Efficient Markets and Behavioral Finance

Up to this point we have concentrated almost exclusively on the left-hand side of the balance sheet—the firm's capital investment decision. Now we move to the right-hand side and to the problems involved in financing the capital investments. To put it crudely, you've learned how to spend money, now learn how to raise it.

Of course we haven't totally ignored financing in earlier chapters. We introduced the weighted-average cost of capital, for example. But in most places we have looked past financing issues and used estimates of the opportunity cost of capital to discount future cash flows. We didn't ask how the cost of capital might be affected by financing.

Now we are turning the problem around. We take the firm's present portfolio of real assets and its future investment strategy as given, and then we determine the best financing strategy. For example,

- Should the firm reinvest most of its earnings in the business, or distribute the cash to shareholders?
- If the firm needs more money, should it issue more stock or should it borrow?
- Should it borrow short term or long term?
- Should it borrow by issuing a normal long-term bond or a convertible bond (a bond which can be exchanged for stock by the bondholders)?

There are countless other financing trade-offs, as you will see.

The purpose of holding the firm's capital investment decision constant is to separate that decision from the financing decision. Strictly speaking, this assumes that investment and financing decisions are *independent.* In many circumstances this is a reasonable assumption. The firm is generally free to change its capital structure by repurchasing one security and issuing another. In that case there is no need to associate a particular investment project with a particular source of cash. The firm can think, first, about which projects to accept and, second, about how they should be financed.

Sometimes decisions about capital structure depend on project choice or vice versa, and in those cases the investment and financing decisions have to be considered jointly. However, we defer discussion of such interactions of financing and investment decisions until Chapter 19.

We start this chapter by contrasting investment and financing decisions. The objective in each case is the same—to maximize NPV. However, it may be harder to find positive-NPV financing opportunities. The reason it is difficult to add value by clever financing decisions is that capital markets are usually efficient. By this we mean that fierce competition between investors eliminates profit opportunities and causes debt and equity issues to be fairly priced. If you think that sounds like a sweeping statement, you are right. That is why we have devoted this chapter to explaining and evaluating the efficient-market hypothesis.

You may ask why we start our discussion of financing issues with this conceptual point, before you have even the most basic knowledge about securities and issue procedures. We do it this way because financing decisions seem overwhelmingly complex if you don't learn to ask the right questions. We are afraid you might flee from confusion to the myths that often dominate popular discussion of corporate financing. You need to understand the efficient-market hypothesis not because it is *universally* true but because it leads you to ask the right questions.

We define the efficient-market hypothesis more carefully in Section 13-2. The hypothesis comes in

different strengths, depending on the information available to investors. Sections 13-2 through 13-4 review the evidence for and against efficient markets. The evidence "for" is considerable, but over the years a number of puzzling anomalies have accumulated.

Advocates for rational and efficient markets also have a hard time explaining *bubbles.* Every decade seems to find its own bubble: the 1980s real estate and stock market bubble in Japan, the 1990s technology stock bubble, and the recent real estate bubble that triggered the subprime crisis. Part of the blame for bubbles goes to the incentive and agency problems that can plague even the most rational people, particularly when they are investing other people's money. But bubbles may also reflect patterns of irrational behavior that have been well documented by behavioral psychologists. We describe the main features of *behavioral finance* and the challenge that it poses to the efficient-market hypothesis.

The chapter closes with the six lessons of market efficiency.

13-1 We Always Come Back to NPV

Although it is helpful to separate investment and financing decisions, there are basic similarities in the criteria for making them. The decisions to purchase a machine tool and to sell a bond each involve valuation of a risky asset. The fact that one asset is real and the other is financial doesn't matter. In both cases we end up computing net present value.

The phrase *net present value of borrowing* may seem odd to you. But the following example should help to explain what we mean: As part of its policy of encouraging small business, the government offers to lend your firm $100,000 for 10 years at 3%. This means that the firm is liable for interest payments of $3,000 in each of the years 1 through 10 and that it is responsible for repaying the $100,000 in the final year. Should you accept this offer?

We can compute the NPV of the loan agreement in the usual way. The one difference is that the first cash flow is *positive* and the subsequent flows are *negative:*

$$\begin{aligned}\text{NPV} &= \text{amount borrowed} - \text{present value of interest payments} \\ &\quad - \text{present value of loan repayment} \\ &= +100{,}000 - \sum_{t=1}^{10} \frac{3{,}000}{(1+r)^t} - \frac{100{,}000}{(1+r)^{10}}\end{aligned}$$

The only missing variable is r, the opportunity cost of capital. You need that to value the liability created by the loan. We reason this way: The government's loan to you is a financial asset: a piece of paper representing your promise to pay $3,000 per year plus the final repayment of $100,000. How much would that paper sell for if freely traded in the capital market? It would sell for the present value of those cash flows, discounted at r, the rate of return offered by other securities issued by your firm. All you have to do to determine r is to answer the question, What interest rate would my firm need to pay to borrow money directly from the capital markets rather than from the government?

Suppose that this rate is 10%. Then

$$\begin{aligned}\text{NPV} &= +100{,}000 - \sum_{t=1}^{10} \frac{3{,}000}{(1.10)^t} - \frac{100{,}000}{(1.10)^{10}} \\ &= +100{,}000 - 56{,}988 = +\$43{,}012\end{aligned}$$

Of course, you don't need any arithmetic to tell you that borrowing at 3% is a good deal when the fair rate is 10%. But the NPV calculations tell you just how much that opportunity is worth ($43,012).[1] It also brings out the essential similarity between investment and financing decisions.

[1] We ignore here any tax consequences of borrowing. These are discussed in Chapter 18.

Differences between Investment and Financing Decisions

In some ways investment decisions are simpler than financing decisions. The number of different securities and financing strategies is well into the hundreds (we have stopped counting). You will have to learn the major families, genera, and species. You will also need to become familiar with the vocabulary of financing. You will learn about such matters as red herrings, greenshoes, and bookrunners; behind each of these terms lies an interesting story.

There are also ways in which financing decisions are much easier than investment decisions. First, financing decisions do not have the same degree of finality as investment decisions. They are easier to reverse. That is, their abandonment value is higher. Second, it's harder to make money by smart financing strategies. The reason is that financial markets are more competitive than product markets. This means it is more difficult to find positive-NPV financing strategies than positive-NPV investment strategies.

When the firm looks at capital investment decisions, it does *not* assume that it is facing perfect, competitive markets. It may have only a few competitors that specialize in the same line of business in the same geographical area. And it may own some unique assets that give it an edge over its competitors. Often these assets are intangible, such as patents, expertise, or reputation. All this opens up the opportunity to make superior profits and find projects with positive NPVs.

In financial markets your competition is all other corporations seeking funds, to say nothing of the state, local, and federal governments that go to New York, London, and other financial centers to raise money. The investors who supply financing are comparably numerous, and they are smart: Money attracts brains. The financial amateur often views capital markets as *segmented,* that is, broken down into distinct sectors. But money moves between those sectors, and it usually moves fast. In general, as we shall see, firms should assume that the securities they issue are fairly priced. That takes us into the main topic of this chapter: efficient capital markets.

13-2 What Is an Efficient Market?

A Startling Discovery: Price Changes Are Random

As is so often the case with important ideas, the concept of efficient capital markets stemmed from a chance discovery. In 1953 Maurice Kendall, a British statistician, presented a controversial paper to the Royal Statistical Society on the behavior of stock and commodity prices.[2] Kendall had expected to find regular price cycles, but to his surprise they did not seem to exist. Each series appeared to be "a 'wandering' one, almost as if once a week the Demon of Chance drew a random number . . . and added it to the current price to determine the next week's price." In other words, the prices of stocks and commodities seemed to follow a *random walk.*

If you are not sure what we mean by "random walk," you might like to think of the following example: You are given $100 to play a game. At the end of each week a coin is tossed. If it comes up heads, you win 3% of your investment; if it is tails, you lose 2.5%.

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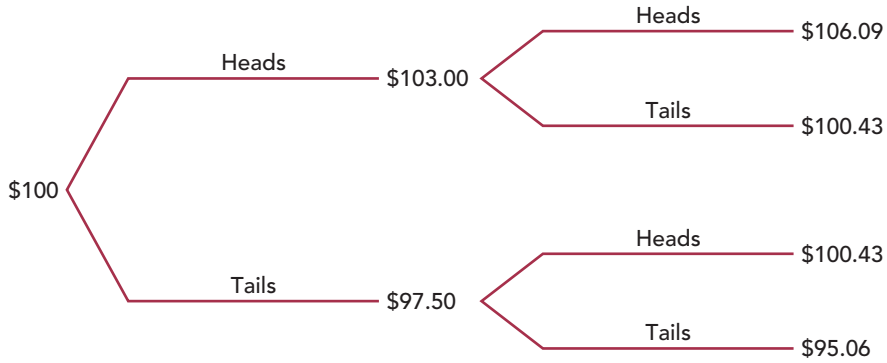
[2] See M. G. Kendall, "The Analysis of Economic Time Series, Part I. Prices," *Journal of the Royal Statistical Society* 96 (1953), pp. 11–25. Kendall's idea was not wholly new. It had been proposed in an almost forgotten thesis written 53 years earlier by a French doctoral student, Louis Bachelier. Bachelier's accompanying development of the mathematical theory of random processes anticipated by five years Einstein's famous work on the random Brownian motion of colliding gas molecules. See L. Bachelier, *Théorie de la Speculation* (Paris: Gauthiers-Villars, 1900). Reprinted in English (A. J. Boness, trans.) in P. H. Cootner (ed.), *The Random Character of Stock Market Prices* (Cambridge, MA: MIT Press, 1964), pp. 17–78.

Therefore, your capital at the end of the first week is either $103.00 or $97.50. At the end of the second week the coin is tossed again. Now the possible outcomes are:



This process is a random walk with a positive drift of .25% per week.[3] It is a random walk because successive changes in value are independent. That is, the odds each week are the same, regardless of the value at the start of the week or of the pattern of heads and tails in the previous weeks.

If you find it difficult to believe that there are no patterns in share price changes, look at the two charts in Figure 13.1. One of these charts shows the outcome from playing our game for five years; the other shows the actual performance of the Standard and Poor's Index for a five-year period. Can you tell which one is which?[4]

When Maurice Kendall suggested that stock prices follow a random walk, he was implying that the price changes are independent of one another just as the gains and losses in our coin-tossing game were independent. Figure 13.2 illustrates this for four stocks, Microsoft, BP, Philips, and Sony. Each panel shows the change in price of the stock on successive days. The circled dot in the southeast quadrant of the Microsoft panel refers to a pair of days in which a 3% increase was followed by a 3% decrease. If there were a systematic tendency for increases to be followed by decreases, there would be many dots in the southeast quadrant and few in the northeast quadrant. It is obvious from a glance that there is very little pattern in these price movements, but we can test this more precisely by calculating the coefficient of correlation between each day's price change and the next. If price movements persisted, the correlation would be positive; if there were no relationship, it would be 0. In our

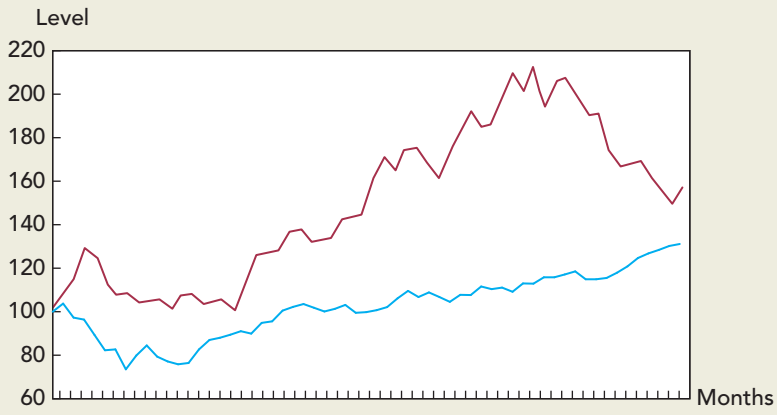


FIGURE 13.1
This chart show the Standard and Poor's Index for a five-year period and the results of playing our coin-tossing game for five years. Can you tell which line is which?

