

# 12

## SOME LESSONS FROM CAPITAL MARKET HISTORY

In 2005, the S&P 500 index was up about 3 percent, which is well below average. But even with market returns below historical norms, some investors were pleased. In fact, it was a great year for investors in pharmaceutical manufacturer ViroPharma, Inc., which shot up a whopping 469 percent! And investors in

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Hansen Natural, makers of Monster energy drinks, had to be energized by

the 333 percent gain of that stock. Of course, not all stocks increased in value during the year. Video game manufacturer Majesco Entertainment fell 92 percent during the year, and stock in Aphton, a biotechnology company, dropped 89 percent. These examples show that there were tremendous potential profits to be made during 2005, but there was also the risk of losing money—lots of it. So what should you, as a stock market investor, expect when you invest your own money? In this chapter, we study eight decades of market history to find out.

**Thus far, we haven't had much** to say about what determines the required return on an investment. In one sense, the answer is simple: The required return depends on the risk of the investment. The greater the risk, the greater is the required return.

Having said this, we are left with a somewhat more difficult problem. How can we measure the amount of risk present in an investment? Put another way, what does it mean to say that one investment is riskier than another? Obviously, we need to define what we mean by *risk* if we are going to answer these questions. This is our task in the next two chapters.

From the last several chapters, we know that one of the responsibilities of the financial manager is to assess the value of proposed real asset investments. In doing this, it is important that we first look at what financial investments have to offer. At a minimum, the return we require from a proposed nonfinancial investment must be greater than what we can get by buying financial assets of similar risk.

Our goal in this chapter is to provide a perspective on what capital market history can tell us about risk and return. The most important thing to get out of this chapter is a feel for the numbers. What is a high return? What is a low one? More generally, what returns should we expect from financial assets, and what are the risks of such investments? This perspective is essential for understanding how to analyze and value risky investment projects.

We start our discussion of risk and return by describing the historical experience of investors in U.S. financial markets. In 1931, for example, the stock market lost 43 percent of its value. Just two years later, the stock market gained 54 percent. In more recent memory, the market lost about 25 percent of its value on October 19, 1987, alone. What lessons, if any, can financial managers learn from such shifts in the stock market? We will explore the last half century (and then some) of market history to find out.

Not everyone agrees on the value of studying history. On the one hand, there is philosopher George Santayana's famous comment: "Those who do not remember the past are condemned to repeat it." On the other hand, there is industrialist Henry Ford's equally famous comment: "History is more or less bunk." Nonetheless, perhaps everyone would agree with Mark Twain's observation: "October. This is one of the peculiarly dangerous months to speculate in stocks in. The others are July, January, September, April, November, May, March, June, December, August, and February."

Two central lessons emerge from our study of market history. First, there is a reward for bearing risk. Second, the greater the potential reward is, the greater is the risk. To illustrate these facts about market returns, we devote much of this chapter to reporting the statistics and numbers that make up the modern capital market history of the United States. In the next chapter, these facts provide the foundation for our study of how financial markets put a price on risk.



The number of Web sites devoted to financial markets and instruments is astounding—and increasing daily. Be sure to check out the RWJ Web page for links to finance-related sites! ([www.mhhe.com/rwj](http://www.mhhe.com/rwj))

## Returns

We wish to discuss historical returns on different types of financial assets. The first thing we need to do, then, is to briefly discuss how to calculate the return from investing.

### 12.1

#### DOLLAR RETURNS

If you buy an asset of any sort, your gain (or loss) from that investment is called the *return on your investment*. This return will usually have two components. First, you may receive some cash directly while you own the investment. This is called the *income component* of your return. Second, the value of the asset you purchase will often change. In this case, you have a capital gain or capital loss on your investment.<sup>1</sup>

To illustrate, suppose the Video Concept Company has several thousand shares of stock outstanding. You purchased some of these shares of stock in the company at the beginning of the year. It is now year-end, and you want to determine how well you have done on your investment.

First, over the year, a company may pay cash dividends to its shareholders. As a stockholder in Video Concept Company, you are a part owner of the company. If the company is profitable, it may choose to distribute some of its profits to shareholders (we discuss the details of dividend policy in Chapter 18). So, as the owner of some stock, you will receive some cash. This cash is the income component from owning the stock.

In addition to the dividend, the other part of your return is the capital gain or capital loss on the stock. This part arises from changes in the value of your investment. For example, consider the cash flows illustrated in Figure 12.1. At the beginning of the year, the stock was selling for \$37 per share. If you had bought 100 shares, you would have had a total outlay of \$3,700. Suppose that, over the year, the stock paid a dividend of \$1.85 per share. By the end of the year, then, you would have received income of:

$$\text{Dividend} = \$1.85 \times 100 = \$185$$

Also, the value of the stock has risen to \$40.33 per share by the end of the year. Your 100 shares are now worth \$4,033, so you have a capital gain of:

$$\text{Capital gain} = (\$40.33 - 37) \times 100 = \$333$$

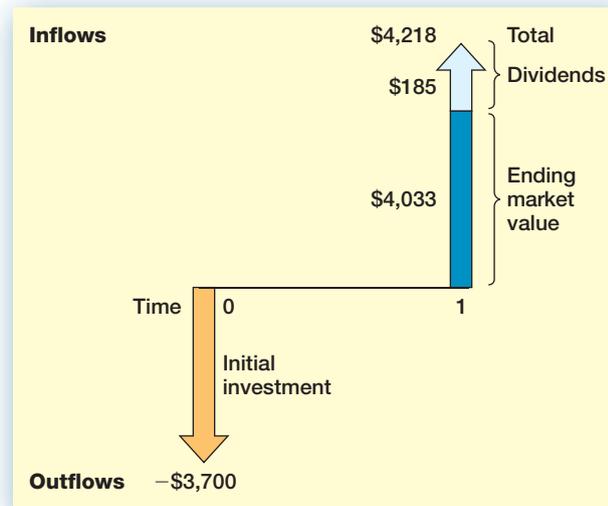


How did the market do today? Find out at [finance.yahoo.com](http://finance.yahoo.com).

<sup>1</sup>As we mentioned in an earlier chapter, strictly speaking, what is and what is not a capital gain (or loss) is determined by the IRS. We thus use the terms loosely.

**FIGURE 12.1**

Dollar Returns



On the other hand, if the price had dropped to, say, \$34.78, you would have a capital loss of:

$$\text{Capital loss} = (\$34.78 - 37) \times 100 = -\$222$$

Notice that a capital loss is the same thing as a negative capital gain.

The total dollar return on your investment is the sum of the dividend and the capital gain:

$$\text{Total dollar return} = \text{Dividend income} + \text{Capital gain (or loss)} \quad [12.1]$$

In our first example, the total dollar return is thus given by:

$$\text{Total dollar return} = \$185 + 333 = \$518$$

Notice that if you sold the stock at the end of the year, the total amount of cash you would have would equal your initial investment plus the total return. In the preceding example, then:

$$\begin{aligned} \text{Total cash if stock is sold} &= \text{Initial investment} + \text{Total return} && [12.2] \\ &= \$3,700 + 518 \\ &= \$4,218 \end{aligned}$$

As a check, notice that this is the same as the proceeds from the sale of the stock plus the dividends:

$$\begin{aligned} \text{Proceeds from stock sale} + \text{Dividends} &= \$40.33 \times 100 + 185 \\ &= \$4,033 + 185 \\ &= \$4,218 \end{aligned}$$

Suppose you hold on to your Video Concept stock and don't sell it at the end of the year. Should you still consider the capital gain as part of your return? Isn't this only a "paper" gain and not really a cash flow if you don't sell the stock?

The answer to the first question is a strong yes, and the answer to the second is an equally strong no. The capital gain is every bit as much a part of your return as the dividend, and you should certainly count it as part of your return. That you actually decided to keep the stock and not sell (you don't "realize" the gain) is irrelevant because you could have converted it to cash if you had wanted to. Whether you choose to do so or not is up to you.

After all, if you insisted on converting your gain to cash, you could always sell the stock at year-end and immediately reinvest by buying the stock back. There is no net difference between doing this and just not selling (assuming, of course, that there are no tax

consequences from selling the stock). Again, the point is that whether you actually cash out and buy sodas (or whatever) or reinvest by not selling doesn't affect the return you earn.

**PERCENTAGE RETURNS**

It is usually more convenient to summarize information about returns in percentage terms, rather than dollar terms, because that way your return doesn't depend on how much you actually invest. The question we want to answer is this: How much do we get for each dollar we invest?

To answer this question, let  $P_t$  be the price of the stock at the beginning of the year and let  $D_{t+1}$  be the dividend paid on the stock during the year. Consider the cash flows in Figure 12.2. These are the same as those in Figure 12.1, except that we have now expressed everything on a per-share basis.

In our example, the price at the beginning of the year was \$37 per share and the dividend paid during the year on each share was \$1.85. As we discussed in Chapter 8, expressing the dividend as a percentage of the beginning stock price results in the dividend yield:

$$\begin{aligned} \text{Dividend yield} &= D_{t+1}/P_t \\ &= \$1.85/37 = .05 = 5\% \end{aligned}$$

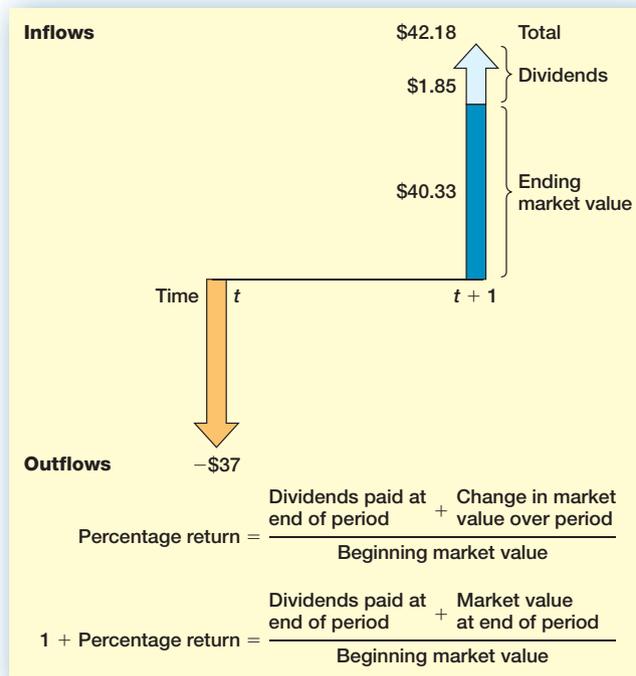
This says that for each dollar we invest, we get five cents in dividends.

The second component of our percentage return is the capital gains yield. Recall (from Chapter 8) that this is calculated as the change in the price during the year (the capital gain) divided by the beginning price:

$$\begin{aligned} \text{Capital gains yield} &= (P_{t+1} - P_t)/P_t \\ &= (\$40.33 - 37)/37 \\ &= \$3.33/37 \\ &= 9\% \end{aligned}$$

So, per dollar invested, we get nine cents in capital gains.

 Go to [www.smartmoney.com/marketmap](http://www.smartmoney.com/marketmap) for a cool Java applet that shows today's returns by market sector.



**FIGURE 12.2**  
Percentage Returns

Putting it together, per dollar invested, we get 5 cents in dividends and 9 cents in capital gains; so we get a total of 14 cents. Our percentage return is 14 cents on the dollar, or 14 percent.

To check this, notice that we invested \$3,700 and ended up with \$4,218. By what percentage did our \$3,700 increase? As we saw, we picked up  $\$4,218 - \$3,700 = \$518$ . This is a  $\$518/\$3,700 = 14\%$  increase.

### EXAMPLE 12.1 Calculating Returns

Suppose you bought some stock at the beginning of the year for \$25 per share. At the end of the year, the price is \$35 per share. During the year, you got a \$2 dividend per share. This is the situation illustrated in Figure 12.3. What is the dividend yield? The capital gains yield? The percentage return? If your total investment was \$1,000, how much do you have at the end of the year?

