Part Five

Risk and Return

Chapter 12 | Some Lessons from Capital Market History

This chapter begins with a description of investors' historical experiences in Canadian capital markets since 1948. It describes the lessons that financial managers can learn from studying capital market history and introduces the important concept of an efficient capital market.

Chapter 13 | Return, Risk, and the Security Market Line

This chapter describes the nature of the risk-return trade-off facing investors and firms. It shows how to use the risk-return trade-off to determine the required return on an investment.

12 Some Lessons from Capital Market History

THE TSE 300 INDEX was up over 31% in 1999 on the strength of high tech stocks like Nortel Networks. Although it was basically flat (down around 1.5%) in 1998, the two prior years both saw strong returns—over 14% in 1997 and around 28% in 1996. From March 2000 to March 2001, however, the TSE was down over 33% as tech stocks collapsed. Based on this recent experience, what return should you expect if you invest in Canadian common stocks? In this chapter we study five decades of capital market history to find out. ■

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THUS FAR, we haven't had much to say about what determines the required return on an investment. In one sense, the answer is very simple: The required return depends on the risk of the investment. The greater the risk is, 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 to know what financial investments have to offer. Going further, we saw in Chapter 2 that the cash flow of a firm equals the cash flow to creditors and shareholders. So the returns and risks of financial investments provide information on the real investments firms undertake.

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 from such investments? This perspective is essential for understanding how to analyze and value risky investment projects.

We start our discussion on risk and return by describing the historical experience of investors in Canadian financial markets. In 1931, for example, the stock market lost about 33 percent of its value. Just two years later, the stock market gained 51 percent. In more recent memory, the market lost about 23 percent of its value in the month of October 1987 alone. What lessons, if any, can financial managers learn from such shifts in the stock market? We explore the last half-century 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, based on recent events, perhaps everyone would agree with Mark Twain when he observed, "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, the greater is the risk. To understand these facts about market returns, we devote much of this chapter to reporting the statistics and numbers that make up modern capital market history in Canada. Canadians also invest in the United States so we include some discussion of U.S. markets. In the next chapter, these facts provide the foundation for our study of how financial markets put a price on risk.

Returns 12.1

We wish to discuss historical returns on different types of financial assets. We do this after briefly discussing how to calculate the return from investing.

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 usually has 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 often changes. In this case, you have a capital gain or capital loss on your investment.[1]

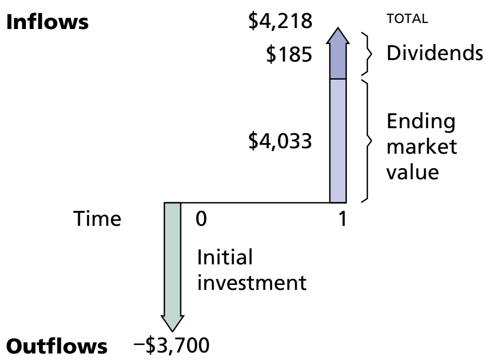
To illustrate, suppose Canadian Atlantic Enterprises has several thousand shares of stock outstanding. You purchased some of these shares at the beginning of the year. It is now year-end, and you want to determine how well you have done on your investment.

Over the year, a company may pay cash dividends to its shareholders. As a shareholder in Canadian Atlantic Enterprises, 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 17). So, as the owner of some stock, you receive some cash. This cash is the income component from owning the stock.

[1] The aftertax dollar returns would be reduced by taxes levied differently for dividends and capital gains as we discussed in Chapter 2.

Figure 12.1

Dollar returns



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. The stock is selling for $37 per share. If you buy 100 shares, you have 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:

Dividend = $1.85 × 100 = $185

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

Capital gain = ($40.33 – $37) × 100 = $333

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

Capital loss = ($34.78 – $37) × 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:

Total dollar return = Dividend income + Capital gain (or loss) **[12.1]**

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

Total dollar return = $185 + 333 = $518

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

Total cash if stock is sold = Initial investment + Total return **[12.2]**
= $3,700 + 518
= $4,218

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

Proceeds from stock sale + Dividends = $40.33 × 100 + $185
= $4,033 + 185
= $4,218

Suppose you hold on to your Canadian Atlantic 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 it?

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 wanted to. Whether you choose to do so or not is up to you.

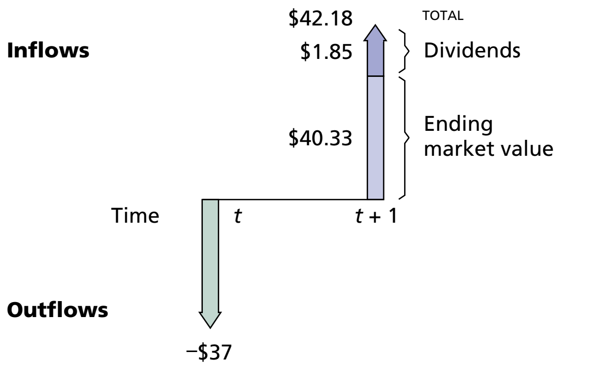
After all, if you insisted on converting your gain to cash, you could always sell the stock at year-end and immediately reinvest by buying the stock back. There is no net difference between doing this and just not selling (assuming, there are no tax consequences from selling the stock). Again, the point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



$$\text{Percentage return} = \frac{\text{Dividends paid at end of period} + \text{Change in market value over period}}{\text{Beginning market value}}$$

$$1 + \text{Percentage return} = \frac{\text{Dividends paid at end of period} + \text{Market value at end of period}}{\text{Beginning market value}}$$

Figure 12.2

Percentage, dollar, and per-share returns

$$\text{Dividend yield} = D_t/P_t$$
$$= \$1.85/\$37 = .05 = 5\%$$

This says that, for each dollar we invest, we get 5 cents in dividends.

The other component of our percentage return is the capital gains yield. This is calculated as the change in the price during the year (the capital gain) divided by the beginning price:

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

So, per dollar invested, you get 9 cents in capital gains.

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

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

Example 12.1 Calculating Returns

Suppose you buy some stock 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:

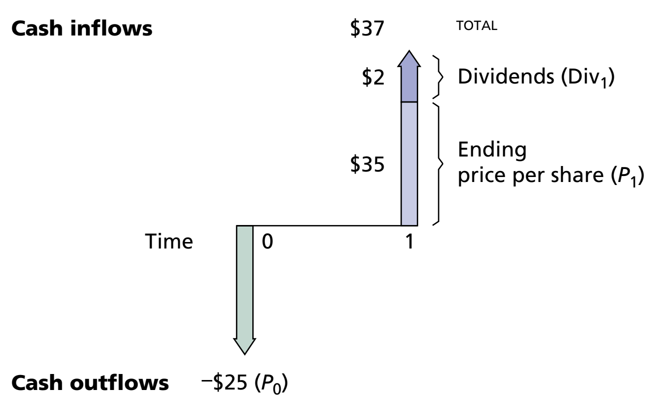
$$\text{Dividend yield} = D_{t+1}/P_t$$
$$= \$2/\$25 = .08 = 8\%$$

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

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

Figure 12.3

Cash flow—an investment example



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, 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 × $2 = $80 in cash dividends. Your $10 per-share gain would give you a total capital gain of $10 × 40 = $400. Add these together, and you get the $480.

Concept Questions

1. What are the two parts of total return?
2. Why are unrealized capital gains or losses included in the calculation of returns?
3. What is the difference between a dollar return and a percentage return? Why are percentage returns more convenient?

