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TECHNICAL ANALYSIS OF STOCKS & COMMODITIES™

Evolution of a Timing Model

The Value Line Percent Swing System

by Nelson Freeburg

How does a trading model evolve? Formula Research newsletter publisher Nelson Freeburg discusses the evolution of a trading model and explains such concepts as out-of-sample testing, parameter sensitivity testing and the inclusion of nonprice indicators for timing trades.

Many come to trading and investment with high expectations. In my case, the markets soon made clear the limitations of my intuitive trading skills. There are talented traders who can sense an impending market move, adjust for risk and enter with a properly scaled commitment, all with instinctive finesse. For me, hard experience in the stock, options and commodity markets told me I was not so blessed.

For those who lack fine trading instincts, mechanical timing systems are a ready alternative. Here, the buy and sell signals are clear and precise. A structured algorithm dictates market action, not a fleeting insight that is subject to emotion. Trading rules can be tested over a broad sample of the data, noting how performance varies through different market cycles. Not only that, the track record is objective, not anecdotal. Everyone who tests the system will get the same results, a *big* plus.

The chief problem with mechanical trading systems is uncertain future reliability. Timing methods that test well in theory may break down in practice. Trading systems can be so elaborately patterned on the past that they no longer work in real time. The fact is, a determined signal jockey can methodically tweak a system to generate almost any desired result. Such curve-fitting is self-defeating. By overoptimizing to a narrow range of market conditions, poor results in actual trading are all but assured.

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CURVE-FIT COUNTERS

There are techniques to counter curve-fitting. This article will illustrate several ways to deal with the problem by examining a familiar stock market timing model, the Value Line 4% swing system, a trend-following signal developed by Ned Davis Research.

Starting with the basic 4% signal, we will add new features, building on the model progressively. At each stage of development, we test for curve-fitting. What finally emerges is a profitable stock market timing model that is also robust.

One derivation, well-suited to mutual fund switching, shows a 15% compound annual return since 1961. Another variant offers a 17% annual return. As the discussion proceeds, we gain new perspective on system design and construction, especially with regard to the all-important question of future reliability and performance.

We normally rely on three main techniques to promote continuing reliability in timing models. First, we like to use a finite range of price history to formulate the buy and sell signals and then apply the same rules to a different segment of the data. If this out-of-sample testing holds up, we have a positive indication — though by no means a conclusive one — that the model may work in the real world.

Second, with any type of quantitative model, we tend to be wary of an overly restricted range of signals. Suppose something like the "14-day crypto-fractal" system appears to have a terrific track record, but when a 13- or 16-day variant is substituted, those profits suddenly disappear. Clearly, this method would be highly suspect.

To help ensure that the timing models are effective across a broad spectrum of values, we do a great deal of *parameter sensitivity testing*. If the model is found to be critically dependent on a narrow mix of inputs, we would have strong grounds for doubt about the model's real-world potential.

Finally, we prefer to rely on various nonprice indicators to boost confidence in the timing logic, and very often, the performance of the model. For instance, the stock market is greatly influenced by the monetary environment. By incorporating such external factors as interest rates, we add a helpful causative dimension to the treatment. This way, our model takes into account not just price action itself, which can be deceptive, but some of the defining properties that help shape and determine price behavior.

4% MODEL: SIGNAL CALCULATIONS

Before putting these ideas to work, let's review the mechanics of the 4% system. The only data series needed to calculate the signals is the weekly close of the Value Line Composite, which is a broad unweighted stock index quoted in *Barron's* and *The Wall Street Journal*. Because the Value Line index includes more than 1,600 listed and unlisted stocks, and because it is neither price weighted (like the Dow Jones Industrial Average) nor capitalization-weighted (like the Standard & Poor's 500), many feel it is more representative of the typical investor's portfolio than the popular averages. In fairness, it may be that the Value Line tends to understate stock market performance due to its use of geometric averaging. Any such tendencies in the data will have a limited impact on a study of this nature.

The 4% timing model is simplicity itself. A buy signal is given when the Value Line rises 4% above a prior low on a weekly closing basis. The 4% move does not have to take place in a single week; a gradual advance might unfold, with progress interrupted by a few minor retracements. As long as the total move up amounts to 4% or better, the result is a buy signal. The opposite is the case for a sell signal. When the weekly close of the Value Line drops by a cumulative 4%, the indicator is rated bearish.

