability is .5 and a 23 percent probability is .23) before being added together to obtain the average. For instance, if an investment has a 75 percent probability of generating 11 percent per year and a 25 percent probability of generating 15 percent per year, then its average expected rate of return will be 12 percent = (.75 × 11 percent) + (.25 × 15 percent). By weighting each possible outcome by its probability, this process ensures that the resulting average gives more weight to those outcomes that are more likely to happen (unlike the normal averaging process that would treat every outcome the same).

Once investors have calculated the average expected rates of return for all the assets they are interested in, there will naturally be some impulse to simply invest in those assets having the highest average expected rates of return. But while this might satisfy investor cravings for higher rates of return, it would not take proper account of the fact that investors dislike risk and uncertainty. To quantify their dislike, investors require a statistic that can measure each investment's risk level.

Beta

One popular statistic that measures risk is called beta. **Beta** is a *relative* measure of nondiversifiable risk. It measures how the nondiversifiable risk of a given asset or portfolio of assets compares with that of the **market portfolio,** which is the name given to a portfolio that contains every asset available in the financial markets. The market portfolio is a useful standard of comparison because it is as diversified as possible. In fact, since it contains every possible asset, every possible diversifiable risk will be diversified away—meaning that it will be exposed *only* to nondiversifiable risk. Consequently, it can serve as a useful benchmark against which to measure the levels of nondiversifiable risk to which individual assets are exposed.

Such comparisons are very simple because the beta statistic is standardized such that the market portfolio's level of nondiversifiable risk is set equal to 1.0. Consequently, an asset with beta = .5 has a level of nondiversifiable risk that is one-half of that possessed by the market portfolio, while an asset with beta = 2.0 has twice as much nondiversifiable risk as the market portfolio. In addition, the beta numbers of various assets also can be used to compare them with each other. For instance, an asset with beta = 2.0 has four times as much exposure to nondiversifiable risk as does an asset with beta = .5.

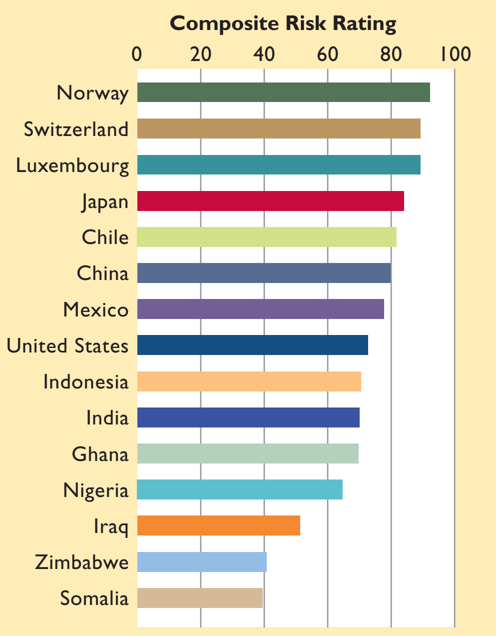
Another useful feature of beta is that it can be calculated not only for individual assets but also for portfolios. Indeed, it can be calculated for portfolios no matter how many or how few assets they contain and no matter what those assets happen to be. This fact is very convenient for mutual fund investors because it means that they can use beta to quickly see how the nondiversifiable risk of any given fund's portfolio compares with that of other potential investments that they may be considering.

The beta statistic is used along with average expected rates of return to give investors standard measures of risk and return that can be used to sensibly compare different investment opportunities. As we will discuss in the next section, this leads to one of the most fundamental relationships in financial economics: riskier assets have higher rates of return.

GLOBAL PERSPECTIVE 34.1

Investment Risks Vary across Different Countries

The International Country Risk Guide is a monthly publication that attempts to distill the political, economic, and financial risks facing 140 countries into a single "composite risk rating" number for each country, with higher numbers indicating less risk and more safety. The table below presents the January 2008 ranks and rating numbers for 15 countries including the three least risky (ranked 1 through 3) and the three most risky (ranked 138 through 140.) Ratings numbers above 80 are considered *very low risk;* 70–80 are considered *low risk; 60–70 moderate risk;* 50–60 *high risk;* and below 50 *very high risk.*



Source: *The International Country Risk Guide,* January 2008. Published by the PRS (Political Risk Survey) Group, Inc. **www.prsgroup.com/icrg/icrg.html.** Used by permission of the PRS Group, Inc.

Relationship of Risk and Average Expected Rates of Return

The fact that investors dislike risk has a profound effect on asset prices and average expected rates of return. In particular, their dislike of risk and uncertainty causes investors to pay higher prices for less-risky assets and lower prices for more-risky assets. But since asset prices and average expected rates of return are inversely related, this implies that less risky assets will have lower average expected rates of return than more risky assets.

Stated a bit more clearly: *Risk levels and average expected rates of return are positively related*. The more risky an investment is, the higher its average expected rate of return will be. A great way to understand this relationship is to think of higher average expected rates of return as being a form of compensation. Since investors dislike risk, they demand higher levels of compensation the more risky an asset is. The higher levels of compensation come in the form of higher average expected rates of return.

