Smarter Trading
Improving Performance in Changing Markets

Perry J. Kaufman
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Preface

You can't dig a new hole by making the old one deeper

Trading is a difficult business. Finding a way to build steady profits takes long, hard work or very good luck. Sometimes the effort fails; no matter how much energy is applied, there is no answer to be found. Other times, a successful program has only a short lifespan before the market changes. Smarter Trading tries to be realistic about how to find broad-based trading strategies that can survive change. It uses a lateral solution rather than a vertical one.

Vertical and Lateral Solutions

A vertical solution is where each new part reinforces the previous work. A lateral solution is where the parts fit side by side, resting on their own foundation. Think of searching for buried treasure. You know it's in the back yard. You can dig one hole deeper and deeper or dig a series of holes in different places.

An 50-floor skyscraper is a vertical solution to living space. Building on the same foundation makes the final result dependent on all the previous work. But markets change causing some assumptions to fail. The top of the building becomes very fragile when you start removing bricks from the middle.
The lateral solution builds a wide base by taking the pieces, each one of which can stand on its own and combining them side-by-side into a single structure. None of the parts are complicated and none of them duplicate another piece. If one part fails, the others continue to work.

A Lesson from Supercomputers

At one time, the biggest "supercomputers," used only for high-powered research, were the creation of a few brilliant engineers. They became so sophisticated that each wire and connection between parts needed to be as short as possible to enable the electric current to travel at maximum speed. The main processing units were designed as a sphere so that each wire was an equal distance from the center.

Faster computers are now built with a lot of slower, off-the-shelf parts. In this design, called "parallel processing," the slower components operate on different parts of the problem at the same time. The computer companies that had invested tremendous resources in building complex systems were put out of business by someone who simply divided the problem into many little pieces and solved them using inexpensive, ready-made parts.

Not all problems can be divided into many small parts, but most can be divided. This book will teach the most important lessons about different aspects of trading, including profit-taking, trends, stops, risk and return, and testing methods. Using any one will improve results; using all of them will improve performance even more.

Looking for What Is Not There

Omissions cause the biggest problems, and they are the hardest to find because they are not there. The mind's eye often fills the empty spaces with what it expects to be there. In the same way that we fill these omissions, we often overlook repeated, small events. We do not hear the ticking of a clock that once seemed too loud.

We will try to understand what to expect, then question the results that are either much better or worse than expected. We are always fast to look for ways to fix losses, but slow to question profits.

Learning is the result of experience. You do the best you can to analyze the problem, find a solution, and see if it works. Most often it
does not work the first time because you failed to see the complete picture, underrated the importance of some factors, or missed an important part altogether. That is the normal way things work. Do not assume that anyone comes up with the perfect answer without trial and error. The process is not glamorous, but it is necessary. Being successful means being tenacious.

Wandering from the Path

Lateral thinking benefits from not following one path. It may take the best from each area, applying those parts in which we have great confidence, rather than developing the "ultimate" indicator. As we get more complicated, the benefits derived from the effort become questionable, and the solution may not be as lasting. Making very small improvements takes much more time and effort once you have extracted the essence of an idea. It is often a good time to switch to another approach when you feel that your efforts are becoming unproductive.

One approach to lateral thinking is to reverse an idea. For example, baby Jane—by playing with the ball of wool—is annoying Grandma, who is trying to knit. A likely solution would be to put baby Jane into her playpen where she cannot reach the wool. Another solution would be to put Grandma and the wool into the playpen to protect them from baby Jane. Either solution could work although most people would not consider asking Grandma to get in the playpen. Later in the book, we look at using the worst test results rather than the best.

Lateral thinking is results oriented. The goal is to get the best answer. A lateral solution often develops from a stumbling block, a point where you can no longer go forward. You shift to another area where there is a possible solution. In doing this, you may discover that parts of each direction can work together to create a better result.

Generalists

We will try to keep our perspective about the value of the techniques used to build a robust trading strategy. We will be generalists, rather than specialists. We want to know, "Should we take profits or should we wait for a trend reversal?" We could always find one case where taking profits is better than staying with the trend. Our objective is to find out if it is a good rule in most cases.
It is unproductive to try to prove that an exponentially weighted trend is better than a simple moving average. Does the accuracy of one approach really make a difference to the direction of prices? If a system worked using an exponential calculation but did not work with a simple moving average, one would be forced to question the validity of the “trend.” As a realistic analyst, I can say that all techniques are imperfect but many have value. When you are estimating answers, you should not calculate them to the 10th decimal place.

Realists

In dealing with a market problem, we must ask if we are looking at the real cause of the price move. Patterns may be coincidental. Even if we know the cause, can we predict the result? Throughout this book, we will return to the need for a logical solution, rather than one that is computer-generated.

Trading programs cannot be perfect, but we need to know what to expect. Is a stop-loss a good way to control risk, or does it only give us unfounded confidence? It is not important whether a stop-loss is good or bad, only that we know the right answer.

This book will also present some new ideas, such as an adaptive, or self-adjusting, moving average and a detailed plan for creating a robust trading program. In the spirit of a lateral solution, it will take a new look at simple ways to improve most trading models, extracting the essential aspects from each idea. Examples will use forex, futures, stock, and stock index markets to show how readily these techniques apply to all markets, and trading in general.

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Acknowledgments

Writing a book is a long process that takes time from those closest to you. Without the encouragement and support of Barbara, this volume would have been long delayed. Credit must be given to our dog Terra, who always knew when it was time to take a break.

P.J.K.
PART 1

How Changing Markets and Technology Affect Results
The Impact of Change on Markets and Trading

This book is about how to improve your trading in the stock, foreign exchange and futures markets. Although many technical solutions and spreadsheet applications appear in these pages, Smarter Trading is really about making decisions and solving problems. It will identify why many trading strategies and forecasts fail and will show how to improve results and create more lasting solutions.

The approach taken here tries to be realistic; trading systems have limitations, as do the tools and the traders. The techniques for improving profits and assessing risk focus on those areas that offer the greatest improvement, rather than the subtleties of fine tuning. Most of the more difficult topics are concerned with risk. Experienced traders usually know what to do with profits; even for novice traders, profits often take care of themselves. It is an unreasonably optimistic attitude toward risk that gets many traders into trouble; therefore, sections of this book keep returning to risk evaluation and control. We’re in this for the long term.

Changing Factors Affecting Markets and Prices

Recent years have seen political and economic changes of large proportion. The emergence of China, the instability of the European Monetary System, and the faltering of Russia are all poised to produce massive changes in trade. At the same time, technology has made immense
advances. More powerful computers come in smaller packages. Prices can
be displayed for any time period in an array of multicolored windows.
Methods that once worked do not work anymore. IBM stumbles, pat-
tterns change, markets are more volatile than ever, and even seasonals
are not the same. Program trading has been declared "disruptive" all
over the world. Traders sit behind screens in massive bank trading
rooms, surrounded by high-powered displays, looking for arbitrage
opportunities between any two markets in any two countries. All this
continues 24 hours each day.
This evolution of markets is a structural change that moves in only
one direction. The introduction of the automated exchanges in the
United States and United Kingdom aren't anomalies, but a trend.
Eventually, the floor traders will disappear—not all at one time, but
edged out by automated exchanges that will surround them and slowly
infringe on the sanctity of even the largest trading floors. Adapting may
take more effort than simply retesting a program, adjusting for inflation,
or changing the value of a stop-loss, but it cannot be ignored.
Along with increasing complexity is additional competition. Floor
traders once had the advantage of being aware of every price tick. Now
we can recall prices and volume instantly, and catch up on market
action even when we have been away from the picture for hours or
days. It requires more to compete successfully. This book will help
identify the problems. It will provide solutions and an understanding
of new tools and how to use them.

Changing Technology for
Market Analysis

Advances in technology have caused great changes in the trading
industry. New tools and techniques are absorbed quickly. The goal of
improving returns by a fraction of a point has tremendous rewards,

Figure 1-1. Technology evolves, markets evolve,...
enough to motivate and finance major research projects. And as machines increase in their ability to process more of everything, pushing those limits becomes a compulsion.

There is also a fascination with the new tools and the ability to display graphics and analyze prices. Real-time data from all over the world is being processed at speeds measured in nanoseconds. We can do more faster and cheaper, even when we're not always sure what we are doing.

**Fundamentals at the Root**

"Fundamentals" will always be the reason for price change. Fundamental analysis is the study of information that can influence corporate earnings, dividends, and interest rates, resulting in a price change. In both stock and commodity markets, forecasts are the result of comparing current and past economic data, and determining the effects of government policy on interest rates and growth. Unexpected events introduce volatility and uncertainty.