The Historical Record 12.2

Capital market history is of great interest to investment consultants who advise institutional investors on portfolio strategy. The data set we use is in Table 12.1. It was assembled by William M. Mercer Ltd. drawing on two major studies. Roger Ibbotson and Rex Sinquefield conducted a famous set of studies dealing with rates of return in U.S. financial markets. James Hatch and Robert White examined Canadian returns.[2] Our data presents 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 held portfolios of the following:

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1. Canadian common stocks. The common stock portfolio is based on a sample of the largest companies (in total market value of outstanding stock) in Canada.[3]
2. U.S. common stocks. The U.S. common stock portfolio consists of 500 of the largest U.S. companies. The full historical series is given in U.S. dollars. A separate series presents U.S. stock returns in Canadian dollars adjusting for shifts in exchange rates.
3. Small stocks. The small stock portfolio is composed of the small capitalization Canadian stocks as compiled by Nesbitt Burns.
4. Long bonds. The long bond portfolio has high-quality, long-term corporate, provincial, and Government of Canada bonds.
5. Canada Treasury bills. The T-bill portfolio has Treasury bills with a three-month maturity.

www.bmonesbittburns.com

[2] The two classic studies are R. G. Ibbotson and R. A. Sinquefield, *Stocks, Bonds, Bills, and Inflation* (Charlottesville, Va.: Financial Analysts Research Foundation, 1982), and J. Hatch and R. White, *Canadian Stocks, Bonds, Bills, and Inflation: 1950-1983* (Charlottesville, Va.: Financial Analysts Research Foundation, 1985). Additional sources used by William M. Mercer Ltd. are Nesbitt Burns for small capitalization for small stocks, Scotia Capital Markets for Canada Treasury bills and long bonds, and Statistics Canada CANSIM for rates of exchange and inflation.

[3] From 1956 on, the TSE 300 is used. For earlier years, William M. Mercer Ltd. used a sample provided by the TSE.

www.statcan.ca

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 Statistics Canada 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.

The five asset classes included in Table 12.1 cover a broad range of investments popular with Canadian individuals and financial institutions. We include U.S. stocks since Canadian investors often invest abroad—particularly in the United States.[4]

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 three of these different portfolios at the beginning of 1948. The growth in value for each of the different portfolios over the 52-year period ending in 1999 is given separately. 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 on a logarithmic scale such that equal distances measure equal percentage changes (as opposed to equal dollar changes) in value.[5]

Looking at Figure 12.4, we see that the common stock investments did the best overall. Every dollar invested in Canadian stocks grew to $357.34 over the 52 years.

At the other end, the T-bill portfolio grew to only $20.36. Long bonds did better with an ending value of $36.37. These values are less impressive when we consider inflation over this period. As illustrated, the price level climbed such that $8.45 is needed just to replace the original $1.

Given the historical record as discussed so far, why would any investor hold any asset class other than common stocks? A close look at Figure 12.4 provides an answer. The T-bill portfolio and the long-term bond portfolio grew more slowly than did the stock portfolio, but they also grew much more steadily. The common stocks ended up on top, but as you can see, they grew erratically at times. For example, comparing Canadian stocks with T-bills, the stocks had a smaller return in 17 years during this period.

A Closer Look

To illustrate the variability of the different investments, we look at a few selected years in Table 12.1. For example, looking at long-term bonds, we see the largest historical return (45.82 percent) occurred in 1982. This was a good year for bonds. The largest single-year return in the table is a very healthy 52.62 percent for the S&P 500 in 1954. In the same year, T-bills returned only 1.62 percent. In contrast, the largest Treasury bill return was 19.11 percent (in 1981).

[4] Chapter 21 discusses exchange rate risk and other risks of foreign investments.

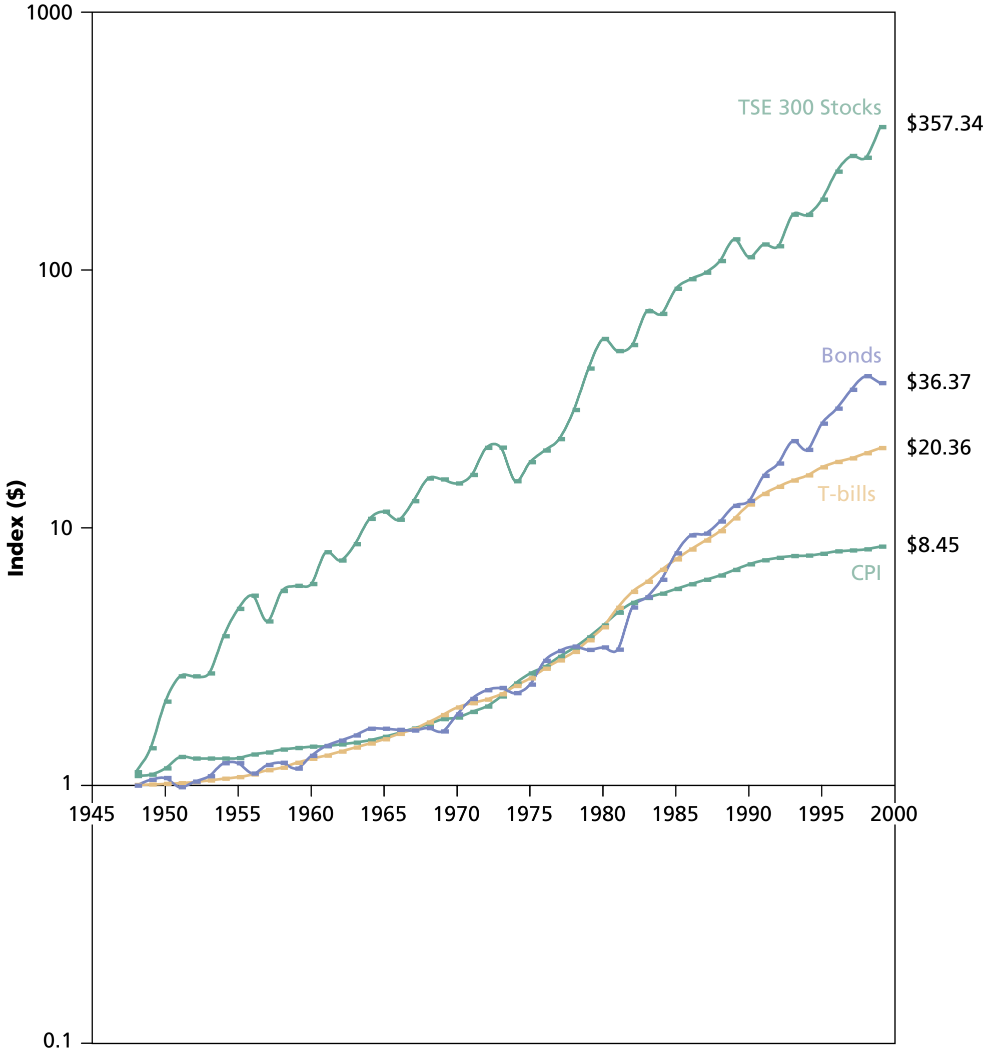
[5] In other words, the scale is logarithmic.