Be sure to note that this phenomenon affects all assets. Regardless of whether the assets are stocks or bonds or real estate or anything else, assets with higher levels of risk always end up with higher average expected rates of return to compensate investors for the higher levels of risk involved. No matter what the investment opportunity is, investors examine its possible future payments, determine how risky they are, and then select a price that reflects those risks. Since less-risky investments get higher prices, they end up with lower rates of return, whereas more-risky investments end up with lower prices and, consequently, higher rates of return. **(Key Question 9)**

The Risk-Free Rate of Return

We have just shown that there is a positive relationship between risk and returns, with higher returns serving to compensate investors for higher levels of risk. One investment, however, is considered to be risk-free for all intents and purposes. That investment is short-term U.S. government bonds.

These bonds are short-term loans to the U.S. government, with the duration of the loans ranging from 4 weeks to 26 weeks. They are considered to be essentially risk-free because there is almost no chance that the U.S. government will not be able to repay these loans on time and in full. Although it is true that the U.S. government may eventually be destroyed or disabled to such an extent that it will not be able to repay some of its loans, the chances of such a calamity happening within 4 or even 26 weeks are essentially zero. Consequently, because it is a near certainty that the bonds will be repaid in full and on time, they are considered by investors to be risk-free.

Since higher levels of risk lead to higher rates of return, a person might be tempted to assume—incorrectly—that since government bonds are risk-free, they should earn a zero percent rate of return. The problem with this line of thinking is that it mistakenly assumes that risk is the *only* thing that rates of return compensate for. The truth is that rates of return compensate not only for risk but also for something that economists call time preference.

Time preference refers to the fact that because people tend to be impatient, they typically prefer to consume things in the present rather than in the future. Stated more concretely, most people, if given the choice between a serving of their favorite dessert immediately or a serving of their favorite dessert in five years, will choose to consume their favorite dessert immediately.

This time preference for consuming sooner rather than later affects the financial markets because people want to be compensated for delayed consumption. In particular, if Dave asks Oprah to lend him $1 million for one year, he is implicitly asking Oprah to delay consumption for a year because if she lends Dave the $1 million, she will not be able to spend that money herself for at least a year. If Oprah is like most people and has a preference for spending her $1 million sooner rather than later, the only way Dave will be able to convince Oprah to let him borrow $1 million is to offer her some form of compensation. The compensation comes in the form of an interest payment that will allow Oprah to consume more in the future than she can now. For instance, Dave can offer to pay Oprah $1.1 million in one year in exchange for $1 million today. That is, Oprah will get back the $1 million she lends to Dave today as well as an extra $100,000 to compensate her for being patient.

Notice the very important fact that this type of interest payment has nothing to do with risk. It is purely compensation for being patient and must be paid even if there is no risk involved and 100 percent certainty that Dave will fulfill his promise to repay.

Since short-term U.S. government bonds are for all intents and purposes completely risk-free and 100 percent likely to repay as promised, their rates of return are *purely* compensation for time preference and the fact that people must be compensated for delaying their own consumption opportunities when they lend money to the government. One consequence of this fact is that the rate of return earned by short-term U.S. government bonds is often referred to as the **risk-free interest rate,** or i^f, to clearly indicate that the rate of return that they generate is not in any way a compensation for risk.

It should be kept in mind, however, that the Federal Reserve has the power to change the risk-free interest rate generated by short-term U.S. government bonds. As discussed in Chapter 33, the Federal Reserve can raise or lower the interest rate earned by government bonds by making large purchases or sales of bonds in the bond markets—an activity referred to as open-market operations. This means that the Federal Reserve determines the risk-free interest rate and, consequently, the compensation that investors receive for being patient. As we will soon demonstrate, this fact is very important because by manipulating the reward for being patient, the Federal Reserve can affect the rate of return and prices of not only government bonds but all assets.

The Security Market Line

Investors must be compensated for time preference as well as for the amount of nondiversifiable risk that an investment carries with it. This section introduces a simple model called the **Security Market Line,** which indicates how this compensation is determined for all assets no matter what their respective risk levels happen to be.

The underlying logic of the model is this: Any investment's average expected rate of return has to be the sum of two parts—one that compensates for time preference and another that compensates for risk. That is,

$$\text{Average expected rate of return} = \text{rate that compensates for time preference} + \text{rate that compensates for risk}$$

As we explained, the compensation for time preference is equal to the risk-free interest rate, i^f, that is paid on government bonds. As a result, this equation can be simplified to

$$\text{Average expected rate of return} = i^f + \text{rate that compensates for risk}$$

Finally, because economists typically refer to the rate that compensates for risk as the **risk premium,** this equation can be simplified even further to

$$\text{Average expected rate of return} = i^f + \text{risk premium}$$

Naturally, the size of the risk premium that compensates for risk will vary depending on how risky an investment happens to be. In particular, it will depend on how