In general, the direction of stock prices is related to the health of business, which might include data on the Gross National Product (GNP), Consumer Price Index (CPI), retail sales, employment, and interest rates. If the economy is expanding, you can expect equity markets to rise. It is still a challenge to look further for the industries and sectors that will perform independently, or without correlation, to the market as a whole.

Supply and demand determine the price of goods and materials: how much there is versus how much is wanted. The more material, the lower the price; the more that is wanted, the higher the price. The fundamentals of price change are clear. It is the changes in those factors or the anticipation of change that causes prices to move.

One of the first computer applications for price forecasting used a technique called multiple regression (Box 1-1). Data on imports, exports, production, consumption, interest rates, inflation, technology, and other essentials could be analyzed in conjunction with the price. Fundamental analysis explains what has happened in the past by assigning "weighting factors" to the information put into the computer. If you don't put in the right data, you don't get a good answer. Putting in too much data isn't as bad, but it takes a longer time to process. Sometimes, too much data allows the computer to find answers that are only coincidental, which we call "overfit."

The answer to a regression analysis is assigned a confidence level, which indicates its accuracy. It is stated as "plus or minus" an error factor (e.g., interest rates will drop to 5½ percent ± 1 percent by May).
Box 1-1. DETERMINING A COMMODITY PRICE WITH FUNDAMENTALS

A simple regression model calculates a commodity price from the history of fundamental factors. In this example, the price of soybeans is simply the weighting of supply and demand:

\[ \text{Est. Price} = \text{constant} + (\text{weightS} \times \text{supply}) + (\text{weightD} \times \text{demand}) \pm \text{error} \]

where Est_Price is the current estimated value
supply is the total production
demand is the total distribution
error is the error reflecting the accuracy of the results
and constant, weightS, and weightD are calculated using a regression program.

Data from 1964 to 1975 gives constant = -1.64, weightS = 3.97 and weightD = 0.81, indicating that changes in the supply of soybeans, represented by the much larger value of weightS, are much more important than demand. The error factor would be large because only a few years were used in the calculation.

A regression analysis of fundamental data tells where prices should be, in the same sense as an option fair value calculation. It is very structured and provides only a single price range, which is considered “normal.” It may not include data that cause the market to anticipate changes.

In general, this classic approach is not helpful to a trader because it says nothing about risk. If the current price level is below the calculated one, but prices start to fall instead of rise, when do you say that something is wrong? The forecast only shows where the price should be; it does not tell anything about how it will get there.

Fundamental analysis still makes sense, but it remains the domain of institutions and long-term traders. It requires a well-capitalized investor to absorb fairly large equity swings during periods when less important factors cause market volatility. For others, the risk is too high, the analysis takes too much time and effort, and the profits are too far off.

This method of econometric analysis can be applied to the stock index, but not to individual shares; however, results are still very general.
Newer methods, such as neural networks and expert systems, which are discussed in later chapters, have replaced econometric analysis, offering some additional accuracy when used in the traditional way, and much more flexibility.

**Technical Analysis**

*Technical analysis* is a broad area that uses price and related data to decide when to buy and sell. It tries to bridge the problems that fundamental analysis has about the specifics of timing and risk. The methods used can be as interpretive as chart patterns and astrology, or as specific as mathematical formulas and spectral analysis.

From the time chart interpretation first appeared to the early use of the home computer, technicians have been separated from fundamentalists. More recently, the line between them has become gray. Fundamentals provide the reason and direction of price movement, and technicals give the timing and risk control.

The two methods can be kept separate by making a decision and commitment based on fundamentals, then creating and implementing the plan using technicals. Or, the process can be integrated with an expert system approach, a sophisticated neural network, or simply a combination of individual programs. It is only necessary that each make sense and satisfy the preset objectives.

**Automating the Trend**

Computerized technical analysis is associated most with the *moving average* (Box 1-2). It came into greatest popularity in the early 1980s and has remained the basis for many technical programs. All factors that influence the market are assumed to be netted out as the current price. A simple moving average applied to those prices gives a trend. The longer term 200-day average is a benchmark indicator of price direction for most stock issues. Short-term 5-, 10-, and 20-day trends, related to weekly and monthly periods, are often used for timing entries and exits and for leveraged futures and options markets.

A moving average, or similar technical indicator, is frequently used to confirm a decision to enter the market. Although there may be reason to believe prices will move higher, fundamental analysis can be complex, and occasionally unexpected external factors overwhelm the normal situation. By waiting for a moving average to turn up, the program may sacrifice some initial profit for a greater chance of being correct and of using capital effectively.
Box 1-2. EASIER NEW WAYS OF CALCULATING MOVING AVERAGES

A moving average is now a “function” in a strategy testing program or a spreadsheet. A 3-day moving average may appear as:

@Average(close,3) = (close + close[1] + close[2])/3

or the spreadsheet form:

@AVG(B3..B5)/3

An exponential trend is simply another function, @Exp_MA(close,10), all of which makes price analysis very easy to perform. The trendline formed by the daily averages produces a buy signal when it turns up and a sell when it turns down.

Trend trading was very successful during the 1970s and into the 1980s. Even now, it is just as important to know the direction of prices, but it has become more difficult to trade a simple trend system. What was once a strong commitment to “the trend is your friend,” we now hear that there are too many systematic trend-followers who are “pushing the market” and “triggering stops.”

Trend following proved to many investors that technical analysis is viable. Some analysts, equipped with real-time intraday data, were able to continue trading the trend by applying the same logic to hourly or 15-minute prices. Others looked for additional indicators or more sophisticated tools, often adapted from another industry.

Indicators

Timing indicators, such as relative strength and stochastics have become very popular. Most quote equipment provides a broad selection of techniques that users can modify. The Relative Strength Index (RSI), developed by Welles Wilder, is a ratio of the total daily upmoves to total daily downmoves over the past 14 days, expressed from 0 to 100:

@RSI(close,14) = 100 × (RS/(1 + RS)

where

RS = @SUM(Total_Up_Moves,14)/@SUM(Total_Down_Moves,14)
Because of the flexibility of computers, any trader can substitute another time period for the standard 14-day interval.

The stochastic, developed by George Lane, is equally popular. It gives the relative position of the closing price within the previous high-low range, determined by the length of the period used for the calculation. The raw stochastic, called FastK, which ranges from a value of 0 to 100, is not normally used for trading because it is too sensitive to price change. Instead, the SlowK (also called %D) and SlowD, a 3-day smoothing of SlowK, have become the popular values for trading. The 5-period stochastic is given as

\[
\text{@Fast}K(\text{series},5) = 100 \times (\text{close} - \text{@Lowest}(5)) / (\text{@Highest}(5) - \text{@Lowest}(5))
\]

\[
\text{@Slow}K(\text{series},5) = \text{@Moving Average}(\text{@Fast}K(\text{series},5),3)
\]

\[
\text{@Slow}D(\text{series},5) = \text{@Moving Average}(\text{@Slow}K(\text{series},5),3)
\]

As with the RSI, traders vary the period of the stochastic to make it more or less sensitive to price movement.

**Stock Market Advance/Decline Indicators**

In addition to indicators that use price, a wide selection of calculations are based on volume, or the number of advancing and declining stocks. It is interesting to see how the same numbers are used with slightly different emphasis:

- **Bolton-Tremblay:** \( BT = (\text{Advancing} - \text{Declining}) / \text{Unchanged} \)

- **Schultz A/T:** \( SAT = \text{Advancing} / (\text{Advancing} + \text{Declining} + \text{Unchanged}) \)

- **McClellan Oscillator:** \( McC = \text{Advancing} - \text{Declining} \)

For each of the indicators, an index is created by adding the current value to the accumulated index value for the previous day, as in the Bolton-Tremblay Index:

\( BTX = BTX[1] + BT \)

While there is virtue in simplicity, it is not clear that an index such as the one based on advancing and declining issues improves a moving
average signal. The indexes themselves require interpretation and selection because they do nothing to filter noise, nor is it apparent how to use those days with significantly greater advancing or declining issues. Instead of just one difficult price series to work with, you now have the original price data plus an equally difficult index.

**Status of Technical Analysis**

Simple moving averages and indicators do not give the complete picture of technical analysis. There are sophisticated graphics programs that allow the user to draw trendlines and channels. They can perform spectral analysis to find cycles; give Gann lines and angles, Fibonacci spirals, and Elliott waves; and create ARIMA (Autoregressive Integrated Moving Average) models, which constantly recalculate the best moving average for every new piece of data.

