

CHAPTER 8

Stock Price Behavior and Market Efficiency

“One of the funny things about the stock market is that every time one man buys, another sells, and both think they are astute.”

William Feather

“There are two times in a man’s life when he shouldn’t speculate: When he can’t afford it, and when he can.”

Mark Twain

Our discussion of investments in this chapter ranges from the most controversial issues, to the most intriguing, to the most baffling. We begin with bull markets, bear markets, and market psychology. We then move into the question of whether you, or indeed anyone, can consistently “beat the market.” Finally, we close the chapter by describing market phenomena that sound more like carnival side shows, such as “the amazing January effect.”

*(marg. def. **technical analysis** Techniques for predicting market direction based on (1) historical price and volume behavior, and (2) investor sentiment.)*

8.1 Technical Analysis

In our previous two chapters, we discussed fundamental analysis. We saw that fundamental analysis focuses mostly on company financial information. There is a completely different, and controversial, approach to stock market analysis called **technical analysis**. Technical analysis boils down to an attempt to predict the direction of future stock price movements based on two major types of information: (1) historical price and volume behavior and (2) investor sentiment.

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Technical analysis techniques are centuries old, and their number is enormous. Many, many books on the subject have been written. For this reason, we will only touch on the subject and introduce some of its key ideas in the next few sections. Although we focus on the use of technical analysis in the stock market, you should be aware that it is very widely used in the commodity markets and most comments or discussion here apply to those markets as well.

As you probably know, investors with a positive outlook on the market are often called “bulls,” and a rising market is called a bull market. Pessimistic investors are called “bears,” and a falling market is called a bear market (just remember that bear markets are hard to bear). Technical analysts essentially search for bullish or bearish signals, meaning positive or negative indicators about stock prices or market direction.

Dow Theory

Dow theory is a method of analyzing and interpreting stock market movements that dates back to the turn of the century. The theory is named after Charles Dow, a cofounder of the Dow Jones Company and an editor of the Dow Jones-owned newspaper, *The Wall Street Journal*.

(marg. def. Dow theory Method for predicting market direction that relies on the Dow Industrial and the Dow Transportation averages.)

The essence of Dow theory is that there are, at all times, three forces at work in the stock market: (1) a primary direction or trend, (2) a secondary reaction or trend, and (3) daily fluctuations. According to the theory, the primary direction is either bullish (up) or bearish (down), and it reflects the long-run direction of the market.

However, the market can, for limited periods of time, depart from its primary direction. These departures are called secondary reactions or trends and may last for several weeks or months. These are eliminated by *corrections*, which are reversions back to the primary direction. Daily fluctuations are essentially noise and are of no real importance.

The basic purpose of the Dow theory is to signal changes in the primary direction. To do this, two stock market averages, the Dow Jones Industrial Average (DJIA) and the Dow Jones Transportation Average (DJTA), are monitored. If one of these departs from the primary trend, the movement is viewed as secondary. However, if a departure in one is followed by a departure in the other, then this is viewed as a *confirmation* that the primary trend has changed. The Dow theory was, at one time, very well known and widely followed. It is less popular today, but its basic principles underlie more contemporary approaches to technical analysis.

Support and Resistance Levels

A key concept in technical analysis is the identification of support and resistance levels. A **support level** is a price or level below which a stock or the market as a whole is unlikely to go. A **resistance level** is a price or level above which a stock or the market as a whole is unlikely to rise.

(marg. def. support level Price or level below which a stock or the market as a whole is unlikely to go.)

(marg. def. resistance level Price or level above which a stock or the market as a whole is unlikely to rise.)

The idea behind these levels is straightforward. As a stock's price (or the market as a whole) falls, it reaches a point where investors increasingly believe that it can fall no further - the point at which it "bottoms out." Essentially, buying by bargain-hungry investors ("bottom feeders") picks up at that

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point, thereby “supporting” the price. A resistance level is the same thing in the opposite direction. As a stock (or the market) rises, it eventually “tops out” and investor selling picks up. This selling is often referred to as “profit taking.”

Resistance and support areas are usually viewed as psychological barriers. As the DJIA approaches levels with three zeroes, such as 8,000, talk of “psychologically important” barriers picks up in the financial press. A “breakout” occurs when a stock (or the market) passes through either a support or a resistance level. A breakout is usually interpreted to mean that the price or level will continue in that direction. As this discussion illustrates, there is much colorful language used under the heading of technical analysis. We will see many more examples just ahead.

Technical Indicators

Technical analysts rely on a variety of so-called technical indicators to forecast the direction of the market. Every day, the *Wall Street Journal* publishes a variety of such indicators in the “Stock Market Data Bank” section. An excerpt of the “Diaries” section appears in Figure 8.1.

Figure 8.1 about here

Much, but not all, of the information presented is self-explanatory. The first item in Figure 8.1 is the number of “issues traded.” This number fluctuates because, on any given day, there may be no trading in certain issues. In the following lines, we see the number of price “advances,” the number of price “declines,” and the number of “unchanged” prices. Also listed are the number of stock prices reaching “new highs” and “new lows.”

One popular technical indicator is called the “advance/decline line.” This line shows, for some period, the cumulative difference between advancing issues and declining issues. For example, suppose we had the following information for a particular trading week:

Advance / Decline Line Calculation				
Weekday	Issues Advancing	Issues Declining	Difference	Cumulative
Monday	1,015	1,200	-185	-185
Tuesday	900	1,312	-412	-597
Wednesday	1,100	1,108	-8	-605
Thursday	1,250	1,000	+250	-355
Friday	1,100	1,080	+20	-335

In the table just above, notice how we take the difference between the number of issues advancing and declining on each day and then cumulate the difference through time. For example, on Monday, 185 more issues declined than advanced. On Tuesday, 412 more issues declined than advanced. Over the two days, the cumulative advance/decline is thus $-185 + -412 = -597$.

This cumulative advance/decline, once plotted, is the advance/decline line. A negative advance/decline line would be considered a bearish signal, but an up direction is a positive sign. The advance/decline line is often used to measure market “breadth.” If the market is going up, for example, then technical analysts view it as a good sign if the advance is widespread as measured by advancing versus declining issues, rather than being concentrated in a small number of issues.

The next three lines in Figure 8.1 deal with trading volume. These lines, titled “zAdv vol,” “zDecl vol,” and “zTotal vol,” represent trading volume for advancing issues, declining issues, and all issues, respectively. The “z” here and elsewhere indicates that the information reported is for the

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NYSE only or AMEX. Also, the sum of “zAdv vol” and “zDecl vol” does not equal “zTotal vol” because of volume in issues with unchanged prices. For a technical analyst, heavy volume is generally viewed as a bullish signal of buyer interest. This is particularly true if more issues are up than down and if there are a lot of new highs to go along.

The final three numbers are also of interest to technicians. The first, labeled “Closing tick” is the difference between the number of shares that closed on an uptick and those that closed on a down tick. From our discussion of the NYSE short sale rule in Chapter 5, you know that an uptick occurs when the last price change was positive; a downtick is just the reverse. The tick gives an indication of where the market was heading as it closed.

The entry labeled “Closing Arms (trin)” is the ratio of average trading volume in declining issues to average trading volume in advancing issues. It is calculated as follows:

$$\text{Trin} = \frac{\text{Declining volume} / \text{Declines}}{\text{Advancing volume} / \text{Advances}} \quad [1]$$

The ratio is named after its inventor, Richard Arms; it is often called the “trin,” which is an acronym for “tr(end) in(dicator).” Values greater than 1.0 are considered bearish because the indication is that declining shares had heavier volume.

The final piece of information in Figure 8.1, “zBlock trades,” refers to trades in excess of 10,000 shares. At one time, such trades were taken to be indicators of buying or selling by large institutional investors. However, today such trades are routine, and it is difficult to see how this information is particularly useful.

Charting

Technical analysts rely heavily on charts showing recent market activity in terms of either prices or, less commonly, volume. In fact, technical analysis is sometimes called “charting,” and technical analysts are often called “chartists.” There are many types of charts, but the basic idea is that by studying charts of past market prices (or other information), the chartist identifies particular patterns that signal the direction of a stock or the market as a whole.

We will briefly describe four charting techniques - relative strength charts, moving average charts, hi-lo-close and candlestick charts, and point and figure charts - just to give you an idea of some common types.

*(marg. def. **relative strength** A measure of the performance of one investment relative to another.)*

Relative Strength Charts

Relative strength charts illustrate the performance of one company, industry, or market relative to another. If you look back at the *Value Line* exhibit in Chapter 6, you will see a plot labeled “relative strength.” Very commonly, such plots are created to analyze how a stock has done relative to its industry or the market as a whole.

To illustrate how such plots are constructed, suppose that on some particular day, we invest equal amounts, say \$100, in both Ford and GM (the amount does not matter, what matters is that the original investment is the same for both). On every subsequent day, we take the ratio of the value of our Ford investment to the value of our GM investment, and we plot it. A ratio bigger than 1.0 indicates that, on a relative basis, Ford has outperformed GM, and vice versa. Thus, a value of 1.20

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indicates that Ford has done 20 percent better than GM over the period studied. Notice that if both stocks are down, a ratio bigger than 1.0 indicates that Ford is down by less than GM.

Example 8.1 Relative Strength Consider the following series of monthly stock prices for two hypothetical companies:

Month	Stock A	Stock B
1	\$25	\$50
2	24	48
3	22	45
4	22	40
5	20	39
6	19	38

On a relative basis, how has Stock A done compared to stock B?

To answer, suppose we had purchased four shares of A and two shares of B for an investment of \$100 in each. We can calculate the value of our investment in each month and then take the ratio of A to B as follows:

Investment value			
Month	Stock A (4 shares)	Stock B (2 shares)	Relative strength
1	\$100	\$100	1.00
2	96	96	1.00
3	88	90	0.98
4	88	80	1.10
5	80	78	1.03
6	76	76	1.00

What we see is that, over the first four months, both stocks were down, but A outperformed B by 10 percent. However, after six months, the two had done equally well (or equally poorly).

(*marg. def.* **moving average** An average daily price or index level, calculated using a fixed number of previous days' prices or levels, updated each day.)

Moving Average Charts

Technical analysts frequently study **moving average** charts. Such charts are used in an attempt to identify short- and long-term trends, often along the lines suggested by Dow theory. The way we construct a 30-day moving average stock price, for example, is to take the prices from the previous 30 trading days and average them. We do this for every day, so that the average “moves” in the sense that each day we update the average by dropping the oldest day and adding the most recent day. Such an average has the effect of smoothing out day-to-day fluctuations.

For example, it is common to compare 30-day moving averages to 200-day moving averages. The 200-day average might be thought of as indicative of the long-run trend, while the 30-day average would be the short-run trend. If the 200-day average was rising while the 30-day average was falling, the indication might be that price declines are expected in the short-term, but the long-term outlook is favorable. Alternatively, the indication might be that there is a danger of a change in the long-term trend.

Example 8.2 A Moving Experience Using the stock prices in Example 8.1, construct three month moving averages for both stocks.

In the table that follows, we repeat the stock prices and then provide the requested moving averages. Notice that the first two months do not have a moving average figure. Why?

Month	Stock prices		Moving averages	
	Stock A	Stock B	Stock A	Stock B
1	\$25	\$50		
2	24	48		
3	22	45	\$23.67	\$47.67
4	22	40	22.67	44.33
5	20	39	21.33	41.33
6	19	38	20.33	??.??