Your \$2 dividend per share works out to a dividend yield of:

$$\begin{aligned}\text{Dividend yield} &= D_{t+1}/P_t \\ &= \$2/\$25 = .08 = 8\%\end{aligned}$$

The per-share capital gain is \$10, so the capital gains yield is:

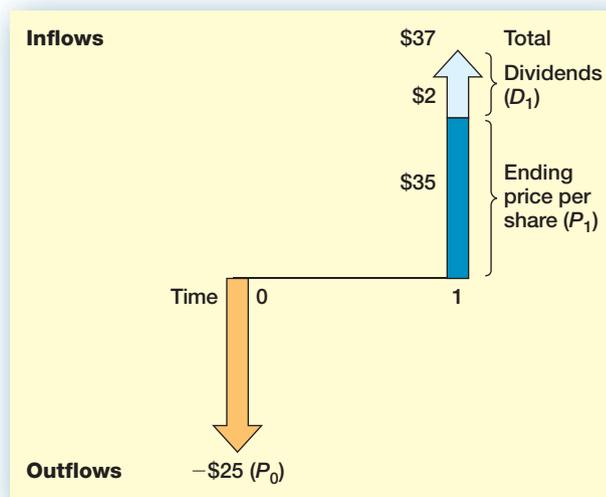
$$\begin{aligned}\text{Capital gains yield} &= (P_{t+1} - P_t)/P_t \\ &= (\$35 - \$25)/\$25 \\ &= \$10/\$25 \\ &= 40\%\end{aligned}$$

The total percentage return is thus 48 percent.

If you had invested \$1,000, you would have \$1,480 at the end of the year, representing a 48 percent increase. To check this, note that your \$1,000 would have bought you  $\$1,000/\$25 = 40$  shares. Your 40 shares would then have paid you a total of  $40 \times \$2 = \$80$  in cash dividends. Your \$10 per share gain would give you a total capital gain of  $\$10 \times 40 = \$400$ . Add these together, and you get the \$480 increase.

FIGURE 12.3

Cash Flow—An Investment Example



To give another example, stock in Goldman Sachs, the famous financial services company, began 2005 at \$102.90 a share. Goldman paid dividends of \$1.00 during 2005, and the stock price at the end of the year was \$127.47. What was the return on Goldman for the year? For practice, see if you agree that the answer is 22.91 percent. Of course, negative returns occur as well. For example, again in 2005, General Motors' stock price at the beginning of the year was \$37.64 per share, and dividends of \$2.00 were paid. The stock ended the year at \$19.42 per share. Verify that the loss was 43.09 percent for the year.

### Concept Questions

- 12.1a** What are the two parts of total return?
- 12.1b** Why are unrealized capital gains or losses included in the calculation of returns?
- 12.1c** What is the difference between a dollar return and a percentage return? Why are percentage returns more convenient?

## The Historical Record

Roger Ibbotson and Rex Sinquefeld conducted a famous set of studies dealing with rates of return in U.S. financial markets.<sup>2</sup> They presented year-to-year historical rates of return on five important types of financial investments. The returns can be interpreted as what you would have earned if you had held portfolios of the following:

1. *Large-company stocks*: This common stock portfolio is based on the Standard & Poor's (S&P) 500 index, which contains 500 of the largest companies (in terms of total market value of outstanding stock) in the United States.
2. *Small-company stocks*: This is a portfolio composed of the stock corresponding to the smallest 20 percent of the companies listed on the New York Stock Exchange, again as measured by market value of outstanding stock.
3. *Long-term corporate bonds*: This is based on high-quality bonds with 20 years to maturity.
4. *Long-term U.S. government bonds*: This is based on U.S. government bonds with 20 years to maturity.
5. *U.S. Treasury bills*: This is based on Treasury bills (T-bills for short) with a three-month maturity.

These returns are not adjusted for inflation or taxes; thus, they are nominal, pretax returns.

In addition to the year-to-year returns on these financial instruments, the year-to-year percentage change in the consumer price index (CPI) is also computed. This is a commonly used measure of inflation, so we can calculate real returns using this as the inflation rate.

### A FIRST LOOK

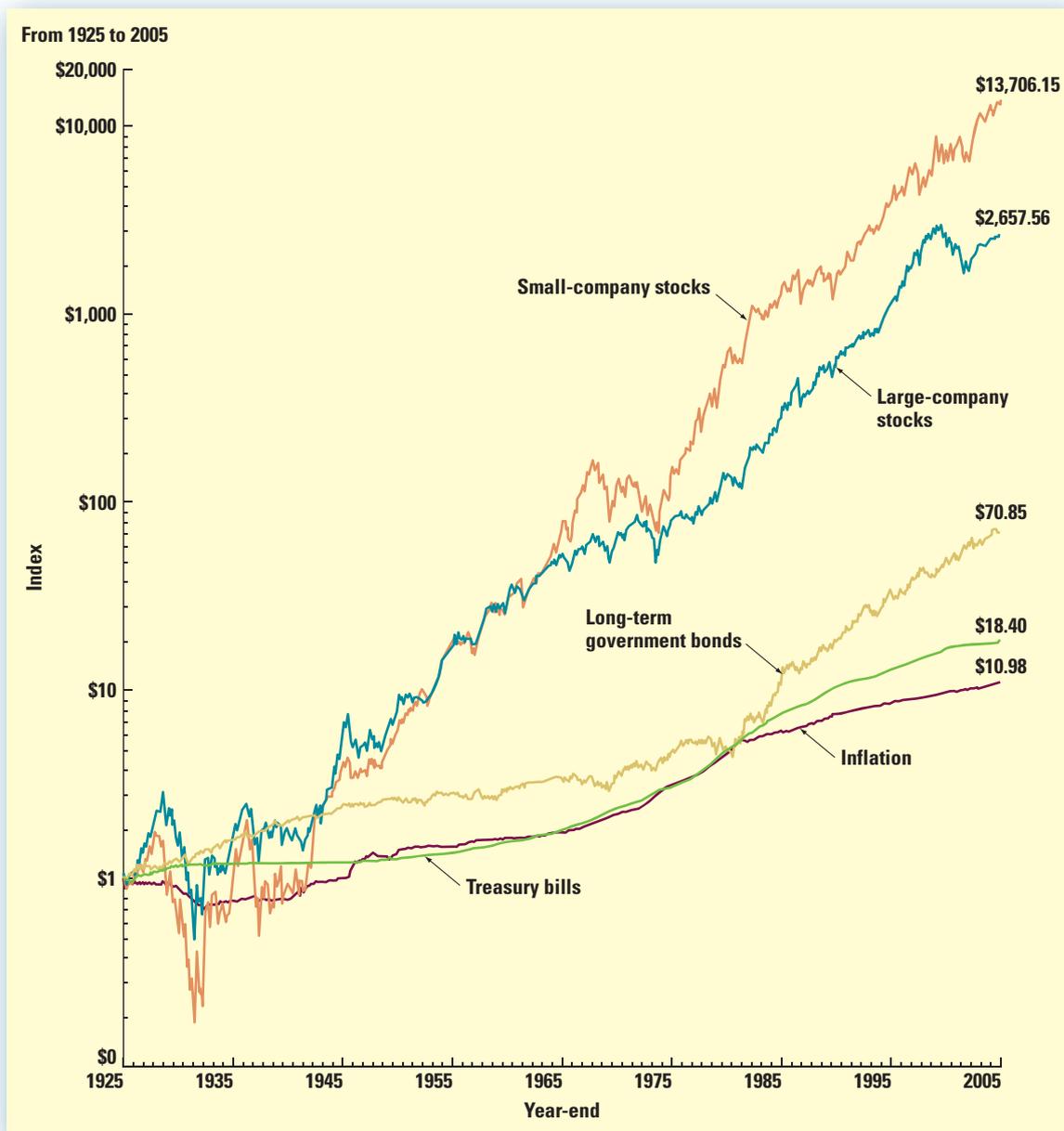
Before looking closely at the different portfolio returns, we take a look at the big picture. Figure 12.4 shows what happened to \$1 invested in these different portfolios at the beginning of 1925. The growth in value for each of the different portfolios over the 80-year

<sup>2</sup>R.G. Ibbotson and R.A. Sinquefeld, *Stocks, Bonds, Bills, and Inflation [SBBBI]* (Charlottesville, VA: Financial Analysis Research Foundation, 1982).

## 12.2



For more about market history, visit [www.globalfindata.com](http://www.globalfindata.com).

**FIGURE 12.4** A \$1 Investment in Different Types of Portfolios: 1925–2005 (Year-End 1925 = \$1)

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period ending in 2005 is given separately (the long-term corporate bonds are omitted). Notice that to get everything on a single graph, some modification in scaling is used. As is commonly done with financial series, the vertical axis is scaled so that equal distances measure equal percentage (as opposed to dollar) changes in values.<sup>3</sup>

<sup>3</sup>In other words, the scale is logarithmic.

Looking at Figure 12.4, we see that the “small-cap” (short for small-capitalization) investment did the best overall. Every dollar invested grew to a remarkable \$13,706.15 over the 80 years. The large-company common stock portfolio did less well; a dollar invested in it grew to \$2,657.56.

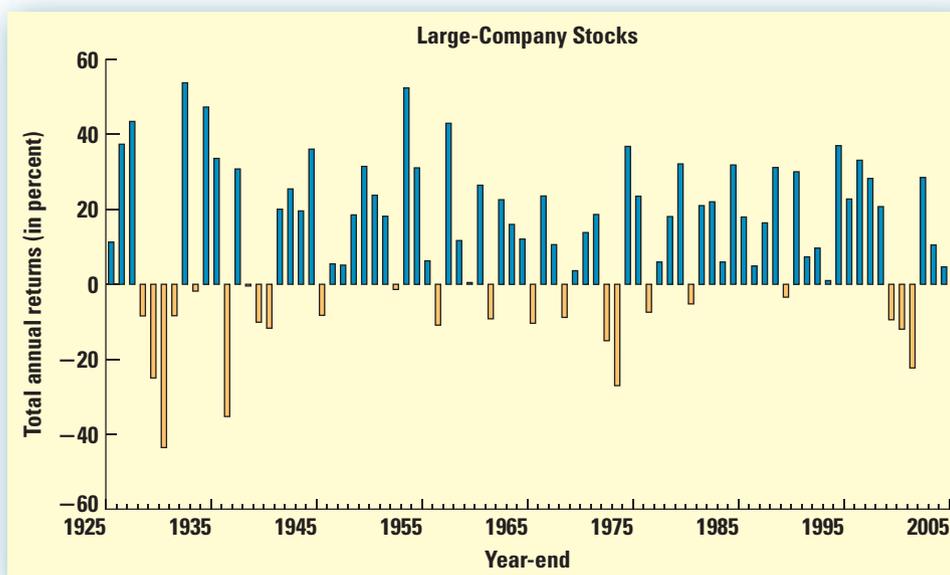
At the other end, the T-bill portfolio grew to only \$18.40. This is even less impressive when we consider the inflation over the period in question. As illustrated, the increase in the price level was such that \$10.98 was needed at the end of the period just to replace the original \$1.

Given the historical record, why would anybody buy anything other than small-cap stocks? If you look closely at Figure 12.4, you will probably see the answer. The T-bill portfolio and the long-term government bond portfolio grew more slowly than did the stock portfolios, but they also grew much more steadily. The small stocks ended up on top; but as you can see, they grew quite erratically at times. For example, the small stocks were the worst performers for about the first 10 years and had a smaller return than long-term government bonds for almost 15 years.

### A CLOSER LOOK

To illustrate the variability of the different investments, Figures 12.5 through 12.8 plot the year-to-year percentage returns in the form of vertical bars drawn from the horizontal axis. The height of the bar tells us the return for the particular year. For example, looking at the long-term government bonds (Figure 12.7), we see that the largest historical return (44.44 percent) occurred in 1982. This was a good year for bonds. In comparing these charts, notice the differences in the vertical axis scales. With these differences in mind, you can see how predictably the Treasury bills (Figure 12.7) behaved compared to the small stocks (Figure 12.6).

The returns shown in these bar graphs are sometimes very large. Looking at the graphs, for example, we see that the largest single-year return is a remarkable 142.87 percent for the small-cap stocks in 1933. In the same year, the large-company stocks returned “only” 52.94 percent. In contrast, the largest Treasury bill return was 15.21 percent in 1981. For future reference, the actual year-to-year returns for the S&P 500, long-term government bonds, Treasury bills, and the CPI are shown in Table 12.1.



Go to [www.bigcharts.marketwatch.com](http://www.bigcharts.marketwatch.com) to see both intraday and long-term charts.