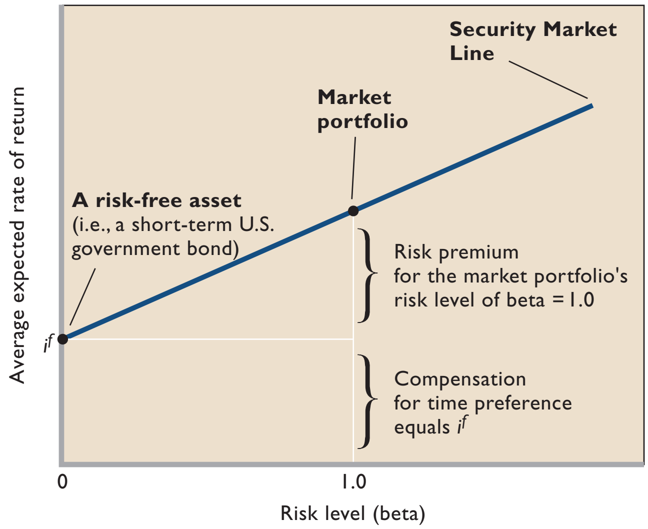


FIGURE 34.1 The Security Market Line. The Security Market Line shows the relationship between average expected rates of return and risk levels that must hold for every asset or portfolio trading in the financial markets. Each investment's average expected rate of return is the sum of the risk-free interest rate that compensates for time preference as well as a risk premium that compensates for the investment's level of risk. The Security Market Line's upward slope reflects the fact that investors must be compensated for higher levels of risk with higher average expected rates of return.

big or small the investment's beta is. Investments with large betas and lots of nondiversifiable risk will obviously require larger risk premiums than investments that have small betas and low levels of nondiversifiable risk. And, in the most extreme case, risk-free assets that have betas equal to zero will require no compensation for risk at all since they obviously have no risk to compensate for.

This logic is translated into the graph presented in Figure 34.1. The horizontal axis of Figure 34.1 measures risk levels using beta; the vertical axis measures average expected rates of return. As a result, any investment can be plotted on Figure 34.1 just as long as we know its beta and its average expected rate of return. We have plotted two investments in Figure 34.1. The first is a risk-free short-term U.S. government bond, which is indicated by the lower-left dot in the figure. The second is the market portfolio, which is indicated by the upper-right dot in the figure.

The lower dot marking the position of the risk-free bond is located where it is because it is a risk-free asset having a beta = 0 and because its average expected rate of return is given by i^f. These values place the lower dot i^f percentage points up the vertical axis, as shown in Figure 34.1. Note that this location conveys the logic that because this asset has no risk, its average expected rate of return only has to compensate investors for time preference—which is why its average expected rate of return is equal to precisely i^f and no more.

The market portfolio, by contrast, is risky so that its average expected rate of return must compensate investors not only for time preference but also for the level of risk to which the market portfolio is exposed, which by definition is beta = 1.0. This implies that the vertical distance from the horizontal axis to the upper dot is equal to the sum of i^f and the market portfolio's risk premium.

The straight line connecting the risk-free asset's lower dot and the market portfolio's upper dot is called the Security Market Line, or SML. The SML is extremely important because it defines the relationship between average expected rates of return and risk levels that must hold for all assets and all portfolios trading in the financial markets. The SML illustrates the idea that every asset's average expected rate of return is the sum of a rate of return that compensates for time preference and a rate of return that compensates for risk. More specifically, the SML has a vertical intercept equal to the rate of interest earned by short-term U.S. government bonds and a positive slope that compensates investors for risk.

As we explained earlier, the precise location of the intercept at any given time is determined by the Federal Reserve's monetary policy and how it affects the rate of return on short-term U.S. government bonds. The slope of the SML, however, is determined by investors' feelings about risk and how much compensation they require for dealing with it. If investors greatly dislike risk, then the SML will have to be very steep, so that any given increase in risk on the horizontal axis will result in a very large increase in compensation as measured by average expected rates of return on the vertical axis. On the other hand, if investors dislike risk only moderately, then the SML will be relatively flat since any given increase in risk on the horizontal axis would require only a moderate increase in compensation as measured by average expected rates of return on the vertical axis.

It is important to realize that once investor preferences about risk have determined the slope of the SML

FIGURE 34.2 Risk levels determine average expected rates of return. The Security Market Line can be used to determine an investment's average expected rate of return based on its risk level. In this figure, investments having a risk level of beta = *X* will have an average expected rate of return of *Y* percent per year. This average expected rate of return will compensate investors for time preference in addition to providing them exactly the right sized risk premium to compensate them for dealing with a risk level of beta = *X*.

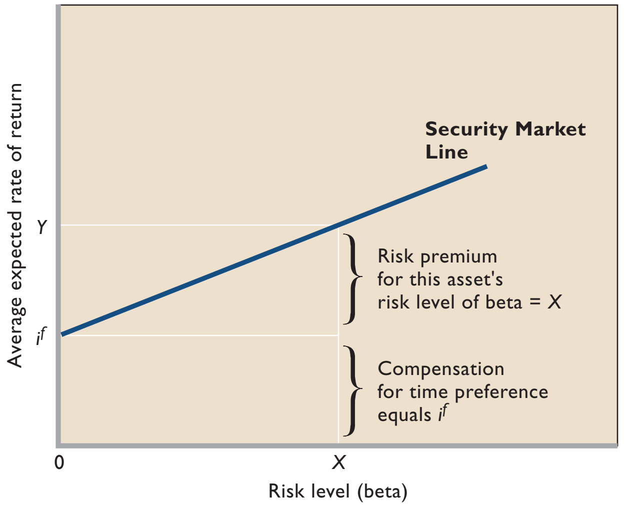
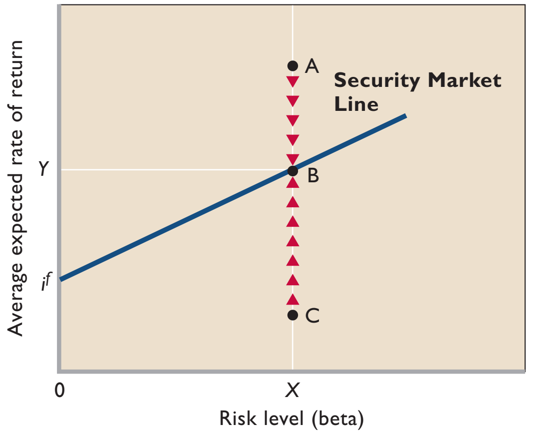