To give an example of these calculations, to get the month 5 average for Stock A, we take the three most recent prices—\$20, \$22, and \$22—and average them: $(20 + 22 + 22) / 3 = 21.33$. Supply the missing number (Hint: its square root is about 6.245!).

(*marg. def.* **hi-lo-close chart** Plot of high, low, and closing prices.)

Hi-Lo-Close and Candlestick Charts

A **hi-lo-close chart** is a bar chart showing, for each day, the high price, the low price, and the closing price. We have already seen such a chart in Chapter 5 where these values were plotted for the Dow Jones Industrials Averages (DJIA). Technical analysts study such charts, looking for particular patterns. We describe some patterns in a section just below.

Candlestick charts have been used in Japan to chart rice prices for several centuries, but they have only recently become popular in the United States.¹ A **candlestick chart** is an extended version of a hi-lo-close chart that provides a compact way of plotting the high, low, open, and closing prices

¹This discussion relies, in part, on Chapter 6 of *The Handbook of Technical Analysis*, Darrell R. Jobman, ed., Chicago: Probus Publishing, 1995..

through time while also showing whether the opening price was above or below the closing price. The name stems from the fact that the resulting figure looks like a candlestick with a wick at both ends. Most spreadsheet packages for personal computers can automatically generate both hi-lo-close and candlestick charts. Candlestick charts are sometimes called hi-lo-close-open charts, abbreviated as HLCO.

*(marg. def. **candlestick chart** Plot of high, low, open, and closing prices that shows whether the closing price was above or below the opening price.)*

Figure 8.2 illustrates the basics of candlestick charting. As shown, the body of the candlestick is defined by the opening and closing prices. If the closing price is higher than the opening, the body is clear or white; otherwise, it is black. Extending above and below the body are the upper and lower shadows, which are defined by the high and low prices for the day.

Figure 8.2 about here

To a candlestick chartist, the length of the body, the length of the shadows, and the color of the candle are all important. Plots of candlesticks are used to foretell future market or stock price movements. For example, a series of white candles is a bullish signal; a series of black candles is a bearish signal.

Example 8.3 Candlesticks On November 17, 1998, the DJIA opened at 9010.99 and closed at 8986.28. The high and low were 9158.26 and 8870.42. Describe the candlestick that would be created with this data.

The body of the candle would be black because the closing price is below the open. It would be $9010.99 - 8986.28 = 24.71$ points in height. The upper shadow would be long since the high price for the day is $9158.26 - 9010.99 = 147.27$ points above the body. The lower shadow would extend $8986.28 - 8870.42 = 115.86$ points below the body.

Certain patterns, some with quite exotic-sounding names, are especially meaningful to the candlestick chartist. We consider just a very few examples in Figure 8.3. The leftmost candlesticks in Figure 8.3 show a “dark cloud cover.” Here a white candle with a long body is followed by a long-bodied black candle. When this occurs during a general uptrend, the possibility of a slowing or reversal in the uptrend is suggested. The middle candlesticks in Figure 8.3 show a “bearish engulfing pattern.” Here the market opened higher than the previous day’s close, but closed lower than the previous day’s open. In the context of an uptrend, this would be considered a bearish indicator. Finally, the rightmost candles in Figure 8.3 show a “harami” (Japanese for “pregnant”) pattern. The body of the second day’s candle lies inside that of the first day’s. To a candlestick chartist, the harami signals market uncertainty and the possibility of a change in trend.

Figure 8.3 about here

(*marg. def.* **point-and-figure chart** Technical analysis chart showing only major price moves and their direction.)

Point-and-Figure Charts

Point-and-figure charts are a way of showing only major price moves and their direction. Because minor, or “sideways,” moves are ignored, some chartists feel that point-and-figure charts provide a better indication of important trends. This type of charting is much easier to illustrate than explain, so Table 8.1 contains 24 days of stock prices that we will use to construct the point-and-figure chart in Table 8.2.

Table 8.1 Stock Price Information							
Date	Price		Date	Price		Date	Price
July 2	\$50		July 13	\$55		July 25	55
July 3	51		July 16	56		July 26	56 X
July 5	52 X		July 17	54 O		July 27	58 X
July 6	51		July 18	54		July 30	60 X
July 9	54 X		July 19	54		July 31	54 O
July 10	54		July 20	53		August 1	55
July 11	56 X		July 23	52 O		August 2	52 O
July 12	55		July 24	54 X		August 3	50 O

To build a point-and-figure chart, we have to decide what constitutes a “major” move. We will use \$2 here, but the size is up to the user. In Table 8.1, the stock price starts at \$50. We take no action until it moves up or down by at least \$2. Here, it moves to \$52 on July 5, and, as shown in the table, we mark an upmove with an “X.” In looking at Table 8.2, notice that we put an “X” in the first column at \$52. We take no further action until the stock price moves up or down by another \$2. When it hits \$54, and then \$56, we mark these prices with an X in Table 8.1, and we put Xs in the first column of Table 8.2 in the boxes corresponding to \$54 and \$56.

60			X	
58			X	
56	X		X	
54	X	O	X	O
52	X	O		O
50				O

After we reach \$56, the next \$2 move is down to \$54. We mark this with an O in Table 8.1. Because the price has moved in a new direction, we start a new column in Table 8.2, marking an O in the second column at \$54. From here, we just keep on going, marking every \$2 move as an X or an O, depending on its direction, and then coding it in Table 8.2. A new column starts every time there is a change in direction.

As shown in the more detailed point-and-figure chart in Figure 8.4, buy and sell signals are created when new highs (buy) or new lows (sell) are reached. A lateral series of price reversals, indicating periods of indecisiveness in the market, is called a congestion area.

Figure 8.4 about here

Chart Formations

Once a chart is drawn, technical analysts examine it for various formations or pattern types in an attempt to predict stock price or market direction. There are many such formations, and we cover only one example here. Figure 8.5 shows a stylized example of one particularly well-known formation, the head-and-shoulders. Although it sounds like a dandruff shampoo, it is, in the eyes of

the technical analyst, a decisively bearish indicator. When the stock price “pierces the neckline” after the right shoulder is finished, it’s time to sell, or so a technical analyst would suggest.

Figure 8.5 about here

The head-and-shoulders formation in Figure 8.5 is quite clear, but real data rarely produce such a neat picture. In reality, whether a particular pattern is present or not seems to be mostly in the eye of the chartist. Technical analysts agree that chart interpretation is more a subjective art than an objective science. This subjectivity is one reason that technical analysis is viewed by many with skepticism. We will discuss some additional problems with technical analysis shortly.

There is one other thing to note under the heading of predicting market direction. Although we are not trained technical analysts, we are able to predict the direction of the stock market with about 70 percent accuracy. Don’t be impressed; we just say “up” every time. (The market indeed goes up about 70 percent of the time.).

Other Technical Indicators

We close our discussion of technical analysis by describing a few additional technical indicators. The “odd-lot” indicator looks at whether odd-lot purchases (purchases of fewer than 100 shares) are up or down. One argument is that odd-lot purchases represent the activities of smaller, unsophisticated investors, so when they start buying, it’s time to sell. This is a good example of a “contrarian” indicator. In contrast, some argue that since short selling is a fairly sophisticated tactic, increases in short selling are a negative signal.

Some indicators can seem a little silly. For example, there is the “hemline” indicator. The claim here is that hemlines tend to rise in good times, so rising hemlines indicate a rising market. One of the most famous (or fatuous, depending on how you look at it) indicators is the Super Bowl indicator, which forecasts the direction of the market based on whether the National Football Conference or the American Football Conference wins. A win by the National Football Conference is bullish. This probably strikes you as absurd, so you might be surprised to learn that for the period 1967 - 1988, this indicator forecast the direction of the stock market with more than 90 percent accuracy!

CHECK THIS

- 8.1a What is technical analysis?
- 8.1b What is the difference between a hi-lo-close chart and a point-and-figure chart?
- 8.1c What does a candlestick chart show?

(marg. def. market efficiency Relation between stock prices and information available to investors indicating whether it is possible to “beat the market.” If a market is efficient, it is not possible, except by luck.)

8.2 Market Efficiency

Now we come to what is probably the most controversial and intriguing issue in investments, **market efficiency**. The debate regarding market efficiency has raged for several decades now, and it shows little sign of abating. The central issue is simple enough: Can you, or can anyone, consistently “beat the market?”

We will give a little more precise definition below, but, in essence, if the answer to this question is “no,” then the market is said to be efficient. The **efficient markets hypothesis (EMH)**

asserts that, as a practical matter, the organized financial markets, particularly the NYSE, are efficient. This is the core controversy.

*(marg. def. **efficiency market hypothesis (EMH)** Theory asserting that, as a practical matter, the major financial markets reflect all relevant information at a given time.)*

In the sections that follow, we discuss the issues surrounding the EMH. We focus on the stock markets because that is where the debate (and the research) has concentrated. However, the same principles and arguments would exist in any of the organized financial markets.

What Does “Beat the Market” Mean?

Good question. As we discussed in Chapter 1 and elsewhere, there is a risk-return trade-off. On average at least, we expect riskier investments to have larger returns than less risky investments. So, the fact that an investment appears to have a high or low return doesn't tell us much. We need to know if the return was high or low relative to the risk involved.

*(marg. def. **excess return** A return in excess of that earned by other investments having the same risk.)*

Instead, to determine if an investment is superior, we need to compare **excess returns**. The excess return on an investment is the difference between what that investment earned and what other investments with the same risk earned. A positive excess return means that an investment has outperformed other investments of the same risk. Thus *consistently earning a positive excess return* is what we mean by “beating the market.”

Forms of Market Efficiency

Now that we have a little more precise notion of what it means to beat the market, we can be a little more precise about market efficiency. A market is efficient *with respect to some particular information* if that information is not useful in earning a positive excess return. Notice the emphasis we place on “with respect to some particular information.”

For example, it seems unlikely that knowledge of Shaquille O’Neal’s free-throw shooting percentage would be of any use in beating the market. If so, we would say that the market is efficient with respect to the information in O’Neal’s free throw percentage. On the other hand, if you have prior knowledge concerning impending takeover offers, you could most definitely use that information to earn a positive excess return. Thus, the market is not efficient with regard to this information. We hasten to add that such information is probably “insider” information and insider trading is illegal (in the United States, at least). Using it might well earn you a jail cell and a stiff financial penalty.

Thus, the question of whether or not a market is efficient is meaningful only relative to some type of information. Put differently, if you are asked whether a particular market is efficient, you should always reply, “With respect to what information?” Three general types of information are particularly interesting in this context, and it is traditional to define three forms of market efficiency:

(1) weak, (2) semistrong, and (3) strong.

*(marg. def. **weak-form efficient**. A market in which past prices and volume figures are of no use in beating the market.)*

A **weak-form efficient market** is one in which the information reflected in past prices and volume figures is of no value in beating the market. You probably realize immediately what is

controversial about this. If past prices and volume are of no use, then technical analysis is of no use whatsoever. You might as well read tea leaves as stock price charts if the market is weak-form efficient.

*(marg. def. **semistrong-form efficient market.** A market in which publicly available information is of no use in beating the market.)*

In a **semistrong-form efficient market**, publicly available information of any and all kinds is of no use in beating the market. If a market is semistrong-form efficient, then the fundamental analysis techniques we described in our previous chapter are useless. Also, notice that past prices and volume data are publicly available information, so if a market is semistrong-form efficient, it is also weak-form efficient.