For example, suppose a downtrend is in effect and the Value Line falls to a low of 100 on a weekly basis. As soon as the weekly close climbs to 104 or higher, you would enter long. The move to 104 could take place in a week, a month or a year. Now assume the Value Line has surged to the 200 level. A sell signal would be given on a drop to 192 or lower. Now suppose a sell signal appears likely, but suddenly the Value Line swings back up, making a new weekly closing high. Here, we reset the trigger point. No sell signal is possible until there is a 4% decline from that higher peak.

The 4% method was introduced by Martin Zweig in *Winning on Wall Street* ; the track record cited there covered 1966 to 1985. During that time, the Value Line index rose from 133 to 194, a 61-point gain. By contrast, the 4% swing method gained 365 Value Line points over the same period, a big advantage, amounting to a compound annual return of better than 16% versus a buy and hold return of under 3%. Only half the signals were profitable, but the average gain far surpassed the average loss. Figures 1 and 2 show all the 4% signals for 1966 to 1985.

As with the original study, calculations here ignore the effects of dividends and transaction costs. Furthermore, following Davis and Zweig, all sell signals are treated as signals to enter short. Although short sales might not be feasible or desirable in practice, this treatment is helpful for purposes of historical testing. After all, to the extent short-sale losses are especially severe, it means that we are not exploiting buy signals to their fullest potential. A look at short-sale performance helps us better isolate the opportunity cost of exiting a long trade prematurely.

CURVE-FIT TESTS

Eight years have passed since the 4% model first appeared in *Winning on Wall Street* . Has the 4% model kept pace with earlier gains? Bringing the results forward to November 1993, profits appear to continue strong. Since mid-1985, the Value Line index has climbed by 100 points. By contrast, the 4% model gained 205 Value Line points. The model offered a 9% compound annual return versus 5% for buy and hold. While the edge on buy and hold may have slipped slightly, the swing method continues to outperform the market decisively. Figure 3 shows all 4% signals from mid-1985 to November 1993.

What about the years prior to the Zweig study? We went back to 1961, as far as the data allows, and tested the system through mid-1966, when the Zweig study began. During this period, the Value Line rose a total of 31 points. By contrast, the 4% model gained 53 Value Line points, 70% more than the rise in the index. The compound return per annum was 10.7% versus 5.5% for buy and hold. Once again, the Value Line model was not only profitable but wound up beating the market by a wide margin. Figure 4 shows the buy and sell signals for 1961 to mid-1966.

The 4% swing system has now been successfully tested both forward and backward in time. The method that worked so well for the Zweig study also excelled in two distinct periods. It is key that performance