Table 12.1 Annual market index returns: 1948–1999

Year	Statistics Canada inflation	Canadian Stocks (TSE 300)	Scotia Capital Markets 91-day T-bill	Scotia Capital Markets long bonds	S&P 500 (U.S. $)	S&P 500 (Cdn. $)	Nesbitt Burns small stocks
1948	8.88	12.25	0.40	–0.08	5.50	5.50	—
1949	1.09	23.85	0.45	5.18	18.79	22.15	—
1950	5.91	51.69	0.51	1.74	31.71	39.18	—
1951	10.66	25.44	0.71	–7.89	24.02	15.00	—
1952	–1.38	0.01	0.95	5.01	18.37	13.68	—
1953	0.00	2.56	1.54	5.00	–0.99	–0.99	—
1954	0.00	39.37	1.62	12.23	52.62	52.62	—
1955	0.47	27.68	1.22	0.13	31.56	35.51	—
1956	3.24	12.68	2.63	–8.87	6.56	2.35	—
1957	1.79	–20.58	3.76	7.94	–10.78	–8.51	—
1958	2.64	31.25	2.27	1.92	43.36	40.49	—
1959	1.29	4.59	4.39	–5.07	11.96	10.54	—
1960	1.27	1.78	3.66	12.19	0.46	5.15	—
1961	0.42	32.75	2.86	9.16	26.89	32.85	—
1962	1.67	–7.09	3.81	5.03	–8.73	–5.77	—
1963	1.64	15.60	3.58	4.58	22.80	23.19	—
1964	2.02	25.43	3.73	6.16	16.48	15.75	—
1965	3.16	6.67	3.79	0.05	12.45	12.58	—
1966	3.45	–7.07	4.89	–1.05	–10.06	–9.33	—
1967	4.07	18.09	4.38	–0.48	23.98	23.61	—
1968	3.91	22.45	6.22	2.14	11.06	10.26	—
1969	4.79	–0.81	6.83	–2.86	–8.50	–8.50	—
1970	1.31	–3.57	6.89	16.39	4.01	–1.96	–11.69
1971	5.16	8.01	3.86	14.84	14.31	13.28	15.83
1972	4.91	27.37	3.43	8.11	18.98	18.12	44.72
1973	9.36	0.27	4.78	1.97	–14.66	–14.58	–7.82
1974	12.30	–25.93	7.68	–4.53	–26.47	–26.87	–26.89
1975	9.52	18.48	7.05	8.02	37.20	40.72	41.00
1976	5.87	11.02	9.10	23.64	23.84	22.97	22.77
1977	9.45	10.71	7.64	9.04	–7.18	0.65	39.93
1978	8.44	29.72	7.90	4.10	6.56	15.50	44.41
1979	9.69	44.77	11.04	–2.83	18.44	16.52	46.04
1980	11.20	30.13	12.23	2.18	32.42	35.51	42.86
1981	12.20	–10.25	19.11	–2.09	–4.91	–5.57	–15.10
1982	9.23	5.54	15.27	45.82	21.41	25.84	4.55
1983	4.51	35.49	9.39	9.61	22.51	24.07	44.30
1984	3.77	–2.39	11.21	16.90	6.27	12.87	–2.33
1985	4.38	25.07	9.70	26.68	32.16	39.82	38.98
1986	4.19	8.95	9.34	17.21	18.47	16.96	12.33
1987	4.12	5.88	8.20	1.77	5.23	–0.96	–5.47
1988	3.96	11.08	8.94	11.30	16.81	7.21	5.46
1989	5.17	21.37	11.95	15.17	31.49	27.74	10.66
1990	5.00	–14.80	13.28	4.32	–3.17	–3.06	–27.32
1991	3.78	12.02	9.90	25.30	30.55	30.05	18.51
1992	2.14	–1.43	6.65	11.57	7.67	18.42	13.01
1993	1.70	32.55	5.63	22.09	10.00	14.40	52.26
1994	0.23	–0.18	4.76	–7.39	1.34	7.48	–9.21
1995	1.75	14.53	7.39	26.34	37.43	33.68	13.88
1996	2.17	28.35	5.02	14.18	23.07	23.62	28.66
1997	0.73	14.98	3.20	18.46	33.36	39.18	6.97
1998	1.02	–1.58	4.74	12.85	28.57	37.71	–17.9
1999	2.58	31.59	4.66	–5.98	21.03	14.14	20.29

Source: William M. Mercer Ltd.

Figure 12.4 Returns to a $1 investing, 1948–1999



Concept Questions

1. With 20-20 hindsight, what was the best investment for the period 1981–82?
2. Why doesn't everyone just buy common stocks as investments?
3. What was the smallest return observed over the 50 years for each of these investments? When did it occur?
4. How many times did large Canadian stocks (common stocks) return more than 30 percent? How many times did they return less than 20 percent?
5. What was the longest winning streak (years without a negative return) for large Canadian stocks? For long-term bonds?
6. How often did the T-bill portfolio have a negative return?
7. How have Canadian stocks compared with U.S. stocks over the last 10 years?

Roger Ibbotson on Capital Market History

The financial markets are perhaps the most carefully documented human phenomena in history. Every day, approximately 2,000 NYSE stocks are traded, and at least 5,000 more are traded on other exchanges and in over-the-counter markets. Bonds, commodities, futures, and options also provide a wealth of data. These data daily fill a dozen pages of *The Wall Street Journal* (and numerous other newspapers), and these pages are only summaries of the day's transactions. A record actually exists of every transaction, providing not only a real-time data base, but 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 a billion shares on active days, and the London exchange reports trades on over 10,000 domestic and foreign issues a day. [The Toronto Stock Exchange ranks 12th in the world in dollar volume as we saw in Chapter 1.]

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 generation ago, the bond market was the staidest province on Wall Street. Today, it attracts swarms of traders seeking to exploit arbitrage opportunities—small temporary mispricings—using real-time data and supercomputers 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. ■

In Their Own Words. . .

Roger Ibbotson is Professor in the Practice of Management at the Yale School of Management. He is the founder and president of Ibbotson Associates, a major supplier of financial data bases to the financial services industry. 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.

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 consider the detailed data. We start 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 the yearly returns and divide by 52. The result is the historical average of the individual values.

For example, if you add the returns for the Canadian common stocks for the 52 years, you get about 6.864. The average annual return is thus 6.864/52 = 13.20%. You interpret this 13.20 percent just like any other average. If you picked a year at random from the 52-year history and you had to guess what the return in that year was, the best guess is 13.20 percent.

Average Returns: The Historical Record

Table 12.2 shows the average returns computed from Table 12.1. As shown, in a typical year, the small stocks increased in value by 14.79 percent. Notice also how much larger the stock returns are than the bond returns.

These averages are, of course, nominal since we haven't worried about inflation. Notice that the average inflation rate was 4.25 percent per year over this 52-year span. The nominal return on Canada Treasury bills was 6.04 percent per year. The average real return on Treasury bills was thus approximately 1.79 percent per year; so the real return on T-bills has been quite low historically.

At the other extreme, Canadian common stocks had an average real return of about 13% – 4% = 9%, which is relatively large. If you remember the Rule of 72 (Chapter 5), then a quick "back of the envelope" calculation tells us that 9 percent real growth doubles your buying power about every eight years.

Risk Premiums

Now that we have computed some average returns, it seems logical to see how they compare with each other. Based on our discussion so far, 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 of Canada borrows money by issuing debt securities in different forms. The ones we focus on are Treasury bills. These have the shortest time to maturity of the different government securities. Because the government can always raise taxes to pay its bills, this debt is virtually free of any default risk over its short life. Thus, we call the rate on such debt the risk-free return, and we 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 Canadian 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 call it a **risk premium**.

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

From Table 12.2, we can calculate the risk premiums for the different investments. We report only the nominal risk premium in Table 12.3 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.

Table 12.2

Average annual returns, 1948–99

Investment	Average Return
Canadian common stocks	13.20%
U.S. common stocks (Cdn $)	15.59
Long bonds	7.64
Treasury bills	6.04
Small stocks	14.79
Inflation	4.25

Average return on small stocks is based on data from 1970 to 1999.

Investment	Average Return	Risk Premium
Canadian common stocks	13.20%	7.16%
U.S. common stocks (Cdn $)	15.59	9.55
Long bonds	7.64	1.60
Treasury bills	6.04	0.00
Small stocks	14.79	8.75
Inflation	4.25	–1.79

Average return on small stocks is based on data from 1970 to 1999.