[3] The drift is equal to the expected outcome: (1/2)(3) + (1/2)(−2.5) = .25%.

[4] The blue in Figure 13.1 shows the actual Standard and Poor's Index for February 2002 to February 2007; the red is a series of cumulated random numbers. Of course, 50% of you are likely to have guessed right, but we bet it was just a guess.

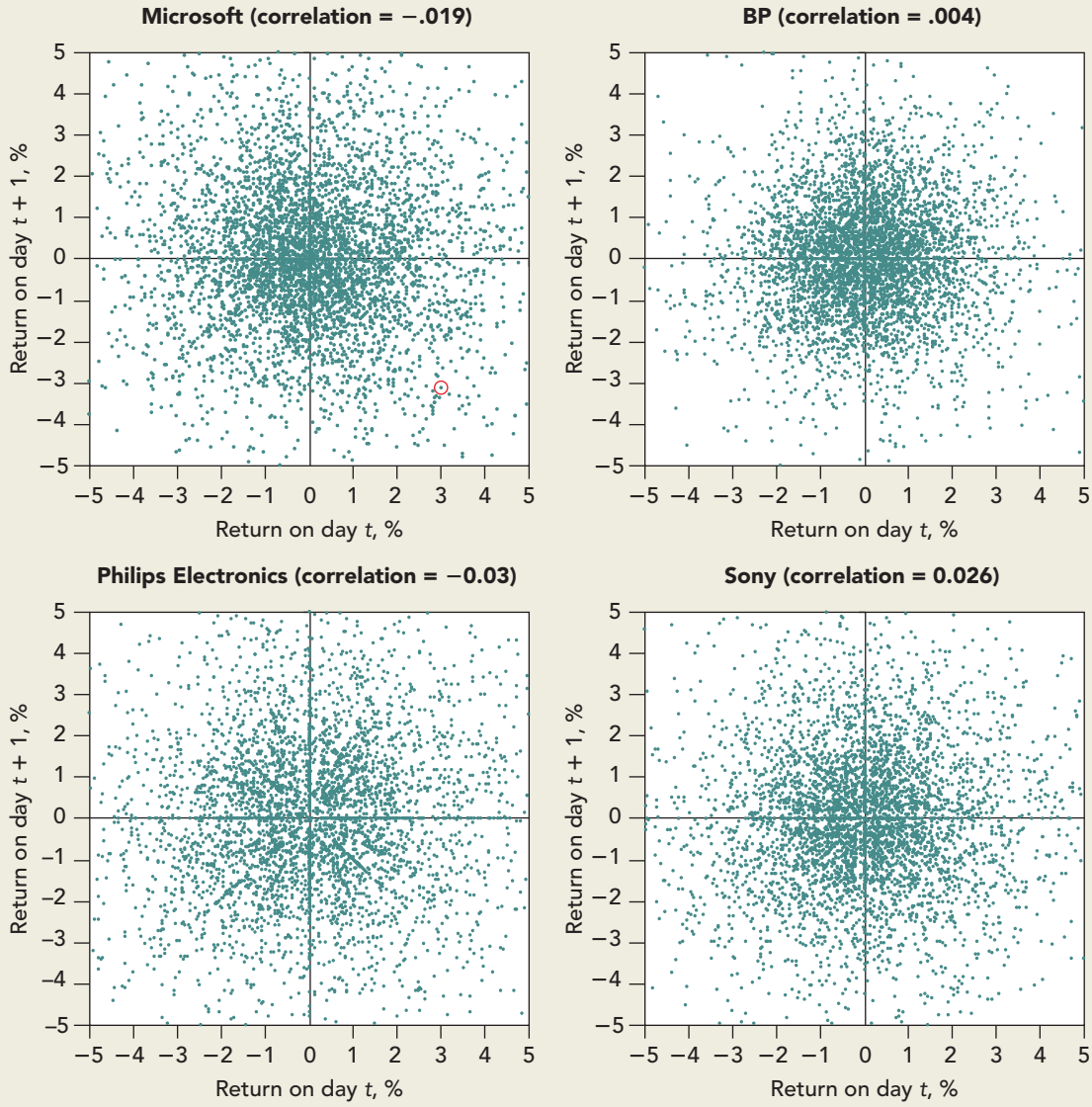


FIGURE 13.2

Each dot shows a pair of returns for a stock on two successive days between January 1990 and May 2009. The circled dot for Microsoft records a daily return of +3% and then −3% on the next day. The scatter diagram shows no significant relationship between returns on successive days.

example, the correlation between successive price changes in Microsoft stock was −.019; there was a negligible tendency for price rises to be followed by price falls.[5] For Philips this correlation was also negative at −.030. However, for BP and Sony the correlations were positive at +.004 and +.026, respectively. In these cases there was a negligible tendency for price rises to be followed by further price rises.

Figure 13.2 suggests that successive price changes of all four stocks were effectively uncorrelated. Today's price change gave investors almost no clue as to the likely change

[5] The correlation coefficient between successive observations is known as the *autocorrelation coefficient*. An autocorrelation of −.019 implies that, if Microsoft's stock price rose by 1% more than the average yesterday, your best forecast of today's change would be .019% *less* than the average.

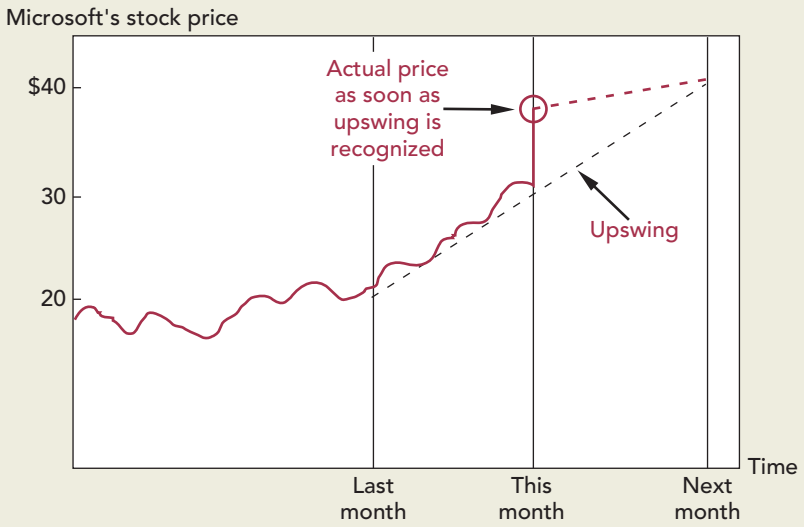


FIGURE 13.3

Cycles self-destruct as soon as they are recognized by investors. The stock price instantaneously jumps to the present value of the expected future price.

tomorrow. Does that surprise you? If so, imagine that it were not the case and that changes in Microsoft's stock price were expected to persist for several months. Figure 13.3 provides an example of such a predictable cycle. You can see that an upswing in Microsoft's stock price started last month, when the price was $20, and it is expected to carry the price to $40 next month. What will happen when investors perceive this bonanza? It will self-destruct. Since Microsoft stock is a bargain at $30, investors will rush to buy. They will stop buying only when the stock offers a normal rate of return. Therefore, as soon as a cycle becomes apparent to investors, they immediately eliminate it by their trading.

Three Forms of Market Efficiency

You should see now why prices in competitive markets must follow a random walk. If past price changes could be used to predict future price changes, investors could make easy profits. But in competitive markets easy profits don't last. As investors try to take advantage of the information in past prices, prices adjust immediately until the superior profits from studying past price movements disappear. As a result, all the information in past prices will be reflected in *today's* stock price, not tomorrow's. Patterns in prices will no longer exist and price changes in one period will be independent of changes in the next. In other words, the share price will follow a random walk.

In competitive markets today's stock price must already reflect the information in past prices. But why stop there? If markets are competitive, shouldn't today's stock price reflect *all* the information that is available to investors? If so, securities will be fairly priced and security returns will be unpredictable. No one earns consistently superior returns in such a market. Collecting more information won't help, because all available information is already impounded in today's stock prices.

Economists define three levels of market efficiency, which are distinguished by the degree of information reflected in security prices. In the first level, prices reflect the information contained in the record of past prices. This is called *weak market efficiency*. If markets are efficient in the weak sense, then it is impossible to make consistently superior profits by studying past returns. Prices will follow a random walk.

The second level of efficiency requires that prices reflect not just past prices but all other public information, for example, from the Internet or the financial press. This is known as *semistrong market efficiency*. If markets are semistrong efficient, then prices will adjust

immediately to public information such as the announcement of the last quarter's earnings, a new issue of stock, or a proposal to merge two companies.

With *strong-market efficiency*, prices reflect *all* the information that can be acquired by painstaking analysis of the company and the economy. In such a market we would observe lucky and unlucky investors, but we wouldn't find any superior investment managers who can consistently beat the market.

Efficient Markets: The Evidence

In the years that followed Maurice Kendall's discovery, financial journals were packed with tests of the efficient-market hypothesis. To test the weak form of the hypothesis, researchers measured the profitability of some of the trading rules used by those investors who claim to find patterns in security prices. They also employed statistical tests, including the test we used to look for patterns in the returns on Microsoft, BP, Philips, and Sony stock. It appears that throughout the world there are few patterns in day-to-day returns.

To analyze the semistrong form of the efficient-market hypothesis, researchers have measured how rapidly security prices respond to different items of news, such as earnings or dividend announcements, news of a takeover, or macroeconomic information.

Before we describe what they found, we should explain how to isolate the effect of an announcement on the price of a stock. Suppose, for example, that you need to understand how stock prices of takeover targets respond when the takeovers are first announced. As a first stab, you could simply calculate the average return on target-company stocks in the days leading up to the announcement and immediately after it. With daily returns on a large sample of targets, the average announcement effect should be clear. There won't be too much contamination from movements in the overall market around the announcement dates, because daily market returns average out to a very small number.[6] The potential contamination increases for weekly or monthly returns, however. Thus you will usually want to adjust for market movements. For example, you can simply subtract out the return on the market:

$$\text{Adjusted stock return} = \text{return on stock} - \text{return on market index}$$

Chapter 8 suggests a refined adjustment based on betas. (Just subtracting the market return assumes that target-firm betas equal 1.0.) This adjustment is called the *market model:*

$$\text{Expected stock return} = \alpha + \beta \times \text{return on market index}$$

Alpha (α) states how much on average the stock price changed when the market index was unchanged. Beta (β) tells us how much *extra* the stock price moved for each 1% change in the market index.[7] Suppose that subsequently the stock price return is $\tilde{r}$ in a month when the market return is $\tilde{r}_m$. In that case we would conclude that the *abnormal return* for that month is

$$\begin{aligned}\text{Abnormal stock return} &= \text{actual stock return} - \text{expected stock return}\\ &= \tilde{r} - (\alpha + \beta\tilde{r}_m)\end{aligned}$$

This abnormal return should reflect firm-specific news only.[8]

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[6] Suppose, for example, that the market return is 12% per year. With 250 trading days in the year, the average daily return is $(1.12)^{1/250} - 1 = .00045$, or .045%.

[7] It is important when estimating α and β that you choose a period in which you believe that the stock behaved normally. If its performance was abnormal, then estimates of α and β cannot be used to measure the returns that investors expected. As a precaution, ask yourself whether your estimates of expected returns look sensible. Methods for estimating abnormal returns are analyzed in A. C. MacKinlay, "Event Studies in Economics and Finance," *Journal of Economic Literature* 35 (1997), pp. 13–39; and also S. P. Kothari and J. B. Warner, "Econometrics of Event Studies," in B. E. Eckbo (ed.), *The Handbook of Empirical Corporate Finance* (Amsterdam: Elsevier/North-Holland, 2007), Chapter 1.