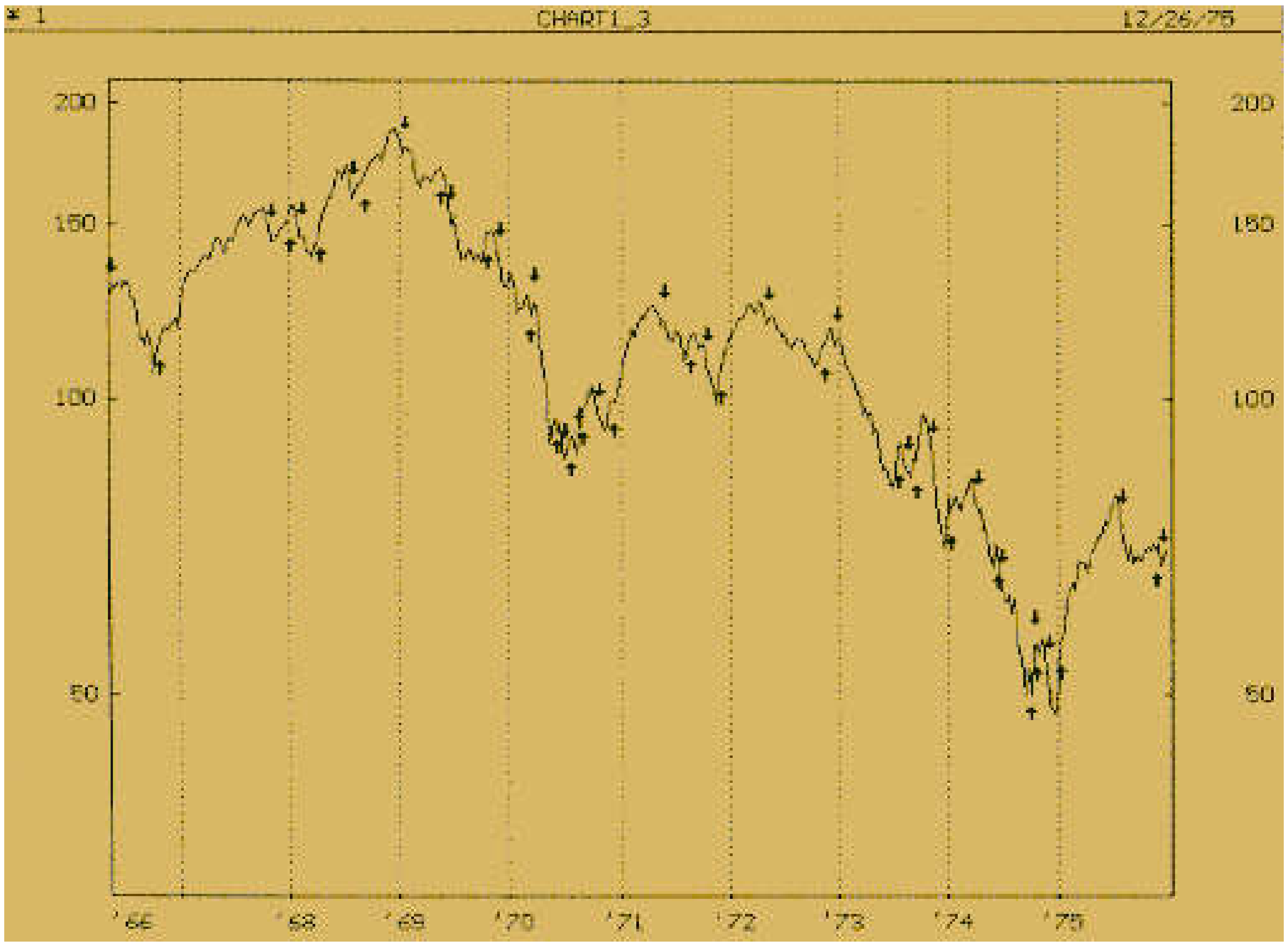

FIGURE 1: Value Line 4% Model, May 1966 - December 1975. *During 1966-85, the Value Line index rose from 133 to 194, a 61-point gain. By contrast, the 4% swing method gained 365 Value Line points over the same period, a significant advantage.*