**FIGURE 12.5**

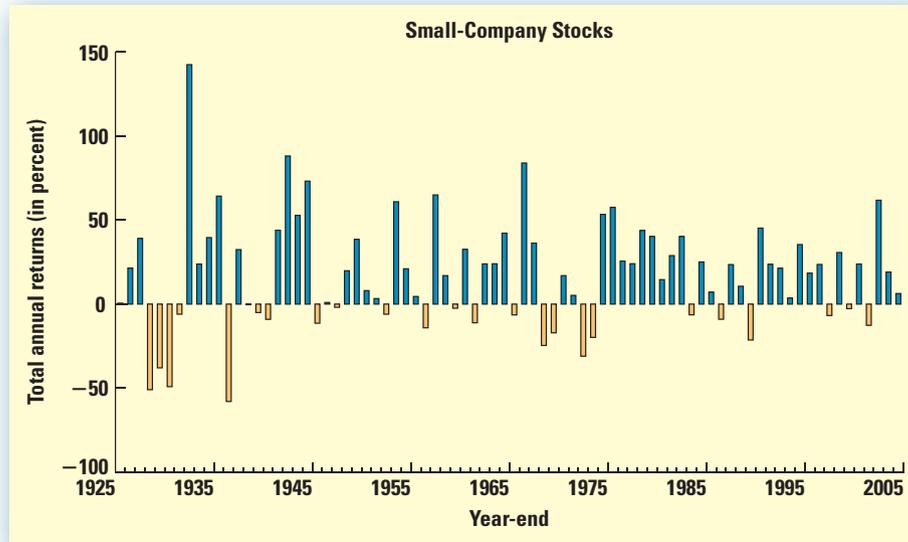
Year-to-Year Total Returns on Large-Company Stocks: 1926–2005

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**FIGURE 12.6**

Year-to-Year Total Returns on Small-Company Stocks: 1926–2005

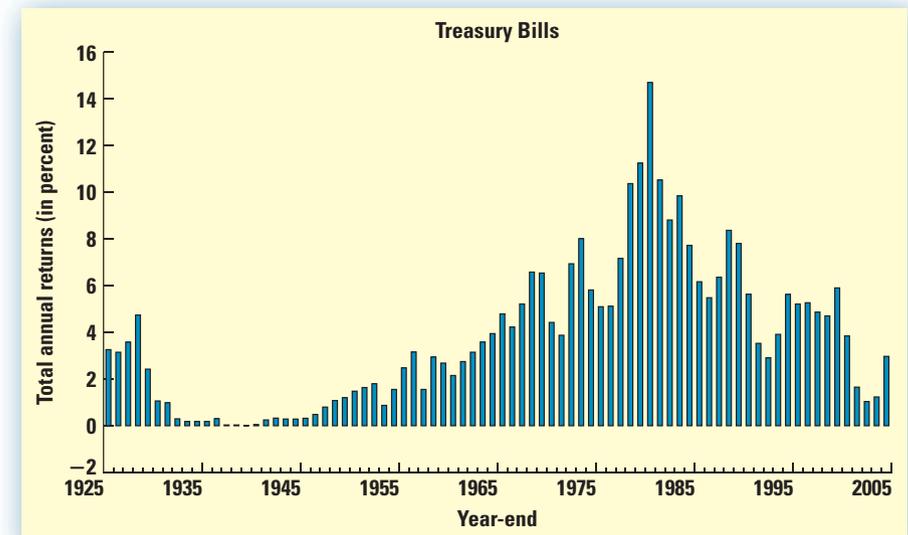
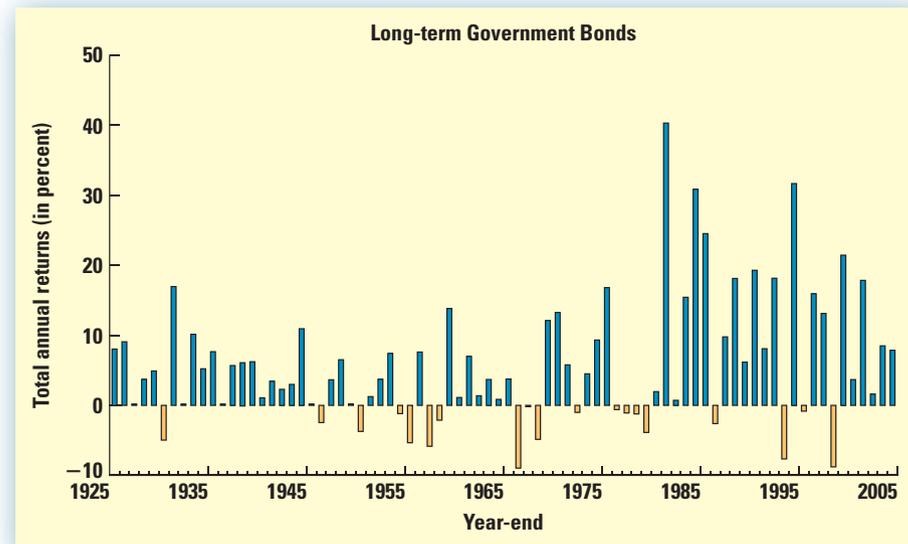
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**FIGURE 12.7**

Year-to-Year Total Returns on Bonds and Bills: 1926–2005

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## IN THEIR OWN WORDS ...

### Roger Ibbotson on Capital Market History

The financial markets are the most carefully documented human phenomena in history. Every day, over 2,000 NYSE stocks are traded, and at least 6,000 more stocks are traded on other exchanges and ECNs. Bonds, commodities, futures, and options also provide a wealth of data. These data daily fill much of *The Wall Street Journal* (and numerous other newspapers), and are available as they happen on numerous financial websites. A record actually exists of almost every transaction, providing not only a real-time database but also a historical record extending back, in many cases, more than a century.

The global market adds another dimension to this wealth of data. The Japanese stock market trades over a billion shares a day, and the London exchange reports trades on over 10,000 domestic and foreign issues a day.

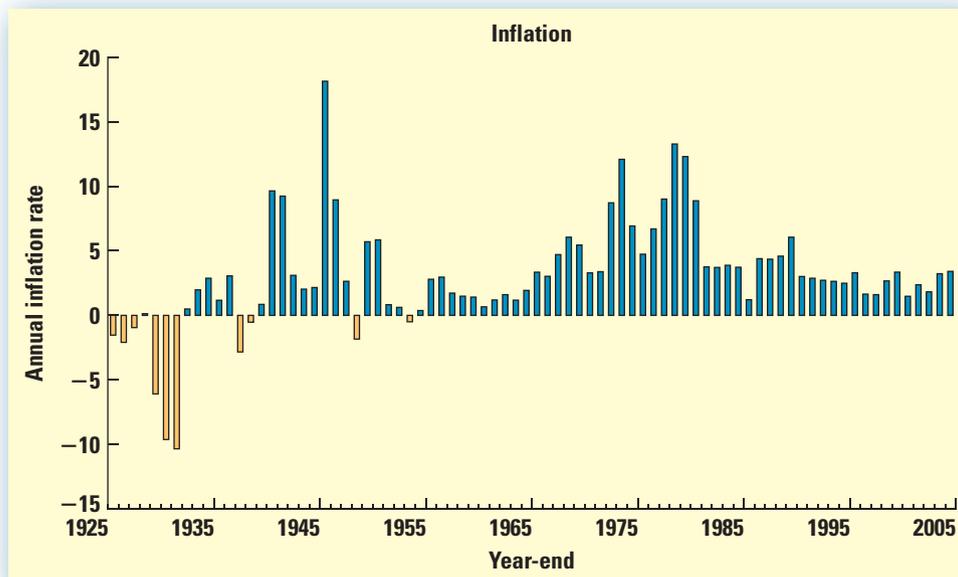
The data generated by these transactions are quantifiable, quickly analyzed and disseminated, and made easily accessible by computer. Because of this, finance has increasingly come to resemble one of the exact sciences. The use of financial market data ranges from the simple, such as using the S&P 500 to measure the performance of a portfolio, to the incredibly complex. For example, only a few decades ago, the bond market was the most staid province on Wall Street. Today, it attracts swarms of traders seeking to exploit arbitrage opportunities—small temporary mispricings—using real-time data and computers to analyze them.

Financial market data are the foundation for the extensive empirical understanding we now have of the financial markets. The following is a list of some of the principal findings of such research:

- Risky securities, such as stocks, have higher average returns than riskless securities such as Treasury bills.
- Stocks of small companies have higher average returns than those of larger companies.
- Long-term bonds have higher average yields and returns than short-term bonds.
- The cost of capital for a company, project, or division can be predicted using data from the markets.

Because phenomena in the financial markets are so well measured, finance is the most readily quantifiable branch of economics. Researchers are able to do more extensive empirical research than in any other economic field, and the research can be quickly translated into action in the marketplace.

Roger Ibbotson is professor in the practice of management at the Yale School of Management. He is founder of Ibbotson Associates, now a Morningstar, Inc. company and a major supplier of financial data and analysis. He is also chairman of Zebra Capital, an equity hedge fund manager. An outstanding scholar, he is best known for his original estimates of the historical rates of return realized by investors in different markets and for his research on new issues.



**FIGURE 12.8**

Year-to-Year Inflation:  
1926–2005

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TABLE 12.1 Year-to-Year Total Returns: 1926–2005

Year	Large-Company Stocks	Long-Term Government Bonds	U.S. Treasury Bills	Consumer Price Index	Year	Large-Company Stocks	Long-Term Government Bonds	U.S. Treasury Bills	Consumer Price Index
1926	13.75%	5.69%	3.30%	-1.12%	1966	-10.06%	5.12%	4.94%	3.46%
1927	35.70	6.58	3.15	-2.26	1967	23.98	-2.86	4.39	3.04
1928	45.08	1.15	4.05	-1.16	1968	11.03	2.25	5.49	4.72
1929	-8.80	4.39	4.47	0.58	1969	-8.43	-5.63	6.90	6.20
1930	-25.13	4.47	2.27	-6.40	1970	3.94	18.92	6.50	5.57
1931	-43.60	-2.15	1.15	-9.32	1971	14.30	11.24	4.36	3.27
1932	-8.75	8.51	0.88	-10.27	1972	18.99	2.39	4.23	3.41
1933	52.95	1.92	0.52	0.76	1973	-14.69	3.30	7.29	8.71
1934	-2.31	7.59	0.27	1.52	1974	-26.47	4.00	7.99	12.34
1935	46.79	4.20	0.17	2.99	1975	37.23	5.52	5.87	6.94
1936	32.49	5.13	0.17	1.45	1976	23.93	15.56	5.07	4.86
1937	-35.45	1.44	0.27	2.86	1977	-7.16	0.38	5.45	6.70
1938	31.63	4.21	0.06	-2.78	1978	6.57	-1.26	7.64	9.02
1939	-1.43	3.84	0.04	0.00	1979	18.61	1.26	10.56	13.29
1940	-10.36	5.70	0.04	0.71	1980	32.50	-2.48	12.10	12.52
1941	-12.02	0.47	0.14	9.93	1981	-4.92	4.04	14.60	8.92
1942	20.75	1.80	0.34	9.03	1982	21.55	44.28	10.94	3.83
1943	25.38	2.01	0.38	2.96	1983	22.56	1.29	8.99	3.79
1944	19.49	2.27	0.38	2.30	1984	6.27	15.29	9.90	3.95
1945	36.21	5.29	0.38	2.25	1985	31.73	32.27	7.71	3.80
1946	-8.42	0.54	0.38	18.13	1986	18.67	22.39	6.09	1.10
1947	5.05	-1.02	0.62	8.84	1987	5.25	-3.03	5.88	4.43
1948	4.99	2.66	1.06	2.99	1988	16.61	6.84	6.94	4.42
1949	17.81	4.58	1.12	-2.07	1989	31.69	18.54	8.44	4.65
1950	30.05	-0.98	1.22	5.93	1990	-3.10	7.74	7.69	6.11
1951	23.79	-0.20	1.56	6.00	1991	30.46	19.36	5.43	3.06
1952	18.39	2.43	1.75	0.75	1992	7.62	7.34	3.48	2.90
1953	-1.07	2.28	1.87	0.75	1993	10.08	13.06	3.03	2.75
1954	52.23	3.08	0.93	-0.74	1994	1.32	-7.32	4.39	2.67
1955	31.62	-0.73	1.80	0.37	1995	37.58	25.94	5.61	2.54
1956	6.91	-1.72	2.66	2.99	1996	22.96	0.13	5.14	3.32
1957	-10.50	6.82	3.28	2.90	1997	33.36	12.02	5.19	1.70
1958	43.57	-1.72	1.71	1.76	1998	28.58	14.45	4.86	1.61
1959	12.01	-2.02	3.48	1.73	1999	21.04	-7.51	4.80	2.68
1960	0.47	11.21	2.81	1.36	2000	-9.10	17.22	5.98	3.39
1961	26.84	2.20	2.40	0.67	2001	-11.89	5.51	3.33	1.55
1962	-8.75	5.72	2.82	1.33	2002	-22.10	15.15	1.61	2.4
1963	22.70	1.79	3.23	1.64	2003	28.89	2.01	0.94	1.9
1964	16.43	3.71	3.62	0.97	2004	10.88	8.12	1.14	3.3
1965	12.38	0.93	4.06	1.92	2005	4.91	6.89	2.79	3.4

SOURCES: Authors' calculation based on data obtained from *Global Financial Data* and other sources.