The implications of semistrong-form efficiency are, at a minimum, semistaggering. What it literally means is that nothing in the library, for example, is of any value in earning a positive excess return. How about a firm's financial statements? Useless. Information in the financial press? Worthless. This book? Sad to say, if the market is semistrong-form efficient, there is nothing in this book that will be of any use in beating the market. You can probably imagine that this form of market efficiency is hotly disputed.

*(marg. def. **strong-form efficient market.** A market in which information of any kind, public or private, is of no use in beating the market.)*

Finally, in a **strong-form efficient market** no information of any kind, public or private, is useful in beating the market. Notice that if a market is strong-form efficient, it is necessarily weak- and semistrong-form efficient as well. Ignoring the issue of legality, it is clear that nonpublic inside information of many types would enable you to earn essentially unlimited returns, so this case is not particularly interesting. Instead the debate focuses on the first two forms.

Why Would a Market be Efficient?

The driving force toward market efficiency is simply competition and the profit motive. Investors constantly try to identify superior performing investments. Using the most advanced information processing tools available, investors and security analysts constantly appraise stock values, buying those that look even slightly undervalued and selling those that look even slightly overvalued. This constant appraisal and buying and selling activity, and the research that backs it all up, act to ensure that prices never differ much from their efficient market price.

To give you an idea of how strong the incentive is to identify superior investments, consider a large mutual fund such as the Fidelity Magellan Fund. As we mentioned in Chapter 5, this is the largest equity fund in the United States, with over \$70 billion under management (as of mid-1999). Suppose Fidelity was able through its research to improve the performance of this fund by 20 basis points (recall that a basis point is 1 percent of 1 percent, i.e., .0001) for one year only. How much would this one-time 20-basis point improvement be worth?

The answer is $.002 \times \$70$ billion, or \$140 million. Thus Fidelity would be willing to spend up to \$140 million to boost the performance of this one fund by as little as 1/5 of 1 percent for a single year only. As this example shows, even relatively small performance enhancements are worth tremendous amounts of money, and thereby create the incentive to unearth relevant information and use it.

Because of this incentive, the fundamental characteristic of an efficient market is that prices are correct in the sense that they fully reflect relevant information. If and when new information comes to light, prices may change, and they may change by a lot. It just depends on the new information. However, in an efficient market, right here, right now, price is a consensus opinion of

value, where that consensus is based on the information and intellect of hundreds of thousands, or even millions, of investors around the world.

So Are Financial Markets Efficient?

Financial markets are the most extensively documented of all human endeavors. Mountains of financial market data are collected and reported every day. These data, and stock market data in particular, have been analyzed and reanalyzed and then reanalyzed some more to address market efficiency.

You would think that with all this analysis going on, we would know whether markets are efficient, but we really don't. Instead, what we seem to have, at least in the minds of some researchers, is a growing realization that beyond a point, we just can't tell.

For example, it is not difficult to program a computer to test trading strategies that are based solely on historic prices and volume figures. Many such strategies have been tested, and the vast bulk of the evidence indicates that such strategies are not useful as a realistic matter. The implication is that technical analysis does not work.

However, a technical analyst would protest that a computer program is just a beginning. The technical analyst would say that other, nonquantifiable information and analysis are also needed. This is the subjective element we discussed earlier, and, since it cannot even be articulated, it cannot be programmed in a computer to test, so the debate goes on.

More generally, there are four basic reasons why market efficiency is so difficult to test:

1. The risk-adjustment problem
2. The relevant information problem
3. The dumb luck problem
4. The data snooping problem

We will briefly discuss each in turn.

The first issue, the risk adjustment problem, is the most straightforward to understand. Earlier, we noted that beating the market means consistently earning a positive excess return. To determine whether an investment has a positive excess return, we have to adjust for its risk. As we will discuss in a later chapter, the truth is that we are not even certain exactly what we mean by risk, much less how to precisely measure it and adjust for it. Thus, what appears to be a positive excess return may just be the result of a faulty risk adjustment procedure.

The second issue, the relevant information problem, is even more troublesome. Remember that market efficiency is meaningful only relative to some particular information. As we look back in time and try to assess whether some particular behavior was inefficient, we have to recognize that we cannot possibly know all the information that may have been underlying that behavior.

For example, suppose we see that 10 years ago the price of a stock shot up by 100 percent over a short period of time and then subsequently collapsed (it happens). We dig through all the historical information we can find, but we can find no reason for this behavior. What can we conclude? Nothing, really. For all we know, a rumor existed of a takeover that never materialized, and, relative to this information, the price behavior was perfectly efficient.

In general, there is no way to tell whether we have all the relevant information. Without *all* the relevant information, we cannot tell if some observed price behavior is inefficient. Put differently,

any price behavior, no matter how bizarre, could probably be efficient, and therefore explainable, with respect to *some* information.

The third problem has to do with evaluating investors and money managers. One type of evidence frequently cited to prove that markets can be beaten is the enviable track record of certain legendary investors. For example, in 1999, Warren Buffett was the second wealthiest person in the United States; he made his \$30+ billion dollar fortune primarily from shrewd stock market investing over many years. The *Wall Street Journal* article reproduced in the nearby Investment Updates box gives some information on the track record of Warren Buffett and other investment superstars.

Investment Updates: Great Investors

The argument presented in the Investment Updates box is that, since at least some investors seem to be able to beat the market, it must be the case that there are inefficiencies. Is this correct? Maybe yes, maybe no. You may be familiar with the following expression: “If you put 1,000 monkeys in front of 1,000 typewriters for 1,000 years, one of them will produce an entire Shakespeare play.” It is equally true that if you put thousands of monkeys to work picking stocks for a portfolio, you would find that some monkeys appear to be amazingly talented and rack up extraordinary gains. As you surely recognize, however, this is just due to random chance.

Now we don't mean to be insulting by comparing monkeys to money managers (some of our best friends are monkeys), but it is true that if we track the performance of thousands of money managers over some period of time, some managers will accumulate remarkable track records and a lot of publicity. Are they good or are they lucky? If we could track them for many decades, we

might be able to tell, but for the most part, money managers are not around long enough for us to accumulate enough data.

Our final problem has to do with what is known as “data snooping.” Instead of 1,000 monkeys at 1,000 typewriters, think now of 1,000 untenured assistant professors of finance with 1,000 computers all studying the same data, looking for inefficiencies. Apparent patterns will surely be found.

In fact, researchers *have* discovered extremely simple patterns that, at least historically, have been quite successful and very hard to explain (we discuss some of these in the next section). These discoveries raise another problem: ghosts in the data. If we look long enough and hard enough at any data, we are bound to find some apparent patterns by sheer chance, but are they real? The nearby Investment Updates box discusses several examples of investment strategies that worked well in the past but no longer appear to provide superior returns.

Investment Updates: Investment Rules of the Past

Notwithstanding the four problems we have discussed, based on the last 20 to 30 years of scientific research, three generalities about market efficiency seem in order. First, short-term stock price and market movements appear to be very difficult, or even impossible, to predict with any accuracy, at least with any objective method of which we are aware. Second, the market reacts quickly and sharply to new information, and the vast majority of studies of the impact of new information find little or no evidence that the market underreacts or overreacts to new information in a way that can be profitably exploited. Third, if the stock market can be beaten, the way to do it is at least not *obvious*. so the implication is that the market is not grossly inefficient.

Some Implications of Market Efficiency

To the extent that you think a market is efficient, there are some important investment implications. Going back to Chapter 2, we saw that the investment process can be viewed as having two parts: asset allocation and security selection. Even if all markets are efficient, asset allocation is still important because the way you divide your money between the various types of investments will strongly influence your overall risk-return relation.

However, if markets are efficient, then security selection is less important, and you do not have to worry too much about overpaying or underpaying for any particular security. In fact, if markets are efficient, you would probably be better off just buying a large basket of stocks and following a passive investment strategy. Your main goal would be to hold your costs to a minimum while maintaining a broadly diversified portfolio. We discussed index funds, which exist for just this purpose, in Chapter 4.

In broader terms, if markets are efficient, then little role exists for professional money managers. You should not pay load fees to buy mutual fund shares, and you should shop for low management fees. You should not work with full-service brokers, and so on. From the standpoint of an investor, it's a commodity-type market.

If markets are efficient, there is one other thing that you should not do: You should not try to time the market. Recall that market timing amounts to moving money in and out of the market based on your expectations of future market direction. All you accomplish with an efficient market is to guarantee that you will, on average, underperform the market.

In fact, market efficiency aside, market timing is hard to recommend. Historically, most of the gains earned in the stock market have tended to occur over relatively short periods of time. If you

miss even a single one of these short market runups, you will likely never catch up. Put differently, successful market timing requires phenomenal accuracy to be of any benefit, and anything less than that will, based on the historic record, result in underperforming the market.

CHECK THIS

- 8.2a What does it mean to “beat the market”?
- 8.2b What are the forms of market efficiency?
- 8.2c Why is market efficiency difficult to evaluate?

8.3 Stock Price Behavior and Market Efficiency

This section concludes our discussion of market efficiency. We first discuss some aspects of stock price behavior that are both baffling and hard to reconcile with market efficiency. We then examine the track records of investment professionals and find results that are both baffling and hard to reconcile with anything *other* than market efficiency.

The Day of the Week Effect

In the stock market, which day of the week has, on average, the biggest return? The question might strike you as a little ridiculous; after all, what would make one day different from any other on average? On further reflection, though, you might realize that one day is different: Monday.

When we calculate a daily return for the stock market, we take the percentage change in closing prices from one trading day to the next. For every day except Monday this is a 24-hour period. However, since the markets are closed on the weekends, the average return on Monday is

based on the percentage change from Friday's close to Monday's close, a 72-hour period. Thus, the average Monday return would be computed over a three-day period, not just a one-day period. We conclude therefore that Monday should have the highest average return; in fact, Monday's average return should be three times as large.

(*marg. def.* **day-of-the-week effect** The tendency for Monday to have a negative average return.)

Given this reasoning, it may come as a surprise to you to learn that Monday has the *lowest* average return! In fact, Monday is the only day with a *negative* average return. This is the **day-of-the-week effect**. Table 8.3 shows the average return by day of the week for the S&P 500 for the period July 1962 through December 1994.

Table 8.3 Average Daily S&P 500 Returns (by day of the week, dividends not included)					
Weekday	Monday	Tuesday	Wednesday	Thursday	Friday
Avg return	-.078%	.035%	.098%	.026%	.063%

The negative return on Monday is quite significant, both in a statistical sense and in an economic sense. This day-of-the-week effect does not appear to be a fluke; it exists in other markets, such as the bond market, and it exists in stock markets outside the United States. It has eluded explanation since it was first carefully documented in the early 1980s, and it continues to do so as this is written.

Critics of the EMH point to this strange behavior as evidence of market inefficiency. The problem with this criticism is that while the behavior is odd, how it can be used to earn a positive excess return is not clear, so whether it points to inefficiency is hard to say.

The Amazing January Effect

We saw in Chapter 1 that small common stocks have significantly outdistanced large common stocks over the last seven decades. Beginning in the early 1980s, researchers reported that the difference was too large even to be explained by differences in risk. In other words, small stocks appeared to earn positive excess returns.