Table 12.3

Average annual returns and risk premiums, 1948–1999

The First Lesson

Looking at Table 12.3, we see that the average risk premium earned by a typical Canadian common stock is around 7 percent: 13.20 – 6.04 = 7.16. 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 common stocks so much larger than the risk premium for long bonds? More generally, what determines the relative sizes 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, part of the answer can be found by looking at the historical variability of the returns of these different investments. So, to get started, we now turn our attention to measuring variability in returns.

Concept Questions

1. What do we mean by excess return and risk premium?
2. What was the nominal risk premium on long bonds? The real risk premium?
3. What is the first lesson from capital market history?

12.4 The Variability of Returns: The Second Lesson

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 bonds. Next we discuss measuring this variability so we can begin examining the subject of risk.

Frequency Distributions and Variability

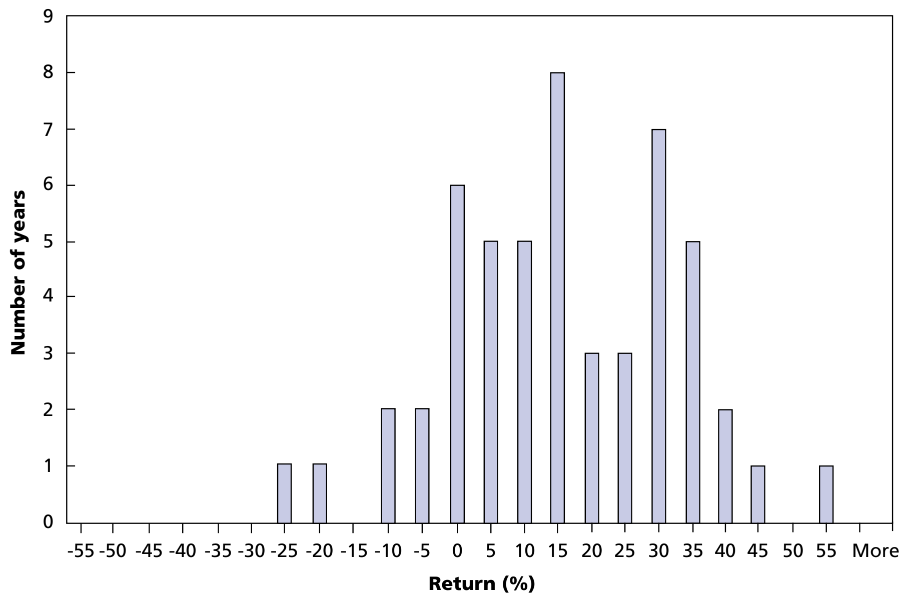
To get started, we can draw a frequency distribution for the common Canadian stock returns similar to the one in Figure 12.5. What we have done here is to count the number of times the annual return on the common stock portfolio falls within each 5 percent range. For example, in Figure 12.5, the height of 1 in the range –25 percent to –30 percent means that 1 of the 50 annual returns was in that range.

Now we need to measure the spread in returns. We know, for example, that the return on Canadian common stocks in a typical year was 13.20 percent. We now want to know how far 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

variance
The average squared deviation between the actual return and the average return.

Figure 12.5

Frequency distribution of returns on Canadian common stocks



standard deviation The positive square root of the variance.

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 are.

The way we calculate the variance and standard deviation depends on the 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, 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 one, or three in this case. This information is summarized in the following table:

	(1) Actual Returns	(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	.16		.00	.0270

In the first column, we write down 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 column 3 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 one. Let Var(R) or σ^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 SD(R) or σ stands for the standard deviation of return:

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

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 is always 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:

$$Var(R) = (1/(T - 1))\ [(R_1 - \overline{R})^2 + \ldots + (R_T - \overline{R})^2] \qquad [12.3]$$

This formula tells us to do just what we did above: Take each of the T individual returns (R_1, R_2, . . .) and subtract the average return, $\overline{R}$; square the result, and add them up; finally, divide this total by the number of returns less one ($T - 1$).[6] The standard deviation is always the square root of Var(R).

Calculating the Variance and Standard Deviation — Example 12.2

Suppose Northern Radio Comm and the Canadian Empire Bank have experienced the following returns in the last four years:

Year	Northern Radio Comm Returns	Canadian Empire Bank Returns
1995	–.20	.05
1996	.50	.09
1997	.30	–.12
1998	.10	.20

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

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

Northern Radio Comm average return = $\overline{R}$ = .70/4 = .175
Canadian Empire Bank average return = $\overline{R}$ = .22/4 = .055

To calculate the variance for Northern Radio Comm, we can summarize the relevant calculations as follows:

[6] We divide by $T - 1$ instead of T because our 52 years' data represent a sample, not the full population.

Year	(1) Actual Returns	(2) Average Returns	(3) Deviation (1) – (2)	(4) Squared Deviation
1995	–.20	.175	–.375	.140625
1996	.50	.175	.325	.105625
1997	.30	.175	.125	.015625
1998	.10	.175	–.075	.005625
Totals	.70		.000	.267500

Since there are four years of returns, we calculate the variances by dividing .2675 by (4 – 1) = 3:

	Northern Radio Comm	Canadian Empire Bank
Variance (σ^2)	.2675/3 = .0892	.0529/3 = .0176
Standard deviation (σ)	$\sqrt{.0892}$ = .2987	$\sqrt{.0176}$ = .1327

For practice, check that you get the same answer as we do for Canadian Empire Bank. Notice that the standard deviation for Northern Radio Comm, 29.87 percent, is a little more than twice Canadian Empire's 13.27 percent; Northern Radio Comm is thus the more volatile investment.[7]

The Historical Record

Table 12.4 summarizes much of our discussion of capital market history so far. It displays average returns and standard deviations of annual returns. We used spreadsheet software to calculate these standard deviations. For example, in Excel it is STDEV. In Table 12.4, notice, for example, that the standard deviation for the Canadian common stock portfolio (16.62 percent per year) is about four times larger than the T-bill portfolio's standard deviation (4.04 percent per year). We return to these figures momentarily.

Normal Distribution

normal distribution
A symmetric, bell-shaped frequency distribution that can be defined by its mean and standard deviation.

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 scores often resemble a bell curve.

Figure 12.6 illustrates a normal distribution and its distinctive bell shape. As you can see, this distribution has a much cleaner appearance than the actual return

Table 12.4

Historical returns and standard deviations, 1948–1999

	Average Return	Standard Deviation
Canadian common stocks	13.20%	16.62%
U.S. common stocks (Cdn $)	15.59	16.86
Long bonds	7.64	10.57
Small stocks	14.79	23.68
Inflation	4.25	3.51
Treasury bills	6.04	4.04

[7] Since our two stocks have different average returns, it may be useful to look at their risks in comparison to the average returns. The coefficient of variation shows this. It equals (Standard deviation)/(Average return).