### Concept Questions

- 12.2a** With 20/20 hindsight, what do you say was the best investment for the period from 1926 through 1935?
- 12.2b** Why doesn't everyone just buy small stocks as investments?
- 12.2c** What was the smallest return observed over the 80 years for each of these investments? Approximately when did it occur?
- 12.2d** About how many times did large-company stocks return more than 30 percent? How many times did they return less than -20 percent?
- 12.2e** What was the longest "winning streak" (years without a negative return) for large-company stocks? For long-term government bonds?
- 12.2f** How often did the T-bill portfolio have a negative return?

## Average Returns: The First Lesson

### 12.3

As you've probably begun to notice, the history of capital market returns is too complicated to be of much use in its undigested form. We need to begin summarizing all these numbers. Accordingly, we discuss how to go about condensing the detailed data. We start out by calculating average returns.

#### CALCULATING AVERAGE RETURNS

The obvious way to calculate the average returns on the different investments in Table 12.1 is simply to add up the yearly returns and divide by 80. The result is the historical average of the individual values.

For example, if you add up the returns for the large-company stocks in Figure 12.5 for the 80 years, you will get about 9.84. The average annual return is thus  $9.84/80 = 12.3\%$ . You interpret this **12.3 percent** just like any other average. If you were to pick a year at random from the 80-year history and you had to guess what the return in that year was, the best guess would be 12.3 percent.

#### AVERAGE RETURNS: THE HISTORICAL RECORD

Table 12.2 shows the average returns for the investments we have discussed. As shown, in a typical year, the small-company stocks increased in value by **17.4 percent**. Notice also how much larger the stock returns are than the bond returns.

These averages are, of course, nominal because we haven't worried about inflation. Notice that the average inflation rate was **3.1 percent** per year over this 80-year span. The nominal return on U.S. Treasury bills was **3.8 percent** per year. The average real return on Treasury bills was thus approximately .7 percent per year; so the real return on T-bills has been quite low historically.

At the other extreme, small stocks had an average real return of about  $17.4\% - 3.1\% = 14.3\%$ , which is relatively large. If you remember the Rule of 72 (Chapter 5), then you know that a quick back-of-the-envelope calculation tells us that 14.3 percent real growth doubles your buying power about every five years. Notice also that the real value of the large-company stock portfolio increased by over 9 percent in a typical year.

TABLE 12.2

Average Annual Returns:  
1926–2005

Investment	Average Return
Large-company stocks	12.3%
Small-company stocks	17.4
Long-term corporate bonds	6.2
Long-term government bonds	5.8
U.S. Treasury bills	3.8
Inflation	3.1

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TABLE 12.3

Average Annual Returns  
and Risk Premiums:  
1926–2005

Investment	Average Return	Risk Premium
Large-company stocks	12.3%	8.5%
Small-company stocks	17.4	13.6
Long-term corporate bonds	6.2	2.4
Long-term government bonds	5.8	2.0
U.S. Treasury bills	3.8	0.0

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## RISK PREMIUMS

Now that we have computed some average returns, it seems logical to see how they compare with each other. One such comparison involves government-issued securities. These are free of much of the variability we see in, for example, the stock market.

The government borrows money by issuing bonds in different forms. The ones we will focus on are the Treasury bills. These have the shortest time to maturity of the different government bonds. Because the government can always raise taxes to pay its bills, the debt represented by T-bills is virtually free of any default risk over its short life. Thus, we will call the rate of return on such debt the *risk-free return*, and we will use it as a kind of benchmark.

A particularly interesting comparison involves the virtually risk-free return on T-bills and the very risky return on common stocks. The difference between these two returns can be interpreted as a measure of the *excess return* on the average risky asset (assuming that the stock of a large U.S. corporation has about average risk compared to all risky assets).

We call this the “excess” return because it is the additional return we earn by moving from a relatively risk-free investment to a risky one. Because it can be interpreted as a reward for bearing risk, we will call it a **risk premium**.

Using Table 12.2, we can calculate the risk premiums for the different investments; these are shown in Table 12.3. We report only the nominal risk premiums because there is only a slight difference between the historical nominal and real risk premiums.

The risk premium on T-bills is shown as zero in the table because we have assumed that they are riskless.

## THE FIRST LESSON

Looking at Table 12.3, we see that the average risk premium earned by a typical large-company stock is  $12.3\% - 3.8\% = 8.5\%$ . This is a significant reward. The fact that it exists historically is an important observation, and it is the basis for our first lesson: Risky assets, on average, earn a risk premium. Put another way, there is a reward for bearing risk.

Why is this so? Why, for example, is the risk premium for small stocks so much larger than the risk premium for large stocks? More generally, what determines the relative sizes

### risk premium

The excess return required from an investment in a risky asset over that required from a risk-free investment.

of the risk premiums for the different assets? The answers to these questions are at the heart of modern finance, and the next chapter is devoted to them. For now, we can find part of the answer by looking at the historical variability of the returns on these different investments. So, to get started, we now turn our attention to measuring variability in returns.

**Concept Questions**

- 12.3a** What do we mean by *excess return* and *risk premium*?
- 12.3b** What was the real (as opposed to nominal) risk premium on the common stock portfolio?
- 12.3c** What was the nominal risk premium on corporate bonds? The real risk premium?
- 12.3d** What is the first lesson from capital market history?

## The Variability of Returns: The Second Lesson

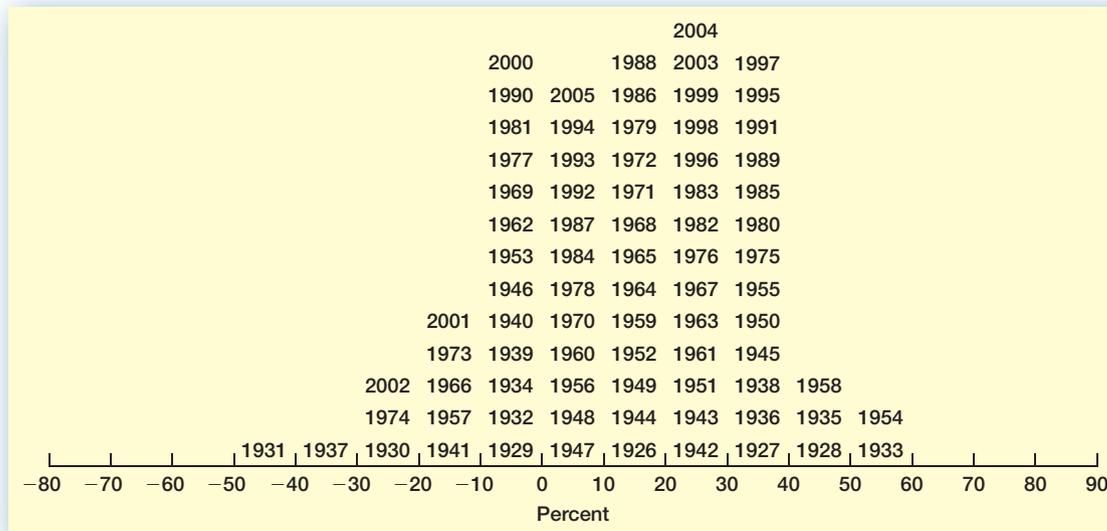
## 12.4

We have already seen that the year-to-year returns on common stocks tend to be more volatile than the returns on, say, long-term government bonds. We now discuss measuring this variability of stock returns so we can begin examining the subject of risk.

### FREQUENCY DISTRIBUTIONS AND VARIABILITY

To get started, we can draw a *frequency distribution* for the common stock returns like the one in Figure 12.9. What we have done here is to count up the number of times the annual return on the common stock portfolio falls within each 10 percent range. For example, in

**FIGURE 12.9** Frequency Distribution of Returns on Large-Company Stocks: 1926–2005



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**variance**

The average squared difference between the actual return and the average return.

**standard deviation**

The positive square root of the variance.

Figure 12.9, the height of 13 in the range of 10 to 20 percent means that 13 of the 80 annual returns were in that range.

What we need to do now is to actually measure the spread in returns. We know, for example, that the return on small stocks in a typical year was 17.4 percent. We now want to know how much the actual return deviates from this average in a typical year. In other words, we need a measure of how volatile the return is. The **variance** and its square root, the **standard deviation**, are the most commonly used measures of volatility. We describe how to calculate them next.

**THE HISTORICAL VARIANCE AND STANDARD DEVIATION**

The variance essentially measures the average squared difference between the actual returns and the average return. The bigger this number is, the more the actual returns tend to differ from the average return. Also, the larger the variance or standard deviation is, the more spread out the returns will be.

The way we will calculate the variance and standard deviation will depend on the specific situation. In this chapter, we are looking at historical returns; so the procedure we describe here is the correct one for calculating the *historical* variance and standard deviation. If we were examining projected future returns, then the procedure would be different. We describe this procedure in the next chapter.

To illustrate how we calculate the historical variance, suppose a particular investment had returns of 10 percent, 12 percent, 3 percent, and -9 percent over the last four years. The average return is  $(.10 + .12 + .03 - .09)/4 = 4\%$ . Notice that the return is never actually equal to 4 percent. Instead, the first return deviates from the average by  $.10 - .04 = .06$ , the second return deviates from the average by  $.12 - .04 = .08$ , and so on. To compute the variance, we square each of these deviations, add them up, and divide the result by the number of returns less 1, or 3 in this case. Most of this information is summarized in the following table:



For an easy-to-read review of basic stats, check out [www.robertniles.com/stats](http://www.robertniles.com/stats).

	(1) Actual Return	(2) Average Return	(3) Deviation (1) - (2)	(4) Squared Deviation
	.10	.04	.06	.0036
	.12	.04	.08	.0064
	.03	.04	-.01	.0001
	-.09	.04	-.13	.0169
Totals	<u>.16</u>		<u>.00</u>	<u>.0270</u>

In the first column, we write the four actual returns. In the third column, we calculate the difference between the actual returns and the average by subtracting out 4 percent. Finally, in the fourth column, we square the numbers in the third column to get the squared deviations from the average.

The variance can now be calculated by dividing .0270, the sum of the squared deviations, by the number of returns less 1. Let  $\text{Var}(R)$ , or  $\sigma^2$  (read this as “sigma squared”), stand for the variance of the return:

$$\text{Var}(R) = \sigma^2 = .027/(4 - 1) = .009$$

The standard deviation is the square root of the variance. So, if  $\text{SD}(R)$ , or  $\sigma$ , stands for the standard deviation of return:

$$\text{SR}(R) = \sigma = \sqrt{.009} = .09487$$

The square root of the variance is used because the variance is measured in “squared” percentages and thus is hard to interpret. The standard deviation is an ordinary percentage, so the answer here could be written as 9.487 percent.

In the preceding table, notice that the sum of the deviations is equal to zero. This will always be the case, and it provides a good way to check your work. In general, if we have  $T$  historical returns, where  $T$  is some number, we can write the historical variance as:

$$\text{Var}(R) = \frac{1}{T-1} [(R_1 - \bar{R})^2 + \dots + (R_T - \bar{R})^2] \quad [12.3]$$

This formula tells us to do what we just did: Take each of the  $T$  individual returns ( $R_1, R_2, \dots$ ) and subtract the average return,  $\bar{R}$ ; square the results, and add them all up; and finally, divide this total by the number of returns less  $1/(T - 1)$ . The standard deviation is always the square root of  $\text{Var}(R)$ . Standard deviations are a widely used measure of volatility. Our nearby *Work the Web* box gives a real-world example.