Further research found that, in fact, a substantial percentage of the return on small stocks has historically occurred early in the month of January, particularly in the few days surrounding the turn of the year. Even closer research documents that this peculiar phenomenon is more pronounced for stocks that have experienced significant declines in value, or “losers.”

*(marg. def. **January effect.** Tendency for small stocks to have large returns in January.)*

Thus we have the famous “small-stock-in-January-especially-around-the-turn-of-the-year-for-losers effect,” or SSIJEATTOTYFL for short. For obvious reasons, this phenomenon is usually just dubbed the **January effect**. To give you an idea of how big this effect is, we have first plotted average returns by month going back to 1925 for the S&P 500 in Figure 8.6A. As shown, the average return per month has been just under 1 percent.

Figures 8.6a and 8.6b about here

In Figure 8.6A, there is nothing remarkable about January; the largest average monthly return has occurred in July; the lowest in September. From a statistical standpoint, there is nothing too exceptional about these large stock returns. After all, some month has to be highest, and some month has to be the lowest.

Figure 8.6B, however, shows average returns by month for small stocks (notice the difference in vertical axis scaling between Figures 8.6A and 8.6B). The month of January definitely jumps out. Over the 70 years covered, small stocks have gained, on average, almost 7 percent in the month of January alone! Comparing Figures 8.6A and 8.6B, we see that outside the month of January, and to a smaller extent, February, small stocks have not done especially well relative to the S&P 500.

The January effect appears to exist in most major markets around the world, so it's not unique to the United States (it's actually more pronounced in some other markets). It also exists in some markets other than the stock markets. Critics of market efficiency point to enormous gains to be had from simply investing in January and ask: How can an efficient market have such unusual behavior? Why don't investors take advantage of this opportunity and thereby drive it out of existence?

Unlike the day of the week effect, the January effect is at least partially understood. There are two factors that are thought to be important. The first is tax-loss selling. Investors have a strong tax incentive to sell stocks that have gone down in value to realize the loss for tax purposes. This leads to a pattern of selling near the end of the year and buying after the turn of the year. In large stocks, this activity wouldn't have much effect, but in the smaller stocks it could. Or so the argument runs.

The tax-loss selling argument is plausible. One study, for example, examined whether the January effect existed in the United States before there was an income tax (yes, Virginia, there was such a time) and found there was no January effect. However, the January effect has been found in

other countries that didn't (or don't) have calendar tax years or didn't (or don't) have capital gains taxes. However, foreign investors in those markets (such as U.S. investors) did (or do). So, debate continues about the tax-loss selling explanation.

The second factor has to do with institutional investors. The argument here has several pieces, but the gist of it is that these large investors compensate portfolio managers based on their performance over the calendar year. Portfolio managers therefore pile into small stocks at the beginning of the year because of their growth potential, bidding up prices. Over the course of the year, they shed the stocks that do poorly because they don't want to be seen as having a bunch of "losers" in their portfolios (this is called "window dressing"). Also, because performance is typically measured relative to the S&P 500, portfolio managers who begin to lag because of losses in small stocks have an incentive to move into the S&P to make sure they don't end up too far behind. Managers who are well ahead late in the year have an incentive to move into the S&P to preserve their leads (this is called "bonus lock-in").

There is a lot more that could be said about the January effect, but we will leave it here. In evaluating this oddity, keep in mind that, unlike the day of the week effect, the January effect does not even exist for the market as a whole, so, in "big picture" terms, it is not all that important. Also, it doesn't happen every year, so attempts to exploit it will occasionally suffer substantial losses.

The day of the week and January effects are examples of calendar effects. There are others. For example, there is a general "turn of the month" effect; stock market returns are highest around the turn of every month. There are non-calendar anomalies as well. For example, the market does worse on cloudy days than sunny days. Rather than continuing with a laundry list of anomalies,

however much fun they might provide, we will instead turn to what was arguably the most spectacular event in market history - The Crash of 1987.

The October 1987 Crash

It used to be that when we spoke of “Black Monday” and “the Crash,” we meant October 29, 1929. On that day alone, the market lost about 13 percent of its value on heavy trading of 16.4 million shares. As the DJIA fell more than 30 points to 230, investors lost over \$10 billion.

Then along came October 19, 1987, which we *now* call Black Monday. It was indeed a dark and stormy day on Wall Street; the market lost over 20 percent of its value on a record volume of 600 million shares traded. The Dow plummeted 500 points to 1,700, leaving investors with about \$500 billion in losses that day. To put this decline in perspective, before October 1987, the Dow had never fallen by more than 100 points, and more than 300 million shares had never traded on a single day.²

What happened? It’s not exactly ancient history, but, here again, debate rages (you’re probably getting tired of hearing that). One faction says that irrational investors had bid up stock prices to ridiculous levels, until Black Monday, when the bubble popped, leading to panic selling as investors headed for the exits.

The other faction says that before October 19, markets were volatile, volume was heavy, and some ominous signs about the economy were filtering in. On October 14-16, the market fell by over 10 percent, the largest three-day drop since May 1940 when German troops broke through French lines near the start of World War II. To top it all off, market values had risen sharply because of a

²We thank Jay R. Ritter of the University of Florida for supplying us with some of this information.

dramatic increase in takeover activity, but Congress was in session (meaning that nobody's money was safe) and was actively considering antitakeover legislation.

Another factor is that beginning a few years before the crash, large investors had developed techniques known as program trading for very rapidly selling enormous quantities of stock following a market decline. These techniques were still largely untested because the market had been strong for years. However, on Friday, October 16, the Dow fell by 108 points on heavy volume. When the market opened on Monday, sell orders came pouring in at a pace never before seen. In fact, these program trades were (and are) blamed for much of what happened.

About the only thing we know for certain about the crash is that the exchanges suffered a meltdown. The NYSE simply could not handle the volume. Posting of prices were delayed by hours, so investors had no idea what their positions were worth. The specialists couldn't handle the order flow, and some specialists actually began selling. Nasdaq basically went off-line as it became impossible to get through to market makers. It has been alleged that many quit answering the phone.

On the two days following the crash, prices *rose* by about 14 percent, one of the biggest short-term gains ever. Prices remained volatile for some time, but, as antitakeover talk died down, the market recovered.

(marg. def. NYSE circuit breakers Rules that kick in to slow or stop trading when the DJIA declines by more than a preset amount in a trading session.)

As a result of the crash, changes have occurred. Upgrades have made it possible to handle much heavier trading volume, for example. One of the most interesting changes was the introduction of **NYSE circuit breakers**. Different circuit breakers are triggered if the DJIA drops by 10, 20, or

30 percent. These 10, 20, and 30 percent decline levels, respectively, in the DJIA will result in the following actions:

1. A 10 percent drop in the DJIA will halt trading for one hour if the decline occurs before 2 P.M.; for 30 minutes if before 2:30 P.M.; and have no effect between 2:30 P.M. and 4 P.M.
2. A 20 percent drop will halt trading for two hours if the decline occurs before 1 P.M.; for one hour if before 2 P.M.; and for the remainder of the day if between 2 P.M. and 4 P.M.
3. A 30 percent drop will halt trading for the remainder of the day regardless of when the decline occurs.

These specific circuit breaker trigger levels were implemented in October 1998. Because circuit breakers are designed to slow a market decline, they are often called “speed bumps.” Naturally, how well they work is a matter of debate.

One of the most remarkable things about the crash is how little impact it seems to have had. If you look back to Chapter 1, you’ll see that the market was actually up slightly in 1987. The post-crash period has been one of the better times to be in the market, and the crash increasingly looks like a blip in one of the greatest bull markets U.S. investors have ever seen. One thing seems clearly true: October is the cruelest month for market investors. Indeed, two years after the crash, on October 13, 1989, a mini-crash occurred as the Dow fell 190 points in the afternoon following the collapse of a proposed buyout of United Airlines.

Performance of Professional Money Managers

By now you're probably wondering how anyone could think that markets are efficient. Before you make up your mind, there's one last "anomaly" that we need to tell you about. It has to do with the performance of professional money managers, a subject we touched on briefly in Chapter 4.

Starting with managers as a group, Figure 8.7 shows, for 1971 through 1993, the percentage of general equity mutual funds (GEFs) that were outperformed by the Wilshire 5000 index. As shown, out of 23 years, the *index* won 15 times.

Figure 8.7 about here

Figure 8.8 shows the cumulative performance of the Wilshire 5000 index versus the average general equity mutual fund and the median equity pension fund. The pros lagged badly over this period. The managed money earned slightly under 11 percent per year, whereas the unmanaged index earned 12 percent per year. Notice that a 1 percent margin over a 22-year period is substantial.

Figure 8.8 about here

Figures 8.7 and 8.8 raise a difficult question for security analysts and other investment professionals. If markets are inefficient, and tools like fundamental analysis are valuable, why don't mutual fund and pension fund managers do better? Why can't they even beat the averages? Why do they actually *lag* the averages?

The performance of professional money managers is especially troublesome when we consider the enormous resources at their disposal and the substantial survivor bias that exists. The survivor bias comes into being because managers and funds that do especially poorly disappear. If it were

possible to beat the market, then this Darwinian process of elimination should lead to a situation in which the survivors, as a group, are capable of doing it.

It is sometimes thought that while professional managers as a group tend to lag the market indexes, some managers are consistently better. There is evidence indicating that some managers are better than other managers, but even this evidence is fairly weak, particularly for recent years. There is little evidence of consistent ability by anyone to beat the averages.

To give an example, we briefly discussed the usefulness of mutual fund rankings in Chapter 4. The most widely read investment magazine, *Forbes*, publishes extensive mutual fund information. In 1995, it published its 40th annual mutual fund survey, which included rankings of 1,801 mutual funds. As *Forbes* has done every year since 1975, it produced a short “honor role” of mutual funds. These are funds judged by *Forbes* as the overall top performers in up and down markets. How useful is this advice?

To answer, suppose that you, as an investor, had followed *Forbes*' advice since 1975 and purchased the honor role funds every year. How would you have done? Over the 16-year period 1975 - 1990, you would have earned an average annual return of 13.38 percent. Not bad, but if you had purchased the S&P 500 instead, you would have earned 14.86 percent! Furthermore, in the second half of the 16 years, the *Forbes* funds earned an average of 10.46 percent while the S&P averaged 16.43 percent.³ Finally, the 13.38 percent earned by the *Forbes* honor role does *not* include load fees, so your actual return would have been worse.

³ The figures are from Table VIII in Burton G. Malkiel, “Returns from Investing in Mutual Funds 1971 - 1991,” *Journal of Finance* 50, June 1995.

CHECK THIS

8.3a What are the day-of-the-week and January effects?

8.3b Why is the performance of professional money managers puzzling?

8.4 Summary and Conclusions

In this chapter, we examined technical analysis, market efficiency, and stock price behavior.