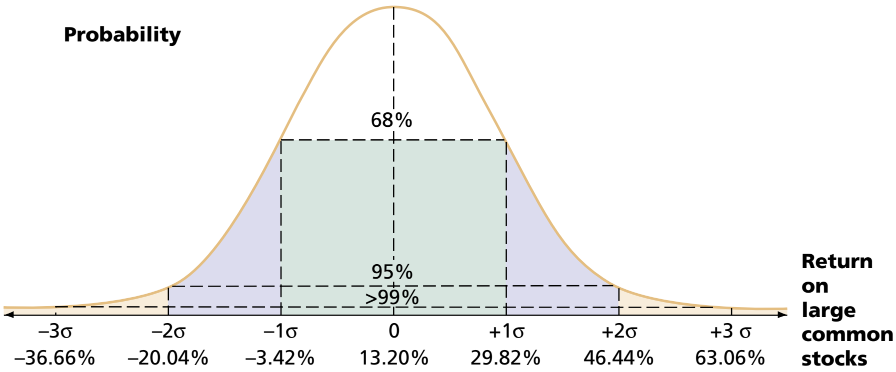


Figure 12.6

The normal distribution. Illustrated returns are based on the historical return and standard deviation for a portfolio of large common stocks.

distributions illustrated in Figure 12.5. Even so, like the normal distribution, the actual distributions do appear to be at least roughly mound-shaped and symmetrical. When this is true, the normal distribution is often a very good approximation.[8]

Also, keep in mind that the distributions in Figure 12.5 are based on only 52 yearly observations while Figure 12.6 is, in principle, based on an infinite number. So, if we had been able to observe returns for, say, 1,000 years, we might have filled in a lot of the irregularities and ended up with a much smoother picture. For our purposes, it is enough to observe that the returns are at least roughly normally distributed.

The usefulness of the normal distribution stems from the fact that it is completely described by the average and standard deviation. If you have these two numbers, there is nothing else to know. For example, with a normal distribution, the probability that we end up within one standard deviation of the average is about two-thirds. The probability that we 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 12.6.

To see why this is useful, recall from Table 12.4 that the standard deviation of returns on Canadian common stocks is 16.62 percent. The average return is 13.20 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 –3.42 percent to 29.82 percent (13.20 percent plus or minus one standard deviation, 16.62 percent) is about two-thirds. This range is illustrated in Figure 12.6. In other words, there is about one chance in three that the return is outside the range. This literally tells you that, if you buy stocks in larger 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 –20.04 percent to 46.44 percent (13.20 percent plus or minus $2 \times 16.62\%$). These points are also illustrated in Figure 12.6.

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

[8] It is debatable whether such a smooth picture would necessarily always be a normal distribution. But we assume it would be normal to make the statistical discussion as simple as possible.

Table 12.5

Historical returns and standard deviations, 1973–1999

	Average Return	Standard Deviation
Canadian common stocks	12.44%	16.70%
U.S. common stocks (Cdn. $)	16.82	17.28
Long bonds	11.32	12.28
Small stocks	14.62	23.75
Inflation	5.50	3.70
Treasury bills	8.73	3.61

change in value. Thus, our second lesson is: The greater the potential reward, the greater is the risk.

To reinforce the second lesson, Table 12.5 shows the average returns and standard deviations on different investments for the recent 27-year period, 1973–1999. Notice that we have added a new investment, small Canadian stocks. Small stocks illustrate the second lesson over again as this investment has both the highest return and the largest standard deviation of any Canadian investment.

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, suppose Canada Treasury bills are paying about 8 percent. Suppose further we have an investment that we think has about the same risk as a portfolio of large-firm Canadian common stocks. At a minimum, what return would this investment have to offer to catch our interest.

To answer this question, we select the risk premium from Table 12.3 instead of Table 12.5 for two reasons: Table 12.3 represents a longer sample period and the larger risk premium is more conservative in this application. From Table 12.3, the risk premium on Canadian common stocks has been 7.16 percent historically, so a reasonable estimate of our required return would be this premium plus the T-bill rate, 8% + 7.16% = 15.16%. This may strike you as high, but, if we were thinking of starting a new business, the risks of doing so might resemble investing in small-company stocks. In this case, the risk premium must be considerably more than 7.16 percent so we might require as much as 20 percent from such an investment at a minimum.

We 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 (IRR) on a risky investment in the 15 to 25 percent range isn't particularly outstanding. It depends on how much risk there is. This, too, is an important lesson from capital market history.

Example 12.3

Investing in Growth Stocks

The phrase *growth stock* is frequently a euphemism for *small-company stock.* Are such investments suitable for elderly, conservative investors? Before answering, you should consider the historical volatility. For example, from the historical record, what is the approximate probability that you could actually lose 10 percent or more of your money in a single year if you buy a portfolio of such companies?

Looking back at Table 12.5, the average return on small stocks is 14.62 percent and the standard deviation is 23.75 percent. Assuming the returns are approximately normal, there is about a one-third probability that you could experience a return outside the range –9.13 percent to 38.37 percent (14.62 plus or minus 23.75 percent).

Because the normal distribution is symmetric, the odds of being above or below this range are equal. There is thus a one-sixth chance (half of one-third) that you could lose more than 9.13 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.[9]

Concept Questions

1. In words, how do we calculate a variance? A standard deviation?
2. With a normal distribution, what is the probability of ending up more than one standard deviation below the average?
3. Assuming that long-term bonds have an approximately normal distribution, what is the approximate probability of earning 17 percent or more in a given year? With T-bills, what is this probability?
4. What is the first lesson from capital market history? The second?

Capital Market Efficiency 12.5

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 behaviour 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 the current price is too low or too high.

efficient capital market
Market in which security prices reflect available information.

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 Behaviour 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 that doubles the speed of available autofocusing systems. FCC's capital budgeting analysis suggests that launching the new camera is 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 only inside information.

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 mar-

[9] Some researchers argue that elderly investors should hold equities to protect against outliving their assets: M. A. Milevsky, K. Ho, and C. Robinson, "Asset Allocation via the Conditional First Exit Time or How to Avoid Outliving Your Money," *Review of Quantitative Finance and Accounting* 9 (July 1997), pp. 53–70.

ket opinion about FCC's potential for future growth and profits. The value of the new autofocusing system is not reflected, however, because the market is unaware of its existence.

If the market agrees with FCC's assessment of the value of the new project, FCC's stock price rises 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 adjusts 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, on Wednesday afternoon the price of FCC shares already reflects the information contained in that morning's press release.

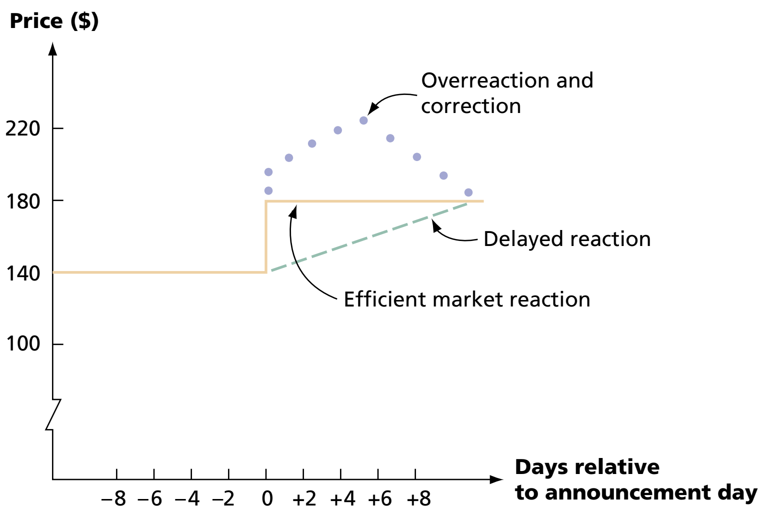
Figure 12.7 presents three possible stock price adjustments for FCC. In Figure 12.7, Day 0 represents the announcement day. As illustrated, before the announcement, FCC's stock sells for $140 per share. The NPV per share of the new system is, say, $40, so the new price would be $180 once the value of the new project is fully reflected.

The solid line in Figure 12.7 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 occur. The broken line in Figure 12.7 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 adjustments to the correct price.