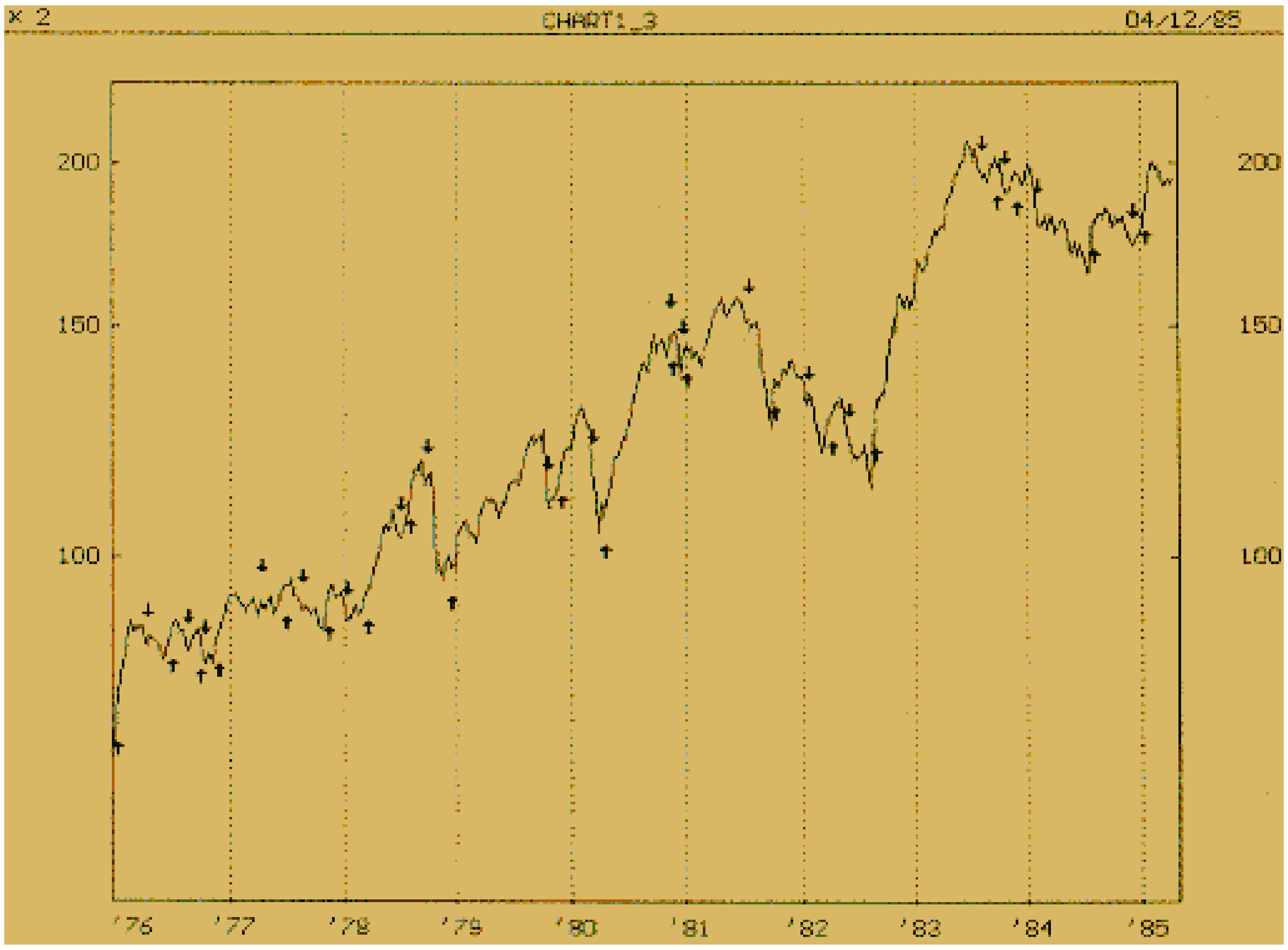

FIGURE 2: Value Line 4% Model, January 1976 - April 1985. *Here are the rest of the signals for the years covered by Martin Zweig in* Winning on Wall Street.