We saw that:

1. Technical analysts rely on past price and volume figures to predict the future. They use various indicators and rely heavily on the interpretation of different types of charts.
2. Beating the market means consistently earning a positive excess return. A positive excess return is a return above that earned by investments of the same risk.
3. If it is not possible to beat the market using a particular type of information, we say that the market is efficient with respect to that information.
4. If markets are weak-form efficient, past price and volume figures are of no use in earning a positive excess return, implying that technical analysis would be of little or no value. If markets are semistrong-form efficient, no public information is of use in earning a positive excess return, implying that fundamental analysis would be of no value. Strong-form efficiency implies that no information, public or private, would be of any use.
5. Market efficiency is difficult to test. We examined four reasons: (1) the risk-adjustment problem, (2) the relevant information problem, (3) the dumb luck problem, and 4) the data snooping problem.
6. Stock prices have exhibited peculiar, difficult to explain, behavior. We discussed the day of the week effect, the January effect, and the crash of 1987 as examples.
7. Despite their tremendous resources, experience, opportunities, and incentives, and despite the patterns and other oddities that have existed historically in the stock market, professional money managers have been unable to consistently beat the market. This is true both for professionals as a group and for individuals. This one fact, more than anything else, seems to suggest that markets are generally rather efficient.

Key Terms

technical analysis

Dow theory

support level

resistance level

relative strength

moving average

hi-lo-close chart

candlestick chart

point-and-figure chart

day-of-the-week effect

January effect

NYSE circuit breaker

market efficiency

efficient market hypothesis (EMH)

excess return

weak-form efficient market

semistrong-form efficient market

strong-form efficient market

Get Real!

This chapter covered technical analysis and market efficiency. In it, we raised a significant question. Can you, or indeed anyone, consistently beat the market? In other words, is the market efficient? This is a question that every investor needs to think about because it has direct, practical implications for investing and portfolio management.

If you think the market is relatively efficient, then your investment strategy should focus on minimizing costs and taxes. Asset allocation is your primary concern, and you will still need to establish the risk level you are comfortable with. But beyond this, you should be a buy-and-hold investor, transacting only when absolutely necessary. Investments such as low cost, low turnover mutual funds make a lot of sense. Tools for analyzing the market, particularly the tools of technical analysis, are irrelevant at best. Thus, in some ways, the appropriate investment strategy is kind of boring, but it's the one that will pay off over the long haul in an efficient market.

In contrast, if you think the market is not particularly efficient, then you've got to be a security picker. You also have to decide what tools - technical analysis, fundamental analysis, or both - will be the ones you use. This is also true if you are in the money management business; you have to decide which specific stocks or bonds to hold.

In the end, the only way to find out if you've got what it takes to beat the market is to try, and the best way to try is with a simulated brokerage account such as Stock-Trak. Be honest with yourself: You think you can beat the market; most novice investors do. Some change their minds and some don't. As to which tools to use, try some technical analysis and see if it works for you. If it does, great. If not, well, there are other tools at your disposal.

STOCK-TRAK FAST TRACK

BEATING THE MARKET WITH STOCK-TRAK

A personal Stock-Trak account provides an excellent opportunity for you to try your favorite strategy to beat the market without putting your personal funds at risk. The discussions in this chapter suggest several strategies. For example, Charles Dow originally intended Dow theory as a method to analyze movements of the overall stock market. However, the basic tenets of Dow theory can also be usefully applied to individual stocks. Essentially, this involves distinguishing genuine price trends from background noise. Since your investment horizon with a Stock-Trak account is probably no longer than a few months, you will want to identify secondary trends expected to last from only a few weeks to a few months. Beginning with about a dozen stock price charts, cull out three or four with the most distinguishable short-term price trends. If a stock has an upward price trend, you should buy that stock. If a stock has a downward price trend, then you should short sell the stock.

Examining price charts for various stocks, you will observe many other types of patterns. Support and resistance levels are examples of simple, yet intriguing patterns. Suppose you discover a stock price bumping up against a resistance ceiling and you conclude that a breakout appears imminent. In this case, you should buy the stock and wait for the breakout. On the other hand, you might discover a stock price bumping down against a support floor. If you decide that a breakout appears imminent then you should buy the stock.

There are many other patterns that you might look for. Indeed technical analysis is based largely on the detection of patterns that might repeat themselves in the near future. Remember, however, that technical analysis is part science and part art. You can learn the science by reading books but you can only learn the art from experience. If there is some special strategy that you want

to experiment with, do it risk-free with your Stock-Trak account. No matter what happens, you will probably learn something useful from the experience.

STOCK-TRAK EXERCISES

1. You will need to peruse a number of different stock price charts before you can identify distinct trends or support and resistance levels. Fortunately, a number of internet quote servers allow access to individual stock price charts. One popular example is the Yahoo quote server (quote.yahoo.com), but there are many others.
2. Identify two stocks with upward price trends and two stocks with downward price trends. Buy the first two stocks and short sell the second two stocks. This strategy focuses on identifying price trends while reducing the risk of an overall market movement that might simultaneously affect all four stocks in your portfolio.
3. Identify two stocks bumping up against a resistance ceiling and another two stocks bumping down against a support floor. Buy the first two stocks and short sell the second two stocks. This strategy focuses on capturing price breakouts while maintaining a market-neutral portfolio.

Chapter 8

Stock Price Behavior and Market Efficiency

Questions and problems

Review Problems and Self-Test

1. **It's All Relative** Consider the following series of monthly stock prices for two companies:

Week	Phat Co	GRRL Power
1	\$10	\$80
2	12	82
3	16	80
4	15	84
5	14	85
6	12	88

On a relative basis, how has Phat done compared to GRRL Power?

2. **Moving Averages** Using the prices from the previous problem, calculate the three month moving average prices for both companies.

Answers to Self-Test Problems

1. Suppose we had purchased 8 shares of Phat and 1 share of GRRL Power. We can calculate the value of our investment in each month and then take the ratio of Phat to GRRL Power as follows:

Investment value			
Week	Phat Co. (8 shares)	GRRL Power (1 shares)	Relative strength
1	\$80	\$80	1.00
2	96	82	1.17
3	128	80	1.60
4	120	84	1.43
5	112	85	1.32
6	96	88	1.09

Phat Co. has significantly outperformed GRRL Power over much of this period; however, after six weeks, the margin has fallen to about 9 percent from as high as 60 percent.

2. The moving averages must be calculated relative to the share price; also note that results can't be computed for the first two weeks because of insufficient data.

Week	Phat Co.	Phat Co. Mov Avg	GRRL Power	GRRL Power Mov Avg
1	\$10	—	\$80	—
2	12	—	82	—
3	16	\$12.67	80	\$80.67
4	15	14.33	84	82.00
5	14	15.00	85	83.00
6	12	13.67	88	85.67

Test Your IQ (Investment Quotient)

1. **Technical analysis** Which of the following is a basic assumption of technical analysis in contrast to fundamental analysis? (1994 CFA exam)
 - a. financial statements provide information crucial in valuing a stock
 - b. a stock's market price will approach its intrinsic value over time
 - c. aggregate supply and demand for goods and services are key determinants of stock value
 - d. security prices move in patterns, which repeat over long periods

2. **Technical analysis** Which of the following is least likely to be of interest to a technical analyst?
 - a. a 15-day moving average of trading volume
 - b. a relative strength analysis of stock price momentum
 - c. company earnings and cash flow growth
 - d. a daily history of the ratio of advancing issues over declining issues

3. **Dow theory** Dow theory asserts that there are three forces at work in the stock market at any time. Which of the following is not one of these Dow theory forces?
 - a. daily price fluctuations
 - b. a secondary reaction or trend
 - c. a primary direction or trend
 - d. reversals or overreactions

4. **Technical indicators** The advance/decline line is typically used to
 - a. measure psychological barriers
 - b. measure market breadth
 - c. assess bull market sentiment
 - d. assess bear market sentiment

5. **Technical indicators** The Closing Arms (trin, or trend indicator) ratio is the ratio of
 - a. average trading volumes in declining issues to advancing issues
 - b. average trading volumes in advancing issues to declining issues
 - c. the number of advancing issues to the number of declining issues
 - d. the number of declining issues to the number of advancing issues

- 6. Technical indicators** Resistance and support areas for a stock market index are viewed as technical indicators of
- economic barriers
 - psychological barriers
 - circuit breakers
 - holding patterns
- 7. Technical charts** Which of the following pieces of information cannot be observed in a daily candlestick chart covering a several month period?
- daily high and low prices
 - weekly high and low prices
 - daily opening and closing prices
 - daily opening and closing trading volume
- 8. Technical charts** Which of the following pieces of information cannot be observed in a point-and-figure chart covering a several month period?
- amount of time elapsed during a major price trend
 - number of major price up moves
 - number of major price down moves
 - number of major price moves forming a trend
- 9. Efficient Markets Hypothesis** After lengthy trial and error, you discover a trading system that would have doubled the value of your investment every six months if applied over the last three years. Which of the following problems makes it difficult to conclude that this is an example of market inefficiency?
- risk-adjustment problem
 - relevant information problem
 - dumb luck problem
 - data snooping problem
- 10. Efficient Markets Hypothesis** Using only publicly available financial information to select stocks for your portfolio, over the past three years your portfolio has outperformed the S&P 500 index by an average of 15 percent per year. Which of the following problems makes it difficult to conclude that this is an example of market inefficiency?
- risk-adjustment problem
 - relevant information problem
 - dumb luck problem
 - data snooping problem

- 11. Efficient Markets Hypothesis** In discussions of financial market efficiency, which of the following is not one of the stylized forms of market efficiency?
- a. Strong form
 - b. Semistrong form
 - c. Weak form
 - d. Economic form
- 12. Beating the market** Which of the follow is not considered a problem when evaluating the ability of a trading system to “beat the market?”
- a. risk-adjustment problem
 - b. relevant information problem
 - c. data measurement problem
 - d. data snooping problem
- 13. Calendar anomalies** Which day of the week, on average, has had the lowest stock market returns as measured by the S&P 500 index?
- a. Monday
 - b. Tuesday
 - c. Thursday
 - d. Friday
- 14. Calendar anomalies** Which month of the year, on average, has had the highest stock market returns as measured by a small-stock portfolio?
- a. January
 - b. March
 - c. June
 - d. December
- 15. Circuit breakers** Which of the following intraday changes in the Dow Jones Industrials Average (DJIA) will trigger a circuit breaker halting NYSE trading for one hour?
- a. 10 percent drop before 2 P.M.
 - b. 10 percent drop after 2 P.M.
 - c. 10 percent rise before 2 P.M.
 - d. 10 percent rise after 2 P.M.

Questions and ProblemsCore Questions

1. **Dow Theory** In the context of Dow theory, what are the three forces at work at all times? Which is the most important?
2. **Technical Analysis** To a technical analyst, what are support and resistance areas?
3. **Dow Theory** In the context of Dow theory, what are corrections and confirmations?
4. **Bad Breadth?** On a particular day, the stock market as a whole is up; however, losers outnumber gainers by 2,000 to 1,600. What might a technical analyst conclude?
5. **A Call to Arms** How is the Arms ratio computed. What is it designed to capture?
6. **Advance/Decline Lines** Use the data below to construct the advance/decline line for the stock market. Volume figures are in thousands of shares.

	Advancing	Adv. Vol.	Declining	Dec. Vol.
Monday	1,685	225,000	840	66,000
Tuesday	1,720	164,000	1,000	115,000
Wednesday	560	59,000	2,025	265,000
Thursday	880	100,000	1,625	145,000
Friday	1,550	185,000	950	105,000

7. **Calculating Arms Ratio** Using the data in the previous problem, construct the Arms ratio on each of the five trading days.
8. **Relative Strength Trends** The table below shows end-of-month stock prices for Coca-Cola and Pepsi over a six-month period. Construct the relative strength indicator over this period for Coca-Cola stock relative to Pepsi.