Testing software has also pushed the industry forward. Anyone with an untried trading strategy or theory can enter simple instructions and test the rules on a wide selection of data. The most popular examples of this software are Dow Jones' *TeleTrac*, Omega's *System Writer*, and Equis' *MetaStock*. These programs eliminate the need for a computer specialist, by providing standard “functions” (as described earlier in this chapter) for calculating a moving average, true range, highest and lowest price, and many other convenient values, in an easy-to-use form. For example,

```plaintext
@Average(Price,Length)
@Bollinger_Band(Price,Length,StdDev)
@Bullish_Divergence(Price,Osc,Strength,Length)
@Linear_Regression(Price,Length)
```

are the functions for a simple moving average, a Bollinger band, bullish divergence, and the angle from the horizontal of a linear regression line. They are all easy to understand even without a manual. Length is the number of periods used in the calculation, and price is any data series, whether daily, hourly, or user defined.

Strategy-testing software takes two forms: (1) a spreadsheet style system, such as *TeleTrac*, in which each calculation becomes a new row, and each day appears as a column; (2) the *System Writer* design, which allows all the power of computer programming, similar to the BASIC language (Box 1-3). In Omega's software, the individual calculation can be displayed by day on request.
Box 1-3. PROGRAMMING SYSTEMS USING NEW COMPUTER SOFTWARE

An "efficiency ratio" is calculated as 10-day price changes divided by the sum of 10 daily closing price differences. The EffRatio gives the efficiency, or relative noise, of price movement over the 10-day period, and is used for the Adaptive Moving Average in Chapter 8.

TeleTrac allows the calculations to be entered in their own spreadsheet format. The first column is the name of the value being created and the second gives the formula. Results are shown for each time interval selected, from ticks to monthly. This example has daily data:

<table>
<thead>
<tr>
<th></th>
<th>18 Feb 93</th>
<th>23 Feb 93</th>
<th>24 Feb 93</th>
<th>25 Feb 93</th>
</tr>
</thead>
<tbody>
<tr>
<td>diff</td>
<td>Abs_val(close-close[1])</td>
<td>0.64</td>
<td>0.97</td>
<td>0.45</td>
</tr>
<tr>
<td>noise</td>
<td>Sum(diff,10)</td>
<td>3.969</td>
<td>4.521</td>
<td>4.839</td>
</tr>
<tr>
<td>signal</td>
<td>close-close[10]</td>
<td>1.29</td>
<td>2.68</td>
<td>2.09</td>
</tr>
<tr>
<td>EffRatio</td>
<td>Abs_val(signal)/noise</td>
<td>0.325</td>
<td>0.593</td>
<td>0.433</td>
</tr>
</tbody>
</table>

System Writer uses Omega's fully programmable Easy Language to find the same ratio:

noise = @Summation(@AbsValue(close[0] - close[1], length)
signal = close[0] - close[10]
if noise <> 0, then Efficiency_Ratio = signal/noise

The last line of the System Writer code tests that the noise is not equal to ("<>") zero before dividing. In the first line, it "nests" the first two lines of the TeleTrac code.

Buy and sell signals, as well as moving average lines, oscillators, and user-defined values can be displayed on split-screen graphics. Every calculation and detailed statistics of the test results can be easily retrieved and printed.

New Technology

As computers have become more powerful and scientists try to synthesize the human brain, some new techniques have become more practical for market analysis. The area called artificial intelligence includes the most promising neural networks, as well as simple pattern recognition, expert systems, and fuzzy logic. These will be covered later in this book.
Neural networks are already replacing regression analysis as the best method for finding how fundamental factors change price. But the power of neural nets is still untouched. It is primarily used to find the same continuous relationships between dividends, economic conditions, and price—or supply, demand, and price—that was the technique of the older tools. It has the ability to identify how today’s set of factors compares with specific cases in history, an equally sophisticated and practical approach.

**Evolution and Obsolescence**

It is easy to argue that communications and computers have changed world and local economies, trading tools, and market participants. The extent of these changes requires us to look at the process as an evolution. It should not be a surprise that simple systems that worked well during the 1970s and 1980s are no longer profitable.

Economic changes have altered price relationships. Countries have floated their currencies and interest rates, as gold was allowed to be traded in the United States in 1975. Other countries have tried to control the fluctuation by forming pacts, such as the European Monetary System or OPEC (Organization of Petroleum Exporting Countries). For each of these events, there is a change in price patterns, sometimes more volatile; other times less volatile; and still other cases go unnoticed. A simple way of looking at this evolution is by comparing the performance of a trend-following system in different types of markets.

**Maturing Markets and Price Trends**

As markets become familiar and accepted, participation increases, and with more participation comes a higher level of “noise.” The U.S. stock market has been a main investment for pension funds, individuals, and other countries for many years. Broad interest takes on the characteristic of a constant level of activity resulting from unrelated objectives of its participants, much like the undercurrent of constant talking at larger and smaller meetings. A pension fund adds to its positions because of new investment capital; a corporation liquidates a stock portfolio to invest in a shopping center, or a family withdraws from a mutual fund to pay medical bills. Much of the price movement has little to do with economic trends or clever timing of entry and exit points.
New or emerging markets do not have this broad participation; therefore, the level of noise is not nearly as high. That makes it easier to trade a simple trend-following system profitably. Table 1-1 and Box 1-4 compare more and less mature markets. They show that it is easier to trade a newer market with a simple system, and just as impossible to use that same approach for a broadly traded, mature market.

**Comparing New and Mature Markets**

Results show that the newest, active world markets, the Hong Kong Hang Seng Index and MATIF's CAC-40 are still very profitable for all trend speeds tested. The Hang Seng has a higher annualized return for faster trends, indicating that short-term price swings are sustained with a relatively low level of noise, even though the longer term trend did not develop as well. Had the noise been greater, the trend would have reversed frequently, causing whipsaw losses.

The CAC-40 shows a drop of about 50 percent in trend returns for the most recent five years compared with the earlier period. It also posted larger profits in faster trading for the earlier period but has evolved to a more uniform distribution as the market matured. There is now only a slightly declining pattern in the rate of return as you move from the shortest 5-day trend speed to the longest 75-day period.

The Deutsche mark, along with other major currencies, has always been actively traded. In the past five years, however, Deutsche mark activity has increased as the mark assumed a dominant role in the European economic structure, combined with greater world trading activity. The first five years, 1983–1987, show greater profits and a tendency toward longer term trends than the more recent years. Both periods show that the fastest trends are the most difficult, the likely result of short-term volatility, frequent price shocks, and intense competition in active Forex trading. The "optimum" trend may vary based on long-term economic shifts, confidence in the European Community, and the ability of the United States to compete in trade. As the foreign exchange markets continue to mature, the ability to produce trending profits with faster trading should decline.

IBM is shown for only the first five-year period, to allow you to study its change. With the exception of the 5-day trend, it shows a clear increase in profits as a longer-term position is taken. With transaction costs included, the smaller profits posted in the 15- to 45-day trends are likely to disappear. The profit of 18 percent for the 5-day trend may seem unusual but would have presented a window of opportunity for some small investors.
Box 1-4. THE ABILITY TO PROFIT FROM
A TREND-FOLLOWING SYSTEM

Changes in price patterns as markets mature can be illustrated with a
simple trend-following system. It shows that newer or emerging mar-
kets have clear trends. As they mature, the increased participation
increases noise and makes the price patterns more complex. Orders
entering continually, for different reasons, obscure the trend.

Table 1-1 shows the results of a simple trend-following system test-
ed for a selection of markets. The system uses the following rules:

1. An exponential moving average determined the trend.
2. Buy when today’s exponential trend value turns up.
3. Sell when today’s exponential trend value turns down.
4. The system is always in the market.
5. No transaction costs were charged.

Table 1-1. Comparison of Trend Performance

<table>
<thead>
<tr>
<th></th>
<th>Hang Seng</th>
<th>CAC-40</th>
<th>D-Mark</th>
<th>IBM</th>
<th>Dow</th>
<th>Crude Oil</th>
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</thead>
<tbody>
<tr>
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<td>--------</td>
<td>--------</td>
<td>-----</td>
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<td>----------</td>
</tr>
<tr>
<td>5</td>
<td>22.3</td>
<td>40.5</td>
<td>16.6</td>
<td>5.7</td>
<td>1.3</td>
<td>18.0</td>
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<td>17.5</td>
<td>33.1</td>
<td>20.7</td>
<td>9.7</td>
<td>4.9</td>
<td>4.0</td>
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<td>32.8</td>
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<td>7.4</td>
<td>4.3</td>
</tr>
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<td>35</td>
<td>9.8</td>
<td>30.0</td>
<td>19.7</td>
<td>9.3</td>
<td>6.2</td>
<td>6.9</td>
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<td>45</td>
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<td>8.5</td>
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<tr>
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<td>11.7</td>
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<td>9.3</td>
<td>6.3</td>
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<td>18.3</td>
<td>11.7</td>
<td>5.8</td>
<td>11.1</td>
</tr>
<tr>
<td>75</td>
<td>18.0</td>
<td>27.8</td>
<td>13.5</td>
<td>11.2</td>
<td>5.8</td>
<td>18.0</td>
</tr>
<tr>
<td>Avg</td>
<td>10.4</td>
<td>31.2</td>
<td>16.6</td>
<td>9.0</td>
<td>6.2</td>
<td>10.3</td>
</tr>
</tbody>
</table>

Results show

1. The most mature market, the Dow, cannot be traded using any
trend within the tested range.
2. Developing markets, such as the Hang Seng and CAC-40 (from
1983 to 1987) show characteristic short-term trends. As they
mature, they begin to show greater profits in long-term trends,
rather than short-term.
3. The D-mark is a deep market, as are all the other major curren-
cies, and shows a tendency toward declining, smaller profits.
4. IBM shows long-term trends with the exception of a small oppor-
tunity window for the 5-day trend, which is difficult to trade.
5. Crude oil volatility, the result of large commercial dominance
and attempted OPEC manipulation, overwhelms the price trend.
We might assume that institutions cannot trade a short-term trend because they cannot trade a large enough position and tend to move the market too far for the expected profit. Small, independent traders can take advantage of this slot only if their commissions and other transaction costs are low. A 5-day trend may have traded as much as once each week. With commissions at $\frac{1}{2}$ percent, an 18 percent profit becomes an 8 percent loss for the year.