[8] Abnormal returns are also often calculated using the Fama-French three-factor model, which we discussed in Chapter 8. The stock return is adjusted for the market return, the difference between small- and large-stock returns, and the difference between returns on high and low book-to-market firms.

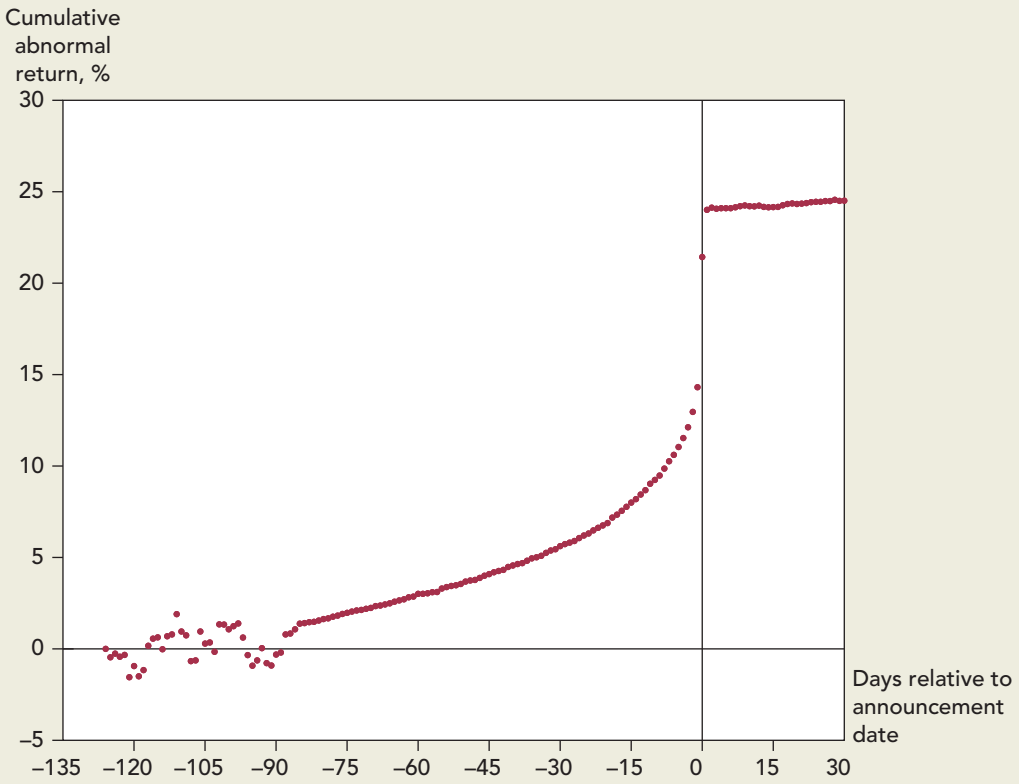

FIGURE 13.4

The performance of the stocks of target companies compared with that of the market. The prices of target stocks jump up on the announcement day, but from then on, there are no unusual price movements. The announcement of the takeover attempt seems to be fully reflected in the stock price on the announcement day.

Source: A. Keown and J. Pinkerton, "Merger Announcements and Insider Trading Activity," *Journal of Finance* 36 (September 1981), pp. 855–869. © 1981. Reprinted with permission of Blackwell Publishers Journal Rights. We are grateful to Jinghua Yan for updating the calculations to the period 1979–2004.

Figure 13.4 illustrates how the release of news affects abnormal returns. The graph shows the abnormal return on a sample of nearly 17,000 firms that were targets of takeover attempts. Acquiring firms usually have to pay a substantial *takeover premium* to get the deal done, so the target firm's stock price increases as soon as the takeover bid is announced. Figure 13.4 shows the average pattern of the target's stock returns before and after the announcement of a takeover (day 0 in the figure). Stock prices drift up before date zero, as investors gradually realize that a takeover may be coming. On the announcement day, prices jump up dramatically.[9] The stock-price adjustment is immediate and complete. After the big price move on the public announcement day, the run-up is over, and there is no significant further drift in the stock price, either upward or downward. Thus within the day, the new stock prices reflect (at least on average) the magnitude of the takeover premium.

Tests of the strong form of the hypothesis have examined the recommendations of professional security analysts and have looked for mutual funds or pension funds that could predictably outperform the market. Some researchers have found a slight persistent

[9] Big profits await if you can identify target firms before the takeover announcement. Purchases based on confidential inside information are illegal, however, and could land you in jail.

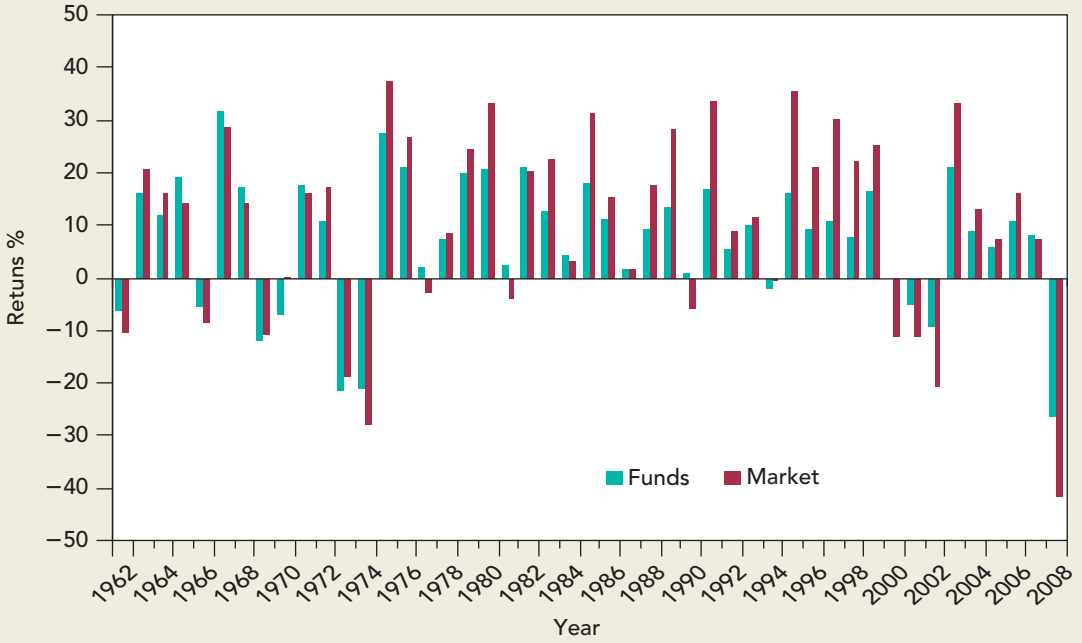

FIGURE 13.5

Average annual returns on a large sample of U.S. mutual funds and the market index, 1962–2008. Notice that mutual funds underperform the market in approximately two-thirds of the years.

Source: M. M. Carhart, "On Persistence in Mutual Fund Performance," *Journal of Finance* 52 (March 1997), pp. 57–82. © 1997 Blackwell Publishers. We are grateful to Jinghua Yan for updating the calculations.

outperformance, but just as many have concluded that professionally managed funds fail to recoup the costs of management. Look, for example, at Figure 13.5, which is an updated version of a study by Mark Carhart of the average return on a large sample of U.S. mutual funds. You can see that in some years the mutual funds beat the market, but roughly two-thirds of the time it was the other way around. Figure 13.5 provides a fairly crude comparison, for mutual funds have tended to specialize in particular sectors of the market, such as low-beta stocks or large-firm stocks, that may have given below-average returns. To control for such differences, each fund needs to be compared with a benchmark portfolio of similar securities. The study by Mark Carhart did this, but the message was unchanged: The funds earned a lower return than the benchmark portfolios *after* expenses and roughly matched the benchmarks *before* expenses.

It would be surprising if some managers were not smarter than others and could earn superior returns. But it seems difficult to spot the smart ones, and the top-performing managers one year have about an average chance of falling on their faces the next year.[10]

The evidence on efficient markets has convinced many professional and individual investors to give up pursuit of superior performance. They simply "buy the index," which maximizes diversification and cuts costs to the bone. Individual investors can buy *index*

[10] See, for example, B. G. Malkiel, "Returns from Investing in Equity Mutual Funds 1971 to 1991," *Journal of Finance* 50 (June 1995), pp. 549–572. Some contrary evidence that good performance does persist is provided in R. Kosowski, A. Timmerman, R. Wermers, and H. White, "Can Mutual Fund 'Stars' Really Pick Stocks? New Evidence from a Bootstrap Analysis," *Journal of Finance* 61 (December 2006), pp. 2551–2595. See also M. J. Gruber, "Another Puzzle: The Growth in Actively Managed Mutual Funds," *Journal of Finance* 51 (July 1996), pp. 783–810.

funds, which are mutual funds that track stock market indexes. There is no active management, so costs are very low. For example, management fees for the Vanguard 500 Index Fund, which tracks the S&P 500 Index, were .18% per year in 2009 (.09% per year for investments over $100,000). The size of this fund was $73 billion.

How far could indexing go? Not to 100%: If all investors hold index funds then nobody will be collecting information and prices will not respond to new information when it arrives. An efficient market needs some smart investors who gather information and attempt to profit from it. To provide incentives to gather costly information, prices cannot reflect *all* information.[11] There must be some profits available to allow the costs of information to be recouped. But if the costs are small, relative to the total market value of traded securities, then the financial market can still be close to perfectly efficient.

13-3 The Evidence Against Market Efficiency

Almost without exception, early researchers concluded that the efficient-market hypothesis was a remarkably good description of reality. So powerful was the evidence that any dissenting research was regarded with suspicion. But eventually the readers of finance journals grew weary of hearing the same message. The interesting articles became those that turned up some puzzle. Soon the journals were packed with evidence of anomalies that investors have apparently failed to exploit.

What exactly is an anomaly? So far we have connected market efficiency to the absence of opportunities to make money. Let's be more precise: in an efficient market it is not possible to find expected returns greater (or less) than the risk-adjusted opportunity cost of capital. This implies that every security trades at its fundamental value, based on future cash flows (C_t) and the opportunity cost of capital (r):

$$P = \sum_{t=1}^{\infty} \frac{C_t}{(1 + r)^t}$$

If price equals fundamental value, the expected rate of return is the opportunity cost of capital, no more and no less. If price differs from fundamental value, then investors can earn more than the cost of capital, by selling if the price is too high and buying when it is too low.

You will recall these principles from our discussion of common stock values in Chapter 4. Here the principles tell us that you can't identify a superior return unless you know what the normal expected return is. Therefore, if you try to determine whether a market is efficient, you usually have to adopt an asset pricing model that specifies the relationship between risk and expected return. Any test of market efficiency is then a combined test of efficiency and the asset pricing model. Any test of an asset pricing model is also a combined test of the model and market efficiency.

The most commonly used asset pricing model is the CAPM. Chapter 8 pointed to some apparent violations of the CAPM, including the abnormally high returns on the stocks of small firms. For example, look back at Figure 8.10, which shows the cumulative difference between the returns on small-firm stocks and large-firm stocks. You can see that since 1926 the stocks of the firms with the lowest market capitalizations have performed substantially better than those with the highest capitalizations.

Now this may mean one (or more) of several things. First, it could be that investors have demanded a higher expected return from small firms to compensate for some extra risk factor that is not captured in the simple capital asset pricing model.

[11] See S. J. Grossman and J. E. Stiglitz, "On the Impossibility of Informationally Efficient Markets," *American Economic Review* 70 (June 1980), pp. 393–408.

Second, the superior performance of small firms could simply be a coincidence, a finding that stems from the efforts of many researchers to find interesting patterns in the data. There is evidence for and against the coincidence theory. Those who believe that the small-firm effect is a pervasive phenomenon can point to the fact that small-firm stocks have provided a higher return in many other countries. On the other hand, you can see from Figure 8.10 that the small-firm effect seems to have disappeared as soon as it was first documented in 1981. Perhaps investors did underestimate the returns on small firms before 1981, but then bid up the firms' stock prices as soon as the mispricing was identified.