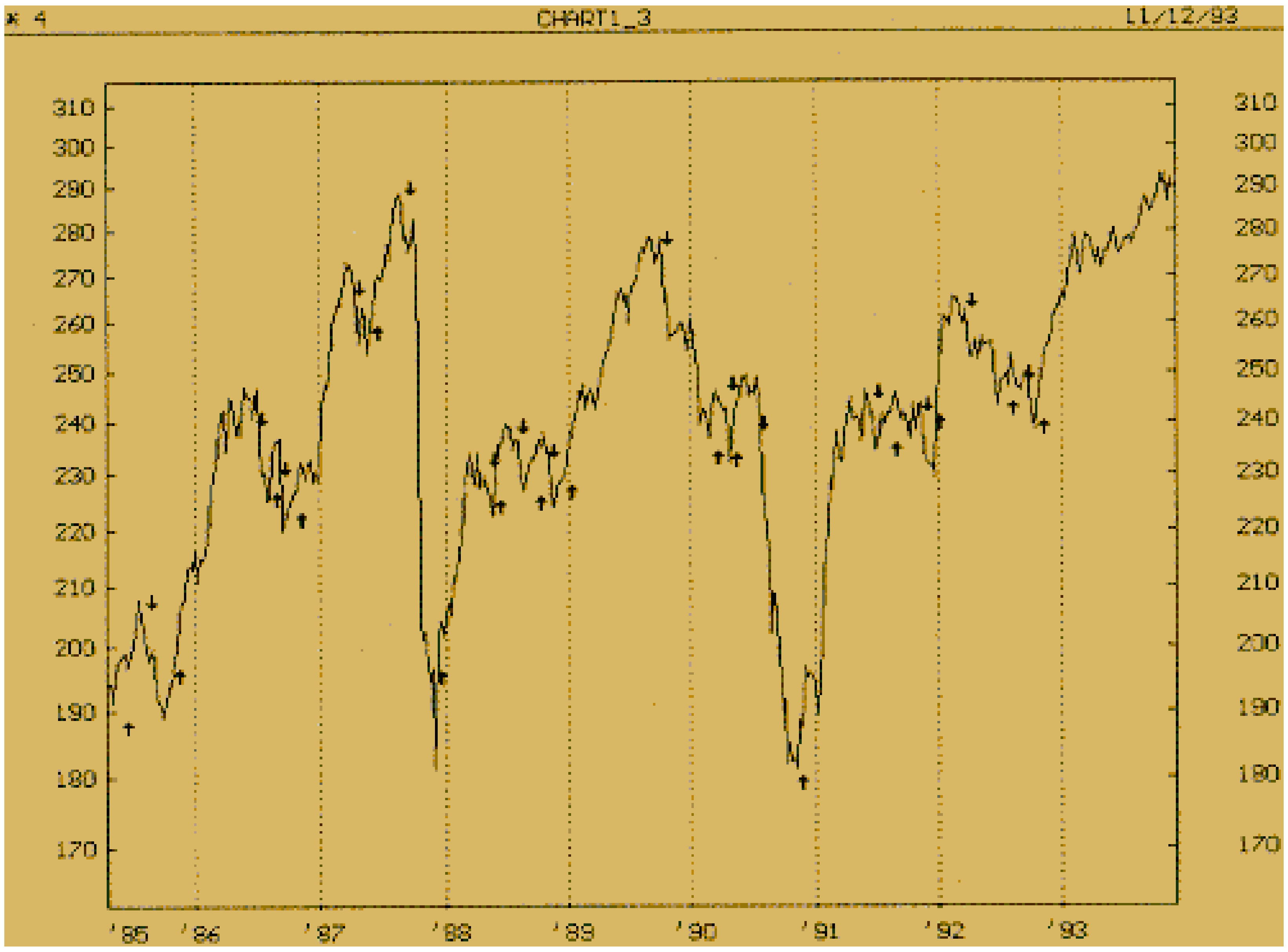

FIGURE 3: Value Line 4% Model, May 1985 - November 1993. *Figure 3 shows all 4% signals from mid-1985 to November 1993.*