FIGURE 34.3 Arbitrage and the Security Market Line. Arbitrage pressures will tend to move any asset or portfolio that lies off of the Security Market Line back onto the Security Market Line. For instance, asset A has an average expected rate of return that exceeds the average expected rate of return *Y* that the Security Market Line tells us is necessary to compensate investors for time preference and for dealing with risk level beta = *X*. As a result, asset A will become very popular and many investors will rush to buy it. This will drive its price up and (because prices and average expected rates of return are inversely related) drive its average expected rate of return down. Arbitrage will continue to happen until point A moves vertically down onto the SML. Arbitrage also will cause asset C, whose average expected rate of return is too low, to move up vertically onto the Security Market Line because as investors begin to sell asset C (because its average expected rate of return is too low), its price will fall, thereby raising its average expected rate of return.



and monetary policy has determined its vertical intercept, the SML plots out the precise relationship between risk levels and average expected rates of return *that should hold for every asset*. For instance, consider Figure 34.2, where there is an asset whose risk level on the horizontal axis is beta = *X*. The SML tells us that every asset with that risk level should have an average expected rate of return equal to *Y* on the vertical axis. This average expected rate of return exactly compensates for both time preference and the fact that the asset in question is exposed to a risk level of beta = *X*.

Finally, it should be pointed out that arbitrage will ensure that all investments having an identical level of risk also will have an identical rate of return—the return given by the SML. This is illustrated in Figure 34.3, where the three assets A, B, and C all share the same risk level of beta = *X* but initially have three different average expected rates of return. Since asset B lies on the SML, it has the average expected rate of return *Y* that precisely compensates investors for time preference and risk level *X*. Asset A, however, has a higher average expected rate of return that overcompensates investors while asset C has a lower average expected rate of return that undercompensates investors.

Arbitrage pressures will quickly eliminate these over- and undercompensations. For instance, consider what will happen to asset A. Investors will be hugely attracted to its overly high rate of return and will rush to buy it. That will drive up its price. But because average expected rates of return and prices are inversely related, the increase in price will cause its average expected rate of return to fall. Graphically, this means that asset A will move vertically downward as illustrated in Figure 34.3. And it will continue to move vertically downward until it reaches the SML since only then will it have the average expected rate of return *Y* that properly compensates investors for time preference and risk level *X*.

A similar process also will move asset C back to the SML. Investors will dislike the fact that its average expected rate of return is so low. This will cause them to sell it, driving down its price. Since average expected rates of return and prices are inversely related, this will cause its average expected rate of return to rise, thereby causing C to rise vertically as illustrated in Figure 34.3. And as with point A, point C will continue to rise until it reaches the SML, since only then will it have the average expected rate of return *Y* that properly compensates investors for time preference and risk level *X*. **(Key Question 11)**

CONSIDER THIS . . .

Does Ethical Investing Increase Returns?

In the last 10 years, ethical investment funds have become very popular. These mutual funds invest only in companies and projects that are consistent with the social and moral preferences of their investors. For instance, some of them avoid investing in tobacco companies or oil companies, while others seek to invest all of their money into companies seeking alternative energy sources or companies that promise not to employ child labor in their factories. Some ethical investment funds deliver average rates of return that are better than those generated by ordinary funds that do not select their investments on the basis of ethical or moral criteria. This has led some people to conclude that "doing good leads to doing well."

However, this analysis fails to take into account the fact that riskier investments generate higher rates of return. Indeed, a closer analysis shows that the higher returns generated by many ethical funds appear to be the result of their investing in riskier companies. So while there may be excellent moral reasons for investing in ethical funds, ethical investing, by itself, does not appear to generate higher returns.

In fact, it is even possible to imagine a situation in which ethical investing could generate *lower* rates of return. Because of the inverse relationship between asset prices and average expected rates of return, if investors preferred ethical companies, they would drive up their prices and thereby lower their rates of return relative to other companies. If that were to happen, then ethical investors might just have to seek solace in the proverb that states that "doing good is its own reward."

AnIn creasei nt he Risk-Free Rate

We have just explained how the position of the Security Market Line is fixed by two factors. The vertical intercept is set by the risk-free interest rate while the slope is determined by the amount of compensation investors demand for bearing nondiversifiable risk. As a result, changes in either one of these factors can shift the SML and thereby cause large changes in both average expected rates of return and asset prices.