Third, the small-firm effect could be an important exception to the efficient-market theory, an exception that gave investors the opportunity for consistently superior returns over a period of several decades. If these anomalies offer easy pickings, you would expect to find a number of investors eager to take advantage of them. It turns out that, while many investors do try to exploit such anomalies, it is surprisingly difficult to get rich by doing so. For example, Professor Richard Roll, who probably knows as much as anyone about market anomalies, confesses

> Over the past decade, I have attempted to exploit many of the seemingly most promising "inefficiencies" by actually trading significant amounts of money according to a trading rule suggested by the "inefficiencies" . . . I have never yet found one that worked in practice, in the sense that it returned more after cost than a buy-and-hold strategy.[12]

Do Investors Respond Slowly to New Information?

We have dwelt on the small-firm effect, but there is no shortage of other puzzles and anomalies. Some of them relate to the short-term behavior of stock prices. For example, returns appear to be higher in January than in other months, they seem to be lower on a Monday than on other days of the week, and most of the daily return comes at the beginning and end of the day.

To have any chance of making money from such short-term patterns, you need to be a professional trader, with one eye on the computer screen and the other on your annual bonus. If you are a corporate financial manager, these short-term patterns in stock prices may be intriguing conundrums, but they are unlikely to change the major financial decisions about which projects to invest in and how they should be financed.

Corporate financial managers should be more concerned about mispricing that lasts months or years. Here are two examples of possible longer-lasting inefficiency.

The Earnings Announcement Puzzle The earnings announcement puzzle is summarized in Figure 13.6, which shows stock performance following the announcement of unexpectedly good or bad earnings during the years 1972 to 2001. The 10% of the stocks of firms with the best earnings news outperform those with the worst news by about 1% per month over the six-month period following the announcement. It seems that investors underreact to the earnings announcement and become aware of the full significance only as further information arrives.

The New-Issue Puzzle When firms issue stock to the public, investors typically rush to buy. On average those lucky enough to receive stock receive an immediate capital gain. However, researchers have found that these early gains often turn into losses. For example, suppose that you bought stock immediately following each initial public offering (IPO) and then held that stock for five years. Over the period 1970–2007 your average annual return would have been 3.8% less than the return on a portfolio of similar-sized stocks.

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[12] R. Roll, "What Every CFO Should Know about Scientific Progress in Financial Economics: What Is Known and What Remains to Be Resolved," *Financial Management* 23 (Summer 1994), pp. 69–75.

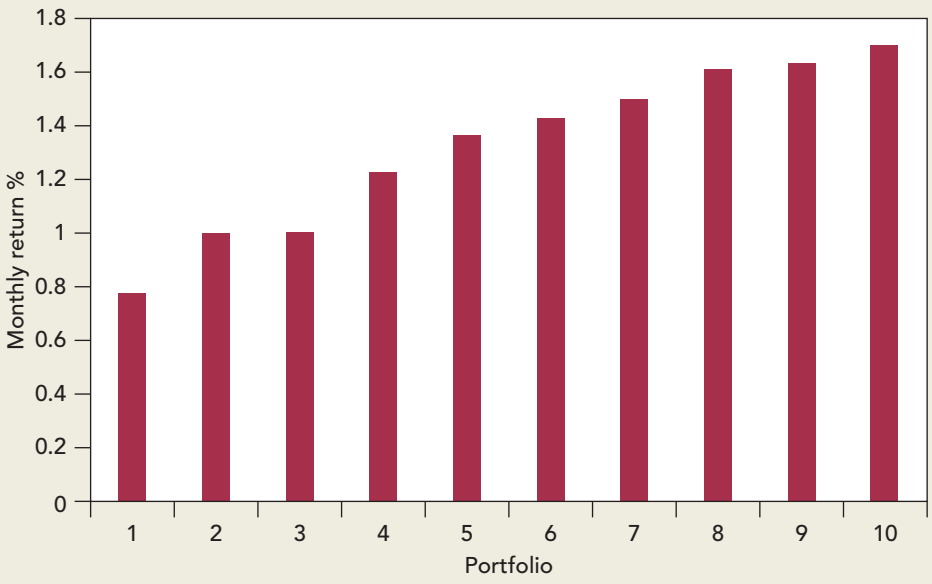

FIGURE 13.6

The average return 1972–2001 on stocks of firms over the six months following an announcement of quarterly earnings. The 10% of stocks with the best earnings news (portfolio 10) outperformed those with the worst news (portfolio1) by about 1% per month.

Source: T. Chordia and L. Shivakumar, "Inflation Illusion and the Post-earnings Announcement Drift," *Journal of Accounting Research* 43 (2005), pp. 521–556.

The jury is still out on these studies of long-term anomalies. Take, for example, the new-issue puzzle. Most new issues during the past 30 years have involved growth stocks with high market values and limited book assets. When the long-run performance of new issues is compared with a portfolio that is matched in terms of both size and book-to-market ratios, the difference in performance almost halves.[13] So the new-issue puzzle could turn out to be just the book-to-market ratio puzzle in disguise.[14]

Anomalies such as the new-issue puzzle may be a sign of inadequate asset pricing models, and so for many people they are not convincing evidence against market efficiency. However, there are other anomalies that cannot be dismissed so easily. One example is that of "Siamese twins," two securities with claims on the same cash flows, which nevertheless trade separately. Before the two companies merged in July 2005, the Dutch company Royal Dutch Petroleum and the British company Shell Transport & Trading (T&T) were Siamese twins, each with a fixed share in the profits and dividends of the oil giant. Since both companies participated in the same underlying cash flows, you would expect the stock prices to have moved in exact lockstep. But, as you can see from Figure 13.7, the prices of the two shares sometimes diverged substantially.[15]

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[13] The long-run underperformance of new issues was documented in R. Loughran and J. R. Ritter, "The New Issues Puzzle," *Journal of Finance* 50 (1995), pp. 23–51. The figures are updated on Jay Ritter's Web site, where IPO returns are compared with those of a portfolio that is matched in terms of size and book-to-market ratio. (See **bear.cba.ufl.edu/ritter**.)

[14] There may be still other reasons for the poor long-term performance of IPOs, including tax effects. Portfolios of IPOs generate many extreme winners and losers. Investors can sell the losers, deducting the losses against other capital gains, and hold the winners, thus deferring taxes. IPO stocks are a good venue for this tax strategy, so tax-savvy investors may have bid up IPO stock prices.

[15] For evidence on the pricing of Siamese twins see K. A. Froot and E. Dabora, "How Are Stock Prices Affected by the Location of Trade?" *Journal of Financial Economics* 53 (August 1999), pp. 189–216, and, for more recent data, A. De Jong, L. Rosenthal, and M. A. Van Dijk, "The Risk and Return of Arbitrage in Dual-Listed Companies," *Review of Finance* 13 (2009), pp. 495–520.

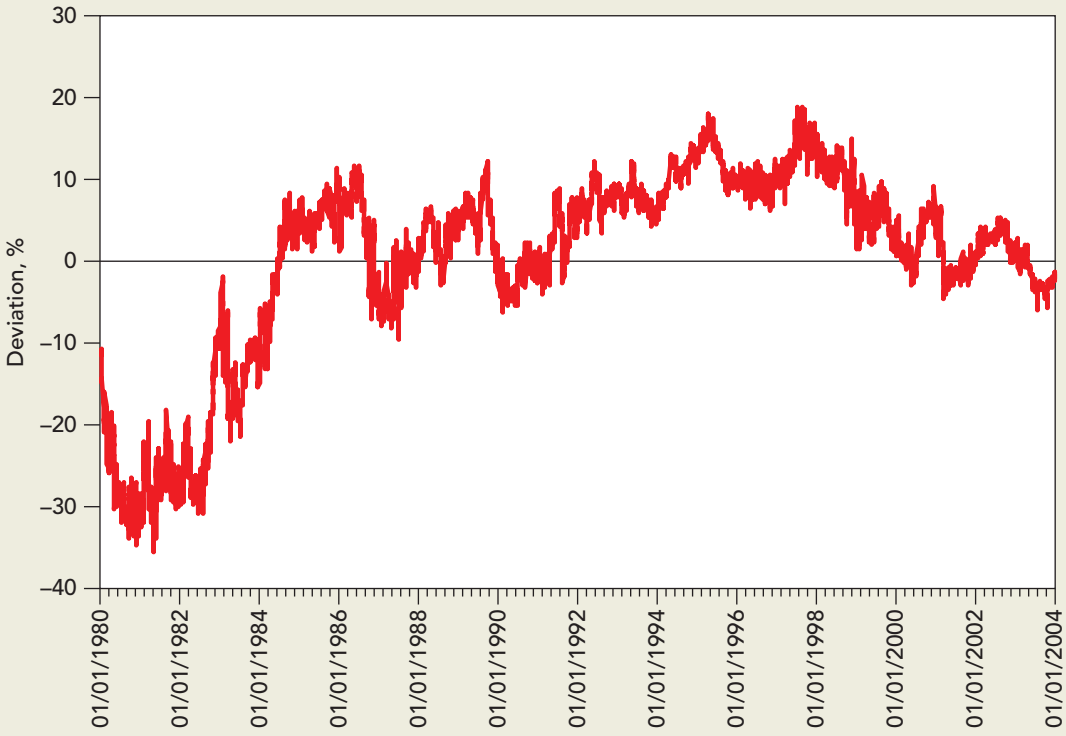

FIGURE 13.7

Log deviations from Royal Dutch Shell/Shell T&T parity.

Source: Mathijs van Dijk Web site www.mathijsavandijk.com/dual-listed-companies. Used with permission.

Bubbles and Market Efficiency

Cases such as the Siamese twins suggest that there are occasions when prices of individual stocks can get out of line. But are there also cases in which prices as a whole can no longer be justified by fundamentals? We will look at the evidence in a moment, but first we should note how difficult it is to value common stocks and to determine whether their prices are irrational.

For example, imagine that in May 2009 you wanted to check whether the stocks forming Standard & Poor's Composite Index were fairly valued. As a first stab you might use the constant-growth formula that we introduced in Chapter 4. In 2009 the annual dividends paid by the companies in the index came to about $217 billion. Suppose that these dividends were expected to grow at a steady rate of 4.1% and that investors required a return of 7.2%. Then the constant-growth formula gives a value for the common stocks of

$$\text{PV common stocks} = \frac{\text{DIV}}{r - g} = \frac{217}{.072 - .041} = \$7{,}000 \text{ billion}$$

which was roughly their value in May 2009. But how confident could you be about these figures? Perhaps the likely dividend growth was only 3.6% per year. In that case your estimate of the value of the common stocks would decline to

$$\text{PV common stocks} = \frac{\text{DIV}}{r - g} = \frac{217}{.072 - .036} = \$6{,}028 \text{ billion}$$

In other words, a reduction of just half a percentage point in the expected rate of dividend growth would reduce the value of common stocks by about 14%.

The extreme difficulty of valuing common stocks from scratch has two important consequences. First, investors find it easier to price a common stock relative to yesterday's price or relative to today's price of comparable securities. In other words, they generally take yesterday's price as correct, adjusting upward or downward on the basis of today's information. If information arrives smoothly, then, as time passes, investors become increasingly confident that today's price level is correct. But when investors lose confidence in the benchmark of yesterday's price, there may be a period of confused trading and volatile prices before a new benchmark is established.

Second, most of the tests of market efficiency are concerned with *relative* prices and focus on whether there are easy profits to be made. It is almost impossible to test whether stocks are *correctly valued*, because no one can measure true value with any precision. Take, for example, Hershey stock, which sold for $36 in April 2009. Could we prove that this was its true value? Of course not, but we could be more confident that the price of Hershey should not be very different from that of Smucker's ($39), because both companies had similar earnings and dividends per share and both had similar growth prospects.