The Dow represents the most mature market. The large losses at nearly every trend speed indicates that the daily market volatility is very high compared with the net movement of stock prices. Mature markets have broad participation, representing traders with diverse interests. Constant institutional buying and selling to fill portfolios, or speculative liquidation to invest in real estate or other assets, adds a high level of noise to the daily activity. As other world markets mature, they should follow the pattern of the Dow.

The last example looks at a single futures contract of NYMEX crude oil. It also shows losses in nearly every trend period. But crude oil is not as much a mature market as it is a manipulated one. Attempts by OPEC to limit production cause sharp moves and discourage small, individual traders from participating. The cash and futures markets, dominated by very large commercials, are used to buy and sell cargoes for delivery and hedging. This combination—attempted price controls and traders with large orders and deep pockets—adds volatility that overwhelms the trend.

**Structural Change: Seasonality**

Can you make the same type of trading decisions today as you could in 1960? No. Many of the markets with the greatest volume form a relatively new “derivatives” group. Foreign exchange futures, options on futures, stock index futures of all types in many countries, and short- and long-term interest rates, including the European Currency Unit or ECU (which is more a concept than a hard currency that you could use to pay a lunch bill) are all very different from the markets only 10 years ago.

Even agricultural markets, the oldest of the exchange-traded commodities, have changed. Crops are still planted and harvested according to their season, but the seasonal price patterns that survived for centuries are no longer dependable. In the 1980s, U.S. grain prices rose with surplus production, confusing traders and delighting farmers. Afterward, the phenomenon was recognized as “parity,” the ability of a freely traded product to hold a constant world value. As the U.S. dollar declined, U.S. grain became more attractive to non-U.S. buyers, causing export demand and price to rise.
It seems odd to think that the normal seasonal patterns have also changed. Beginning in the mid-1970s, farmers built more storage facilities. Before there was adequate storage, farmers needed to forward price their production with a local grain elevator or be subject to selling everything that couldn't be stored at harvest. They could rent storage space, but only if they booked in advance and paid a minimum 3-month fee. On-farm storage relieved the pressure on harvest prices and farmers could recoup their cost by adding carrying charges to the crop price each month after harvest. With 100 percent storage, it is possible to eliminate the price drop at harvest.

With their own storage facilities, carrying charges become "soft dollars" to the farmers. When crops were stored in a rented space, farmers paid out-of-pocket costs to elevator operators. On-farm storage is similar to price "bundling"; it is harder to distinguish the cost of the parts, and the total price becomes more flexible.

Orange juice presents two more seasonal wrinkles. Crop freezes are no longer devastating to consumers. Prices may jump sharply when temperatures hold under freezing in central Florida, but not for long. For the past few years, Brazil has been anxious to fill the gap in U.S. supply, and consumers are equally agreeable to paying lower prices at the expense of domestic U.S. growers. Because the government bowed to the pressure and permitted juice to be imported from tremendous Brazilian reserves, what will happen the next time there is a freeze? Do prices jump on a sharp reduction in supply, or will traders anticipate a fast substitution of Brazilian product? In either case, the seasonal pattern is disrupted.

The second twist is the result of the opposite North American-South American crop years. Orange juice, soybeans, and eventually other crops can be produced in quantity in the opposite season. When the U.S. farmers are harvesting in the fall, Brazilian farmers are planting in the spring. Just when carryover stores are dwindling, crops from the other hemisphere are being harvested. When U.S. crop production is not good, Southern Hemisphere stocks and plantings can be abundant. The world import market is fungible. If the Russians need grain, they will go to the best price, not just to the U.S. market. What does this do to the seasonal patterns? It makes supply and demand a global concept, and far less predictable.

The Evolution of Markets

This is not just an agricultural phenomenon. It is no secret that financial markets have been globalized. These effects are permanent. Even if governments change and exchanges disappear, the United States will never again be the only center of activity. Undoubtedly, the People's Republic
of China (PRC) and Russia will play an increasing role in world trade. Despite the PRC’s apparent resistance to political change, it has shown an aversion to cutting off its Hong Kong arm. Regardless of inconsistency, China—with a quarter of the world population—wants to enter into world trade more actively. Russia has already made it clear that it wants a market economy. The effects on supply-and-demand equilibrium will be enormous. If the transition is fast, the imbalance will provide short-term opportunities in business and speculation that are unprecedented. Either way, the future will not look the same as the past.
Assessing Market Reality

Trading looks easier than it is. Think of how clear the trends and patterns seem on an old chart of the DOW, or gold, or bonds. The recession that started in 1990–1991 was severe and prolonged, and it caused bond prices to move steadily higher for three years. It is perfectly clear that interest rates could do nothing other than decline. But how many "traders" just held bonds rather than bought and sold throughout the whole period? Not many. Whether people are trading stocks or selling crops, they usually buy and sell when they are forced to, or when they can no longer stand the stress of holding the position.

Change is difficult. We tend to be resistant, slow to recognize change, and often slower to react. Awareness of change often comes when it becomes obvious that the old way doesn't work anymore. Only then do we look for new solutions. This chapter looks at changes in the market structure, its participants, and in the way we use the new tools. Recognizing the problems can be a convincing argument for changing some of your trading methods.

The Screen Is History

Prices that appear on the quote screen are already part of history. In a fast futures market, the price you see may have traded 5 minutes ago. At any time, the market is more likely to be trading at a price that is different from the one you see on the screen. The screen shows where the price traded last, not where it's going to trade next. When execution timing is critical, you cannot wait for a screen price. The screen is not the market. It lags the market in the same way a trend lags actual price movement.
That's not to say that you always get a poor execution price. There are those times when, because you were too slow, you got in at a better price later. But they are exceptions. Even when you can make the entry gracefully, exiting a trade can be a rushed event. Use of spontaneous judgment only gives you the opportunity to delay the exit, hold onto that losing trade, and wait for a worse price to come along.

The screen is a poor substitute for a resting order, which gets executed immediately. Unfortunately, Stops and Limit orders only work for small lots. However, anticipating a trade, whether a computerized or intuitive system, will improve the ability to get a target price for smaller, individual traders as well as institutions. The importance of anticipation will be discussed later in this chapter.

**Nonexistent Spread Profits**

During the trading day, screens often show prices within a single market, such as crude oil, that appear out of line. Or, a part of the yield curve, such as the 10-year note, may be too high with regard to the 5- and 20-year instruments. Box 2-1 shows the prices as they might appear at midday, with the November quote clearly out of line with respect to other delivery months.

If you try to spread those markets, to profit by selling the apparent distortion, you find that the bid-asked is perfectly in line with the other months, although the screen price only reflects the last trade. The price was higher or lower on the screen simply because one forward month had not traded while activity in the neighboring delivery months had moved those prices lower.

In general, spreads that are constructed by matching two separate price series will suffer the same problem. The traded spread price is not often saved as historic data because it seems easy enough to create a spread once you have the prices for each of the components. It simply involves getting the prices at the same time.

Frequently, two markets do not trade at exactly the same time. The spread will appear to move in and out based entirely on one market trading while the other remains quiet. This is especially the case for a nearby versus deferred delivery of the same futures market. In reality, the spread price (the difference between the two months) may have remained unchanged during the entire time.

**Closing Prices**

It is more common to use the closing prices to generate a spread. For financial markets that close at the same time, these prices can be reason-
Box 2-1. MIDDAY CRUDE OIL PRICES IN AUGUST 1993

Figure 2-1. Distortion in crude oil forward prices. A relative price distortion is shown for the November contract.