The broken line and the dotted line in Figure 12.7 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), buying stock immediately following the release of new information and then selling it several days later would

Figure 12.7

Reaction of stock price to new information in efficient and inefficient markets



Efficient market reaction: The price instantaneously adjusts to and fully reflects new information; there is no tendency for subsequent increases and decreases.
Delayed reaction: The price partially adjusts to the new information; 10 days elapse before the price completely reflects the new information.
Overreaction: The price overadjusts to the new information; it "overshoots" the new price and subsequently corrects.

be a positive NPV activity because the price is too low for several days after the announcement.

The Efficient Markets Hypothesis

The **efficient markets hypothesis (EMH)** asserts that well-organized capital markets such as the TSE and the NYSE are efficient markets, at least as a practical matter. In other words, an advocate of the EMH might argue that while inefficiencies may exist, they are relatively small and not common.

efficient markets hypothesis (EMH)
The hypothesis is that actual capital markets, such as the TSE, are efficient.

When a market is efficient, there is a very important implication for market participants: All investments in an efficient market are zero NPV investments. The reason is not complicated. If prices are neither too low nor too high, 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 lives trying to find mispriced stocks. For any given stock, they study what has happened in the past to the stock price and its dividends. They learn, to the extent possible, what a company's earnings have been, how much it 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 selling it if you have bad news.

The logical consequences of all this information being gathered and analyzed is that mispriced stocks will become fewer and fewer. In other words, because of competition among investors, the market is becoming increasingly efficient. A kind of equilibrium comes into being where 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 does not pay. We can use Microsoft to illustrate the competition for information. A recent survey found that there are 60 analysts on Wall Street, Bay Street, and around the world assigned to following this stock. As a result, the chances are very low that one analyst will discover some information or insight into the company that is unknown to the other 59.

www.microsoft.com/canada

No idea in finance has attracted as much attention as that of efficient markets, and not all the attention has been flattering. Rather than rehash the arguments here, we are 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.

Efficiency does imply that the price a firm obtains 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 it. 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 prior discussion, 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.

Market Efficiency—Forms and Evidence

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. Thus, in our previous FCC example, we apparently were assuming the market was not strong form efficient.

Casual observation, particularly in recent years, suggests that inside information exists 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.[10]

The second form of efficiency, semistrong efficiency, is the most controversial. In a market that is semistrong form efficient, 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.

Studies of semistrong form efficiency include event studies that measure whether prices adjust rapidly to new information following the efficient markets pattern in Figure 12.7. Announcements of mergers, dividends, earnings, capital expenditures, and new issues of securities are a few examples. Although there are exceptions, event study tests for major exchanges including the TSE, NYSE, and Nasdaq generally support the view that these markets are semistrong efficient with respect to the arrival of new information. In fact, the tests suggest these markets are gifted with a certain amount of foresight. By this, we mean that news tends to leak out and be reflected in stock prices even before the official release of the information.

www.nationalpost.com/financialpost

Referring back to Figure 12.7, what this means is that for stocks listed on major exchanges, the stock price reaction to new information is typically the one shown for an efficient market. In some cases, the price follows the pattern shown for overreaction and correction. For example, a recent study found that stocks recommended in *The Financial Post* "Hot Stock" column experienced price increases followed by declines.[11] Our conclusion here is that the market is mainly efficient but that there are some exceptions.

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[10] The video, *Wall Street*, realistically illustrates how valuable the information can be.

[11] For more details see V. Mehrotra, W.W. Yu, and C. Zhang, "Market Reactions to *The Financial Post's* 'Hot Stock' Column," *Canadian Journal of Administrative Sciences* 16, June 1999, pp. 118-131.

In Their Own Words. . .

A Case of Insider Trading in Canada

Michael DeGroote and an associate settled one of the largest insider trading cases [in April 1993]. Mr DeGroote, who built Laidlaw over 30 years from a small trucking company into a waste management and transportation giant, resigned as an officer and director of the company in December 1990. He had sold control of Laidlaw to Canadian Pacific Ltd. two years earlier for $500 million.

Rather than a smooth transition, the first few months after Mr. DeGroote left Laidlaw have become a recurring nightmare for the company and many of those associated with it.

Laidlaw had been a favourite growth stock for investors in the 1980s, but its earnings fell apart in early 1991, shocking shareholders who believed the waste management sector was recession-proof.

Last April, Ontario securities regulators alleged that Seakist Overseas Ltd., which was based in the Channel Islands and directed by Mr. Henri Herbots, sold Laidlaw stock short using Mr. DeGroote's money and inside knowledge as a former Laidlaw officer and director that the company was doing much worse than the investing public knew.

Investors sell stock short when they expect its price to fall. Short positions give investors the right to "sell" stock they don't own at its current price and then "buy" it back in the future. If the price falls, investors can make a profit.

Mr. DeGroote lent Seakist $27 million (Canadian), at an annual interest rate of 20 percent, to run the short-selling effort, but he maintained he did not have or use inside information about Laidlaw in making the loan on an arm's-length basis.

Seakist opened an account with Midland Walwyn Capital Inc. on January 31, 1991, and, through former Midland broker, Keith Walker, sold short three million Laidlaw shares for about $61 million by March 13, when Laidlaw warned about its poor earnings. The stock fell 18.6 percent in the next trading session and by March 21, Seakist had covered its short positions for $44.5 million, making a $16.5 million profit on the deal.

Mr. Herbots said he devised the short-selling plan based solely on publicly available information.

The two sides agreed to disagree on many of the facts in the settlement, with Mr. DeGroote, Mr. Herbots, and Seakist losing their trading privileges in Ontario for five years, paying $5 million to the provincial treasury and $18 million to compensate investors adversely affected by the short selling. Midland and Mr. Walker paid their total commissions from Seakist's short selling—$304,286—to the provincial treasury. ■

Source: Abridged from Casey Mahood, "DeGroote Faces U.S. Suit," *The Globe and Mail's "Report on Business"*, September 28, 1993, p. B1. Used with permission.

If the market is efficient in the semistrong form, no matter what publicly available information mutual fund managers rely on to pick stocks, their average returns should be the same as those of the average investor in the market as a whole. Researchers have tested mutual fund performance against a market index and found that, on average, fund managers have no special ability to beat the market.[12] This supports semistrong form efficiency. An important practical result of such studies is the growth of index funds that follows a passive investment strategy of investing in the market index. For example, TD Waterhouse Canadian Index Fund invests in the TSE 300 and its performance tracks that of the index. The fund has lower expenses than an actively managed fund because it does not employ analysts to pick stocks. Investors who believe in market efficiency prefer index investing because market efficiency means that the analysts will not beat the market consistently. At the time of writing in 2000, the market share of index funds is growing.

www.tdwaterhouse.ca

The third form of efficiency, weak form efficiency, suggests that, at a minimum, the current price of a stock reflects its own past prices. In other words, studying past

[12] A current Canadian study is G. Athanassakos, P. Carayannopoulos, and M. Racine, "Mutual Fund Performance: The Canadian Experience Between 1985 and 1996," *Canadian Journal of Financial Planning of the CAFP*, June 2000, Vol. 1, Issue 2, pp. 5–9.

prices in an attempt to identify mispriced securities is futile if the market is weak form efficient. Research supporting weak form efficiency suggests that successive price changes are generally consistent with a random walk where deviations from expected return are random. Tests on both the TSE and NYSE support weak form efficiency, although the results are more conclusive for the NYSE. This form of efficiency might seem rather mild; however, it implies that searching for patterns in historical prices that identify mispriced stocks does not work in general. An exception to this statement occurred in the hot high tech market of the late 1990s. Some investors were able to achieve superior returns following momentum strategies based on the idea that stocks that went up yesterday are likely also to go up today. Day trading became very popular in this "momentum market." With the high tech shakeout in 2000 and 2001, the lasting power of this momentum effect remains an open question.[13]

www.tse.com
www.nyse.com
www.nasdaq.com

Although the bulk of the evidence supports the view that major markets such as the TSE, NYSE, and Nasdaq are reasonably efficient, we would not be fair if we did not note the existence of selected contrary results often termed anomalies. The most striking anomaly is the seasonality of stock prices. For instance, the January effect is the well-documented tendency for firms with small capitalizations to have abnormally high returns in the first five days of that month in both the United States and Canada.[14] While the effect is small relative to commissions on stock purchases and sales, investors who have decided to buy small capitalization stocks can exploit the anomaly by buying in December rather than in January.