It may be impossible to *prove* that market levels are, or are not, consistent with fundamentals. However, every now and again investors seem to be caught up in a speculative frenzy, and asset prices then reach levels that (at least with hindsight) cannot easily be justified by the outlook for profits and dividends. Investors refer to such occasions as *bubbles*. Bubbles can result when prices rise rapidly, and more and more investors join the game on the assumption that prices will *continue* to rise. These bubbles can be self-sustaining for a while. It can be rational to jump on the bandwagon as long as you are sure that there will be greater fools that you can sell out to. But remember that lots of money will be lost, perhaps by you, when the bubble bursts.[16]

The Japanese bubble is a good example. The Nikkei 225 Index rose about 300% between the start of 1985 and December 1989. After a sharp increase in interest rates at the beginning of 1990, stock prices began to fall. By October the Nikkei had sunk to about half its peak. In March 2009, the Nikkei was still down 80% from its peak 19 years before.

The boom in Japanese stock prices was matched by an even greater explosion in land prices. For example, Ziemba and Schwartz document that the few hundred acres of land under the Emperor's Palace in Tokyo, evaluated at neighborhood land prices, was worth as much as all the land in Canada or California.[17] But then the real estate bubble also burst. By 2005 land prices in the six major Japanese cities had slumped to just 13% of their peak.

Such bubbles are not confined to Japan. Toward the end of the twentieth century investors in technology stocks saw a remarkable run-up in the value of their holdings. The Nasdaq Composite Index, which has a heavy weighting in high-tech stocks, rose 580% from the start of 1995 to its high in March 2000. Then, as rapidly as it began, the boom ended, and by October 2002 the Nasdaq index had fallen 78% from its peak.

Some of the largest gains and losses were experienced by dot.com stocks. For example, Yahoo! shares, which began trading in April 1996, appreciated by 1,400% in four years. In these heady days some companies found that they could boost their stock price simply by adding "dot.com" to the company name.[18]

Looking back at the Japanese and dot.com bubbles, it seems difficult to believe that future cash flows could ever have been sufficient to provide investors with a reasonable return.[19] If that is the case, we have two important exceptions to the theory of efficient markets.

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[16] Bubbles are not necessarily irrational. See M. Brunnermeier, *Asset Pricing under Asymmetric Information: Bubbles, Crashes, Technical Analysis and Herding* (Oxford: Oxford University Press, 2001).

[17] See W. T. Ziemba and S. L. Schwartz, *Invest Japan* (Chicago, IL: Probus Publishing Co., 1992), p. 109.

[18] P. R. Rau, O. Dimitrov, and M. Cooper, "A Rose.com by Any Other Name," *Journal of Finance* 56 (2001), pp. 2371–2388.

[19] For an analysis of Japanese stock prices, see K. French and J. M. Poterba, "Were Japanese Stock Prices Too High?" *Journal of Financial Economics* 29 (October 1991), pp. 337–364. For more on dot.com stock prices, see E. Ofek and M. Richardson, "The Valuation and Market Rationality of Internet Stock Prices," *Oxford Review of Economic Policy* 18 (Autumn 2002), pp. 265–287.

13-4 Behavioral Finance

Why might prices depart from fundamental values? Some believe that the answer lies in behavioral psychology. People are not 100% rational 100% of the time. This shows up in investors' attitudes to risk and the way they assess probabilities.

1. *Attitudes toward risk.* Psychologists have observed that, when making risky decisions, people are particularly loath to incur losses. It seems that investors do not focus solely on the current value of their holdings, but look back at whether their investments are showing a profit or a loss. For example, if I sell my holding of IBM stock for $10,000, I may feel on top of the world if the stock only cost me $5,000, but I will be much less happy if it had cost $11,000. This observation is the basis for *prospect theory*.[20] Prospect theory states that (a) the value investors place on a particular outcome is determined by the gains or losses that they have made since the asset was acquired or the holding last reviewed, and (b) investors are particularly averse to the possibility of even a very small loss and need a high return to compensate for it.

   The pain of loss seems also to depend on whether it comes on the heels of earlier losses. Once investors have suffered a loss, they may be even more concerned not to risk a further loss. Conversely, just as gamblers are known to be more willing to make large bets when they are ahead, so investors may be more prepared to run the risk of a stock market dip after they have enjoyed a run of unexpectedly high returns.[21] If they do then suffer a small loss, they at least have the consolation of still being ahead for the year.

   When we discussed portfolio theory in Chapters 7 and 8, we pictured investors as forward-looking only. Past gains or losses were not mentioned. All that mattered was the investor's current wealth and the expectation and risk of future wealth. We did not allow for the possibility that Nicholas would be elated because his investment is in the black, while Nicola with an equal amount of wealth would be despondent because hers is in the red.

2. *Beliefs about probabilities.* Most investors do not have a Ph.D. in probability theory and may make systematic errors in assessing the probability of uncertain events. Psychologists have found that, when judging possible future outcomes, individuals tend to look back at what happened in a few similar situations. As a result, they are led to place too much weight on a small number of recent events. For example, an investor might judge that an investment manager is particularly skilled because he has "beaten the market" for three years in a row, or that three years of rapidly rising prices are a good indication of future profits from investing in the stock market. The investor may not stop to reflect on how little one can learn about expected returns from three years' experience.

   Most individuals are also too *conservative,* that is, too slow to update their beliefs in the face of new evidence. People tend to update their beliefs in the correct direction but the magnitude of the change is less than rationality would require.

   Another systematic bias is *overconfidence.* Most of us believe that we are better-than-average drivers and most investors think they are better-than-average stock pickers. Two speculators who trade with each other cannot both make money, but may be prepared to continue trading because each is confident that the other is the patsy. Overconfidence also shows up in the certainty that people express about their judgments. They consistently overestimate the odds that the future will turn out as they say and underestimate the chances of unlikely events.

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[20] Prospect theory was first set out in D. Kahneman and A. Tversky, "Prospect Theory: An Analysis of Decision under Risk," *Econometrica* 47 (1979), pp. 263–291.

[21] The effect is described in R. H. Thaler and E. J. Johnson, "Gambling with the House Money and Trying to Break Even: The Effects of Prior Outcomes on Risky Choice," *Management Science* 36 (1990), pp. 643–660. The implications of prospect theory for stock returns are explored in N. Barberis, M. Huang, and T. Santos, "Prospect Theory and Asset Prices," *Quarterly Journal of Economics* 116 (February 2001), pp. 1–53.

You can see how these behavioral characteristics may help to explain the Japanese and dot.com bubbles. As prices rose, they generated increased optimism about the future and stimulated additional demand. The more that investors racked up profits, the more confident they became in their views and the more willing they became to bear the risk that next month might not be so good.

Limits to Arbitrage

It is not difficult to believe that amateur investors may sometimes be caught up in a scatty whirl of irrational exuberance.[22] But there are plenty of hard-headed professional investors managing huge sums of money. Why don't these investors bail out of overpriced stocks and force their prices down to fair value? One reason is that there are *limits to arbitrage,* that is, limits on the ability of the rational investors to exploit market inefficiencies.

Strictly speaking, *arbitrage* means an investment strategy that guarantees superior returns without any risk. In practice, arbitrage is defined more casually as a strategy that exploits market inefficiency and generates superior returns if and when prices return to fundamental values. Such strategies can be very rewarding, but they are rarely risk-free.

In an efficient market, if prices get out of line, then arbitrage forces them back. The arbitrageur buys the underpriced securities (pushing up their prices) and sells the overpriced securities (pushing down their prices). The arbitrageur earns a profit by buying low and selling high and waiting for prices to converge to fundamentals. Thus arbitrage trading is often called *convergence trading.*

In practice arbitrage is harder than it looks. Trading costs can be significant and some trades are difficult to execute. For example, suppose that you identify an overpriced security that is *not* in your existing portfolio. You want to "sell high," but how do you sell a stock that you don't own? It can be done, but you have to *sell short.*

To sell a stock short, you borrow shares from another investor's portfolio, sell them, and then wait hopefully until the price falls and you can buy the stock back for less than you sold it for. If you're wrong and the stock price increases, then sooner or later you will be forced to repurchase the stock at a higher price (therefore at a loss) to return the borrowed shares to the lender. But if you're right and the price does fall, you repurchase, pocket the difference between the sale and repurchase prices, and return the borrowed shares. Sounds easy, once you see how short selling works, but there are costs and fees to be paid, and in some cases you will not be able to find shares to borrow.[23]

The perils of selling short were dramatically illustrated in 2008. Given the gloomy outlook for the automobile industry, a number of hedge funds decided to sell Volkswagen (VW) shares short in the expectation of buying them back at a lower price. Then in a surprise announcement Porsche revealed that it had effectively gained control of 74% of VW's shares. Since a further 20% was held by the state of Lower Saxony, there was not enough stock available for the short sellers to buy back. As they scrambled to cover their positions, the price of VW stock rose in just two days from €209 to a high of €1005, making VW the most highly valued company in the world. Although the stock price drifted rapidly down, those short-sellers who were caught in the *short squeeze* suffered large losses.

The VW example illustrates that the most important limit to arbitrage is the risk that prices will diverge even further before they converge. Thus an arbitrageur has to have the guts and resources to hold on to a position that may get much worse before it gets better.

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[22] The term "irrational exuberance" was coined by Alan Greenspan, former chairman of the Federal Reserve Board, to describe the dot.com boom. It was also the title of a book by Robert Shiller that examined the boom. See R. Shiller, *Irrational Exuberance* (New York: Broadway Books, 2001).

[23] Investment and brokerage firms identify shares eligible for lending and arrange to make them available to short-sellers. The supply of shares that can be borrowed is limited. You are charged a fee for borrowing the stock, and you are required to put up collateral to protect the lender in case the share price rises and the short-seller is unable to repurchase and return the shares. Putting up collateral is costless if the short-seller gets a market interest rate, but sometimes only lower interest rates are offered.

Take another look at the relative prices of Royal Dutch and Shell T&T in Figure 13.7. Suppose that you were a professional money manager in 1980, when Royal Dutch was about 12% below parity. You decided to buy Royal Dutch, sell Shell T&T short, and wait confidently for prices to converge to parity. It was a long wait. The first time you would have seen any profit on your position was in 1983. In the meantime the mispricing got worse, not better. Royal Dutch fell to more than 30% below parity in mid-1981. Therefore, you had to report a substantial loss on your "arbitrage" strategy in that year. You were fired and took up a new career as a used-car salesman.

The demise in 1998 of Long Term Capital Management (LTCM) provides another example of the problems with convergence trades. LTCM, one of the largest and most profitable hedge funds of the 1990s, believed that interest rates in the different euro zone countries would converge when the euro replaced the countries' previous currencies. LTCM had taken massive positions to profit from this convergence, as well as massive positions designed to exploit other pricing discrepancies. After the Russian government announced a moratorium on some of its debt payments in August 1998, there was great turbulence in the financial markets, and many of the discrepancies that LTCM was betting on suddenly got much larger.[24] LTCM was losing hundreds of millions of dollars daily. The fund's capital was nearly gone when the Federal Reserve Bank of New York arranged for a group of LTCM's creditor banks to take over LTCM's remaining assets and shut down what was left in an orderly fashion.

LTCM's sudden meltdown has not prevented rapid growth in the hedge fund industry in the 2000s. If hedge funds can push back the limits to arbitrage and avoid the kinds of problems that LTCM ran into, markets will be more efficient going forward. But asking for complete efficiency is probably asking too much. Prices can get out of line and stay out if the risks of an arbitrage strategy outweigh the expected returns.

Incentive Problems and the Subprime Crisis

The limits to arbitrage open the door to individual investors with built-in biases and misconceptions that can push prices away from fundamental values. But there can also be incentive problems that get in the way of a rational focus on fundamentals. We illustrate with a brief look at the subprime crisis in the United States.