**Calculating the Variance and Standard Deviation**

**EXAMPLE 12.2**

Suppose the Supertech Company and the Hyperdrive Company have experienced the following returns in the last four years:

Year	Supertech Return	Hyperdrive Return
2001	-.20	.05
2002	.50	.09
2003	.30	-.12
2004	.10	.20

What are the average returns? The variances? The standard deviations? Which investment was more volatile?

To calculate the average returns, we add up the returns and divide by 4. The results are:

Supertech average return =  $\bar{R} = .70/4 = .175$

Hyperdrive average return =  $\bar{R} = .22/4 = .055$

To calculate the variance for Supertech, we can summarize the relevant calculations as follows:

Year	(1) Actual Return	(2) Average Return	(3) Deviation (1) - (2)	(4) Squared Deviation
2001	-.20	.175	-.375	.140625
2002	.50	.175	.325	.105625
2003	.30	.175	.125	.015625
2004	.10	.175	-.075	.005625
Totals	<u>.70</u>		<u>.000</u>	<u>.267500</u>

Because there are four years of returns, we calculate the variance by dividing .2675 by  $(4 - 1) = 3$ :

	Supertech	Hyperdrive
Variance ( $\sigma^2$ )	.2675/3 = .0892	.0529/3 = .0176
Standard deviation ( $\sigma$ )	$\sqrt{.0892} = .2987$	$\sqrt{.0176} = .1327$

(continued)

For practice, verify that you get the same answer as we do for Hyperdrive. Notice that the standard deviation for Supertech, 29.87 percent, is a little more than twice Hyperdrive's 13.27 percent; Supertech is thus the more volatile investment.

### THE HISTORICAL RECORD

Figure 12.10 summarizes much of our discussion of capital market history so far. It displays average returns, standard deviations, and frequency distributions of annual returns on a common scale. In Figure 12.10, for example, notice that the standard deviation for the small-stock portfolio (32.9 percent per year) is more than 10 times larger than the T-bill portfolio's standard deviation (3.1 percent per year). We will return to these figures momentarily.

#### normal distribution

A symmetric, bell-shaped frequency distribution that is completely defined by its mean and standard deviation.

### NORMAL DISTRIBUTION

For many different random events in nature, a particular frequency distribution, the **normal distribution** (or *bell curve*), is useful for describing the probability of ending up in a given range. For example, the idea behind “grading on a curve” comes from the fact that exam score distributions often resemble a bell curve.

## WORK THE WEB



**Standard deviations** are widely reported for mutual funds. For example, the Fidelity Magellan fund was the second largest mutual fund in the United States at the time this was written. How volatile is it? To find out, we went to [www.morningstar.com](http://www.morningstar.com), entered the ticker symbol FMAGX, and clicked the “Risk Measures” link. Here is what we found:

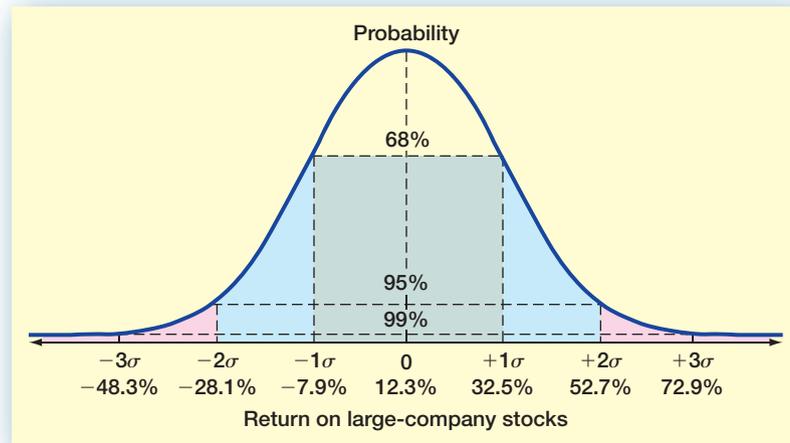
Fidelity Magellan FMAGX		<a href="#">See Fund Family Data</a> ▶▶			
<b>Volatility Measurements</b>		Trailing 3-Yr through 04-30-06   *Trailing 5-Yr through 04-30-06			
Standard Deviation	7.92	Sharpe Ratio	1.37		
Mean	13.63	Bear Market Decile Rank*	8		
<b>Modern Portfolio Theory Statistics</b>		Trailing 3-Yr through 04-30-06			
	<b>Standard Index</b>	<b>Best Fit Index</b>			
	S&P 500	S&P 500 PR			
R-Squared	90	90			
Beta	0.96	0.96			
Alpha	-0.40	-0.40			

The standard deviation for the Fidelity Magellan Fund is 7.92 percent. When you consider that the average stock has a standard deviation of about 50 percent, this seems like a low number. The reason for the low standard deviation has to do with the power of diversification, a topic we discuss in the next chapter. The mean is the average return, so over the last three years, investors in the Magellan Fund gained 13.63 percent per year. Also, under the Volatility Measurements section, you will see the Sharpe ratio. The Sharpe ratio is calculated as the risk premium of the asset divided by the standard deviation. As such, it is a measure of return relative to the level of risk taken (as measured by standard deviation). The “beta” for the Fidelity Magellan Fund is 0.96. We will have more to say about this number—lots more—in the next chapter.



**FIGURE 12.11**

The Normal Distribution. Illustrated returns are based on the historical return and standard deviation for a portfolio of large-firm common stocks.



that we will end up within two standard deviations is about 95 percent. Finally, the probability of being more than three standard deviations away from the average is less than 1 percent. These ranges and the probabilities are illustrated in Figure 12.11.

To see why this is useful, recall from Figure 12.10 that the standard deviation of returns on the large-company stocks is 20.2 percent. The average return is 12.3 percent. So, assuming that the frequency distribution is at least approximately normal, the probability that the return in a given year is in the range of  $-7.9$  to  $32.5$  percent (12.3 percent plus or minus one standard deviation, 20.2 percent) is about  $2/3$ . This range is illustrated in Figure 12.11. In other words, there is about one chance in three that the return will be *outside* this range. This literally tells you that, if you buy stocks in large companies, you should expect to be outside this range in one year out of every three. This reinforces our earlier observations about stock market volatility. However, there is only a 5 percent chance (approximately) that we would end up outside the range of  $-28.1$  to  $52.7$  percent (12.3 percent plus or minus  $2 \times 20.2\%$ ). These points are also illustrated in Figure 12.11.

### THE SECOND LESSON

Our observations concerning the year-to-year variability in returns are the basis for our second lesson from capital market history. On average, bearing risk is handsomely rewarded; but in a given year, there is a significant chance of a dramatic change in value. Thus our second lesson is this: The greater the potential reward, the greater is the risk.

### USING CAPITAL MARKET HISTORY

Based on the discussion in this section, you should begin to have an idea of the risks and rewards from investing. For example, in mid-2006, Treasury bills were paying about 4.7 percent. Suppose we had an investment that we thought had about the same risk as a portfolio of large-firm common stocks. At a minimum, what return would this investment have to offer for us to be interested?

From Table 12.3, we see that the risk premium on large-company stocks has been 8.5 percent historically, so a reasonable estimate of our required return would be this premium plus the T-bill rate,  $4.7\% + 8.5\% = 13.2\%$ . This may strike you as being high; but if we were thinking of starting a new business, then the risks of doing so might resemble those of investing in small-company stocks. In this case, the historical risk premium is 13.6 percent, so we might require as much as 18.3 percent from such an investment at a minimum.

We will discuss the relationship between risk and required return in more detail in the next chapter. For now, you should notice that a projected internal rate of return, or IRR, on

a risky investment in the 10 to 20 percent range isn't particularly outstanding. It depends on how much risk there is. This, too, is an important lesson from capital market history.

### Investing in Growth Stocks

### EXAMPLE 12.3

The term *growth stock* is frequently used as a euphemism for small-company stock. Are such investments suitable for “widows and orphans”? Before answering, you should consider the historical volatility. For example, from the historical record, what is the approximate probability that you will actually lose more than 16 percent of your money in a single year if you buy a portfolio of stocks of such companies?

Looking back at Figure 12.10, we see that the average return on small-company stocks is 17.4 percent and the standard deviation is 32.9 percent. Assuming the returns are approximately normal, there is about a 1/3 probability that you will experience a return outside the range of  $-15.5$  to  $50.3$  percent ( $17.4\% \pm 32.9\%$ ).

Because the normal distribution is symmetric, the odds of being above or below this range are equal. There is thus a 1/6 chance (half of 1/3) that you will lose more than 15.5 percent. So you should expect this to happen once in every six years, on average. Such investments can thus be *very* volatile, and they are not well suited for those who cannot afford the risk.

### Concept Questions

- 12.4a** In words, how do we calculate a variance? A standard deviation?
- 12.4b** With a normal distribution, what is the probability of ending up more than one standard deviation below the average?
- 12.4c** Assuming that long-term corporate bonds have an approximately normal distribution, what is the approximate probability of earning 14.7 percent or more in a given year? With T-bills, roughly what is this probability?
- 12.4d** What is the second lesson from capital market history?

## More about Average Returns

## 12.5

Thus far in this chapter, we have looked closely at simple average returns. But there is another way of computing an average return. The fact that average returns are calculated two different ways leads to some confusion, so our goal in this section is to explain the two approaches and also the circumstances under which each is appropriate.

### ARITHMETIC VERSUS GEOMETRIC AVERAGES

Let's start with a simple example. Suppose you buy a particular stock for \$100. Unfortunately, the first year you own it, it falls to \$50. The second year you own it, it rises back to \$100, leaving you where you started (no dividends were paid).

What was your average return on this investment? Common sense seems to say that your average return must be exactly zero because you started with \$100 and ended with \$100. But if we calculate the returns year-by-year, we see that you lost 50 percent the first year (you lost half of your money). The second year, you made 100 percent (you doubled your money). Your average return over the two years was thus  $(-50\% + 100\%)/2 = 25\%$ !



Jeremy J. Siegel on Stocks for the Long Run

The most fascinating characteristic about the data on real financial market returns that I collected is the stability of the long-run real equity returns. The compound annual (geometric) real return on U.S. stocks averaged 6.8% per year from 1802 through 2005 and this return had remained remarkably stable over long-term periods. From 1802 through 1871, the real return averaged 7.0%, from 1871, when the Cowles Foundation data became available, through 1925, the real return on stocks averaged 6.6% per year, and since 1925, which the well-known Ibbotson data cover, the real return has averaged 6.7%. Despite the fact that the price level has increased nearly ten times since the end of the Second World War, real stock returns have still averaged 6.8%.

The long run stability of real returns on stocks is strongly indicative of *mean reversion of equity return*. Mean reversion means that stock return can be very volatile in the short run, but show a remarkable stability in the long run. When my research was first published, there was much skepticism of the mean reversion properties of equity market returns, but now this concept is widely accepted for stocks. If mean reversion prevails, portfolios geared for the long-term should have a greater share of equities than short-term portfolios. This conclusion has long been the “conventional” wisdom on investing, but it does not follow if stock returns follow a random walk, a concept widely accepted by academics in the 1970s and 1980s.

When my data first appeared, there was also much discussion of “survivorship bias,” the fact the U.S. stock returns are unusually good because the U.S. was the most successful capitalist country. But three British researchers, Elroy Dimson, Paul Marsh, and Michael Staunton, surveyed stock returns in 16 countries since the beginning of the 20th century and wrote up their results in a book entitled *Triumph of the Optimists*. The authors concluded that U.S. stock returns do not give a distorted picture of the superiority of stocks over bonds worldwide.

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**geometric average return**

The average compound return earned per year over a multiyear period.

**arithmetic average return**

The return earned in an average year over a multiyear period.

So which is correct, 0 percent or 25 percent? Both are correct: They just answer different questions. The 0 percent is called the **geometric average return**. The 25 percent is called the **arithmetic average return**. The geometric average return answers the question “What was your average compound return per year over a particular period?” The arithmetic average return answers the question “What was your return in an average year over a particular period?”

Notice that, in previous sections, the average returns we calculated were all arithmetic averages, so we already know how to calculate them. What we need to do now is (1) learn how to calculate geometric averages and (2) learn the circumstances under which average is more meaningful than the other.

**CALCULATING GEOMETRIC AVERAGE RETURNS**

First, to illustrate how we calculate a geometric average return, suppose a particular investment had annual returns of 10 percent, 12 percent, 3 percent, and -9 percent over the last four years. The geometric average return over this four-year period is calculated as  $(1.10 \times 1.12 \times 1.03 \times .91)^{1/4} - 1 = 3.66\%$ . In contrast, the average arithmetic return we have been calculating is  $(.10 + .12 + .03 - .09)/4 = 4.0\%$ .