In addition, the stock market crash of October 19, 1987, is extremely puzzling. The NYSE dropped by more than 20 percent and the TSE by more than 11 percent on a Monday following a weekend during which little surprising news was released. A drop of this magnitude for no apparent reason is not consistent with market efficiency. One theory sees the crash as evidence consistent with the bubble theory of speculative markets. That is, security prices sometimes move wildly above their true values. Eventually, prices fall back to their original level, causing great losses for investors. The tulip craze of the 17th century in Holland and the South Sea Bubble in England the following century are perhaps the two best-known bubbles. From the vantage point of early 2001, it appears that stocks of Internet startups experienced a speculative bubble in 1999.

In summary, what does research on capital market history say about market efficiency? At risk of going out on a limb, the evidence does seem to tell us three things: First, prices do appear to respond very 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 very difficult to predict based on publicly available information. Third, if mispriced stocks do exist, there is no obvious means of identifying them. Put another way, simple-minded schemes based on public information will probably not be successful.[15]

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[13] A Canadian study on momentum is M. Inglis and S. Cleary, "Momentum in Canadian Stock Returns," *Canadian Journal of Administrative Sciences*, September 1998, pp. 279–291.

[14] The effect is international and has been documented in most stock exchanges around the world occurring immediately after the close of the tax year. See V. Jog, "Stock Pricing Anomalies Revisited," *Canadian Investment Review*, Winter 1998, pp. 28–33 and S. Elfakhani, L.J. Lockwood, and R.S. Zaher, "Small Firm and Value Effects in the Canadian Stock Market," *Journal of Financial Research* 21, Fall 1998, pp. 277–291.

[15] The suggested readings for this chapter give references to the large body of U.S. and Canadian research on efficient markets.

Steven Foerster on Canadian Market Efficiency

Two University of Chicago finance professors were walking down the street. One looked down and noticed a twenty-dollar bill on the sidewalk. He pointed it out to his colleague who replied "If markets are efficient, then that twenty-dollar bill shouldn't be there." So instead of attempting to pick it up, they walked on.

Should investment managers rely on active (market timing and security selection) strategies versus passive (index) strategies when managing a portfolio? Another way of asking this same question is to ask whether one believes markets are efficient. While the question is straightforward, the search for an answer is not so easy.

The debate as to whether markets are efficient has plagued academics for years. Simply stated, market efficiency says that the prices of securities fully (and immediately) reflect all "relevant information." In other words, when it comes to buying a stock, the price you pay is exactly what that stock is worth. From this basic premise, academics (particularly professors or graduates from the University of Chicago) have for years attempted to test the validity of this hypothesis.

A problem arises when attempting to operationalize any EMH tests. In order to test the efficiency of stock markets, one must specify a model which describes how prices are formed. But this poses a dilemma—what is the proper model which describes how stock prices are formed? Invariably, any test of the EMH becomes a joint test of both the EMH as well as the specification of the stock price model.

While we can never be certain whether markets are efficient, we can still proceed with joint tests. For three decades, the central stock price model, known to countless business school graduates and professionals, is the Capital Asset Pricing Model, or CAPM, attributed to Nobel Prize-winning finance professor, Bill Sharpe. [Chapter 13 presents the CAPM.] While this stock price paradigm has received many challenges, it has had (and continues to have) an important impact on professionals.

The acceptability of both the EMH (in both the weak form and semi-strong form), along with the CAPM probably reached a peak in the late 1970s, since then many studies have challenged the EMH and CAPM paradigm. This branch of research studies, which started in the U.S. but spread to other countries world wide, became known as the "anomalies" studies—anomalous relative to this particular CAPM paradigm.

Much of the Canadian evidence is consistent with return patterns uncovered in the U.S., as summarized below.

Calendar-based return patterns such as the "day-of-the-week effect" document significant and negative returns on Mondays only. The "January effect" documents high average returns in January relative to other months. The effect is strongest in years when the market goes up.

Price-based return patterns include the "size effect" documenting significantly higher returns for smaller (market capitalization) firms than larger firms, even after adjusting for risk differences (based on CAPM. The "price-earnings ratio effect" documents that stocks that have lower price-earnings ratios have higher subsequent return performance. Other price-based effects are documented including stocks that have low prices or low price-to-book ratios tend to outperform on a risk-adjusted basis.

Price momentum, or relative strength, refers to the observation that stocks that have done well over a particular "intermediate" horizon—usually three months to one year—tend to continue to do well over the subsequent intermediate period. Conversely, stocks that have done poorly over this period tend to continue to do poorly. Canadian stocks are no exception.

Current economic and political factors are related to future (i.e., six-months ahead) stock return performance, suggesting a predictive component to expected returns. Three key economic variables are changes in the inflation rate (stocks tend to perform better when inflation is declining), the shape of the yield curve (stocks tend to do better when long-term rates are higher than short-term rates), and the default premium or difference between corporate and government yields (stocks tend to do better when the premium is smaller).

Politics can have an impact on the stock market. Markets react positively around and subsequent to federal elections, regardless of which of the (traditionally) two main parties wins the election, suggesting that markets react positively to the resolution of uncertainty. In addition, Canadian markets tend to follow the four-year U.S. election cycle, with negative average returns experienced during the second year following a presidential election, and strongest returns during years three and four.

Of course, as we examine any evidence which—on the surface—suggests markets are not efficient, we must ask ourselves whether such anomalies are exploitable. For example, an apparent anomaly may disappear once transaction costs, including commissions, bid-ask spreads and price impacts are taken into consideration.

What are we to conclude from this evidence? My view is that most stock markets—particularly in the U.S. and Canada—are probably relatively efficient (more so in the U.S.), but not completely so. What are the implications for portfolio managers? In the U.S., in particular, for decades it has been extremely difficult for fund managers to outperform a benchmark (such as the S&P 500 index). It's not surprising that index portfolios have grown over the years as managers have gone the passive route—not a bad strategy (but not very exciting either). On the other hand, there may be "exploitable" pockets of inefficiency, which may allow savvy managers to outperform.

Back to our original story: what would you do if you noticed a twenty-dollar bill on the sidewalk? I think I would at least bend down, pick it up, and see if it looked real. ■

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Example 12.4 **The EMH and the Accounting Veil**

The accounting profession provides firms with a significant amount of leeway in their reporting practices. Firms and their accountants have frequently been accused of misusing this leeway in hopes of boosting earning and stock prices.

However, accounting choice should not affect stock price if two conditions hold. First, enough information must be provided in the annual report so financial analysts can recast earnings under their own choice of accounting methods. Second, the market must be efficient in the semistrong form. In other words, the market must appropriately use all this accounting information to "lift the accounting veil" in determining the market price.

One example in which this occurred involved the Northland Bank. Before its failure in 1985, the bank used questionable accounting to cover up its exposure to bad energy loans in western Canada. According to the Estey Commission, which investigated the bank failure, "The financial statements became gold fillings covering cavities in the assets and in the earnings of the bank." Yet, research on stock prices prior to the collapse has shown that stock market investors were aware the bank was highly risky.[16]

Concept Questions

1. What is an efficient market?
2. What are the forms of market efficiency?
3. What evidence exists that major stock markets are efficient?
4. Explain anomalies in the efficient market hypothesis.