Few U.S. homeowners foresaw a collapse in the price of their home. After all, the average house price in the U.S. had not fallen since the Great Depression of the 1930s. But in 2005 *The Economist* surveyed the widespread increase in property prices and warned:

> [T]he total value of the residential property in developed economies rose by more than $30 trillion over the past five years to over $70 trillion, an increase equivalent to 100% of those countries' combined GDPs. Not only does this dwarf any previous house-price boom, it is larger than the global stock market bubble in the late 1920s (55% of GDP). In other words it looks like the biggest bubble in history.[25]

Shortly afterward the bubble burst. By March 2009, U.S. house prices had fallen by nearly a third from their peak in 2006.[26]

How could such a boom and crash arise? In part because banks, credit rating agencies, and other financial institutions all had distorted incentives. Purchases of real estate are generally financed with mortgage loans from banks. In most parts of the U.S., borrowers can default on their mortgages with relatively small penalties. If property prices fall, they can simply walk away. But, if prices rise, they make money. Thus borrowers may be willing to take large risks, especially if the fraction of the purchase price financed with their own money is small.

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[24] The Russian debt moratorium was unexpected and unusual, because the debt had only recently been issued and was denominated in *roubles*. The government preferred to default rather than to print roubles to service the debt.

[25] "In come the waves," *The Economist,* June 16, 2005.

[26] Investors who did foresee that the fall in house prices would lead to the subprime debacle were able to earn high profits. For example, John Paulson, the hedge fund manager, earned $3.7 billion in 2007 as a result (*Financial Times,* January 15, 2008, and June 18, 2008).

Why, then, are banks willing to lend money to people who are bound to default if property prices fall significantly? Since the borrowers benefited most of the time, they were willing to pay attractive up-front fees to banks to get mortgage loans. But the banks could pass on the default risk to somebody else by packaging and reselling the mortgages as mortgage-backed securities (MBSs). Many MBS buyers assumed that they were safe investments, because the credit rating agencies said so. As it turned out, the credit ratings were a big mistake. (The rating agencies introduced another agency problem, because issuers paid the agencies to rate the MBS issues, and the agencies consulted with issuers over how MBS issues should be structured.)

The "somebody else" was also the government. Many subprime mortgages were sold to FNMA and FMAC ("Fannie Mae" and "Freddie Mac"). These were private corporations with a special advantage: government credit backup. (The backup was implicit, but quickly became explicit when Fannie and Freddie got into trouble in 2008. The U.S. Treasury had to take them over.) Thus these companies were able to borrow at artificially low rates, channeling money into the mortgage market.

The government was also on the hook because large banks that held subprime MBSs were "too big to fail" in a financial crisis. So the original incentive problem—the temptation of home buyers to take out a large mortgage and hope for higher real estate prices—was never corrected. The government could have cut its exposure by reining in Fannie and Freddie before the crisis but did not do so.

Agency and incentive problems do not arise just in real estate. They are widespread in the financial services industry. In the U.S. and many other countries, people engage financial institutions such as pension funds and mutual funds to invest their money. These institutions are the investors' agents, but the agents' incentives do not always match the investors' interests. Just as with real estate, these agency relationships can lead to mispricing, and potentially bubbles.[27]

13-5 The Six Lessons of Market Efficiency

The efficient-market hypothesis emphasizes that arbitrage will rapidly eliminate any profit opportunities and drive market prices back to fair value. Behavioral-finance specialists may concede that there are no easy profits, but argue that arbitrage is costly and sometimes slow-working, so that deviations from fair value may persist.

Sorting out the puzzles will take time, but we suggest that financial managers should assume, at least as a starting point, that there are no free lunches to be had on Wall Street.

The "no free lunch" principle gives us the following six lessons of market efficiency. After reviewing these lessons, we consider what market *in*efficiency can mean for the financial manager.

Lesson 1: Markets Have No Memory

The weak form of the efficient-market hypothesis states that the sequence of past price changes contains no information about future changes. Economists express the same idea more concisely when they say that the market has no memory. Sometimes financial managers *seem* to act as if this were not the case. For example, after an abnormal market rise, managers prefer to issue equity rather than debt.[28] The idea is to catch the market while it is high. Similarly, they are often reluctant to issue stock after a fall in price. They are inclined

[27] See F. Allen, "Do Financial Institutions Matter?" *Journal of Finance* 56 (2001), pp. 1165–1175.

[28] See, for example, P. Asquith and D. W. Mullins, Jr., "Equity Issues and Offering Dilution," *Journal of Financial Economics* 15 (January–February 1986), pp. 16–89; and (for the U.K.) P. R. Marsh, "The Choice between Debt and Equity: An Empirical Study," *Journal of Finance* 37 (March 1982), pp. 121–144.

to wait for a rebound. But we know that the market has no memory and the cycles that financial managers seem to rely on do not exist.[29]

Sometimes a financial manager will have inside information indicating that the firm's stock is overpriced or underpriced. Suppose, for example, that there is some good news that the market does not know but you do. The stock price will rise sharply when the news is revealed. Therefore, if your company sells shares at the current price, it would offer a bargain to new investors at the expense of present stockholders.

Naturally, managers are reluctant to sell new shares when they have favorable inside information. But such information has nothing to do with the history of the stock price. Your firm's stock could be selling at half its price of a year ago, and yet you could have special information suggesting that it is *still* grossly overvalued. Or it may be undervalued at twice last year's price.

Lesson 2: Trust Market Prices

In an efficient market you can trust prices, for they impound all available information about the value of each security. This means that in an efficient market, there is no way for most investors to achieve consistently superior rates of return. To do so, you not only need to know more than *anyone* else; you also need to know more than *everyone* else. This message is important for the financial manager who is responsible for the firm's exchange-rate policy or for its purchases and sales of debt. If you operate on the basis that you are smarter than others at predicting currency changes or interest-rate moves, you will trade a consistent financial policy for an elusive will-o'-the-wisp.

The company's assets may also be directly affected by management's faith in its investment skills. For example, one company may purchase another simply because its management thinks that the stock is undervalued. On approximately half the occasions the stock of the acquired firm will with hindsight turn out to be undervalued. But on the other half it will be overvalued. On average the value will be correct, so the acquiring company is playing a fair game except for the costs of the acquisition.

Lesson 3: Read the Entrails

If the market is efficient, prices impound all available information. Therefore, if we can only learn to read the entrails, security prices can tell us a lot about the future. For example, in Chapter 23 we show how information in a company's financial statements can help the financial manager to estimate the probability of bankruptcy. But the market's assessment of the company's securities can also provide important information about the firm's prospects. Thus, if the company's bonds are trading at low prices, you can deduce that the firm is probably in trouble.

Here is another example: Suppose that investors are confident that interest rates are set to rise over the next year. In that case, they will prefer to wait before they make long-term loans, and any firm that wants to borrow long-term money today will have to offer the inducement of a higher rate of interest. In other words, the long-term rate of interest will have to be higher than the one-year rate. Differences between the long-term interest rate and the short-term rate tell you something about what investors expect to happen to short-term rates in the future.

The nearby box shows how market prices reveal opinions about issues as diverse as a presidential election, the weather, or the demand for a new product.

[29] If high stock prices signal expanded investment opportunities and the need to finance these new investments, we would expect to see firms raise more money *in total* when stock prices are historically high. But this does not explain why firms prefer to raise the extra cash at these times by an issue of equity rather than debt.

Prediction Markets

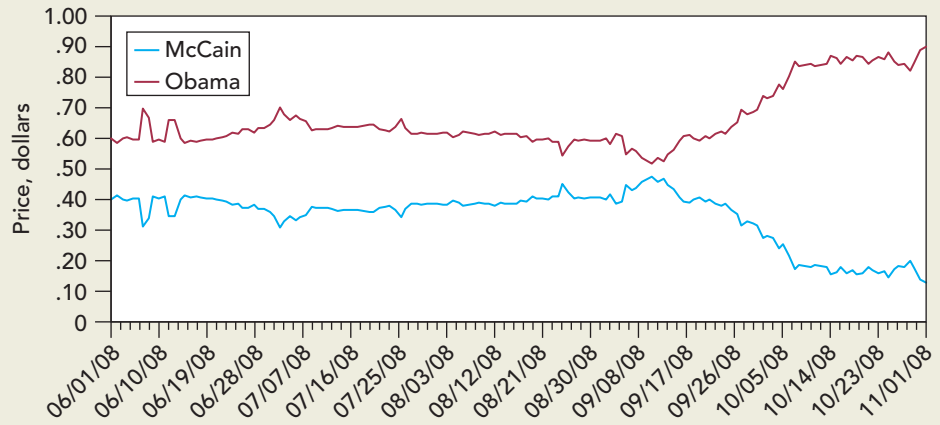
Stock markets allow investors to bet on their favorite stocks. Prediction markets allow them to bet on almost anything else. These markets reveal the collective guess of traders on issues as diverse as New York City snowfall, an avian flu outbreak, and the occurrence of a major earthquake.

Prediction markets are conducted on the major futures exchanges and on a number of smaller online exchanges such as Intrade (**www.intrade.com**) and the Iowa Electronic Markets (**www.biz.uiowa.edu/iem**). Take the 2008 presidential race as an example. On the Iowa Electronic Markets you could bet that Barack Obama would win by buying one of his contracts. Each Obama contract paid $1 if he won the presidency and nothing if he lost. If you thought that the probability of an Obama victory was 55% (say), you would have been prepared to pay up to $.55 for his contract. Someone who was relatively pessimistic about Obama's chances would have been happy to *sell* you such a contract, for that sale would turn a profit if Obama were to lose. With many participants buying and selling, the market price of a contract revealed the collective wisdom of the crowd.

Take a look at the accompanying figure from the Iowa Electronic Markets. It shows the contract prices for the two contenders for the White House between June and November 2008. Following the Republican convention at the start of September, the price of a McCain contract reached a maximum of $.47. From then on the market suggested a steady fall in the probability of a McCain victory.

Participants in prediction markets are putting their money where their mouth is. So the forecasting accuracy of these markets compares favorably with those of major polls. Some businesses have also formed internal prediction markets to survey the views of their staff. For example, Google operates an internal market to forecast product launch dates, the number of Gmail users, and other strategic questions.*

*Google's experience is analyzed in B. Cowgill, J. Wolfers, and E. Zitzewitz, "Using Prediction Markets to Track Information Flows: Evidence from Google," Working paper, Dartmouth College, January 2009.



Lesson 4: There Are No Financial Illusions

In an efficient market there are no financial illusions. Investors are unromantically concerned with the firm's cash flows and the portion of those cash flows to which they are entitled. However, there are occasions on which managers seem to assume that investors suffer from financial illusion.

For example, some firms devote considerable ingenuity to the task of manipulating earnings reported to stockholders. This is done by "creative accounting," that is, by choosing accounting methods that stabilize and increase reported earnings. Presumably firms go to this trouble because management believes that stockholders take the figures at face value.[30]

One way that companies can affect their reported earnings is through the way that they cost the goods taken out of inventory. Companies can choose between two methods. Under the FIFO (first-in, first-out) method, the firm deducts the cost of the first goods to have been placed in inventory. Under the LIFO (last-in, first-out) method companies deduct the cost of the latest goods to arrive in the warehouse. When inflation is high, the cost of the goods that were bought first is likely to be lower than the cost of those that were bought last. So earnings calculated under FIFO appear higher than those calculated under LIFO.

Now, if it were just a matter of presentation, there would be no harm in switching from LIFO to FIFO. But the IRS insists that the same method that is used to report to shareholders also be used to calculate the firm's taxes. So the lower apparent earnings from using the LIFO method also bring lower immediate tax payments.

If markets are efficient, investors should welcome a change to LIFO accounting, even though it reduces earnings. Biddle and Lindahl, who studied the matter, concluded that this is exactly what happens, so that the move to LIFO is associated with an abnormal rise in the stock price.[31] It seems that shareholders look behind the figures and focus on the amount of the tax savings.