In general, if we have  $T$  years of returns, the geometric average return over these  $T$  years is calculated using this formula:

$$\text{Geometric average return} = [(1 + R_1) \times (1 + R_2) \times \dots \times (1 + R_T)]^{1/T} - 1 \quad [12.4]$$

This formula tells us that four steps are required:

1. Take each of the  $T$  annual returns  $R_1, R_2, \dots, R_T$  and add 1 to each (after converting them to decimals!).
2. Multiply all the numbers from step 1 together.

3. Take the result from step 2 and raise it to the power of  $1/T$ .
4. Finally, subtract 1 from the result of step 3. The result is the geometric average return.

### Calculating the Geometric Average Return

### EXAMPLE 12.4

Calculate the geometric average return for S&P 500 large-cap stocks for the first five years in Table 12.1, 1926–1930.

First, convert percentages to decimal returns, add 1, and then calculate their product:

S&P 500 Returns	Product
13.75	1.1375
35.70	×1.3570
45.08	×1.4508
−8.80	×0.9120
−25.13	×0.7487
	1.5291

Notice that the number 1.5291 is what our investment is worth after five years if we started with a \$1 investment. The geometric average return is then calculated as follows:

$$\text{Geometric average return} = 1.5291^{1/5} - 1 = 0.0887, \text{ or } 8.87\%$$

Thus, the geometric average return is about 8.87 percent in this example. Here is a tip: If you are using a financial calculator, you can put \$1 in as the present value, \$1.5291 as the future value, and 5 as the number of periods. Then, solve for the unknown rate. You should get the same answer we did.

One thing you may have noticed in our examples thus far is that the geometric average returns seem to be smaller. This will always be true (as long as the returns are not all identical, in which case the two “averages” would be the same). To illustrate, Table 12.4 shows the arithmetic averages and standard deviations from Figure 12.10, along with the geometric average returns.

As shown in Table 12.4, the geometric averages are all smaller, but the magnitude of the difference varies quite a bit. The reason is that the difference is greater for more volatile investments. In fact, there is a useful approximation. Assuming all the numbers are expressed in decimals (as opposed to percentages), the geometric average return is approximately equal to the arithmetic average return minus half the variance. For example, looking at the large-company stocks, the arithmetic average is .123 and the standard deviation is .202, implying that the variance is .040804. The approximate geometric average is thus  $.123 - .040804/2 = .1026$ , which is quite close to the actual value.

Series	Average Return		Standard Deviation
	Geometric	Arithmetic	
Large-company stocks	10.4%	12.3%	20.2%
Small-company stocks	12.6	17.4	32.9
Long-term corporate bonds	5.9	6.2	8.5
Long-term government bonds	5.5	5.8	9.2
Intermediate-term government bonds	5.3	5.5	5.7
U.S. Treasury bills	3.7	3.8	3.1
Inflation	3.0	3.1	4.3

**TABLE 12.4**

Geometric versus Arithmetic Average Returns: 1926–2005

**EXAMPLE 12.5** More Geometric Averages

Take a look back at Figure 12.4. There, we showed the value of a \$1 investment after 80 years. Use the value for the large-company stock investment to check the geometric average in Table 12.4.

In Figure 12.4, the large-company investment grew to \$2,657.56 over 80 years. The geometric average return is thus

$$\text{Geometric average return} = 2,657.56^{1/80} - 1 = .1036, \text{ or } 10.4\%$$

This 10.4% is the value shown in Table 12.4. For practice, check some of the other numbers in Table 12.4 the same way.

**ARITHMETIC AVERAGE RETURN OR GEOMETRIC AVERAGE RETURN?**

When we look at historical returns, the difference between the geometric and arithmetic average returns isn't too hard to understand. To put it slightly differently, the geometric average tells you what you actually earned per year on average, compounded annually. The arithmetic average tells you what you earned in a typical year. You should use whichever one answers the question you want answered.

A somewhat trickier question concerns which average return to use when forecasting future wealth levels, and there's a lot of confusion on this point among analysts and financial planners. First, let's get one thing straight: If you *know* the true arithmetic average return, then this is what you should use in your forecast. For example, if you know the arithmetic return is 10 percent, then your best guess of the value of a \$1,000 investment in 10 years is the future value of \$1,000 at 10 percent for 10 years, or \$2,593.74.

The problem we face, however, is that we usually have only *estimates* of the arithmetic and geometric returns, and estimates have errors. In this case, the arithmetic average return is probably too high for longer periods and the geometric average is probably too low for shorter periods. So, you should regard long-run projected wealth levels calculated using arithmetic averages as optimistic. Short-run projected wealth levels calculated using geometric averages are probably pessimistic.

The good news is that there is a simple way of combining the two averages, which we will call *Blume's formula*.<sup>4</sup> Suppose we have calculated geometric and arithmetic return averages from  $N$  years of data, and we wish to use these averages to form a  $T$ -year average return forecast,  $R(T)$ , where  $T$  is less than  $N$ . Here's how we do it:

$$R(T) = \frac{T-1}{N-1} \times \text{Geometric average} + \frac{N-T}{N-1} \times \text{Arithmetic average} \quad [12.5]$$

For example, suppose that, from 25 years of annual returns data, we calculate an arithmetic average return of 12 percent and a geometric average return of 9 percent. From these averages, we wish to make 1-year, 5-year, and 10-year average return forecasts. These three average return forecasts are calculated as follows:

$$R(1) = \frac{1-1}{24} \times 9\% + \frac{25-1}{24} \times 12\% = 12\%$$

$$R(5) = \frac{5-1}{24} \times 9\% + \frac{25-5}{24} \times 12\% = 11.5\%$$

$$R(10) = \frac{10-1}{24} \times 9\% + \frac{25-10}{24} \times 12\% = 10.875\%$$

<sup>4</sup>This elegant result is due to Marshal Blume ("Unbiased Estimates of Long-Run Expected Rates of Return," *Journal of the American Statistical Association*, September 1974, pp.634–638).

Thus, we see that 1-year, 5-year, and 10-year forecasts are 12 percent, 11.5 percent, and 10.875 percent, respectively.

As a practical matter, Blume's formula says that if you are using averages calculated over a long period (such as the 80 years we use) to forecast up to a decade or so into the future, then you should use the arithmetic average. If you are forecasting a few decades into the future (as you might do for retirement planning), then you should just split the difference between the arithmetic and geometric average returns. Finally, if for some reason you are doing very long forecasts covering many decades, use the geometric average.

This concludes our discussion of geometric versus arithmetic averages. One last note: In the future, when we say "average return," we mean arithmetic unless we explicitly say otherwise.

### Concept Questions

- 12.5a** If you wanted to forecast what the stock market is going to do over the next year, should you use an arithmetic or geometric average?
- 12.5b** If you wanted to forecast what the stock market is going to do over the next century, should you use an arithmetic or geometric average?

## Capital Market Efficiency

## 12.6

Capital market history suggests that the market values of stocks and bonds can fluctuate widely from year to year. Why does this occur? At least part of the answer is that prices change because new information arrives, and investors reassess asset values based on that information.

The behavior of market prices has been extensively studied. A question that has received particular attention is whether prices adjust quickly and correctly when new information arrives. A market is said to be "efficient" if this is the case. To be more precise, in an **efficient capital market**, current market prices fully reflect available information. By this we simply mean that, based on available information, there is no reason to believe that the current price is too low or too high.

The concept of market efficiency is a rich one, and much has been written about it. A full discussion of the subject goes beyond the scope of our study of corporate finance. However, because the concept figures so prominently in studies of market history, we briefly describe the key points here.

### PRICE BEHAVIOR IN AN EFFICIENT MARKET

To illustrate how prices behave in an efficient market, suppose the F-Stop Camera Corporation (FCC) has, through years of secret research and development, developed a camera with an autofocus system whose speed will double that of the autofocus systems now available. FCC's capital budgeting analysis suggests that launching the new camera will be a highly profitable move; in other words, the NPV appears to be positive and substantial. The key assumption thus far is that FCC has not released any information about the new system; so, the fact of its existence is "inside" information only.

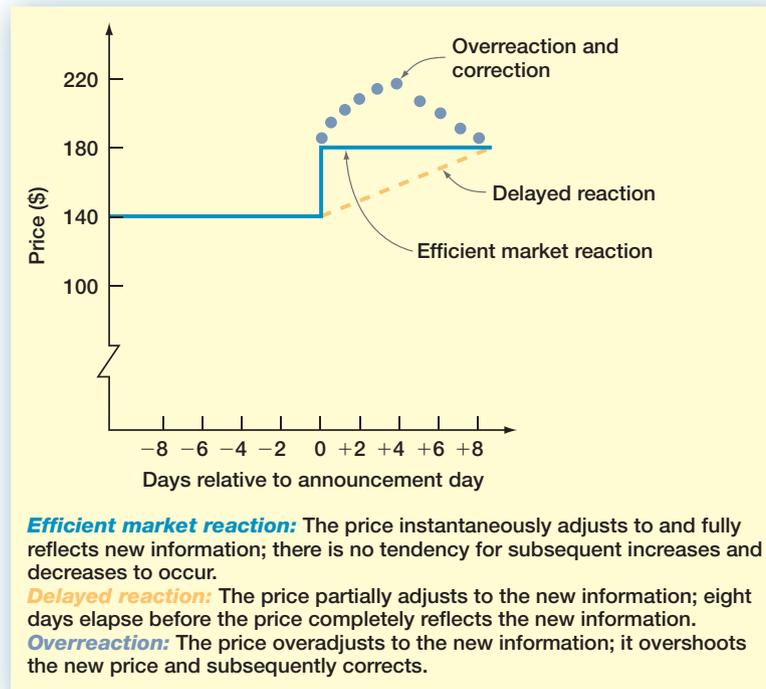
Now consider a share of stock in FCC. In an efficient market, its price reflects what is known about FCC's current operations and profitability, and it reflects market opinion about FCC's potential for future growth and profits. The value of the new autofocus system is not reflected, however, because the market is unaware of the system's existence.

### efficient capital market

A market in which security prices reflect available information.

**FIGURE 12.12**

Reaction of Stock Price to New Information in Efficient and Inefficient Markets



If the market agrees with FCC's assessment of the value of the new project, FCC's stock price will rise when the decision to launch is made public. For example, assume the announcement is made in a press release on Wednesday morning. In an efficient market, the price of shares in FCC will adjust quickly to this new information. Investors should not be able to buy the stock on Wednesday afternoon and make a profit on Thursday. This would imply that it took the stock market a full day to realize the implication of the FCC press release. If the market is efficient, the price of shares of FCC stock on Wednesday afternoon will already reflect the information contained in the Wednesday morning press release.

Figure 12.12 presents three possible stock price adjustments for FCC. In Figure 12.12, day 0 represents the announcement day. As illustrated, before the announcement, FCC's stock sells for \$140 per share. The NPV per share of the new system is, say, \$40, so the new price will be \$180 once the value of the new project is fully reflected.

The solid line in Figure 12.12 represents the path taken by the stock price in an efficient market. In this case, the price adjusts immediately to the new information and no further changes in the price of the stock take place. The broken line in Figure 12.12 depicts a delayed reaction. Here it takes the market eight days or so to fully absorb the information. Finally, the dotted line illustrates an overreaction and subsequent adjustment to the correct price.

The broken line and the dotted line in Figure 12.12 illustrate paths that the stock price might take in an inefficient market. If, for example, stock prices don't adjust immediately to new information (the broken line), then buying stock immediately following the release of new information and then selling it several days later would be a positive NPV activity because the price is too low for several days after the announcement.

### efficient markets hypothesis (EMH)

The hypothesis that actual capital markets, such as the NYSE, are efficient.

### THE EFFICIENT MARKETS HYPOTHESIS

The **efficient markets hypothesis (EMH)** asserts that well-organized capital markets, such as the NYSE, are efficient markets, at least as a practical matter. In other words, an

advocate of the EMH might argue that although inefficiencies may exist, they are relatively small and not common.

If a market is efficient, then there is a very important implication for market participants: All investments in that market are *zero* NPV investments. The reason is not complicated. If prices are neither too low nor too high, then the difference between the market value of an investment and its cost is zero; hence, the NPV is zero. As a result, in an efficient market, investors get exactly what they pay for when they buy securities, and firms receive exactly what their stocks and bonds are worth when they sell them.