The November quote of 18.70 should be closer to 18.45 if the carrying charge pattern is to remain uniform. A butterfly spread that buys one Oct and one Dec and sells two Nov would capture certain profits. When the spread prices are quoted, however, you find that Nov is bid at the equivalent of 18.45. The distortion only exists on the screen because Nov has not traded in 5 minutes while the other delivery months were more active.

able, if you consider the slightly higher transaction costs of executing a spread. However, creating a spread from the closing prices of two markets that did not close at the same time (and at the same exchange) creates an unrealistic spread price. If you trade only the IMM (International Monetary Market) currencies and the Swiss franc closes 5 minutes after the Deutsche mark, then the spread may appear to widen or narrow during those 5 minutes. The Deutsche mark will remain aligned with the Swiss franc in the cash market, and open the next day at the spread price that existed 5 minutes before the Swiss closed, when both markets
were open. A trading signal based on prices quoted at different times could easily have been an error.

**Execution Problems and Performance**

Brokerage fees are often only a small part of transaction costs. Slippage, the difference between the price you wanted and the price you got, is a costly component in trading. This ignores the fact that some trades don’t get filled at all. Unables, the trades that don’t get executed, are the biggest problem and the greatest cost for large traders.

You can get filled on any trade if you must be in or out of the market. By placing an order “at the market,” it will be filled; or, you can take the bid or asked price in the cash market, regardless of the amount. But most traders won’t take any price; systematic trading generally requires a price relatively close to the signal or target price to produce profits.

"Unables"

Unables are usually orders that were canceled because the market moved too fast and too far. This applies to entering new positions much more than getting out of existing ones. Entering a position allows more selectivity; exiting a trade always seems to be an urgent matter.

Experience shows that a fast trend-following or breakout system can miss nearly all profitable trades under poor market conditions, and up to 30 percent of all profitable trades during a volatile 1-month period.

Intraday breakout systems show the typical problems. Buying a breakout that occurs during the trading day may not be possible. When government reports are released just after the opening of the U.S. financial markets, prices can leap to new levels. Only a few contracts in total may be executed during the price move that lasts only a few seconds. You can’t expect to be filled by being fast or using a Stop order. You can only buy the top or not buy at all.

An individual with a small order may be pleasantly surprised once in a while, by getting an execution somewhere before the market reaches its extreme. If you trade larger lots, say 100 or more futures contracts, and limit the slippage that you will accept (by using Limit orders or waiting for a specific price level), expect that 5 percent to 30 percent of your trading volume won’t be filled over the long term. Many times all of an order will be filled, other times very little.
Who Is Likely to Have Execution Problems?

Not all traders have difficulty getting fills. The worst performance comes from a combination of five features:

1. **High-volume traders, such as fund managers and institutions.** Large orders mean pushing the price, especially if you are exiting a position. It means that it may take from 10 minutes to 3 days to execute an order. It’s difficult to get a specific price under those conditions.

2. **Short-term traders, holding positions for less than two days.** Fast trading keeps both profits and losses small. Slippage can take a large percentage from profits, in addition to increasing the size of each loss.

3. **Trend-followers, buying and selling in the direction of the price move.** Buying when the market is rising always results in sizable slippage, and occasionally an unpleasant surprise when prices jump. Good news is rare.

4. **Intraday traders, executing orders between the open and close.** Volume drops sharply between the open and close of an exchange trading session, and between traditional business hours in interbank markets. It is not always easy to find someone to take the trade, or the bid-asked moves to an unacceptable spread.

5. **Traders who use limit orders, such as “Or Better.”** Rather than using “At the Market orders,” professionals try to execute at a price. They can find themselves chasing the market more often than they expect. At some point, the price becomes unacceptable.

An institutional trader, such as a fund, using a short-term breakout system (considered to be trend-following) in which signals occur at any time during the day, would have the largest slippage and the most unables. Few traders and methods are immune from unables.

Only the Profits Don’t Get Filled

It is easy to see that the unfilled positions would have all been profits. If prices had reversed after a breakout or trend signal, there would have been an opportunity to enter the whole trade. Therefore, it is the profitable move—where prices keep going (or pull back only a small amount)—that does not get executed. The losing trades are always filled and you miss only the winners.

Can you make money trading a system where 5 percent to 30 percent of the profitable positions aren’t filled or when you must execute in a fast market? Box 2-2 shows that a single unexpected price jump
Box 2-2. THE IMPACT OF SLIPPAGE

Example 1: Impact of normal slippage

A trend-following program has an average profit of $500, an average loss of $150, and is profitable 40 percent of the time, netting an average combined profit of $110 per trade after commissions, without slippage. Trades in the Deutsche mark, entered as Stop orders, are typically filled 4 pips from the signal price, but no less than 2 pips. For a Chicago International Monetary Market contract, traded in 8ths of a million, that means a cost of no less than $25, but normally at least $50 of added cost for each entry and exit. That leaves only $10 per trade as an expected profit!

Example 2: Impact of slippage in a fast market

The importance of slippage can be reduced by increasing the expected profits per trade. Using a slower trend-following approach, with larger profits and fewer trades, the program produces the same $500 average profits, $150 losses, and a 40 percent reliability, but this time net of both fees and normal slippage.

When the IMM Deutsche mark opens at 7:20 A.M. in Chicago, the price is at 58.10. The trend-following system has a buy Stop entered for 20 lots at 58.25. At 7:30, the U.S. Balance of Trade is released, showing a deficit of $12 billion, unchanged from the previous month, but $4 billion worse than expected. The fills come back from the floor: 2 at 58.30, 5 at 58.60, and 13 at 58.75, averaging 58.667. The total slippage is US$521 per contract. If this program has one trade per week, the expected returns would be:

\[
\begin{align*}
21 \text{ Profits @ $500} &= 21 \times 500 = 10,500 \\
31 \text{ Losses @ $150} &= 31 \times 150 = -4,650 \\
52 \text{ Trades total} &= 10,500 - 4,650 = 5,850
\end{align*}
\]

A single added loss of $521 is 9 percent of the annual returns.

could cost nearly 10 percent of the expected yearly profits. If you do not plan for execution problems during development, most programs will not survive.

**Improving Results**

The three ways of reducing the unpleasant effects of unables and slippage are to seek larger profits per trade, use realistic transaction costs
in testing, and anticipate the trading signal (anticipation is discussed in Chapter 11). Larger profits can be accomplished in the following ways:

- **Holding long-term positions.** Trading only one to three times per year, with large expected profits, reduces the importance of slippage and allows a longer time to enter and exit a trade. An average price or a specific entry strategy can work well.

- **Targeting larger profits per trade.** When using a faster trading method, which is a necessity for many foreign exchange operations, profits per trade can be increased by selecting more volatile markets or by including a profit-taking strategy. Profit taking will improve the overall profile of a system and will contribute significantly to reducing slippage.

**Test Criteria**

The use of a realistic execution price when simulating a trading strategy can resolve all slippage and profitability problems. You cannot know if a strategy will be profitable unless you assign correct entry and exit prices. The following procedures are advisable:

- **Approximate “normal” slippage.** Box 2-3 shows that fill prices are based on a number of factors. The net transaction cost is difficult to determine in advance. A “worst-case scenario” may be too extreme, but something less than an optimistic approach is best.

- **Estimate fills for intraday trading.** It is safe to assume that you get the worst price during the 5–15 minutes following your order. That means taking the worst high or low during the interval, not just the price at the end of the period.

- **Test for “locked-limit” moves in futures markets.** In most cases, you can’t buy if the closing price equals the high of the day; you can’t sell if the close equals the low of the day. The exchange system of settlement, based on an average of the last one minute of trading, makes it unlikely that the close will settle at the high or low. Of course, when the high and low are the same, no trading occurred.

The best estimate comes from monitoring a system that is actually traded, as discussed in Chapter 11. Unfortunately, that does not help at the early stages of development. Previous experience will allow you to estimate the transaction costs for trend-following and other programs, even though those strategies are not identical to the current system.
Box 2-3. GUIDELINES FOR CALCULATING SLIPPAGE

The following guidelines are for buy orders:

<table>
<thead>
<tr>
<th></th>
<th>Small Orders</th>
<th>Large Orders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable slippage. Add a percentage of the high-low range to the fill price, e.g., Price = .15 x (High - Low)</td>
<td>15% above the system signal price</td>
<td>15% above the average of the execution interval price</td>
</tr>
<tr>
<td>Minimum slippage. Each market is assigned a minimum slippage that is larger than the normal bid-asked spread. For IMM Japanese yen or Deutsche marks, the spread is 8 pips, or US$50. For the S&amp;P, it is often 20 ticks, or US$100. Use the minimum slippage if it is greater than the variable slippage.</td>
<td>For trend following: (Ask-Bid) x 1.5</td>
<td>(Ask-Bid) x 3.0</td>
</tr>
<tr>
<td></td>
<td>Countertrend orders: (Ask-Bid) x 1.0</td>
<td>(Ask-Bid) x 2.0</td>
</tr>
<tr>
<td>Orders on the Open or Close. Orders executed in the opening or closing range receive the worst price of the range.</td>
<td>Worst of the opening or closing range</td>
<td>Worst of the range x 1.5</td>
</tr>
</tbody>
</table>

Maximum volume. Assume that an order will not be entirely filled, at any price, if it exceeds 5 percent of the daily volume.