Lesson 5: The Do-It-Yourself Alternative

In an efficient market investors will not pay others for what they can do equally well themselves. As we shall see, many of the controversies in corporate financing center on how well individuals can replicate corporate financial decisions. For example, companies often justify mergers on the grounds that they produce a more diversified and hence more stable firm. But if investors can hold the stocks of both companies why should they thank the companies for diversifying? It is much easier and cheaper for them to diversify than it is for the firm.

The financial manager needs to ask the same question when considering whether it is better to issue debt or common stock. If the firm issues debt, it will create financial leverage. As a result, the stock will be more risky and it will offer a higher expected return. But stockholders can obtain financial leverage without the firm's issuing debt; they can borrow on their own accounts. The problem for the financial manager is, therefore, to decide whether the company can issue debt more cheaply than the individual shareholder.

Lesson 6: Seen One Stock, Seen Them All

The elasticity of demand for any article measures the percentage change in the quantity demanded for each percentage addition to the price. If the article has close substitutes, the elasticity will be strongly negative; if not, it will be near zero. For example, coffee, which is a staple commodity, has a demand elasticity of about $-.2$. This means that a 5% increase in the price of coffee changes sales by $-.2 \times .05 = -.01$; in other words, it reduces demand by only 1%. Consumers are likely to regard different *brands* of coffee as much closer substitutes for each other. Therefore, the demand elasticity for a particular brand could be in the region of, say, -2.0. A 5% increase in the price of Maxwell House relative to that of Folgers would in this case reduce demand by 10%.

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[30] For a discussion of the evidence that investors are not fooled by earnings manipulation, see R. Watts, "Does It Pay to Manipulate EPS?" in J. M. Stern and D. H. Chew, Jr. (eds.), *The Revolution in Corporate Finance* (Oxford: Basil Blackwell, 1992).

[31] G. C. Biddle and F. W. Lindahl, "Stock Price Reactions to LIFO Adoptions: The Association between Excess Returns and LIFO Tax Savings," *Journal of Accounting Research* 20 (Autumn 1982, Part 2), pp. 551–588.

Investors don't buy a stock for its unique qualities; they buy it because it offers the prospect of a fair return for its risk. This means that stocks should be like *very* similar brands of coffee, almost perfect substitutes. Therefore, the demand for a company's stock should be highly elastic. If its prospective return is too low relative to its risk, *nobody* will want to hold that stock. If the reverse is true, *everybody* will scramble to buy.

Suppose that you want to sell a large block of stock. Since demand is elastic, you naturally conclude that you need to cut the offering price only very slightly to sell your stock. Unfortunately, that doesn't necessarily follow. When you come to sell your stock, other investors may suspect that you want to get rid of it because you know something they don't. Therefore, they will revise their assessment of the stock's value downward. Demand is still elastic, but the whole demand curve moves down. Elastic demand does not imply that stock prices never change when a large sale or purchase occurs; it *does* imply that you can sell large blocks of stock at close to the market price *as long as you can convince other investors that you have no private information.*

Here again we encounter an apparent contradiction with practice. State and federal regulatory commissions, which set the prices charged by local telephone companies, electric companies, and other utilities, have sometimes allowed significantly higher earnings to compensate the firm for price "pressure." This pressure is the decline in the firm's stock price that is supposed to occur when new shares are offered to investors. Yet Paul Asquith and David Mullins, who searched for evidence of pressure, found that new stock issues by utilities drove down their stock prices on average by only .9%.[32] We come back to the subject of pressure when we discuss stock issues in Chapter 15.

What If Markets Are Not Efficient? Implications for the Financial Manager

Our six lessons depend on efficient markets. What should financial managers do when markets are *not* efficient? The answer depends on the nature of the inefficiency.

Trading Opportunities—Are They Really There for Nonfinancial Corporations? Suppose that the treasurer's staff in your firm notices mispricing in fixed-income or commodities markets, the kind of mispricing that a hedge fund would attempt to exploit in a convergence trade. Should the treasurer authorize the staff to undertake a similar convergence trade? In most cases, the answer should be *no.* First, the corporation faces the same limits to arbitrage that afflict hedge funds and other investors. Second, the corporation probably has no competitive edge in the convergence-trade business.

Procter & Gamble (P&G) supplied a costly example of this point in early 1994, when it lost $102 million in short order. It seems that in 1993 P&G's treasury staff believed that interest rates would be stable and decided to act on this belief to reduce P&G's borrowing costs. They committed P&G to deals with Bankers Trust designed to do just that. Of course there was no free lunch. In exchange for a reduced interest rate, P&G agreed to compensate Bankers Trust if interest rates rose sharply. Rates did increase dramatically in early 1994, and P&G was on the hook.

Then P&G accused Bankers Trust of misrepresenting the transactions—an embarrassing allegation, since P&G was hardly investing as a widow or orphan—and sued Bankers Trust.

We take no stand on the merits of this litigation, which was eventually settled. But think of P&G's competition when it traded in the fixed-income markets. Its competition included the trading desks of all the major investment banks, hedge funds like LTCM, and fixed-income portfolio managers. P&G had no special insights or competitive advantages on the fixed-income playing field. There was no evident reason to expect positive NPV on

[32] See P. Asquith and D. W. Mullins, "Equity Issues and Offering Dilution," *Journal of Financial Economics* 15 (January–February 1986), pp. 61–89.

the trades it committed to. Why was it trading at all? P&G would never invest to enter a new consumer market if it had no competitive advantage in that market.

In Chapter 11 we argued that a corporation should not invest unless it can identify a competitive advantage and a source of economic rents. Market inefficiencies may offer economic rents from convergence trades, but few corporations have a competitive edge in pursuing these rents. As a general rule, nonfinancial corporations gain nothing, on average, by speculation in financial markets. They should not try to imitate hedge funds.[33]

What If Your Company's Shares Are Mispriced? The financial manager may not have special information about future interest rates, but definitely has special information about the value of his or her own company's shares. The strong form of market efficiency does not always hold, so the financial manager will often have information that outside investors do not have. Or investors may have the same information as management, but be slow in reacting to that information or may be infected with behavioral biases.

Sometimes you hear managers thinking out loud like this:

> Great! Our stock is clearly overpriced. This means we can raise capital cheaply and invest in Project X. Our high stock price gives us a big advantage over our competitors who could not possibly justify investing in Project X.

But that doesn't make sense. If your stock is truly overpriced, you can help your current shareholders by selling additional stock and using the cash to invest in other capital market securities. But you should *never* issue stock to invest in a project that offers a lower rate of return than you could earn elsewhere in the capital market. Such a project would have a negative NPV. You can always do better than investing in a negative-NPV project: Your company can go out and buy common stocks. In an efficient market, such purchases are always *zero* NPV.

What about the reverse? Suppose you know that your stock is *underpriced.* In that case, it certainly would not help your current shareholders to sell additional "cheap" stock to invest in other fairly priced stocks. If your stock is sufficiently underpriced, it may even pay to forgo an opportunity to invest in a positive-NPV project rather than to allow new investors to buy into your firm at a low price. Financial managers who believe that their firm's stock is underpriced may be justifiably reluctant to issue more stock, but they may instead be able to finance their investment program by an issue of debt. In this case the market inefficiency would affect the firm's choice of financing but not its real investment decisions. In Chapter 15 we will have more to say about the financing choice when managers believe their stock is mispriced.

What If Your Firm Is Caught in a Bubble? Once in a lifetime, your company's stock price may be swept up in a bubble like the dot.com boom of the late 1990s. Bubbles can be exhilarating. It's hard not to join in the enthusiasm of the crowds of investors bidding up your firm's stock price.[34] On the other hand, financial management *inside* a bubble poses difficult personal and ethical challenges. Managers don't want to "talk down" a high-flying stock price, especially when bonuses and stock-option payoffs depend on it. The temptation to cover up bad news or manufacture good news can be very strong. But the longer a bubble lasts, the greater the damage when it finally bursts. When it does burst, there will be lawsuits and possibly jail time for managers who have resorted to tricky accounting or misleading public statements in an attempt to sustain the inflated stock price.

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[33] There are of course some likely exceptions. Hershey and Nestlé are credible traders in cocoa futures markets. The major oil companies probably have special skills and knowledge relevant to energy markets.

[34] See J. C. Stein, "Rational Capital Budgeting in an Irrational World," *Journal of Business* 69 (October 1996), pp. 429–455.

When a firm's stock price is swept upward in a bubble, CEOs and financial managers are tempted to acquire another firm using the stock as currency. One extreme example where this arguably happened is AOL's acquisition of Time Warner at the height of the dot.com bubble in 2000. AOL was a classic dot.com company. Its stock rose from $2.34 at the end of 1995 to $75.88 at the end of 1999. Time Warner's stock price also increased during this period, but only from $18.94 to $72.31. AOL's total market capitalization was a small fraction of Time Warner's in 1995, but overtook Time Warner's in 1998. By the end of 1999 AOL's outstanding shares were worth $173 billion, compared with Time Warner's $95 billion. AOL managed to complete the acquisition before the Internet bubble burst. AOL-Time Warner's stock then plummeted, but not by nearly as much as the stocks of dot.com companies that had not managed to find and acquire safer partners.[35]

[35] Pavel Savor and Qi Lu provide evidence that many other firms were able to benefit from stock acquisitions. See "Do Stock Mergers Create Value for Acquirers?" *Journal of Finance,* 64 (June 2009), pp. 1061–1097.

SUMMARY

The patron saint of the Bolsa (stock exchange) in Barcelona, Spain, is Nuestra Señora de la Esperanza—Our Lady of Hope. She is the perfect patroness, for we all hope for superior returns when we invest. But competition between investors will tend to produce an efficient market. In such a market, prices will rapidly impound any new information, and it will be difficult to make consistently superior returns. We may indeed hope, but all we can rationally *expect* in an efficient market is a return just sufficient to compensate us for the time value of money and for the risks we bear.

The efficient-market hypothesis comes in three different flavors. The weak form of the hypothesis states that prices efficiently reflect all the information in the past series of stock prices. In this case it is impossible to earn superior returns simply by looking for patterns in stock prices; in other words, price changes are random. The semistrong form of the hypothesis states that prices reflect all published information. That means it is impossible to make consistently superior returns just by reading the newspaper, looking at the company's annual accounts, and so on. The strong form of the hypothesis states that stock prices effectively impound all available information. It tells us that superior information is hard to find because in pursuing it you are in competition with thousands, perhaps millions, of active, intelligent, and greedy investors. The best you can do in this case is to assume that securities are fairly priced and to hope that one day Nuestra Señora will reward your humility.

During the 1960s and 1970s every article on the topic seemed to provide additional evidence that markets are efficient. But then readers became tired of hearing the same message and wanted to read about possible exceptions. During the 1980s and 1990s more and more anomalies and puzzles were uncovered. Bubbles, including the dot.com bubble of the 1990s and the real estate bubble of the 2000s, cast doubt on whether markets were always and everywhere efficient.

Limits to arbitrage can explain why asset prices may get out of line with fundamental values. Behavioral finance, which relies on psychological evidence to interpret investor behavior, is consistent with many of the deviations from market efficiency. Behavioral finance says that investors are averse to even small losses, especially when recent investment returns have been disappointing. Investors may rely too much on a few recent events in predicting the future. They may be overconfident in their predictions and may be sluggish in reacting to new information.

There are plenty of quirks and biases in human behavior, so behavioral finance has plenty of raw material. But if every puzzle or anomaly can be explained by some recipe of quirks, biases,

and hindsight, what have we learned? Research in behavioral finance literature is informative and intriguing, but not yet at the stage where a few parsimonious models can account for most of the deviations from market efficiency.