As an example, consider what happens to the SML if the Federal Reserve changes policy and uses open-market operations (described in Chapter 33) to raise the interest rates of short-term U.S. government bonds. Since the risk-free interest rate earned by these bonds is also the SML's vertical intercept, an increase in their interest rate will cause the SML's vertical intercept to shift upward, as illustrated in Figure 34.4. This, in turn, causes a parallel upward shift of the SML from SML_1 to SML_2. (The shift is parallel because nothing has happened that would affect the SML's slope, which is determined by the amount of compensation that investors demand for bearing risk.)

Notice what this upward shift implies. Not only does the rate of return on short-term U.S. government bonds increase when the Federal Reserve changes policy, but the rate of return on risky assets increases as well. For instance, consider asset A, which originally has rate of return Y_1. After the SML shifts upward, asset A ends up with the higher rate of return Y_2. There is a simple intuition behind this increase. Risky assets must compete with risk-free assets for investor money. When the Federal Reserve increases the rate of return on risk-free short-term U.S. government bonds, they become more attractive to investors. But to get the money to

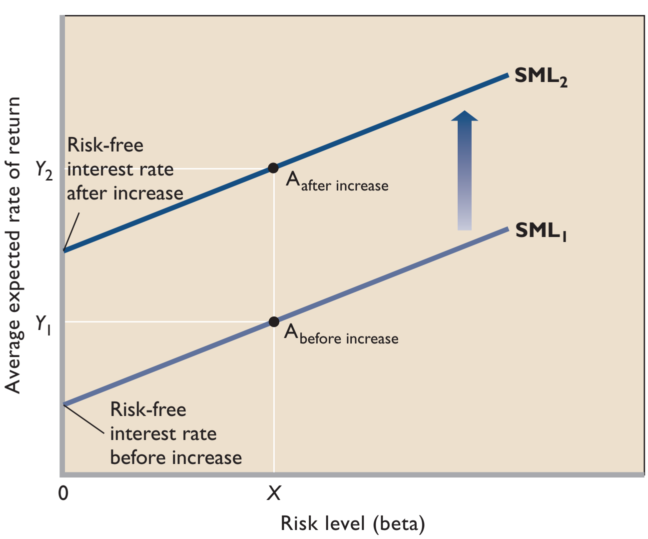


FIGURE 34.4 An increase in risk-free interest rates causes the SML to shift up vertically. The risk-free interest rate set by the Federal Reserve is the Security Market Line's vertical intercept. Consequently, if the Federal Reserve increases the risk-free interest rate, the Security Market Line's vertical intercept will move up. This rise in the risk-free interest rate will result in a decline in all asset prices and thus an increase in the average expected rate of return on all assets. So the Security Market Line will shift up parallel from SML_1 to SML_2. Here, asset A with risk level beta = X sees its average expected rate of return rise from Y_1 to Y_2.

LAST Word

Why Do Index Funds Beat Actively Managed Funds?

Mutual fund investors have a choice between putting their money into actively managed mutual funds or into passively managed index funds. Actively managed funds constantly buy and sell assets in an attempt to build portfolios that will generate average expected rates of return that are higher than those of other portfolios possessing a similar level of risk. In terms of Figure 34.3, they try to construct portfolios similar to point A, which has the same level of risk as portfolio B but a much higher average expected rate of return. By contrast, the portfolios of index funds simply mimic the assets that are included in their underlying indexes and make no attempt whatsoever to generate higher returns than other portfolios having similar levels of risk.

As a result, expecting actively managed funds to generate higher rates of return than index funds would seem only natural. Surprisingly, however, the exact opposite actually holds true. Once costs are taken into account, the average returns generated by index funds trounce those generated by actively managed funds by well over 1 percent per year. Now, 1 percent per year may not sound like a lot, but the compound interest formula of equation 1 shows that $10,000 growing for 30 years at 10 percent per year becomes $170,449.40, whereas that same amount of money growing at 11 percent for 30 years becomes $220,892.30. For anyone saving for retirement, an extra 1 percent per year is a very big deal.

Why do actively managed funds do so much worse than index funds? The answer is twofold. First, arbitrage makes it virtually impossible for actively managed funds to select portfolios that will do any better than index funds that have similar levels of risk. As a result, *before taking costs into account*, actively managed funds and index funds produce very similar returns. Second, actively managed funds charge their investors much higher fees than do passively managed funds, so that, *after taking costs into account*, actively managed funds do worse by about 1 percent per year.

Let us discuss each of these factors in more detail. The reason that actively managed funds cannot do better than index funds before taking costs into account has to do with the power of arbitrage to ensure that investments having equal levels of risk also have equal average expected rates of return. As we explained above with respect to Figure 34.3, assets and portfolios that deviate from the SML are very quickly forced back onto the SML by arbitrage, so that assets and portfolios with equal levels of risk have equal average expected rates of return. This implies that index funds and actively managed funds with equal levels of risk will end up with identical average expected rates of return despite the best efforts of actively managed funds to produce superior returns.

The reason actively managed funds charge much higher fees than index funds is because they run up much higher costs while trying to produce superior returns. Not only do they have to pay large salaries to professional fund managers; they also have to pay for the massive amounts of trading that those managers engage in as they buy and sell assets in their quest to produce superior returns. The costs of running an index fund are, by contrast, very small since changes are made to an index fund's portfolio only on the rare occasions when the fund's underlying index changes. As a result, trading costs are low and there is no need to pay for a professional manager. The overall result is that while the largest and most popular index fund currently charges its investors only .18 percent per year for its services, the typical actively managed fund charges more than 1.5 percent per year.