Month	Coca-Cola	Pepsi
1	\$40	\$25
2	45	28
3	48	32
4	44	33
5	49	35
6	55	36

9. **Moving Average Indicators** Using the data in the previous problem, calculate the three-month moving average for Coca-Cola and Pepsi stock.
10. **January** With regard to the January effect, what is the role that institutional investors are thought to play?

Intermediate Questions

11. **Candlesticks** Suppose that on a particular day the S&P 500 opened at 431.30, closed at 439.50, and the high and low for the day were 447.20 and 430.00, respectively. Describe how you would construct a candlestick plot for these data.
12. **Bad Timing?** A key concern in technical analysis such as the Dow theory is to identify turning points in market direction and thereby time the market. What are the implications of market efficiency for market timing?
13. **Point-and-Figure Plots** Daily closing prices for U.S. Surgical, Inc., are shown below for a six-week period. If you consider a major move to be \$3, construct the point-and-figure chart for U.S. Surgical stock over this time period.

Week 1	80	79	78	75	72	Week 4	58	62	60	57	58
Week 2	70	66	60	62	63	Week 5	57	62	69	70	70
Week 3	64	64	62	59	55	Week 6	72	70	68	69	69

14. **Point-and-Figure Plots** Point-and-figure plots differ from high-low-close and candlestick charts in one important way. What is it? Why might a point-and-figure chart be more informative?
15. **Efficient Markets** A stock market analyst is able to identify mispriced stocks by comparing the average price for the last 10 days to the average price for the last 60 days. If this is true, what do you know about the market?
16. **Efficient Markets** Critically evaluate the following statement: “Playing the stock market is like gambling. Such speculative investing has no social value, other than the pleasure people get from this form of gambling.”
17. **Misconceptions about Efficient Markets** There are several celebrated investors and stock pickers who have recorded huge returns on their investments over the past two decades. Is the success of these particular investors an invalidation of an efficient stock market? Explain.

- 18. Interpreting Efficient Markets** For each of the following scenarios, discuss whether profit opportunities exist from trading in the stock of the firm under the conditions that (1) the market is not weak form efficient, (2) the market is weak form but not semistrong form efficient, (3) the market is semistrong form but not strong form efficient, and (4) the market is strong form efficient.
- a. The stock price has risen steadily each day for the past 30 days.
 - b. The financial statements for a company were released three days ago, and you believe you've uncovered some anomalies in the company's inventory and cost control reporting techniques that are understating the firm's true liquidity strength.
 - c. You observe that the senior management of a company has been buying a lot of the company's stock on the open market over the past week.
 - d. Your next-door neighbor, who happens to be a computer analyst at the local steel plant, casually mentions that a German steel conglomerate hinted yesterday that it might try to acquire the local firm in a hostile takeover.
- 19. Dow Theory** Why do you think the industrial and transportation averages are the two that underlie Dow theory?
- 20. Performance of the Pros** In the mid- to late 1990s, the performance of the pros was unusually poor - on the order of 90 percent of all equity mutual funds underperformed a passively managed index fund. How does this bear on the issue of market efficiency?

Chapter 8
Stock Price Behavior and Market Efficiency
Answers and solutions

Answers to Multiple Choice Questions

1. D
2. C
3. D
4. B
5. A
6. B
7. D
8. A
9. D
10. C
11. D
12. C
13. A
14. A
15. A

Answers to Questions and ProblemsCore Questions

1. There are three trends at all times, the primary, secondary, and tertiary trends. For a market timer, the secondary, or short-run trend, might be the most important, but, for most investors, it is the primary, or long-run trend that matters.
2. A support area is a price or level below which a stock price or market index is not likely to drop. A resistance area is a price or level above which a stock price or market index is not likely to rise.
3. A correction is movement toward the long-run trend. A confirmation is a signal that the long-run trend has changed direction.
4. The fact that the market is up is good news, but market breadth (the difference between the number of gainers and losers) is negative. To a technical analyst, a market advance on narrow or negative breadth is not a particularly positive event.

5. The Arms (or trin) is the ratio. The numerator has the average number of shares traded in stocks that were down for the day; the denominator has the average number of shares traded that were up for the day. It indicates whether trading is heavier in down or up issues.

	Monday	Tuesday	Wednesday	Thursday	Friday
Adv – Dec	845	720	-1,465	-745	600
Cumulative	845	1,565	100	-645	-45

The market closed the week on a modestly bullish signal according to this technical indicator.

	Monday	Tuesday	Wednesday	Thursday	Friday
Avg Dec Vol	78.571	115.000	130.864	89.231	110.526
Avg Adv Vol	133.531	95.349	105.357	113.636	119.355
Arms Ratio	0.588	1.206	1.242	0.785	0.926

The market closed the week on an essentially neutral signal according to this technical indicator.

8. For initial investments of equal value, will need to purchase 1.6 shares of Pepsi for every share of Coke. Suppose you buy 5 shares of Coke and 8 shares of Pepsi.

Month	Coke	Pepsi	Relative Strength
1	\$200	\$200	1.000
2	225	224	1.004
3	240	256	0.938
4	220	264	0.833
5	245	280	0.875
6	275	288	0.955

Coke stock underperformed relative to Pepsi over this period, although both stocks increased in value. Note that no adjustment for the risk of either firm is included, however.

9. The moving averages must be calculated relative to the share price; also note that results can't be computed for the first two months because of insufficient data.

Month	Coke	Coke Mov Avg	Pepsi	Pepsi Mov Avg
1	\$40	—	\$25	—
2	45	—	28	—
3	48	\$44.33	32	\$28.33
4	44	45.67	33	31.00
5	49	47.00	35	33.33
6	55	49.33	36	34.67

Notice how the moving average has smoothed out Coke's performance over the period.

10. Institutional investors play two roles. First, they tend to sell losers and buy winners in the fourth quarter so that their end of year portfolio holdings look like a winning group ("window dressing"). Second, in search of better performance, they have a tendency to buy smaller stocks immediately after the turn of the year. If the smaller stocks do well, the pros may have an incentive to sell them off and move into the benchmark portfolio to lock in the gain ("bonus lock-in"). Also, if the smaller stocks do poorly, there may be an incentive to bail out and move into the benchmark to prevent even greater damage.

Intermediate Questions

11. The index was up on the day, so the body would be white. It would be $439.50 - 431.30 = 8.20$ points in length, the difference between the open and closing price. The upper shadow or wick would extend $447.20 - 439.50 = 7.70$ points above the top of the body, reflecting trading at much higher levels during the day. The lower shadow or wick would extend $431.30 - 430.00 = 1.30$ points below the bottom of the body, reflecting that the market was generally up throughout the day.
12. If the market is efficient, then market timing is a bad idea. Trying to time market moves will only mean that over a long period, the investor will underperform a strategy that stays fully invested. A timing strategy will incur significant costs and, likely, taxes as well.
13. The first column is a down column; there are 7 columns in all with 14 ticks. The number of ticks in each of the columns are 4, 1, 2, 2, 1, 3, and 1, respectively. The figure indicates a strong down trend at the outset, and a modest up trend towards the end. The stock basically meanders in the middle period.
14. A point-and-figure chart does not have time on the horizontal axis. It may be that by only focusing on larger moves and by abstracting from calendar time, a point-and-figure chart can better isolate market patterns and directions.
15. The market is not weak form efficient.
16. Unlike gambling, the stock market is a positive sum game; everybody can win. Also, speculators provide liquidity to markets and thus help to promote efficiency.
17. The efficient markets paradigm only says, within the bounds of increasingly strong assumptions about the information processing of investors, that assets are fairly priced. An implication of this is that, on average, the typical market participant cannot earn excess profits from a particular trading strategy. However, that does not mean that a few particular investors cannot outperform the market over a particular investment horizon. Certain investors who do well for a period of time get a lot of attention from the financial press, but

the scores of investors who do not do well over the same period of time generally get considerably less attention.

- 18.**

 - a. If the market is not weak form efficient, then this information could be acted on and a profit earned from following the price trend. Under 2, 3, and 4, this information is fully impounded in the current price and no abnormal profit opportunity exists.
 - b. Under 2, if the market is not semistrong form efficient, then this information could be used to buy the stock “cheap” before the rest of the market discovers the financial statement anomaly. Since 2 is stronger than 1, both imply a profit opportunity exists; under 3 and 4, this information is fully impounded in the current price and no profit opportunity exists.
 - c. Under 3, if the market is not strong form efficient, then this information could be used as a profitable trading strategy, by noting the buying activity of the insiders as a signal that the stock is underpriced or that good news is imminent. Since 1 and 2 are weaker than 3, all three imply that a profit opportunity exists. Under 4, this information does not signal any profit opportunity for traders; any pertinent information the manager-insiders may have is fully reflected in the current share price.
 - d. Despite the fact that this information is obviously less open to the public and a clearer signal of imminent price gains than is the scenario in part (c), the conclusions remain the same. If the market is strong form efficient, a profit opportunity does not exist. A scenario such as this one is the most obvious evidence against strong-form market efficiency; the fact that such insider trading is also illegal should convince you of this fact.
- 19.** At the time the theory was developed, large companies in the U.S. were either involved in the manufacturing of goods or the transportation of them (primarily railroads). The basic idea behind the Dow theory is that these activities are fundamentally related, so the two averages must move in the same direction over time.
- 20.** Taken at face value, this fact suggests that markets have become more efficient. The increasing ease with which information is available over the internet lends strength to this conclusion. On the other hand, during this particular period, large cap growth stocks were the top performers. Value-weighted indexes such as the S&P 500 are naturally concentrated in such stocks, thus making them especially hard to beat during this period. So, it may be that the dismal record compiled by the pros is just a matter of bad luck.