Screen trading execution lag. If Stop orders are not used, traders must assume that prices have moved past their price by the time that price appears on the screen. At best, the screen shows the bid price. The calculations above assume that the time to call the broker, quote the price, and place one or more orders results in larger slippage.

Small lot Stop orders. Small orders placed as Stops are usually filled at prices showing slippage greater than you would expect from the bid-asked spread. You often pay a premium for trading small.

Globalization: Simultaneous Absorption

The Nikkei drops 700 points, and the S&P opens 200 lower. The Bundesbank raises the rate on the bund by a half-point, and U.S. bonds drop. The old theories of isolationism no longer exist. Economic events in one financial center affect financial markets everywhere with
nearly instant reactions. As Great Britain struggles with its economy, its equity market fails to react to rate changes by the Bank of England. Instead, it is pulled by the more influential trading partners in the European Monetary System.

Portfolio diversification is more difficult when markets are tied together, pulling at each other. Some of the new links between investments are not yet obvious because they have not been tested. Diversifying a portfolio into 30 percent selected stocks, 30 percent bonds, and 10 percent currencies seems safe until a political crisis surfaces. Then money runs to the safety of the U.S. dollar. Bonds move sharply higher, stocks move slightly higher, and the dollar gains, posting a loss in the Forex holdings. The currency allocation is reduced to compensate for the sudden increase in risk just when the international problems ease. Money flows away from the dollar, bond prices drop, the dollar drops, and stocks drop. Your holdings in currencies are too small to help the portfolio. So much for diversification.

Even though each investment group, individual stock, and commodity is directly affected by its own fundamental factors, the global picture can overwhelm all of them. The purpose of diversification is, foremost, to protect a portfolio from extreme risk. Normally, there is ample time to shift positions and take advantage of changing opportunities. With a crisis or price shock, it is too late. Investors pull funds from entirely unrelated investments to cover losses elsewhere. This causes all markets to reverse at the same time.

**Factors That Always Exist**

**Noise**

An unusual market move may cause you to forget that many underlying factors still exist. A fast move always includes some noise, which should be no less than in a normal market, perhaps larger. An anticipated price or target level may be over- or understated by the amount of market noise. Profit taking when high volatility has clearly favored your position is a way to take advantage of noise. Waiting to liquidate a position that has taken a bad loss on a price shock shows an understanding of noise.

**Inflation**

Inflation moves along at a relatively steady rate. If prices do not have an upward bias, then they are going down relative to other products. This relative decline can be confirmed by a long-term drop in volatility and a better return to risk ratio for purchases rather than sales.
Seasonality

A market that does not exhibit known seasonal tendencies is still seasonal. During the prolonged devaluation of the U.S. dollar in the 1980s, grain prices tended to move higher, sometimes during periods when seasonal patterns would have favored lower levels. Attractive exports, combined with price parity (a buyer in any country seeks the cheapest price) causes the price of freely traded commodities to maintain a constant world value. Seasonal patterns are overwhelmed by outside interest but still exert their influence on prices. During periods of lower supply, the commodity price will be that much higher to include a supply premium. Because seasonal factors cannot be removed, a period that overwhelms them, causing them to appear ineffective, is even more volatile and more unstable than it might seem.

Change and Evolution

An interesting phenomenon of change is that, when events stabilize, they are never quite the same as they were. Globalization and communications, broader markets, new technology, and better quote machines and analytic tools mean that markets are evolving. They will never respond to one another in the same way they have in the past.

The European Monetary System tries to regulate the variation (although not the volatility) between member currencies. The entry of Russia and China into the free market system can change both the supply and demand of nearly everything. It increases the chances of shortage and surplus. U.S. stock prices could double quickly if money could move freely between countries. Or, money could flow to the rapidly expanding Asian economies, shifting the center of finance.

Change means that the past does not help us to forecast the future as much as we would want. Unless you view the past as an evolving process, trading methods that worked in the past may no longer work. If market relationships change, you cannot use old data to forecast the future. You only know that the future is going to be different.

The assumption made by rigid systems, such as trend-following, fixed cycles, or patterns, that the current state of affairs will continue, contradicts reality. We are only passing through the current state. A trend-follower can only hope that unexpected changes do not cause extreme volatility that results in unreasonable losses. It is not the forecasting attributes of a trending system that allow profits, it is the risk controls.
To forecast successfully is to accept the inevitability of change and the risks associated with it. You cannot assume that the future will be the same as the past, that the risks and profits and patterns will repeat themselves. We can only try to develop systems that recognize the possibility of change and are flexible enough to profit from it.
Reasonable Expectations Give Achievable Results

The combination of technology, optimism, and the success of some highly visible traders can easily lead to unrealistic expectations. We see the profits before the risks, then we attack and eliminate the risks without questioning the validity of the profits. When developing a trading strategy, the failure to understand what is most likely to happen can waste time and effort, as well as cost a great deal of money.

Trade-Offs

Every profit opportunity has risk. Larger profits have larger risk. Each systematic approach to trading has its own risk and reward trade-offs. And a trade-off is always an unpleasant compromise. It is a mistake to think that you can find a trading strategy that has no losses, or an arbitrage that will absorb unlimited funds.

A pure trend-following method has smaller losses and larger profits. It is classified as a “conservation of capital” approach. To keep losses small, it is necessary to close out trades quickly. The system continually tries to find a trend but exits as soon as prices move in the wrong direction. Therefore, there are more losing trades than winning ones. If you increase your tolerance for risk, by using a slower trend or larger stop-loss, the system will have a larger percentage of winning trades but larger losses and equity swings. Make the trend very slow and the stop-loss far away and you have a passive portfolio of one open trade.
Countertrading strategies typically allow more risk to achieve frequent, small profits. When the strategy errs, there are large losses. Its trade-offs have the same, continuous relationship as a trend-following method, but in reverse. As the targeted profits get smaller, they are more frequent. In exchange, the fewer losses get larger.

Trend and countertrading traders have similar choices: smaller losses or smaller profits more often, offset by larger profits or smaller losses less often.

Commodity arbitrageurs compete for “riskless” opportunities, such as a location arbitrage. Profits can be made when the differential between the same product selling in separate locations is greater than the cost of transportation, insurance, and other carrying charges. Competition can be so keen that the arbitrageur accepts both small profits and small volume, a situation that, at some minimum, is not worth the effort.

There is no secret way to produce constant trading profits. Some methods are better than others, but none of them are immune from these trade-offs. It is important to identify and understand the alternatives before making a final choice (see Table 3-1).

**Risk and Reward**

We all know that there is higher risk with higher profits and that the only system that doesn’t have losses is the one that doesn’t trade. When you sit in front of a powerful computer with sophisticated tools, however, you tend to forget that these limitations still apply.

Profits seems to stand out when you look at the trading results of hundreds of strategies. The high leverage of options and futures pushes many of the test returns well above 100 percent per year. These are exceptionally high compared with most investment returns and can be intoxicating at first. But presented in a more traditional risk-adjusted form, with adequate capitalization to insure safety, results are scaled

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**Table 3-1. Trade-Offs**

<table>
<thead>
<tr>
<th></th>
<th>For Every Positive</th>
<th>There Is a Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trend-following</td>
<td>Large profits</td>
<td>Many small losses</td>
</tr>
<tr>
<td></td>
<td>Small losses</td>
<td>More losses than profits</td>
</tr>
<tr>
<td>Countertrading</td>
<td>Many profits</td>
<td>Each one small</td>
</tr>
<tr>
<td></td>
<td>Only a few losses</td>
<td>Each one large</td>
</tr>
<tr>
<td>Arbitrage</td>
<td>Very low risk</td>
<td>Few opportunities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Very competitive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Small profits</td>
</tr>
<tr>
<td>All systems</td>
<td>High profits</td>
<td>High risk</td>
</tr>
</tbody>
</table>
down to a more sensible range of 5 percent to 25 percent annually. This is discussed in Chapters 4 and 11. You may discover that the risk-adjusted returns of a very profitable trading method are no better than a conservative bond fund.