So why are actively managed funds still in business? The answer may well be that index funds are boring. Because they are set up to mimic indexes that are in turn designed to show what average performance levels are, index funds are by definition stuck with average rates of return and absolutely no chance to exceed average rates of return. For investors who want to try to beat the average, actively managed funds are the only way to go.

buy more risk-free bonds, investors have to sell risky assets. This drives down their prices and—because prices and average expected rates of return are inversely related—causes their average expected rates of return to increase. The result is that asset A moves up vertically in Figure 34.4, its average expected rate of return increasing from Y_1 to Y_2 as investors reallocate their wealth from risky assets like asset A to risk-free bonds.

This process explains why investors are so sensitive to Federal Reserve policies. Any increase in the risk-free interest rate leads to a decrease in asset prices that directly reduces investors' wealth. This reduction obviously hurts investors personally but it also may have broader implications. As was pointed out in Chapter 29, the reduction of wealth caused by falling asset prices may lead to a reverse wealth effect, the result of which could be less spending by consumers. Thus, increases in interest rates matter greatly for the economy as a whole. They not only tend to cause direct reductions in investment spending and interest-sensitive consumption spending (the main intent of restrictive monetary policy), but they also may reduce aggregate demand indirectly through their impact on asset prices.

The underlying reason that the Federal Reserve has so much power to manipulate asset prices by shifting the SML is because the SML defines all of the investment options available in the financial markets. As we pointed out previously, arbitrage will force every investment to lie on the SML. This means that when investors think about investing their limited wealth, all of their options will lie on the SML and they will be forced to select a portfolio that best suits their personal preferences about risk and returns from the limited options defined by the SML. The Federal Reserve's power to change asset prices stems entirely from the fact that when it shifts the SML, it totally redefines the investment opportunities available in the economy. As the set of options changes, investors modify their portfolios in order to obtain the best possible combination of risk and returns from the new set of investment options. In doing so, they engage in massive amounts of buying and selling in order to get rid of assets they no longer want and acquire assets that they now desire. These massive changes in supply and demand for financial assets are what cause their prices to change so drastically when the Federal Reserve alters the risk-free interest rate.

Summary

1. The compound interest formula shows how quickly a given amount of money will grow if interest is paid not only on the amount initially invested but also on any interest payments previously paid. It states that if X dollars is invested today at interest rate i and allowed to grow for t years, it will become $(1 + i)^t X$ dollars in t years.
2. The present value model rearranges the compound interest formula to make it easy to determine the present value (that is, the current number of dollars) that you would have to invest today in order to receive X dollars in t years. The present value formula says that you would have to invest $X/(1 + i)^t$ dollars today at interest rate i in order for it to grow into X dollars in t years.
3. An extremely wide variety of financial assets is available to investors, but it is possible to study them all under a unified framework because they have a common characteristic: In exchange for a certain price today they all promise to make one or more payments in the future. A risk-free investment's proper current price is simply equal to the sum of the present values of each of the investment's expected future payments.
4. The three most popular investments are stocks, bonds, and mutual funds. Stocks are ownership shares in corporations. They have value because they give shareholders the right to share in any future profits that the corporations may generate. Their primary risk is that future profits are unpredictable and that companies may go bankrupt. Bonds are a type of loan contract. They are valuable because they give bondholders the right to receive a fixed stream of future payments that serve to repay the loan. They are risky because of the possibility that the corporations or government bodies that issued the bonds may default on them, or not make the promised payments. Mutual funds are investment companies that pool the money of many investors in order to buy a portfolio (or collection) of assets. They are valuable to investors because any returns generated by that portfolio belong to fund investors. Their risks reflect the risks of the stocks and bonds that they hold in their portfolios. Some funds are actively managed, with portfolio managers constantly trying to buy and sell stocks to maximize returns, whereas others are passively managed index funds whose portfolios are determined by the indexes that they mimic.
5. Investors evaluate the possible future returns to risky projects using average expected rates of return, which give higher weight to outcomes that are more likely to happen.
6. Average expected rates of return are inversely related to an asset's current price. When the price goes up, the average expected rate of return goes down.