What makes a market efficient is competition among investors. Many individuals spend their entire lives trying to find mispriced stocks. For any given stock, they study what has happened in the past to the stock price and the stock's dividends. They learn, to the extent possible, what a company's earnings have been, how much the company owes to creditors, what taxes it pays, what businesses it is in, what new investments are planned, how sensitive it is to changes in the economy, and so on.

Not only is there a great deal to know about any particular company, but there is also a powerful incentive for knowing it—namely, the profit motive. If you know more about some company than other investors in the marketplace, you can profit from that knowledge by investing in the company's stock if you have good news and by selling it if you have bad news.

The logical consequence of all this information gathering and analysis is that mispriced stocks will become fewer and fewer. In other words, because of competition among investors, the market will become increasingly efficient. A kind of equilibrium comes into being with which there is just enough mispricing around for those who are best at identifying it to make a living at it. For most other investors, the activity of information gathering and analysis will not pay.<sup>5</sup>



Look under the "contents" link at [www.investorhome.com](http://www.investorhome.com) for more info on the EMH.

### SOME COMMON MISCONCEPTIONS ABOUT THE EMH

No other idea in finance has attracted as much attention as that of efficient markets, and not all of the attention has been flattering. Rather than rehash the arguments here, we will be content to observe that some markets are more efficient than others. For example, financial markets on the whole are probably much more efficient than real asset markets.

Having said this, however, we can also say that much of the criticism of the EMH is misguided because it is based on a misunderstanding of what the hypothesis says and what it doesn't say. For example, when the notion of market efficiency was first publicized and debated in the popular financial press, it was often characterized by words to the effect that "throwing darts at the financial page will produce a portfolio that can be expected to do as well as any managed by professional security analysts."<sup>6</sup>

Confusion over statements of this sort has often led to a failure to understand the implications of market efficiency. For example, sometimes it is wrongly argued that market efficiency means that it doesn't matter how you invest your money because the efficiency of the market will protect you from making a mistake. However, a random dart thrower might wind up with all of the darts sticking into one or two high-risk stocks that deal in genetic engineering. Would you really want all of your money in two such stocks?

<sup>5</sup>The idea behind the EMH can be illustrated by the following short story: A student was walking down the hall with her finance professor when they both saw a \$20 bill on the ground. As the student bent down to pick it up, the professor shook his head slowly and, with a look of disappointment on his face, said patiently to the student, "Don't bother. If it were really there, someone else would have picked it up already." The moral of the story reflects the logic of the efficient markets hypothesis: If you think you have found a pattern in stock prices or a simple device for picking winners, you probably have not.

<sup>6</sup>B. G. Malkiel, *A Random Walk Down Wall Street*, (revised and updated ed.) (New York: Norton, 2003).

## IN THEIR OWN WORDS ...

### Richard Roll on Market Efficiency

**The concept of** an efficient market is a special application of the “no free lunch” principle. In an efficient financial market, costless trading policies will not generate “excess” returns. After adjusting for the riskiness of the policy, the trader’s return will be no larger than the return of a randomly selected portfolio, at least on average.

This is often thought to imply something about the amount of “information” reflected in asset prices. However, it really doesn’t mean that prices reflect all information nor even that they reflect publicly available information. Instead it means that the connection between unreflected information and prices is too subtle and tenuous to be easily or costlessly detected.

Relevant information is difficult and expensive to uncover and evaluate. Thus, if costless trading policies are ineffective, there must exist some traders who make a living by “beating the market.” They cover their costs (including the opportunity cost of their time) by trading. The existence of such traders is actually a necessary precondition for markets to become efficient. Without such professional traders, prices would fail to reflect everything that is cheap and easy to evaluate.

Efficient market prices should approximate a random walk, meaning that they will appear to fluctuate more or less randomly. Prices can fluctuate nonrandomly to the extent that their departure from randomness is expensive to discern. Also, observed price series can depart from apparent randomness due to changes in preferences and expectations, but this is really a technicality and does not imply a free lunch relative to current investor sentiments.

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A contest run by *The Wall Street Journal* provides a good example of the controversy surrounding market efficiency. Each month, the *Journal* asked four professional money managers to pick one stock each. At the same time, it threw four darts at the stock page to select a comparison group. In the 147 five-and one-half month contests from July 1990 to September 2002, the pros won 90 times. When the returns on the portfolios are compared to the Dow Jones Industrial Average, the score is 90 to 57 in favor of the pros.

The fact that the pros are ahead of the darts by 90 to 57 suggests that markets are not efficient. Or does it? One problem is that the darts naturally tend to select stocks of average risk. The pros, however, are playing to win and naturally select riskier stocks, or so it is argued. If this is true, then, on average, we *expect* the pros to win. Furthermore, the pros’ picks are announced to the public at the start. This publicity may boost the prices of the shares involved somewhat, leading to a partially self-fulfilling prophecy. Unfortunately, the *Journal* discontinued the contest in 2002, so this test of market efficiency is no longer ongoing.

More than anything else, what efficiency implies is that the price a firm will obtain when it sells a share of its stock is a “fair” price in the sense that it reflects the value of that stock given the information available about the firm. Shareholders do not have to worry that they are paying too much for a stock with a low dividend or some other sort of characteristic because the market has already incorporated that characteristic into the price. We sometimes say that the information has been “priced out.”

The concept of efficient markets can be explained further by replying to a frequent objection. It is sometimes argued that the market cannot be efficient because stock prices fluctuate from day to day. If the prices are right, the argument goes, then why do they

change so much and so often? From our discussion of the market, we can see that these price movements are in no way inconsistent with efficiency. Investors are bombarded with information every day. The fact that prices fluctuate is, at least in part, a reflection of that information flow. In fact, the absence of price movements in a world that changes as rapidly as ours would suggest inefficiency.

### THE FORMS OF MARKET EFFICIENCY

It is common to distinguish between three forms of market efficiency. Depending on the degree of efficiency, we say that markets are either *weak form efficient*, *semistrong form efficient*, or *strong form efficient*. The difference between these forms relates to what information is reflected in prices.

We start with the extreme case. If the market is strong form efficient, then *all* information of *every* kind is reflected in stock prices. In such a market, there is no such thing as inside information. Therefore, in our FCC example, we apparently were assuming that the market was not strong form efficient.

Casual observation, particularly in recent years, suggests that inside information does exist, and it can be valuable to possess. Whether it is lawful or ethical to use that information is another issue. In any event, we conclude that private information about a particular stock may exist that is not currently reflected in the price of the stock. For example, prior knowledge of a takeover attempt could be very valuable.

The second form of efficiency, semistrong form efficiency, is the most controversial. If a market is semistrong form efficient, then all *public* information is reflected in the stock price. The reason this form is controversial is that it implies that a security analyst who tries to identify mispriced stocks using, for example, financial statement information is wasting time because that information is already reflected in the current price.

The third form of efficiency, weak form efficiency, suggests that, at a minimum, the current price of a stock reflects the stock's own past prices. In other words, studying past prices in an attempt to identify mispriced securities is futile if the market is weak form efficient. Although this form of efficiency might seem rather mild, it implies that searching for patterns in historical prices that will be useful in identifying mispriced stocks will not work (this practice is quite common).

What does capital market history say about market efficiency? Here again, there is great controversy. At the risk of going out on a limb, we can say that the evidence seems to tell us three things. First, prices appear to respond rapidly to new information, and the response is at least not grossly different from what we would expect in an efficient market. Second, the future of market prices, particularly in the short run, is difficult to predict based on publicly available information. Third, if mispriced stocks exist, then there is no obvious means of identifying them. Put another way, simpleminded schemes based on public information will probably not be successful.

#### Concept Questions

**12.6a** What is an efficient market?

**12.6b** What are the forms of market efficiency?

## 12.7 Summary and Conclusions

This chapter has explored the subject of capital market history. Such history is useful because it tells us what to expect in the way of returns from risky assets. We summed up our study of market history with two key lessons:

1. Risky assets, on average, earn a risk premium. There is a reward for bearing risk.
2. The greater the potential reward from a risky investment, the greater is the risk.

These lessons have significant implications for the financial manager. We will consider these implications in the chapters ahead.

We also discussed the concept of market efficiency. In an efficient market, prices adjust quickly and correctly to new information. Consequently, asset prices in efficient markets are rarely too high or too low. How efficient capital markets (such as the NYSE) are is a matter of debate; but, at a minimum, they are probably much more efficient than most real asset markets.

### CHAPTER REVIEW AND SELF-TEST PROBLEMS

**12.1 Recent Return History** Use Table 12.1 to calculate the average return over the years 1996 through 2000 for large-company stocks, long-term government bonds, and Treasury bills.

**12.2 More Recent Return History** Calculate the standard deviation for each security type using information from Problem 12.1. Which of the investments was the most volatile over this period?

### ANSWERS TO CHAPTER REVIEW AND SELF-TEST PROBLEMS

**12.1** We calculate the averages as follows:

Actual Returns			
Year	Large-Company Stocks	Long-Term Government Bonds	Treasury Bills
1996	0.2296	0.0013	0.0514
1997	0.3336	0.1202	0.0519
1998	0.2858	0.1445	0.0486
1999	0.2104	-0.0751	0.0480
2000	-0.0910	0.1722	0.0598
Average	0.1937	0.0726	0.0519

**12.2** We first need to calculate the deviations from the average returns. Using the averages from Problem 12.1, we get the following values:

Deviations from Average Returns			
Year	Large-Company Stocks	Long-Term Government Bonds	Treasury Bills
1996	0.0359	-0.0713	-0.0005
1997	0.1400	0.0476	0.0000
1998	0.0921	0.0719	-0.0033
1999	0.0167	-0.1477	-0.0039
2000	-0.2847	0.0996	0.0079
Total	0.0000	0.0000	0.0000

We square these deviations and calculate the variances and standard deviations:

Squared Deviations from Average Returns			
Year	Large-Company Stocks	Long-Term Government Bonds	Treasury Bills
1996	0.0012906	0.0050865	0.0000003
1997	0.0195872	0.0022639	0.0000000
1998	0.0084837	0.0051667	0.0000112
1999	0.0002801	0.0218212	0.0000155
2000	0.0810670	0.0099162	0.0000618
Variance	0.0276771	0.0110636	0.0000222
Std dev	0.1663645	0.1051838	0.0047104

To calculate the variances, we added up the squared deviations and divided by 4, the number of returns less 1. Notice that the stocks had much more volatility than the bonds with a much larger average return. For large-company stocks, this was a particularly good period: The average return was 19.37 percent.

### CONCEPTS REVIEW AND CRITICAL THINKING QUESTIONS

- Investment Selection** Given that ViroPharma was up by over 469 percent for 2005, why didn't all investors hold?
- Investment Selection** Given that Majesco Entertainment was down by almost 92 percent for 2005, why did some investors hold the stock? Why didn't they sell out before the price declined so sharply?
- Risk and Return** We have seen that over long periods, stock investments have tended to substantially outperform bond investments. However, it is common to observe investors with long horizons holding entirely bonds. Are such investors irrational?
- Market Efficiency Implications** Explain why a characteristic of an efficient market is that investments in that market have zero NPVs.

5. **Efficient Markets Hypothesis** A stock market analyst is able to identify mispriced stocks by comparing the average price for the last 10 days to the average price for the last 60 days. If this is true, what do you know about the market?
6. **Semistrong Efficiency** If a market is semistrong form efficient, is it also weak form efficient? Explain.
7. **Efficient Markets Hypothesis** What are the implications of the efficient markets hypothesis for investors who buy and sell stocks in an attempt to “beat the market”?
8. **Stocks versus Gambling** Critically evaluate the following statement: Playing the stock market is like gambling. Such speculative investing has no social value other than the pleasure people get from this form of gambling.
9. **Efficient Markets Hypothesis** Several celebrated investors and stock pickers frequently mentioned in the financial press have recorded huge returns on their investments over the past two decades. Is the success of these particular investors an invalidation of the EMH? Explain.
10. **Efficient Markets Hypothesis** For each of the following scenarios, discuss whether profit opportunities exist from trading in the stock of the firm under the conditions that (1) the market is not weak form efficient, (2) the market is weak form but not semistrong form efficient, (3) the market is semistrong form but not strong form efficient, and (4) the market is strong form efficient.
  - a. The stock price has risen steadily each day for the past 30 days.
  - b. The financial statements for a company were released three days ago, and you believe you’ve uncovered some anomalies in the company’s inventory and cost control reporting techniques that are causing the firm’s true liquidity strength to be understated.
  - c. You observe that the senior managers of a company have been buying a lot of the company’s stock on the open market over the past week.