**Be Wary of Unreasonably Good Results**

Developing a trading method is hard work. The main idea can be the result of years of watching market patterns, or the formation of precise mathematical relationships. The process of testing and verifying is also difficult. Each calculation needs to be checked and entry and exit prices must be reviewed. It can be so tedious that, at some point, you would willingly accept good test results and stop looking for errors. You begin to look at larger individual losses without also reviewing the larger profits. But errors cause both good and bad results, and a program is not valid until it is error free.

A trading strategy that returns more than 20 percent annually, with a reward/risk ratio greater than 3.0, is an enviable achievement. If you add a stop-loss to a system to reduce its risk, you find that the returns also drop; or, by selecting specific trades with better opportunities, you reduce the frequency of trading so that each trade must generate larger profits to reach the original rate of return. Each day that you are out of the market, waiting for an entry signal, reduces the rate of return.

In the end, all systems must conform to the expected trade-offs. If they don’t, you have reason to be suspicious. A system with no losses, a reward/risk ratio over 5.0, or annualized returns over 50 percent for 10 years must have compensating limitations for these benefits. You cannot accept their results at face value; you must find and understand their problems. There is no room for careless optimism.

**Giving the Computer Free Rein**

Computers excel in the manipulation of data. Great advances in technology are the result of the ability to consolidate massive amounts of information and produce solutions. What better application than solving a price-forecasting problem?

It is a simple task to input fundamental and economic data necessary for the interpretation of stock prices. Or information about supply and demand, which are the primary factors affecting the price of food, energy, and other commodities. It is also possible to add to the database less obvious influences (e.g., financial data, such as money supply, unemployment,
and per capita income) that when combined with other events, will cause prices to shift.

The computer can be given sophisticated tools for finding relationships in the data that explain price movement. The most popular has been a form of multiple regression—finding constant relationships over time between numerous factors. More recently, neural networks are replacing regression analysis as the favorite method. For example, when crude oil stocks decline more than 10 percent below the average, prices rise. And, when OPEC calls an emergency meeting, prices rise. When the two happen at the same time, the prices rise higher. Fundamentals provide a reasonable, classic approach to predicting price movement.

In the past, the speed limitations of computers curtailed the amount of data that could be matched against each other. Calculations were lengthy and the results showed a clear relationship, but large variability. Because not all the price movement could be "explained," the predictive quality also had uncertainty. Newer, faster computers can analyze much more data. They should be able to reduce the variance and improve forecasting. Entering as much data as possible and letting the computer find the relationships is a simple extension of the same problem.

But the solution usually is not improved. Many choices of statistics, in combination, can "explain" the price movement. Which combination is the right one? Or are any of them correct? With enough data, countless patterns are produced. The power of the computer can find them all, without having any way to identify the right ones.

**Recognizing Reliable Patterns**

A common use of computer analysis is pattern recognition. In an attempt to find relationships not yet clear to others, the computer can scan, for example, unemployment data and find that a drop greater than 3 percent in November was followed by a rally of at least 4 percent in housing starts during the following May, for all of the 18 years available.

Is that a perfect solution or a coincidence? It depends on how much data the computer scanned. If you started with the premise that unemployment affects housing, and that more people working means more home sales, then you needed to scan only those two data series to confirm the relationship that you already believed to be true.

If you began with the entire database of U.S. statistics spanning the past 50 years, looking for a perfect relationship, this would have been one of many that you found. Another one may have been the infestation of gypsy moths relating perfectly to the import of Chilean grapes. Employment and housing sound right, but how do you know it is any
more significant than moths and grapes? You can only know if you applied a logical argument, determined before testing, then validated the theory using the computer. Because we never would have thought of a trading program using gypsy moths, even the most astounding result must be ignored. Box 3-1 shows how to calculate when a relationship is “significant.”

**Throwing Microchips at It**

Big companies have more choices than individuals. When they need to solve a more complicated problem, they can buy a bigger computer and get more crunching power. They also get a very impressive computer center and a higher electric bill.

Some solutions require long calculations. Finding meaningful relationships among thousands of data series can require hours of computing time even on large machines. Yet, figuring out the navigational sequences and landing instructions for putting a space team on the moon takes a small computer only a few minutes. Why is the difference so great? The computer that guides explorers to the moon has both objectives and well-defined physical relationships. The effects of planetary motion and gravity are precise, although intricate. Specify the time and everything else can be solved.

Although forecasting a price can be stated as a clear objective, the solution is not clear. The answer may not even be hidden in all the data stored in the computer. The method used to scrutinize the information may not be the way the market works.

You do not necessarily get a better solution by using more computer power, you just get a faster one. Power can overwhelm reason. No matter how big or fast, the computer only solves problems the way it is told. It does not claim to solve a problem that has no answer.

**Oversimplifying a Solution**

Indicators have been given credit for correctly signaling major price moves in stocks and financial markets. On-balance volume, short-interest, customer margin debt, “insider” trading, percentage of cash holdings of mutual funds, oscillators, contrary opinion, and countless others claim accurate forecasting ability. It is true that they have produced buy and sell signals at key points. But at other times, they signal the wrong moves or no move at all.

A indicator is an optimistic, oversimplification of a solution. It is an attempt to find a single, orderly solution to a complex problem.
Box 3-1. WHEN DOES 18 OUT OF 18 BECOME SIGNIFICANT?

You would think that finding a perfect pattern over 18 years is an impressive discovery. But not if the computer finds it by scanning a large database. For example, with 5 years of data, there are $2^5 = 32$ possible up-down patterns:

<table>
<thead>
<tr>
<th>Year</th>
<th>Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UUUUUUUUUUUUUDDDDDDDDDDDDDDDD</td>
</tr>
<tr>
<td>2</td>
<td>UUUUUUUUUDDDDDDDDDDDDDDDDDDDD</td>
</tr>
<tr>
<td>3</td>
<td>UUUDDDDDDDDDDDDDDDDDDDDDDDDDD</td>
</tr>
<tr>
<td>4</td>
<td>UUUDDDDDDDDDDDDDDDDDDDDDDDDDD</td>
</tr>
<tr>
<td>5</td>
<td>UUUDDDDDDDDDDDDDDDDDDDDDDDDDD</td>
</tr>
</tbody>
</table>

If you scan 33 series of 5-year up-down patterns, two of those series must be identical although that doesn’t prove they have anything in common. There is only a 1 in 32 chance that any two series will be identical. Therefore, if you were to take only two series that you thought depended on one another, and they proved to be identical, you would succeed with a 3.1 percent probability. If you were able to match 6 years, there would be a 1 in 64 chance, or 1.5 percent.

**Rating the Results**

Statistics say that there has to be less than a 5 percent chance of occurrence before an event is called probably significant. But that’s of minimum

Combining multiple indicators does not seem to eliminate the bad signals, as you would want. Instead, the new composite indicator has the same erratic properties as its components.

This disappointing inconsistency is not the fault of the indicator, but of the user. Indicators are constructed to emphasize a particular market feature. On-balance volume will confirm a trend if there is one; stochastics and contrary opinion will show when a market is overbought or oversold, but not whether it’s a good time to buy or sell.

A reliable strategy is one that uses relevant information or specific indicators only when they are important. At other times, these indicators have no value; forcing them to say something all the time is a misdirected approach to analysis. The market does not always have something to say.

Standard econometric analysis, often based on multiple regression analysis, tries to form continuous relations between the data. That requires all data to interact in the same way throughout history, even
Box 3-1. (Continued)

interest. It needs to have less than a 1 percent chance (1/100) of occurring to be called significant, and less than .1 percent (1/1000) to be highly significant.

When Is 18 Out of 18 Significant?
Finding the importance of a pattern of results requires only a few simple steps:

Step 1: How many different combinations are there in a series of 18 ups and downs?
There are 2 possibilities (up or down) for every one of the 18 items in the series. Then there are $2 \times 2 \times 2 \times \ldots \times 2$ (18 times), or 262,144 total combinations.

Step 2: What are the chances of having two identical series?
If you entered one more than the total combinations, or 262,145, series of 18 years into the computer, one of those series must be a duplicate. When half the data (131,072 series) have been tested, there is a 50 percent chance that one of them is a duplicate.

Step 3: When is there a "significant" 1 percent chance?
When you compare only two data series of 18 items, there is only a 1 in 262,144 chance of them being the same (which is very small). There is a 1 percent chance of finding two identical patterns in 2,622 series. Selected at random, statistics states that it is not likely to be coincidence.

when markets are being driven by different forces, or by nothing at all. That technique is similar to forcing a relationship. This problem can now be avoided by using a neural network for threshold analysis to isolate different market scenarios. A single event, or combination of events, will trigger the use of a selected set of information applying only to that situation. For example, an unusually large jump in inflation will turn the focus to interest rates, and begin monitoring the Producer Price Index, the Goldman Sachs Commodity Index, the yield curve, and the U.S. dollar, looking for confirmation. More about this can be found in Chapter 9.