7. Arbitrage is the process whereby investors equalize the average expected rates of return generated by identical or nearly identical assets. If two identical assets have different rates of return, investors will sell the asset with the lower rate of return in order to buy the asset with the higher rate of return. Because average expected rates of return are inversely related to asset prices, this will cause the rates of return to converge: As investors buy the asset with the higher rate of return, its price will be driven up, causing its average expected rate of return to fall. At the same time, as investors sell the asset with the lower rate of return, its price will fall, causing its average expected rate of return to rise. The process will continue until the two assets have equal average expected rates of return.
8. In finance, an asset is risky if its future payments are uncertain. Under this definition of risk, what matters is not whether the payments are big or small, positive or negative, or good or bad—only that they are not guaranteed ahead of time.
9. Diversification is an investment strategy that seeks to reduce the overall risk facing an investment portfolio by selecting a group of assets whose risks offset—so that when bad things are happening to some of the assets, good things are happening to others. Risks that can be canceled out by diversification are called diversifiable risks. Risks that cannot be canceled out by diversification are called nondiversifiable risks. Nondiversifiable risks include things like recessions, which affect all investments in the same direction simultaneously so that selecting assets that offset each other is not possible.
10. Beta is a statistic that measures the nondiversifiable risk of an asset or portfolio relative to the amount of nondiversifiable risk facing the market portfolio. By definition, the market portfolio has a beta of 1.0, so that if an asset has a beta of 0.5, it has half as much nondiversifiable risk as the market portfolio. Since the market portfolio is the portfolio that contains every asset trading in the financial markets, it is as diversified as possible and consequently has eliminated all of its diversifiable risk—meaning that the only risk to which it is exposed is nondiversifiable risk. Consequently, it is the perfect standard against which to measure levels of nondiversifiable risk.
11. Because investors dislike risk, they demand compensation for bearing risk. The compensation comes in the form of higher average expected rates of return. The riskier the asset, the higher its average expected rate of return will be. Notice, however, that we always assume that an asset is part of a well-diversified portfolio—meaning that all of its diversifiable risk has been eliminated. As a result, investors will need to be compensated only for the asset's level of nondiversifiable risk as measured by beta.
12. Average expected rates of return also must compensate for time preference and the fact that, all other things being equal, most people prefer to consume sooner rather than later. Consequently, an asset's average expected rate of return will be the sum of the rate of return that compensates for time preference plus the rate of return that compensates for the asset's level of nondiversifiable risk as measured by beta. Note that because all investment activities involve delaying consumption, the rate of return that compensates for time preference will be the same for all assets regardless of how risky they are.
13. The rate of return that compensates for time preference is assumed to be equal to the rate of interest generated by short-term U.S. government bonds. This is true because these bonds are considered to be risk-free, meaning that their rate of return must be purely compensation for time preference since they have no risk to compensate for. Indeed, the interest rate that these bonds generate is often called the risk-free interest rate, partly to remind people that the bonds are risk-free and partly to remind them that, because they are risk-free, their interest rate must be solely to compensate for time preference. The Federal Reserve has the power to manipulate this interest rate and thereby affect what the economywide compensation for time preference will be.
14. The Security Market Line (SML) is a straight line that plots how the average expected rates of return on assets and portfolios in the economy must vary with their respective levels of nondiversifiable risk as measured by beta. Arbitrage ensures that every asset in the economy should plot onto the SML. The slope of the SML indicates how much investors dislike risk. If investors greatly dislike risk, then the SML will be very steep, indicating that investors demand a great amount of compensation in terms of higher average expected rates of return for bearing increasingly large amounts of nondiversifiable risk. If investors are more comfortable with risk, then the SML will be flatter, indicating that that they require only moderately higher average expected rates of return to compensate them for higher levels of nondiversifiable risk.
15. The SML takes account of time preference and the fact that investors must be compensated for delaying consumption. Since the compensation for time preference is the risk-free interest rate on short-term U.S. government bonds, which is controlled by the Federal Reserve, the Federal Reserve can shift the entire SML by changing risk-free interest rates and the compensation for time preference that must be paid to investors in all assets regardless of their risk level. When the SML shifts, the average expected rate of return on all assets changes. This is very important because, since average expected rates of return are inversely related to asset prices, the shift in the SML also will change asset prices. Consequently, the Federal Reserve's power to shift short-run interest rates also gives it the power to shift asset prices throughout the economy.

Terms and Concepts

economic investment
financial investment
compound interest
present value
stocks
bankrupt
limited liability rule
capital gains
dividends
bonds
default
mutual funds
portfolios
index funds
actively managed funds
passively managed funds
percentage rate of return
arbitrage
risk
diversification
diversifiable risk
nondiversifiable risk
average expected rate of return
probability weighted average
beta
market portfolio
time preference
risk-free interest rate
Security Market Line
risk premium

Study Questions

1. Suppose that the city of New York issues bonds to raise money to pay for a new tunnel linking New Jersey and Manhattan. An investor named Susan buys one of the bonds on the same day that the city of New York pays a contractor for completing the first stage of construction. Is Susan making an economic or a financial investment? What about the city of New York? **LO1**
2. Suppose that a risk-free investment will make three future payments of $100 in one year, $100 in two years, and $100 in three years. If the Federal Reserve has set the risk-free interest rate at 8 percent, what is the proper current price of this investment? What if the Federal Reserve raises the risk-free interest rate to 10 percent? **LO1**
3. How do stocks and bonds differ in terms of the future payments that they are expected to make? Which type of investment (stocks or bonds) is considered to be more risky? Given what you know, which investment (stocks or bonds) do you think commonly goes by the nickname "fixed income"? **LO2**
4. Mutual funds are very popular. What do they do? What different types of mutual funds are there? And why do you think they are so popular with investors? **LO2**
5. Consider an asset that costs $120 today. You are going to hold it for 1 year and then sell it. Suppose that there is a 25 percent chance that it will be worth $100 in a year, a 25 percent chance that it will be worth $115 in a year, and a 50 percent chance that it will be worth $140 in a year. What is its average expected rate of return? Next, figure out what the investment's average expected rate of return would be if its current price were $130 today. Does the increase in the current price increase or decrease the asset's average expected rate of return? At what price would the asset have a zero rate of return? **LO3**
6. **KEY QUESTION** Corporations often distribute profits to their shareholders in the form of dividends, which are simply checks mailed out to shareholders. Suppose that you have the chance to buy a share in a fashion company called Rogue Designs for $35 and that the company will pay dividends of $2 per year on that share every year. What is the annual percentage rate of return? Next, suppose that you and other investors could get a 12 percent per year rate of return by owning the stocks of other very similar fashion companies. If investors care only about rates of return, what should happen to the share price of Rogue Designs? (Hint: This is an arbitrage situation.) **LO3**
7. This question will compare two different arbitrage situations. Recall that arbitrage should equalize rates of return. We want to explore what this implies about equalizing prices. In the first situation, two assets, A and B, will each make a single guaranteed payment of $100 in 1 year. But asset A has a current price of $80 while asset B has a current price of $90. **LO3**
   - **a.** Which asset has the higher expected rate of return at current prices? Given their rates of return, which asset should investors be buying and which asset should they be selling?
   - **b.** Assume that arbitrage continues until A and B have the same expected rate of return. When arbitrage ceases, will A and B have the same price?