For the corporate treasurer who is concerned with issuing or purchasing securities, the efficient-market theory has obvious implications. In one sense, however, it raises more questions than it answers. The existence of efficient markets does not mean that the financial manager can let financing take care of itself. It provides only a starting point for analysis. It is time to get down to details about securities and issue procedures. We start in Chapter 14.

FURTHER READING

Malkiel's book is an easy-to-read book on market efficiency. Fama has written two classic review articles on the topic:

B. G. Malkiel, *A Random Walk Down Wall Street,* 8th ed. (New York: W.W. Norton, 2004).

E. F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance* 25 (May 1970), pp. 383–417.

E. F. Fama, "Efficient Capital Markets: II," *Journal of Finance* 46 (December 1991), pp. 1575–1617.

There are several useful surveys of behavioral finance:

N. Barberis and R. H. Thaler, "A Survey of Behavioral Finance," in G. M. Constantinides, M. Harris, and R. M. Stulz (eds.), *Handbook of the Economics of Finance* (Amsterdam: Elsevier Science, 2003).

M. Baker, R. S. Ruback, and J. Wurgler, "Behavioral Corporate Finance," in B. E. Eckbo (ed.), *The Handbook of Empirical Corporate Finance* (Amsterdam: Elsevier/North-Holland, 2007), Chapter 4.

R. J. Shiller, "Human Behavior and the Efficiency of the Financial System," in J. B. Taylor and M. Woodford (eds.), *Handbook of Macroeconomics* (Amsterdam: North-Holland, 1999).

A. Shleifer, *Inefficient Markets: An Introduction to Behavioral Finance* (Oxford: Oxford University Press, 2000).

R. H. Thaler (ed.), *Advances in Behavioral Finance* (New York: Russell Sage Foundation, 1993).

Some conflicting views on market efficiency are provided by:

G. W. Schwert, "Anomalies and Market Efficiency," in G. M. Constantinides, M. Harris, and R. M. Stulz (eds.), *Handbook of the Economics of Finance* (Amsterdam: Elsevier Science, 2003).

M. Rubinstein, "Rational Markets: Yes or No? The Affirmative Case?" *Financial Analysts Journal* 57 (May–June 2001), pp. 15–29.

B. G. Malkiel, "The Efficient Market Hypothesis and Its Critics," *Journal of Economic Perspectives* 17 (Winter 2003), pp. 59–82.

R. J. Shiller, "From Efficient Markets Theory to Behavioral Finance," *Journal of Economic Perspectives* 17 (Winter 2003), pp. 83–104.

E. F. Fama and K. R. French, "Dissecting Anomalies," *Journal of Finance* 63 (August 2008), pp. 1653–1678.

Bubbles are discussed in:

M. Brunnermeier, *Asset Pricing under Asymmetric Information: Bubbles, Crashes, Technical Analysis, and Herding* (Oxford: Oxford University Press, 2001).

R. J. Shiller, *Irrational Exuberance,* 2nd ed. (Princeton, NJ: Princeton University Press, 2005).

Select problems are available in McGraw-Hill Connect. Please see the preface for more information.

PROBLEM SETS

BASIC

1. Which (if any) of these statements are true? Stock prices appear to behave as though successive values (a) are random numbers, (b) follow regular cycles, (c) differ by a random number.
2. Supply the missing words:

   "There are three forms of the efficient-market hypothesis. Tests of randomness in stock returns provide evidence for the _____ form of the hypothesis. Tests of stock price reaction to well-publicized news provide evidence for the _____ form, and tests of the performance of professionally managed funds provide evidence for the _____ form. Market efficiency results from competition between investors. Many investors search for new information about the company's business that would help them to value the stock more accurately. Such research helps to ensure that prices reflect all available information; in other words, it helps to keep the market efficient in the _____ form. Other investors study past stock prices for recurrent patterns that would allow them to make superior profits. Such research helps to ensure that prices reflect all the information contained in past stock prices; in other words, it helps to keep the market efficient in the _____ form."
3. True or false? The efficient-market hypothesis assumes that
   a. There are no taxes.
   b. There is perfect foresight.
   c. Successive price changes are independent.
   d. Investors are irrational.
   e. There are no transaction costs.
   f. Forecasts are unbiased.
4. True or false?
   a. Financing decisions are less easily reversed than investment decisions.
   b. Tests have shown that there is almost perfect negative correlation between successive price changes.
   c. The semistrong form of the efficient-market hypothesis states that prices reflect all publicly available information.
   d. In efficient markets the expected return on each stock is the same.
5. Analysis of 60 monthly rates of return on United Futon common stock indicates a beta of 1.45 and an alpha of −.2% per month. A month later, the market is up by 5%, and United Futon is up by 6%. What is Futon's abnormal rate of return?
6. True or false?
   a. Analysis by security analysts and investors helps keep markets efficient.
   b. Psychologists have found that, once people have suffered a loss, they are more relaxed about the possibility of incurring further losses.
   c. Psychologists have observed that people tend to put too much weight on recent events when forecasting.
   d. If the efficient-market hypothesis is correct, managers will not be able to increase stock prices by creative accounting that boosts reported earnings.
7. Geothermal Corporation has just received good news: its earnings increased by 20% from last year's value. Most investors are anticipating an increase of 25%. Will Geothermal's stock price increase or decrease when the announcement is made?

8. Here again are the six lessons of market efficiency. For each lesson give an example showing the lesson's relevance to financial managers.
   a. Markets have no memory.
   b. Trust market prices.
   c. Read the entrails.
   d. There are no financial illusions.
   e. The do-it-yourself alternative.
   f. Seen one stock, seen them all.
9. Give two or three examples of research results or events that raise doubts about market efficiency. Briefly explain why.

INTERMEDIATE

10. How would you respond to the following comments?
    a. "Efficient market, my eye! I know lots of investors who do crazy things."
    b. "Efficient market? Balderdash! I know at least a dozen people who have made a bundle in the stock market."
    c. "The trouble with the efficient-market theory is that it ignores investors' psychology."
    d. "Despite all the limitations, the best guide to a company's value is its written-down book value. It is much more stable than market value, which depends on temporary fashions."
11. Respond to the following comments:
    a. "The random-walk theory, with its implication that investing in stocks is like playing roulette, is a powerful indictment of our capital markets."
    b. "If everyone believes you can make money by charting stock prices, then price changes won't be random."
    c. "The random-walk theory implies that events are random, but many events are not random. If it rains today, there's a fair bet that it will rain again tomorrow."
12. Which of the following observations *appear* to indicate market inefficiency? Explain whether the observation appears to contradict the weak, semistrong, or strong form of the efficient-market hypothesis.
    a. Tax-exempt municipal bonds offer lower pretax returns than taxable government bonds.
    b. Managers make superior returns on their purchases of their company's stock.
    c. There is a positive relationship between the return on the market in one quarter and the change in aggregate profits in the next quarter.
    d. There is disputed evidence that stocks that have appreciated unusually in the recent past continue to do so in the future.
    e. The stock of an acquired firm tends to appreciate in the period before the merger announcement.
    f. Stocks of companies with unexpectedly high earnings appear to offer high returns for several months after the earnings announcement.
    g. Very risky stocks on average give higher returns than safe stocks.
13. Here are alphas and betas for Intel and Conagra for the 60 months ending April 2009. Alpha is expressed as a percent per month.

	Alpha	Beta
Intel	−.57	1.08
Conagra	−.46	.65

Explain how these estimates would be used to calculate an abnormal return.

14. "If the efficient-market hypothesis is true, the pension fund manager might as well select a portfolio with a pin." Explain why this is not so.

15. Two financial managers, Alpha and Beta, are contemplating a chart showing the actual performance of the Standard and Poor's Composite Index over a five-year period. Each manager's company needs to issue new shares of common stock sometime in the next year.

Alpha: My company's going to issue right away. The stock market cycle has obviously topped out, and the next move is almost surely down. Better to issue now and get a decent price for the shares.

Beta: You're too nervous; we're waiting. It's true that the market's been going nowhere for the past year or so, but the figure clearly shows a basic upward trend. The market's on the way up to a new plateau.

What would you say to Alpha and Beta?

16. What does the efficient-market hypothesis have to say about these two statements?

a. "I notice that short-term interest rates are about 1% below long-term rates. We should borrow short-term."

b. "I notice that interest rates in Japan are lower than rates in the United States. We would do better to borrow Japanese yen rather than U.S. dollars."

17. Fama and French show that average stock returns on firms with small market capitalizations have been significantly higher than average returns for "large-cap" firms. What are the possible explanations for this result? Does the result disprove market efficiency? Explain briefly.

18. Column (A) in Table 13.1 on the following page shows the monthly return on the British FTSE 100 index from May 2007 through February 2009. Columns (B) and (C) show returns on the stocks of two firms—Executive Cheese and Paddington Beer. Both firms announced their earnings in February 2009. Calculate the average abnormal return of the two stocks during the month of the earnings announcement.

19. On May 15, 1997, the government of Kuwait offered to sell 170 million BP shares, worth about $2 billion. Goldman Sachs was contacted after the stock market closed in London and given one hour to decide whether to bid on the stock. They decided to offer 710.5 pence ($11.59) per share, and Kuwait accepted. Then Goldman Sachs went looking for buyers. They lined up 500 institutional and individual investors worldwide, and resold all the shares at 716 pence ($11.70). The resale was complete before the London Stock Exchange opened the next morning. Goldman Sachs made $15 million overnight.[36]

What does this deal say about market efficiency? Discuss.

20. Explain how incentive and agency problems can contribute to mispricing of securities or to bubbles. Give examples.

21. Many commentators have blamed the subprime crisis on "irrational exuberance." What is your view? Explain briefly.

CHALLENGE

22. "The strong-form of the efficient-market hypothesis is nonsense. Look at mutual fund X; it has had superior performance for each of the last 10 years." Does the speaker have a point? Suppose that there is a 50% probability that X will obtain superior performance in any year simply by chance.

a. If X is the only fund, calculate the probability that it will have achieved superior performance for each of the past 10 years.

b. Now recognize that there are over 10,000 mutual funds in the United States. What is the probability that by chance there is at least 1 out of 10,000 funds that obtained 10 successive years of superior performance?

[36] "Goldman Sachs Earns a Quick $15 Million Sale of BP Shares," *The Wall Street Journal,* May 16, 1997, p. A4.

TABLE 13.1

See Problem 18. Rates of return in percent per month:

Month	(A) Market Return	(B) Executive Cheese Return	(C) Paddington Beer Return
May 07	2.7	−3	1.6
Jun	−0.2	2.3	−0.8
Jul	−3.8	−5.1	0.3
Aug	−0.9	−0.7	−1.6
Sep	2.6	3.1	2.8
Oct	3.9	13	2.1
Nov	−4.3	−2.1	−6
Dec	0.4	6.2	−1.7
Jan 08	−8.9	−4	−5
Feb	0.1	0.4	−0.4
Mar	−3.1	−2.1	−2
Apr	6.8	4.6	3.2
May	−0.6	−0.3	0.4
Jun	−7.1	−12.7	−7.3
Jul	−3.8	1.1	−4.1
Aug	4.2	7.2	2.3
Sep	−13.0	−18.1	−8.7
Oct	−10.7	−6.2	−12
Nov	−2.0	0.5	−4.2
Dec	3.4	4.7	2.7
Jan 09	−6.4	−8.1	−0.4
Feb	−7.7	−2.1	−9.4

23. Some extreme bubbles are obvious with hindsight, *after* they burst. But how would you *define* a bubble? There are many examples of good news and rising stock prices, followed by bad news and falling stock prices. Can you set out rules and procedures to distinguish bubbles from the normal ups and downs of stock prices?

REAL-TIME DATA ANALYSIS

STANDARD &POOR'S

Use either finance.yahoo.com or the Market Insight database (www.mhhe.com/edumarketinsight) to download daily prices for five U.S. stocks for a recent five-year period.

For each stock, construct a scatter diagram of successive returns as in Figure 13.2. Calculate the correlation among the returns on successive days. Do you find any consistent patterns?