## QUESTIONS AND PROBLEMS



### BASIC

(Questions 1–12)

1. **Calculating Returns** Suppose a stock had an initial price of \$84 per share, paid a dividend of \$2.05 per share during the year, and had an ending share price of \$97. Compute the percentage total return.
2. **Calculating Yields** In Problem 1, what was the dividend yield? The capital gains yield?
3. **Return Calculations** Rework Problems 1 and 2 assuming the ending share price is \$79.
4. **Calculating Returns** Suppose you bought a 6 percent coupon bond one year ago for \$940. The bond sells for \$920 today.
  - a. Assuming a \$1,000 face value, what was your total dollar return on this investment over the past year?
  - b. What was your total nominal rate of return on this investment over the past year?
  - c. If the inflation rate last year was 4 percent, what was your total real rate of return on this investment?
5. **Nominal versus Real Returns** What was the average annual return on large-company stock from 1926 through 2005:

- a. In nominal terms?  
b. In real terms?
6. **Bond Returns** What is the historical real return on long-term government bonds? On long-term corporate bonds?
7. **Calculating Returns and Variability** Using the following returns, calculate the arithmetic average returns, the variances, and the standard deviations for X and Y.

Year	Returns	
	X	Y
1	6%	18%
2	24	39
3	13	-6
4	-14	-20
5	15	47

8. **Risk Premiums** Refer to Table 12.1 in the text and look at the period from 1970 through 1975.
- a. Calculate the arithmetic average returns for large-company stocks and T-bills over this period.  
b. Calculate the standard deviation of the returns for large-company stocks and T-bills over this period.  
c. Calculate the observed risk premium in each year for the large-company stocks versus the T-bills. What was the average risk premium over this period? What was the standard deviation of the risk premium over this period?  
d. Is it possible for the risk premium to be negative before an investment is undertaken? Can the risk premium be negative after the fact? Explain.
9. **Calculating Returns and Variability** You've observed the following returns on Crash-n-Burn Computer's stock over the past five years: 2 percent, -8 percent, 24 percent, 19 percent, and 12 percent.
- a. What was the arithmetic average return on Crash-n-Burn's stock over this five-year period?  
b. What was the variance of Crash-n-Burn's returns over this period? The standard deviation?
10. **Calculating Real Returns and Risk Premiums** For Problem 9, suppose the average inflation rate over this period was 3.5 percent and the average T-bill rate over the period was 4.2 percent.
- a. What was the average real return on Crash-n-Burn's stock?  
b. What was the average nominal risk premium on Crash-n-Burn's stock?
11. **Calculating Real Rates** Given the information in Problem 10, what was the average real risk-free rate over this time period? What was the average real risk premium?
12. **Effects of Inflation** Look at Table 12.1 and Figure 12.7 in the text. When were T-bill rates at their highest over the period from 1926 through 2005? Why do you think they were so high during this period? What relationship underlies your answer?
13. **Calculating Investment Returns** You bought one of Great White Shark Repellant Co.'s 7 percent coupon bonds one year ago for \$920. These bonds make annual payments and mature six years from now. Suppose you decide to



**INTERMEDIATE**  
(Questions 13–22)

sell your bonds today, when the required return on the bonds is 8 percent. If the inflation rate was 4.2 percent over the past year, what was your total real return on investment?

- 14. Calculating Returns and Variability** You find a certain stock that had returns of 13 percent, -9 percent, -15 percent, and 41 percent for four of the last five years. If the average return of the stock over this period was 11 percent, what was the stock's return for the missing year? What is the standard deviation of the stock's return?
- 15. Arithmetic and Geometric Returns** A stock has had returns of 18 percent, 4 percent, 39 percent, -5 percent, 26 percent, and -11 percent over the last six years. What are the arithmetic and geometric returns for the stock?
- 16. Arithmetic and Geometric Returns** A stock has had the following year-end prices and dividends:

Year	Price	Dividend
1	\$51.87	—
2	52.89	\$0.84
3	64.12	0.91
4	57.18	1.00
5	67.13	1.11
6	75.82	1.24

What are the arithmetic and geometric returns for the stock?

- 17. Using Return Distributions** Suppose the returns on long-term corporate bonds are normally distributed. Based on the historical record, what is the approximate probability that your return on these bonds will be less than -2.3 percent in a given year? What range of returns would you expect to see 95 percent of the time? What range would you expect to see 99 percent of the time?
- 18. Using Return Distributions** Assuming that the returns from holding small-company stocks are normally distributed, what is the approximate probability that your money will double in value in a single year? What about triple in value?
- 19. Distributions** In Problem 18, what is the probability that the return is less than -100 percent (think)? What are the implications for the distribution of returns?
- 20. Blume's Formula** Over a 30-year period an asset had an arithmetic return of 12.8 percent and a geometric return of 10.7 percent. Using Blume's formula, What is your best estimate of the future annual returns over 5 years? 10 years? 20 years?
- 21. Blume's Formula** Assume that the historical return on large-company stocks is a predictor of the future returns. What return would you estimate for large-company stocks over the next year? The next 5 years? 20 years? 30 years?
- 22. Calculating Returns** Refer to Table 12.1 in the text and look at the period from 1973 through 1980:
- Calculate the average return for Treasury bills and the average annual inflation rate (consumer price index) for this period.
  - Calculate the standard deviation of Treasury bill returns and inflation over this period.

- c. Calculate the real return for each year. What is the average real return for Treasury bills?
- d. Many people consider Treasury bills risk-free. What do these calculations tell you about the potential risks of Treasury bills?
- 23. Using Probability Distributions** Suppose the returns on large-company stocks are normally distributed. Based on the historical record, use the cumulative normal probability table (rounded to the nearest table value) in the appendix of the text to determine the probability that in any given year you will lose money by investing in common stock.
- 24. Using Probability Distributions** Suppose the returns on long-term corporate bonds and T-bills are normally distributed. Based on the historical record, use the cumulative normal probability table (rounded to the nearest table value) in the appendix of the text to answer the following questions:
- a. What is the probability that in any given year, the return on long-term corporate bonds will be greater than 10 percent? Less than 0 percent?
- b. What is the probability that in any given year, the return on T-bills will be greater than 10 percent? Less than 0 percent?
- c. In 1979, the return on long-term corporate bonds was  $-4.18$  percent. How likely is it that such a low return will recur at some point in the future? T-bills had a return of 10.32 percent in this same year. How likely is it that such a high return on T-bills will recur at some point in the future?

**CHALLENGE**

(Questions 23–24)

**WEB EXERCISES**

- 12.1 Market Risk Premium** You want to find the current market risk premium. Go to [money.cnn.com](http://money.cnn.com), and follow the “Bonds & Rates” link and the “Latest Rates” link. What is the shortest-maturity interest rate shown? What is the interest rate for this maturity? Using the large-company stock return in Table 12.3, what is the current market risk premium? What assumption are you making when calculating the risk premium?
- 12.2 Historical Interest Rates** Go to the St. Louis Federal Reserve Web site at [www.stls.frb.org](http://www.stls.frb.org) and follow the “FRED II®/Data” link and the “Interest Rates” link. You will find a list of links for different historical interest rates. Follow the “10-Year Treasury Constant Maturity Rate” link and you will find the monthly 10-year Treasury note interest rates. Calculate the average annual 10-year Treasury interest rate for 2004 and 2005 using the rates for each month. Compare this number to the long-term government bond returns and the U.S. Treasury bill returns found in Table 12.1. How does the 10-year Treasury interest rate compare to these numbers? Do you expect this relationship to always hold? Why or why not?

**MINICASE****A Job at S&S Air**

You recently graduated from college, and your job search led you to S&S Air. Because you felt the company’s business was taking off, you accepted a job offer. The first day on the job, while you are finishing your employment paperwork, Chris Guthrie, who works in Finance, stops by to inform you about the company’s 401(k) plan.

A 401(k) plan is a retirement plan offered by many companies. Such plans are tax-deferred savings vehicles, meaning that any deposits you make into the plan are deducted from your current pretax income, so no current taxes are paid on the money. For example, assume your salary will be \$50,000 per year. If you contribute \$3,000 to the 401(k) plan, you will

pay taxes on only \$47,000 in income. There are also no taxes paid on any capital gains or income while you are invested in the plan, but you do pay taxes when you withdraw money at retirement. As is fairly common, the company also has a 5 percent match. This means that the company will match your contribution up to 5 percent of your salary, but you must contribute to get the match.

The 401(k) plan has several options for investments, most of which are mutual funds. A mutual fund is a portfolio of assets. When you purchase shares in a mutual fund, you are actually purchasing partial ownership of the fund's assets. The return of the fund is the weighted average of the return of the assets owned by the fund, minus any expenses. The largest expense is typically the management fee, paid to the fund manager. The management fee is compensation for the manager, who makes all of the investment decisions for the fund.

S&S Air uses Bledsoe Financial Services as its 401(k) plan administrator. Here are the investment options offered for employees:

**Company Stock** One option in the 401(k) plan is stock in S&S Air. The company is currently privately held. However, when you interviewed with the owners, Mark Sexton and Todd Story, they informed you the company stock was expected to go public in the next three to four years. Until then, a company stock price is simply set each year by the board of directors.

**Bledsoe S&P 500 Index Fund** This mutual fund tracks the S&P 500. Stocks in the fund are weighted exactly the same as the S&P 500. This means the fund return is approximately the return on the S&P 500, minus expenses. Because an index fund purchases assets based on the composition of the index it is following, the fund manager is not required to research stocks and make investment decisions. The result is that the fund expenses are usually low. The Bledsoe S&P 500 Index Fund charges expenses of .15 percent of assets per year.

**Bledsoe Small-Cap Fund** This fund primarily invests in small-capitalization stocks. As such, the returns of the fund are more volatile. The fund can also invest 10 percent of its assets in companies based outside the United States. This fund charges 1.70 percent in expenses.

**Bledsoe Large-Company Stock Fund** This fund invests primarily in large-capitalization stocks of companies based in the United States. The fund is managed by Evan Bledsoe and has outperformed the market in six of the last eight years. The fund charges 1.50 percent in expenses.

**Bledsoe Bond Fund** This fund invests in long-term corporate bonds issued by U.S.-domiciled companies. The fund is restricted to investments in bonds with an investment-grade credit rating. This fund charges 1.40 percent in expenses.

**Bledsoe Money Market Fund** This fund invests in short-term, high credit-quality debt instruments, which include Treasury bills. As such, the return on the money market fund is only slightly higher than the return on Treasury bills. Because of the credit quality and short-term nature of the investments, there is only a very slight risk of negative return. The fund charges .60 percent in expenses.

1. What advantages do the mutual funds offer compared to the company stock?
2. Assume that you invest 5 percent of your salary and receive the full 5 percent match from S&S Air. What EAR do you earn from the match? What conclusions do you draw about matching plans?
3. Assume you decide you should invest at least part of your money in large-capitalization stocks of companies based in the United States. What are the advantages and disadvantages of choosing the Bledsoe Large-Company Stock Fund compared to the Bledsoe S&P 500 Index Fund?
4. The returns on the Bledsoe Small-Cap Fund are the most volatile of all the mutual funds offered in the 401(k) plan. Why would you ever want to invest in this fund? When you examine the expenses of the mutual funds, you will notice that this fund also has the highest expenses. Does this affect your decision to invest in this fund?
5. A measure of risk-adjusted performance that is often used is the Sharpe ratio. The Sharpe ratio is calculated as the risk premium of an asset divided by its standard deviation. The standard deviation and return of the funds over the past 10 years are listed in the following table. Calculate the Sharpe ratio for each of these funds. Assume that the expected return and standard deviation of the company stock will be 18 percent and 70 percent, respectively. Calculate the Sharpe ratio for the company stock. How appropriate is the Sharpe ratio for these assets? When would you use the Sharpe ratio?

	10-Year Annual Return	Standard Deviation
Bledsoe S&P 500 Index Fund	11.48%	15.82%
Bledsoe Small-Cap Fund	16.68	19.64
Bledsoe Large-Company Stock Fund	11.85	15.41
Bledsoe Bond Fund	9.67	10.83

6. What portfolio allocation would you choose? Why? Explain your thinking carefully.