   Next, consider another pair of assets, C and D. Asset C will make a single payment of $150 in one year while D will make a single payment of $200 in one year. Assume that the current price of C is $120 and that the current price of D is $180.
   - **c.** Which asset has the higher expected rate of return at current prices? Given their rates of return, which asset should investors be buying and which asset should they be selling?
   - **d.** Assume that arbitrage continues until C and D have the same expected rate of return. When arbitrage ceases, will C and D have the same price?

   Compare your answers to questions *a* through *d* before answering question *e*.

e. We know that arbitrage will equalize rates of return. Does it also guarantee to equalize prices? In what situations will it also equalize prices?

8. **KEY QUESTION** Why is it reasonable to ignore diversifiable risk and care only about nondiversifiable risk? What about an investor who puts all of his money into only a single risky stock? Can he properly ignore diversifiable risk? **LO4**

9. **KEY QUESTION** If we compare the betas of various investment opportunities, why do the assets that have higher betas also have higher average expected rates of return? **LO5**

10. In this chapter we discussed short-term U.S. government bonds. But the U.S. government also issues longer-term bonds with horizons of up to 30 years. Why do 20-year bonds issued by the U.S. government have lower rates of return than 20-year bonds issued by corporations? And which would you consider more likely, that longer-term U.S. government bonds have a higher interest rate than short-term U.S. government bonds, or vice versa? Explain. **LO5**

11. **KEY QUESTION** Consider the Security Market Line (SML). What determines its vertical intercept? What determines its slope? And what will happen to an asset's price if it initially plots onto a point above the SML? **LO3**

12. Suppose that the Federal Reserve wants to increase stock prices. What should it do to interest rates? **LO3**

13. Consider another situation involving the SML. Suppose that the risk-free interest rate stays the same, but that investors' dislike of risk grows more intense. Given this change, will average expected rates of return rise or fall? Next, compare what will happen to the rates of return on low-risk and high-risk investments. Which will have a larger increase in average expected rates of return, investments with high betas or investments with low betas? And will high-beta or low-beta investments show larger percentage changes in their prices? **LO5**

14. **LAST WORD** Why is it so hard for actively managed funds to generate higher rates of return than passively managed index funds having similar levels of risk? Is there a simple way for an actively managed fund to increase its average expected rate of return?

Web-Based Questions

1. **CALCULATING PRESENT VALUES USING CURRENT INTEREST RATES** To see the current interest rates ("yields") on bonds issued by the U.S. government, please go to **www.bloomberg.com/markets/rates/index.html** and scroll down to the section labeled U.S. Treasuries. By tradition, U.S. government bonds with maturities of less than 1 year are called bills, while those with longer maturities are referred to as either notes or bonds. The notes have maturities of 1 to 10 years, while the bonds have maturities exceeding 10 years. What are the current yields on 2-year notes and 30-year bonds? Use the current yield for the 2-year note to calculate the present value of an investment that will make a single payment of $95,000 in 2 years. Use the current yield on the 30-year bond to calculate the present value of an investment that will make a single payment of $95,000 in 30 years. To assist your computations, you can try out the present value calculator available at **www.timevalue.com/tools.html.** (When you go to that page, click on the Investment Calculators menu and then select "What is my future value worth today?" That will get you to the present value calculator.) Why the large difference in present values in the two situations?

2. **EVALUATING THE RISK LEVELS OF TOP MUTUAL FUNDS** The Security Market Line tells us that assets and portfolios that deliver high average expected rates of return should also have high levels of risk as measured by beta. Let us see if this appears to hold true for mutual fund portfolios. Go to the Mutual Fund Center at Yahoo Finance at **http://finance.yahoo.com/funds,** click on Top Performers, and then click on Overall Top Performers. This will give you lists of funds with the 10 best rates of return over various time periods. Click on each of the 10 funds listed under Top Performers—1 Year and find each fund's beta by clicking on the link labeled Risk. Do any of the funds have a beta less than 1.0? Do these results make sense given what you have learned? Should you be impressed that funds with risky portfolios generate high returns?