12.6 Summary and Conclusions

This chapter explores 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:

[16] R. Giammarino, E. Schwartz, and J. Zechner, "Market Valuation of Bank Assets and Deposit Insurance in Canada," *Canadian Journal of Economics 22* (February 1989), pp. 109–26.

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

These lessons have significant implications for financial managers. We 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 TSE and NYSE) are is a matter of debate, but, at a minimum, they are probably much more efficient than most real asset markets.

Key Terms

risk premium (page 388)
variance (page 389)
standard deviation (page 390)
normal distribution (page 392)
efficient capital market (page 395)
efficient markets hypothesis (EMH) (page 397)

Chapter Review Problems and Self-Test

12.1 **Recent Return History** Use Table 12.1 to calculate the average return over the last five years for Canadian common stocks, small stocks, and Treasury bills.

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

Answers to Self-Test Problems

12.1 We calculate the averages as follows:

Year	TSE	Small	T-bills
1995	0.14530	0.1388	0.07390
1996	0.28350	0.2866	0.05020
1997	0.14980	0.0697	0.03200
1998	−0.01580	−0.1790	0.04740
1999	0.31590	0.2029	0.04660
Average	0.17574	0.1038	0.05002

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

Year	TSE	Small	T-bills
1995	−0.03044	0.0350	0.02388
1996	0.10776	0.1828	0.00018
1997	−0.02594	−0.0341	−0.01802
1998	−0.19154	−0.2828	−0.00262
1999	0.14016	0.0991	−0.00342

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

Year	TSE	Small	T-bills
1995	0.000927	0.001225	0.00057030
1996	0.011612	0.033416	0.00000000
1997	0.000673	0.001163	0.00032472
1998	0.036688	0.079976	0.00000000
1999	0.019645	0.009821	0.00001170
Variance	0.017390	0.031400	0.00023000
Standard deviation	0.131900	0.177200	0.01506000

To calculate the variances, we added the squared deviations and divided by four, the number of returns less one. Notice that the small stocks had substantially greater volatility with a smaller average return. Once again, such investments are risky, particularly over short periods.

Concepts Review and Critical Thinking Questions

1. Given that Nortel was up by more than 300 percent in the 12 months ending in July 2000, why didn't all investors hold Nortel?
2. Given that Hayes was down by 98 percent for 1998, why did some investors hold the stock? Why didn't they sell out before the price declined so sharply?
3. We have seen that, over long periods of time, stock investments have tended to substantially outperform bond investments. However, it is not at all uncommon to observe investors with long horizons holding entirely bonds. Are such investors irrational?
4. Explain why a characteristic of an efficient market is that investments in that market have zero NPVs.
5. 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. If a market is semistrong form efficient, is it also weak form efficient? Explain.
7. What are the implications of the efficient markets hypothesis for investors who buy and sell stocks in an attempt to "beat the market"?
8. 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. There are several celebrated investors and stock pickers frequently mentioned in the financial press who 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. 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 management of a company has 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 $58 per share, paid a dividend of $1.25 per share during the year, and had an ending share price of $45. Compute the percentage total return.

Basic (continued)

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 $75.
4. **Calculating Returns** Suppose you bought a 12 percent coupon bond one year ago for $975. The bond sells for $925 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 Canadian stock from 1948 through 1999:
   a. In nominal terms?
   b. In real terms?
6. **Bond Returns** What is the historical real return on long-term bonds? On long-term corporate bonds?
7. **Calculating Returns and Variability** Using the following returns, calculate the average returns, the variances, and the standard deviations for X and Y.

	Returns	
Year	**X**	**Y**
1	18%	28%
2	11%	– 7%
3	– 9%	–20%
4	13%	33%
5	7%	16%

8. **Risk Premiums** Refer to Table 12.1 in the text and look at the period from 1980 through 1986.
   a. Calculate the average returns for large-company stocks and T-bills over this time period.
   b. Calculate the standard deviation of the returns for large-company stocks and T-bills over this time 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 Missing Data Corporation's stock over the past five years: 6 percent, –10 percent, 4 percent, 23 percent, and 17 percent.
   a. What was the average return on Missing's stock over this five-year period?
   b. What was the variance of Missing'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 3.8 percent.
    a. What was the average real return on Missing's stock?
    b. What was the average nominal risk premium on Missing'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 in the text. When were T-bill rates at their highest over the period from 1948 through 1999? Why do you think they were so high during this period? What relationship underlies your answer?

Intermediate (Questions 13–16)

13. **Calculating Investment Returns** You bought one of Better Bus Manufacturing Co.'s 10 percent coupon bonds one year ago for $1,025.50. These bonds make annual payments and mature

Intermediate ***(continued)***

six years from now. Suppose you decide to sell your bonds today, when the required return on the bonds is 11 percent. If the inflation rate was 3.5 percent over the past year, what would be your total real return on investment?

14. **Using Return Distributions** Suppose the returns on long-term bonds are normally distributed. Based on the historical record, what is the approximate probability that your return on these bonds will be less than –2.93 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?
15. **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?
16. **Distributions** In Problem 15, what is the probability that the return is less than –100 percent (think)? What are the implications for the distribution of returns?

Challenge (Questions 17–18)

17. **Using Probability Distributions** Suppose the returns on Canadian 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.
18. **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 1974, the return on long-term corporate bonds was –4.53 percent. How likely is it that this low of a return will recur at some point in the future? T-bills had a return of 7.68 percent in this same year. How likely is it that this high of a return on T-bills will recur at some point in the future?

Internet Application Questions

1. Russell Fuller and Richard Thaler operate an asset management company that capitalizes on market inefficiencies caused by investors' misprocessing of information. Explain the strategies for their
   a. Small/Mid-Cap Growth Fund
   b. Small-Cap Value Fund

   The website for the Fuller and Thaler Asset Management company is provided below:

   www.fullerthaler.com/
2. While evidence favouring the Efficient Market Hypothesis (EMH) is generally favouable for stock markets in the U.S. and Canada, there are several documented cases of persistent anomalies that defy the EMH. Pick two anomalies from the site listed below, and discuss whether investment strategies based on them can be profitably exploited in the future.

   www.investorhome.com/anomaly.htm
3. Valuing Internet stocks rattles even the best of professional analysts. The following sites provide pointers to understanding valuation of Internet stocks.
   a. www.businessweek.com/1998/50/b3608010.htm
   b. stocks.miningco.com/money/stocks/library/weekly/aa040300a.htm
   c. FOOL ON THE HILL: An Investment Opinion at www.fool.com/EveningNews/1998/EveningNews981120.htm

   Pick an Internet stock such as Yahoo! at www.yahoo.com. Based on the comments in the sites above, do you think the Internet stock you have chosen is over- or under-valued?

Suggested Readings

Two good reviews of research on efficient markets in Canada are:

Z. Bodie, A. Kane, A. Marcus, S. Perrakis, and P. J. Ryan. *Investments.* 3rd Canadian ed. Whitby, ON: McGraw-Hill Ryerson, 2000.

W. F. Sharpe, G. J. Alexander, J. V. Bailey, D. J. Fowler, and D. Domian, *Investments.* 3rd Canadian ed. Scarborough, ON: Prentice-Hall, 1999.

A useful source of highly readable current Canadian capital markets research is the *Canadian Investment Review.*

A good collection of short pieces on investments and markets is:

M.S. Bonham and J. Hull, eds. *Advisor's Guide to Financial Research.* Bonham Centre for Finance, University of Toronto, Toronto, Ontario, 1999.