Data Grows
An interesting feature common to price charts and system testing is that many of the patterns depend on the length of the chart. You cannot find
a head-and-shoulders formation with only one week of daily data, or a major bull market with one year. Performance expectations are also distorted by using too little data, or selected data. It is not necessarily the profile of the profitable trades that change as you look at more price examples, but the risk. A sustained sideways market and an exceptionally volatile period will create prolonged large losses not seen in a smaller test.

The more data you use, the more patterns you see. A test of 500 days of data will have longer sustained moves than a test of 250 days; 1000 days is that much better than 500 days. More data means more of every price pattern and their combinations. There will be more new highs and new lows, whipsaw periods, and price shocks. In total, the risk gets greater as you use more data, and the profits rarely keep pace with them.

When you begin trading, you are adding the current data to your data history. After a year, you have increased a 1000-day test to 1250 days. The combined periods will contain new or more extreme patterns, just as though you had tested 1250 days, and as the data grows, so does the trading risk. As a result, when you begin trading, the risk may be larger than is seen in testing.

The Use of Systems

Computers and systems have added valuable structure to both individual and institutional trading. Arbitrage, strips, multiple decision-making programs, and expert systems would not be possible without current technology. It has also contributed to risk control and dynamic asset allocation. It allows theories to be tested without real losses.

The use of computerized strategies is not the "easy" answer. It is really a more disciplined and limited form than traditional trading. It requires users to carefully review their procedures and decision making, and put them in an orderly form. In doing this, many traders question what they have been doing. Discretionary trading—the ability to apply instinct and select outside factors—is what makes a great trader. A computer is not going to make an exception. For those traders who consistently benefit from their market judgment, a computerized program often serves as a guideline. It can tell them the trend direction, show key price levels, and give them an idea of how others are positioned.

Some successful traders already use systems as a basis for trading. They are able to select which trades have more potential, enter at a better price, or exit before profits disappear. You might find that they attribute much of their success to the system, while a careful, systematic
test of the method will show that it does not produce net profits at all. The traders' skill is what actually makes it work. Yet these traders swear to the system's success.

Many traders are unsure whether computerized strategies improve their performance or only contribute to their peace of mind. It is said that, because life is a struggle against disorder, some traders would rather use a bad system than no system at all. Systems are good because they are definitive and can be validated by testing. Not all systems work simply because they are clear. This book is intended to help you understand systems and improve your trading performance.

**Right Position, Wrong Reason**

When a market technician holds a position supported by fundamentals, expectations of success increase. But the rules of most systematic trading are not compatible with the equity fluctuations needed to maintain a trade based on government policy, supply and demand, or corporate expectations.

The reason for technical analysis is to cope with the unpredictable way that prices react to fundamentals, the difficulty in assessing objectives, and the need to control risk. In exchange for improving control over an investment, it is necessary to sacrifice what seems to be an "obvious" bull move because prices retrace from their recent highs and exceed preset risk levels.

A technical system grinds out profits, alternating with losing trades. It may take a big loss on a short position during a bull move. Although traders can claim that they "know the system was wrong," it is the discipline of the program that ultimately succeeds.

Technical trading is not glamorous. It will never let you say that you bought at the lows and took profits at the top. But trading should be a business, and a systematic program is a plan to profit over time, rather from a single trade.

**Why Does Everyone Know Except You?**

*If you can keep your head, when all about you are losing theirs, then maybe you haven't heard the news.*

—H. L. MENCKEN

Conversations with other traders can lead you to believe that they knew more than you did about a surprising market move. You lost and they profited. However, if the move was a price shock, then no one could
have known it was going to happen. They were probably caught on the right side of the market while you were on the wrong side.

Newspapers highlight the big winners or those newsletters that gave the right advice. Considering the number of reports published, some must have been short before the October 1987 stock market crash. Their advice could have been mediocre before that and worse, but you always find out who was right after a price shock. You can always assume that half the traders you know were right about a move, and those are the ones most likely to talk about it.

**Expectations**

High expectations are essential to success, but unrealistic ones just waste time. Computers do not tell you how to profit in the market, they can only verify your own ideas. Using a computer to develop trading programs is a sensible, conservative approach. As with other tools, it requires skill, which comes from study and practice. As you become more proficient, you will learn more.

Because it is only a tool, results of system testing must be compared fairly with all other investments. Returns should be risk adjusted, and investments must be properly capitalized.

Be suspicious of unrealistic results, even when they are profitable. Strategies are trade-offs between many features. With more complex tools, there are many more chances for error. Check the details carefully before accepting the results. There is no substitution for careful work.

Use new technology cautiously. Increased computer power takes the pressure off the individual’s need to conceive a profitable strategy before testing. Many of the new methods discussed later can be a great asset or a crutch; their benefits are entirely in the hands of the user.

Researching and developing trading programs are unique activities among businesses. There is no assurance that some problems have a solution. Other times, successful plans and opportunities are short-lived; even market patterns that have been reliable for many years can disappear. Part of developing a program is identifying when it no longer works.
Amateur traders first look at profits while professionals first look at risk. It is far more interesting to search for a profitable system than to concentrate on losses, but an understanding of risk is essential to every aspect of trading. Otherwise, it is only a matter of time before a price shock forces you out of the market, or a series of losses become enough of a worry to stop your trading. In this book, you will find that some trading methods are considered better than others. This chapter will explain how those choices were made. The preferred methods are based on sound rules that incorporate both risk and return. These techniques can be applied to any trading method.

Figure 4-1 shows two equity plots for the same time period. The left one (a) shows much higher profits, but more risk. The price fluctuations above and below the straight line (the rate of return) are clearly larger than in the right plot (b). Which is better, the one with higher profits, or the returns with lower risk? Is it investor “risk preference” that decides the answer?

The “best” performance is not based on whether the investor is conservative or risk-seeking. It is entirely a function of which performance gives the highest returns for the lowest risk, which in turn will translate back into higher profits. In Figure 4-1, it is difficult to decide which is better without being given the exact risk and return for each chart.

**Risk Preference**

Risk preference is the investor’s willingness to accept more or less risk in exchange for profits. When two systems have the same returns, rational investors will choose the system with the lowest risk. Similarly, when
two systems have the same risk, investors would choose the one with the highest returns. Among programs with the best combination of risk and reward, it is necessary to accept proportionately higher risk to increase returns by a small amount.

**Standardizing Risk and Return**

Before comparing the currency and bond portfolios in Figure 4-1, the returns and risk must be represented in a standard, convenient form. This allows different test periods to be compared equally with one another. The most popular approach is used extensively by equities and financial analysts:

- Return is the annualized, compounded rate of return.
- Risk is the annualized standard deviation of the equity changes.

**Compounded Rate of Return**

A *compounded* rate of return means that the accumulated funds are reinvested. In the case of a simple interest-bearing savings account, “daily
Risk and Return

compounding means that the interest earned each day is added to the total savings and earns interest starting the next day.

Using annualized compounding, you may earn, for example, 5 percent on an investment, leaving the interest to accumulate. Because the interest is posted only once each year, a $1,000 investment is worth $1,050 at the end of the first year. At the end of the second year, the $1,050 has grown by another 5 percent to $1,102.50, and after the third year to $1,157.625. The same result can be found by multiplying the initial investment of $1,000 by the rate of interest raised to the number of years that the funds were invested.

This technique is useful for system evaluation when you have the starting and ending value of an investment and you want to find the compounded rate of return that would give those values. The calculation can simply be reversed, as shown in Box 4-1.

Annualized Standard Deviation

The annualized standard deviation measures risk. It is simply the standard deviation of the annual increase or decrease in equity (compounded returns). Therefore, if the annualized return is only one value each of 20 years, the annualized standard deviation uses only those 20 values. You may use monthly changes in equity to get more accuracy. The next few sections will compare risk and return evaluated over different time periods, and show that they are not easily interchanged.

Using a Standard Deviation to Determine the Chance of Loss

The standard deviation is the classic measurement of distribution. It shows how data is clustered around the average value. It assumes that the pattern of results is symmetrical. For example, a chart of trading performance is shown in Figure 4-2(a). The rate of return is the solid angled line drawn upward through the center of the equity. The standard deviation of the monthly profits and losses (subtracting last month’s equity, or accumulated profits and losses, from this month’s value) will show how the returns are clustered above and below the rate-of-return line.

It is easier to see the distribution of equity changes in Figure 4-2(b). By subtracting the equity value of each month from the previous month, the equity has been detrended. Fluctuations are centered above and below a zero line, rather than an upward regression line, as in Figure 4-2(a). The standard deviation is useful because it puts a value on the chance of loss. In Figure 4-2(b) bands are drawn parallel to the straight-