Figure 8.1. Market Diaries

STOCK MARKET DATA BANK 11/19/98

DIARIES			
NYSE	THUR	WED	WK AGO
Issues traded	3,530	3,547	3,527
Advances	1,714	1,514	1,350
Declines	1,267	1,545	1,681
Unchanged	549	488	496
New highs	75	50	42
New lows	31	33	23
zAdv vol (000)	372,453	353,132	a271,110
zDecl vol (000)	253,705	269,123	a393,562
zTotal vol (000)	669,388	650,509	660,248
Closing tick ¹	+479	+476	+428
Closing Arms ² (trin)	0.92	.75	1.17
zBlock trades	14,058	12,783	13,397
NASDAQ			
Issues traded	5,352	5,352	5,359
Advances	2,119	2,044	1,788
Declines	1,848	1,935	2,219
Unchanged	1,385	1,373	1,352
New highs	89	57	40
New lows	31	41	32
Adv vol (000)	567,991	564,106	381,060
Decl vol (000)	369,686	296,121	385,220
Total vol (000)	981,677	899,113	804,298
Block trades	12,360	11,141	9,655
AMEX			
Issues traded	740	728	724
Advances	261	270	248
Declines	304	289	311
Unchanged	175	169	165
New highs	11	9	9
New lows	15	12	14
zAdv vol (000)	17,289	14,100	9,879
zDecl vol (000)	7,905	7,836	12,389
zTotal vol (000)	27,861	25,279	24,510
Comp vol (000)	37,682	36,468	32,889
zBlock trades	n.a.	486	451

Figure 8.2. Candlestick Making

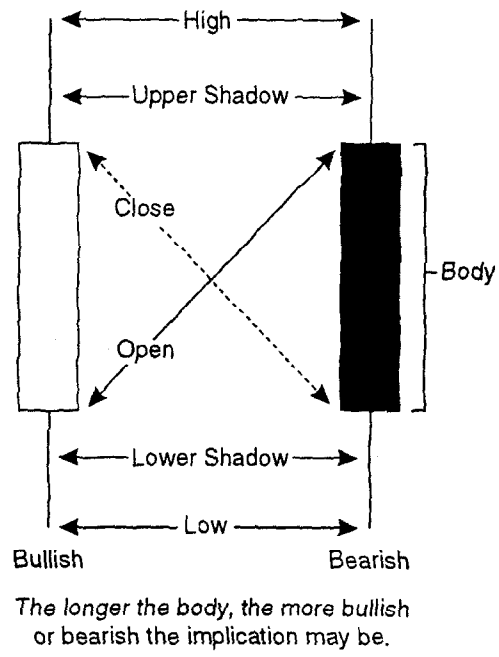
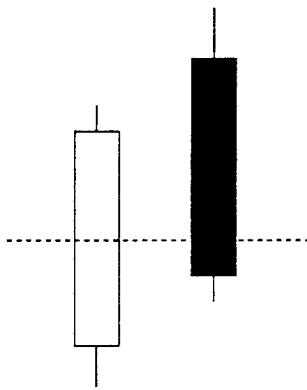
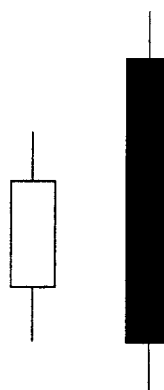


Figure 8.3. Candlestick Formations

DARK CLOUD COVER



BEARISH ENGULFING PATTERN



HARAMI

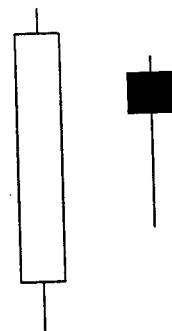


Figure 8.4. Point-and-Figure Chart

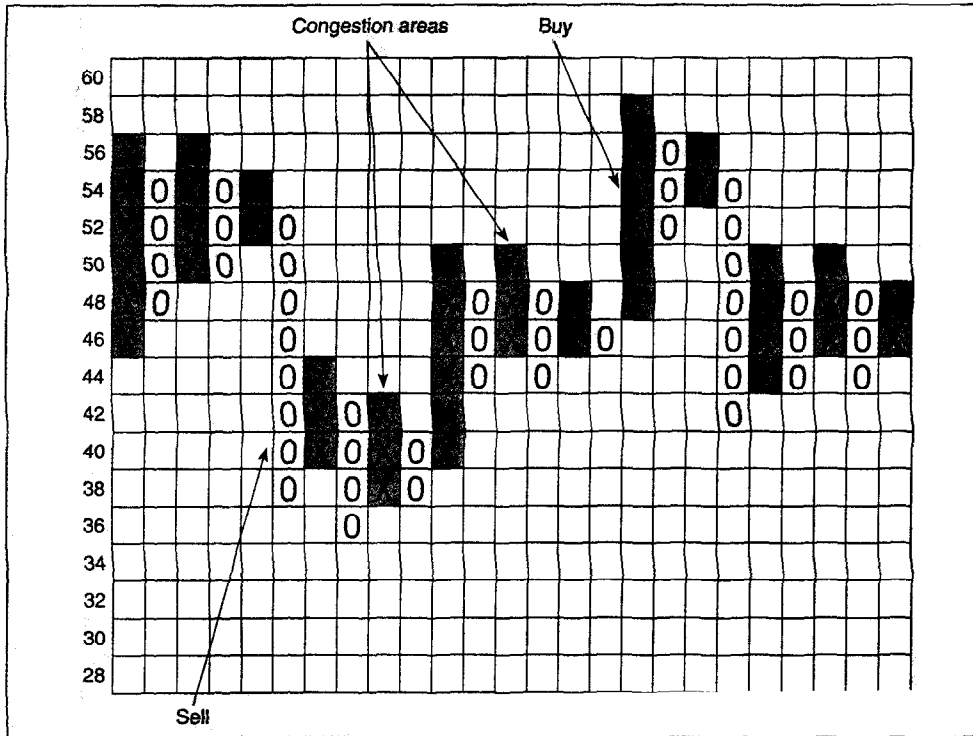
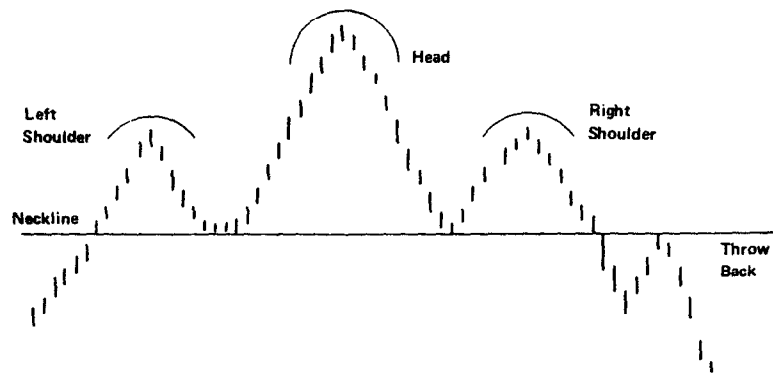


Figure 8.5. Head-and-Shoulders Formation



Investments Update (WSJ 8/18/95)

Who's Number One?

By JOHN R. DORFMAN
Staff Reporter of THE WALL STREET JOURNAL

IS WARREN BUFFETT the greatest investor of all time? That question can never be settled, any more than baseball fans can settle the question of whether Babe Ruth was greater than Hank Aaron. But a good case can be made for Mr. Buffett.

The table lists a few of the most successful investors in history. A couple of them—George Soros and Peter Lynch—show higher compound average annual returns than Mr. Buffett's. But that doesn't truly settle the debate.

Mr. Lynch, for example, compiled a sparkling 29% annual return as manager of the Fidelity Magellan Fund. At first blush, that seems to top Mr. Buffett's 27% annual return. However, during the 13-year stretch when Mr. Lynch was burning up the track, Mr. Buffett did even better: up 39% a year, according to Morningstar Inc.

Mr. Soros, manager of Quantum Fund, also has a higher annual return than Mr. Buffett. But Mr. Buffett has maintained his performance for a longer time. Also, notes Edward Macheski, a money manager in Chatham, N.Y., Mr. Buffett racked up his king-sized returns without much use of leverage, or debt, to magnify investment results. Hedge funds, such as those run by Mr. Soros, Michael Steinhardt and Julian Robertson, often use heavy leverage.

The Buffett record shown in the table is a composite. From 1957 to 1969, his main investment vehicle was Buffett Partnership Ltd. In 1965, the partnership acquired a controlling interest in Berkshire, which became Mr. Buffett's main vehicle in 1970.

A Pantheon of Great Investors

Financial professionals consider these people among the greatest investors of all time. Even in this select group, Warren Buffett stands out.

NAME	MAIN AFFILIATION	ESTIMATED RETURNS (1)	COMMENTS
Warren Buffett	Berkshire Hathaway	Up 27% a year since 1957	Wants to invest in "wonderful businesses." Favorite holding period: forever.
Benjamin Graham	Graham-Newman	Up 17% a year, 1929-56	Considered the father of value investing. Liked stocks that are cheap relative to earnings or book value.
John Maynard Keynes	National Mutual Life Assurance Society (Britain)	Up most years during treacherous 1930s markets	Famous economist was also an avid and serious investor. Posted big losses but even bigger gains.
Peter Lynch	Fidelity Magellan Fund	Up 29% a year, May 1977-May 1990	Bought dozens of stocks in industries he favored. Workaholic until his surprise "retirement."
Julian Robertson	Tiger Fund	Up 27% a year since September 1980	Names hedge funds after big cats—"Tiger," "Puma," "Jaguar." Big player in Latin America, Japan, etc.
George Soros	Quantum Fund	Up 34% a year since 1969	Huge bets on international currencies and bonds; uses major leverage.
Michael Steinhardt	Steinhardt Partners	Up 21% a year since 1968	Hunch player, bold trader in both U.S. and foreign markets.
John Templeton	Templeton Growth Fund	Up 18% a year, Nov. 1954-March 1987	Bargain hunter world-wide; a pioneer of international investing

Estimated compound annual returns, after fees. With certain funds, publicly available results for foreign clients are used to approximate results for U.S. clients.

Sources: Morningstar Inc.; U.S. Offshore Funds Directory; "Benjamin Graham on Value Investing" by Janet Lowe, Wall Street Journal research

Bull Market Is Trampling Investment Rules of the Past

By GREG IP

Staff Reporter of THE WALL STREET JOURNAL

Rules are made to be broken, at least as far as today's stock market is concerned.

The remarkable bull market in stocks that carried the Dow Jones Industrial Average temporarily over 9000 for the first time Friday has made mincemeat of not just valuation relics like dividend yield; many other favorite investment rules are also losing their reliability. (The average, at one point up 43.85 to 9030.49, failed to close above the milestone, ending the day down 3.23, at 8983.41.)

Vernon Winters, chief investment officer of Mellon Private Asset Management in Boston, says, "Certain techniques and rules of thumb may work for a period of time but they generally aren't going to stand the test of time. With the technology available today, if there is some simple formula that someone is espousing for making money, it will probably be arbitrated away fairly quickly."

There are good, fundamental reasons rules that once worked may no longer. Richard Bernstein, head of quantitative research at Merrill Lynch, tracks 40 stock selection styles and finds one style tends to outperform for three to five years before sinking back. But the winning style is a function of the profit cycle, not the popularity of the style, he maintains.

Whoever is right, it's certainly getting harder to find reliable ways to beat the market. Consider the "Dogs of the Dow." A portfolio of the 10 highest-yielding of the 30 stocks in the Dow industrials normally the average's underperformers, or dogs—selected at the beginning of every year outperformed the overall average in all but five of the 23 years from 1971 to 1993.

That track record proved irresistible. Since 1991, the assets in Merrill Lynch's unit investment trust dedicated to the

strategy have ballooned to \$10 billion from \$50 million. Alas, the Dogs have since lost their winning ways. They have underperformed in three of the four years from 1994 to 1997. In the first quarter of this year, the dogs rose 7.3%, lagging behind the industrials' 11.7%, according to Merrill. "The dollars flowing into the strategy have perhaps arbitrated away the potential for superior performance," says Mr. Winters.

Mike Kochmann, director of marketing and trading for defined asset funds at Merrill Lynch, counters that the Dogs of the Dow is "a value strategy . . . that will show its real strength in choppy or down markets."

Other rules have predicted small stocks are the place to be. But they've been crushed by the big-cap juggernaut of recent years. For example, small stocks should outperform when the dollar is strong because large multinationals take a hit to their foreign currency-denominated sales and profits. Last year, the dollar rose 10% against a basket of foreign currencies. Yet Prudential Securities calculated that the fourth-quarter profits of companies with capitalization of \$50 billion and over were up 13.1% from a year earlier, while

the profits of companies with capitalization between \$500 million and \$1 billion rose just 1.5%. Last year, the S&P 500 rose 31% while the Russell 2000 index of smaller capitalization stocks advanced 21%.

Remember the January effect? Donald Keim, a finance professor at the Wharton School of Business, found in a landmark study that small stocks outperformed large ones in the first weeks of every year but two between 1926 and the mid-1970s. One explanation was that illiquid (or hard-to-trade) small stocks would be depressed by investors' tax-related year-end selling, only to bounce back early in the new year. But small stocks have underperformed each January for the past five years, according to Prudential, leading some to dub it the "January defect." One explanation is that fund managers buy up small stocks in December in anticipation of the effect.

Prof. Keim says the effect can still be found if measured as he originally did, but it has weakened. But even when it did exist, it was almost impossible to exploit because the underlying small stocks were so illiquid that trading costs would eat up most or all of the profit, he says.

Figure 8.6A. S&P 500 Average Monthly Returns

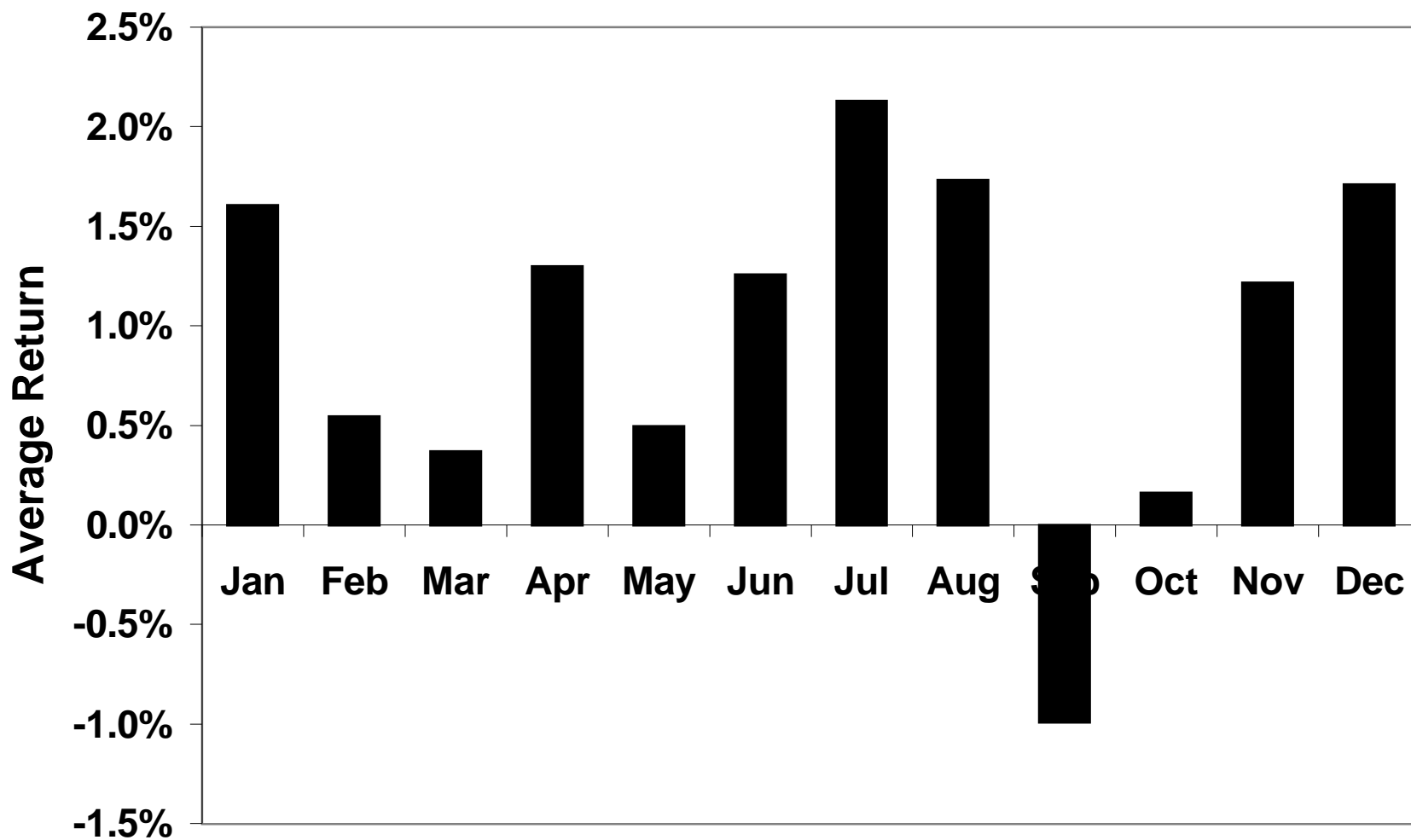


Figure 8.6B. Small Stocks Average Monthly Returns

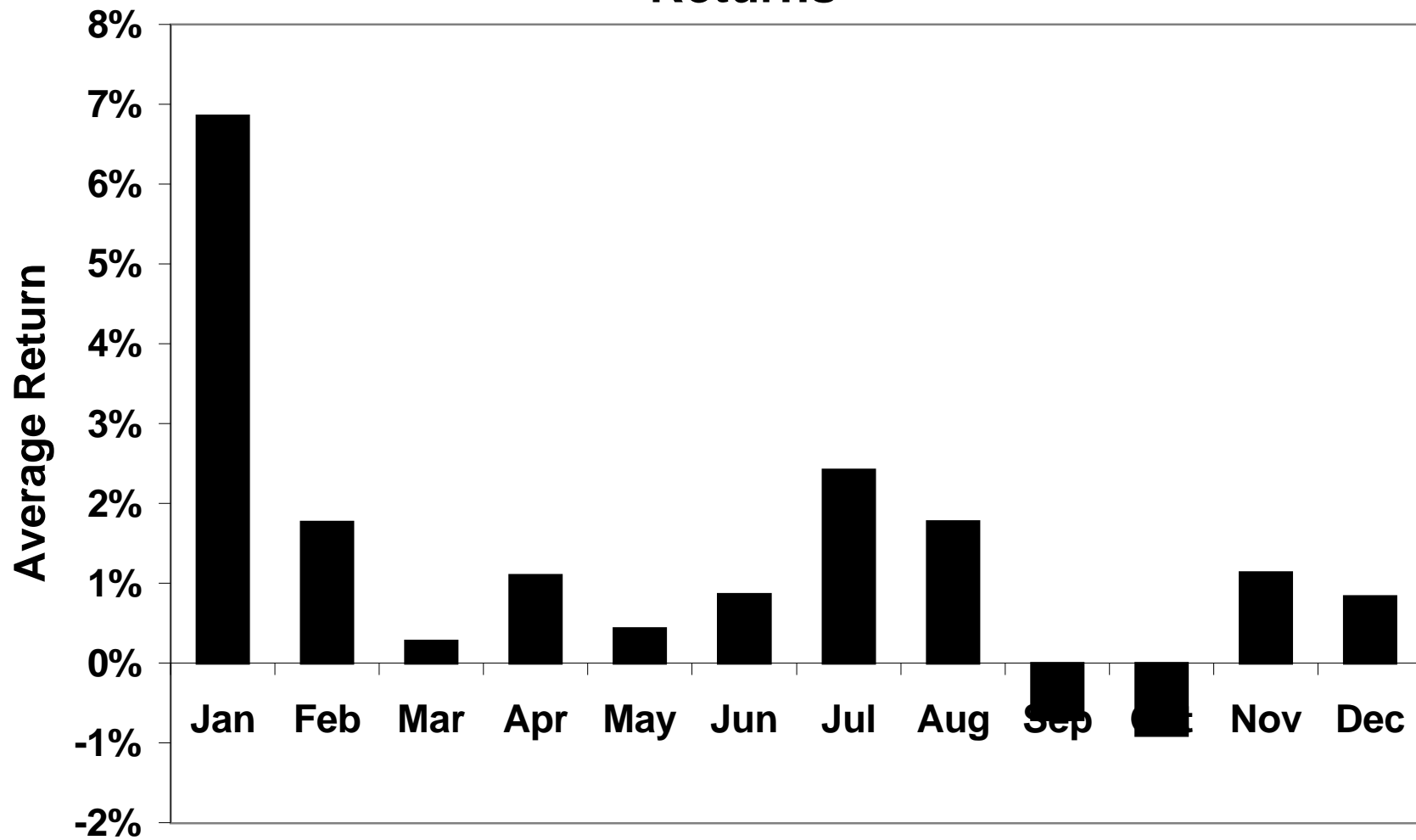
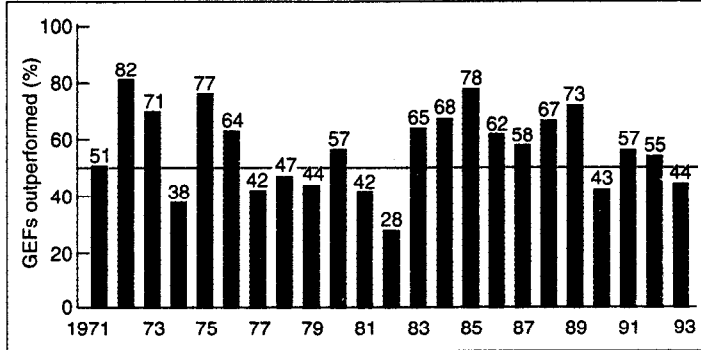
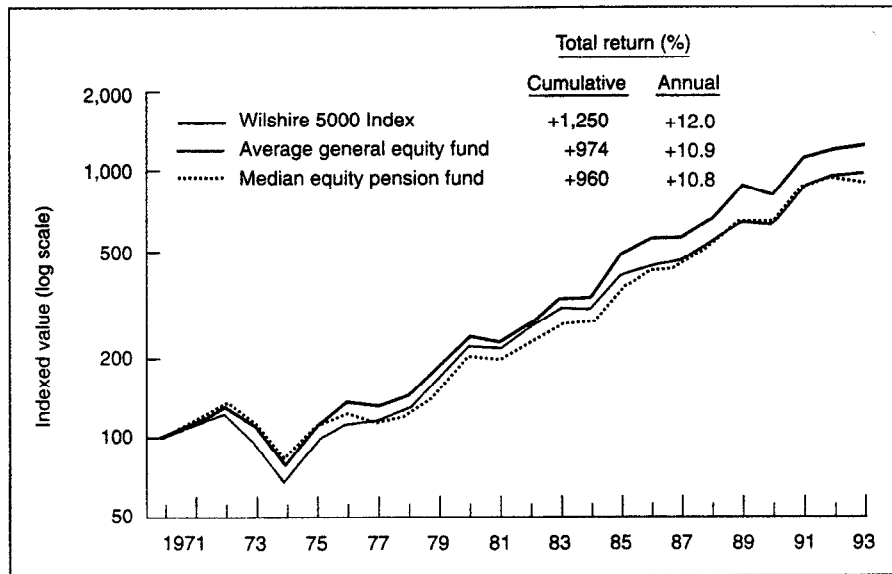


Figure 8.7. Equity Funds vs. Wilshire 5000



Source: John C. Bogle, *Bogle on Mutual Funds: New Perspective for the Intelligent Investor* (New York: Irwin Professional Publishing), 1994.

Figure 8.8. Equity Funds vs. Wilshire 5000



Source: John C. Bogle, *Bogle on Mutual Funds: New Perspective for the Intelligent Investor* (New York: Irwin Professional Publishing), 1994.