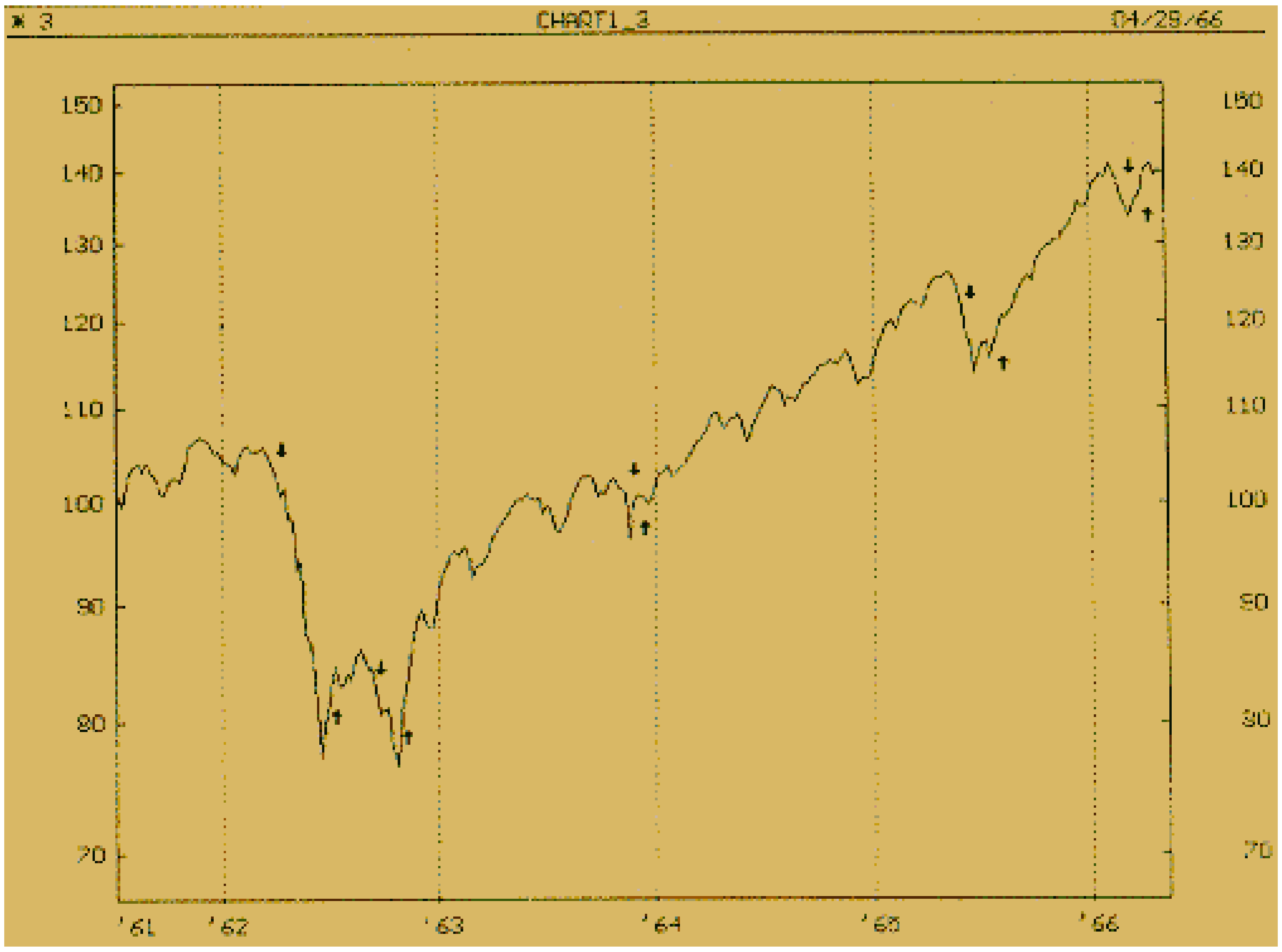

FIGURE 4: Value Line 4% Model, July 1961 - April 1966. *Figure 4 shows all 4% signals from mid-1985 to November 1993.*

held up outside the nucleus of data that defined the trading logic in the first place. This consistency suggests the method is robust across time. The strong out-of-sample performance reinforces confidence in the underlying logic.

Now consider results over the full length of the study. Between 1961 and 1993, the Value Line rose 186 points, compared with a gain of 626 Value Line points for the 4% model. Compared with a buy and hold return of about 3% a year, the swing method produced a 13.7% compound annual return — a fourfold advantage. Of 127 signals, 60 were profitable for a 47% batting average. While 4% signals are not always profitable, losses tend to be small and winners can produce dramatic gains. With this trend-following system, it is impossible to miss out on any sustained market move.

The out-of-sample results are encouraging. Now we can test for parameter sensitivity. How dependent is the model on a 4% swing? Would performance falter if some other percent swing were used — say, 2% or 6%? We can go a step further and consider asymmetrical signals. For example, you might buy on a 5% swing up and sell on a 3% decline, or buy on a 2% swing up and sell on a 7% decline.

To determine how sensitive performance is to different buy and sell signals, I tested every swing value from 1% to 8% for each type of entry, long and short. A total of 64 parameter sets was tested over the 32-year study. Results were positive, regardless of the percent swing used. The least satisfactory signal mix offered an 80% advantage over buy and hold, with a gain of 332 versus 186 Value Line points (Figure 5). The most profitable combination showed a gain of *769* Value Line points. The table below can give a sense of the performance range, presenting a conspectus of results. As you can see, every parameter set beat the market by a wide margin. Such performance across a broad spectrum of signals lends further support to the timing logic.

Value Line Points Gained : Selected Percent Swings

Percent Swing Required to Trigger a Buy or Sell Signal		Sell Signal: Minimum Swing Down			
		2%	4%	6%	8%
Buy Signal: Minimum Swing Up	2%	599	525	365	411
	4%	659	626	464	556
	6%	550	607	378	494
	8%	399	559	345	535
		Buy-and-Hold Gain: 186 Value Line Points			

Thus far, the model has satisfied two key tests designed to promote system reliability. First, it beat the market across three distinct segments of the data, a fine showing. Second, we have just noted consistent performance across a wide range of signal values; the model is not speciously dependent on a narrow parameter set. With two challenges met, we proceed to the third stage of development.

ADDING A MONETARY FILTER

The stock market has always been sensitive to trends in interest rates. In recent decades, the monetary

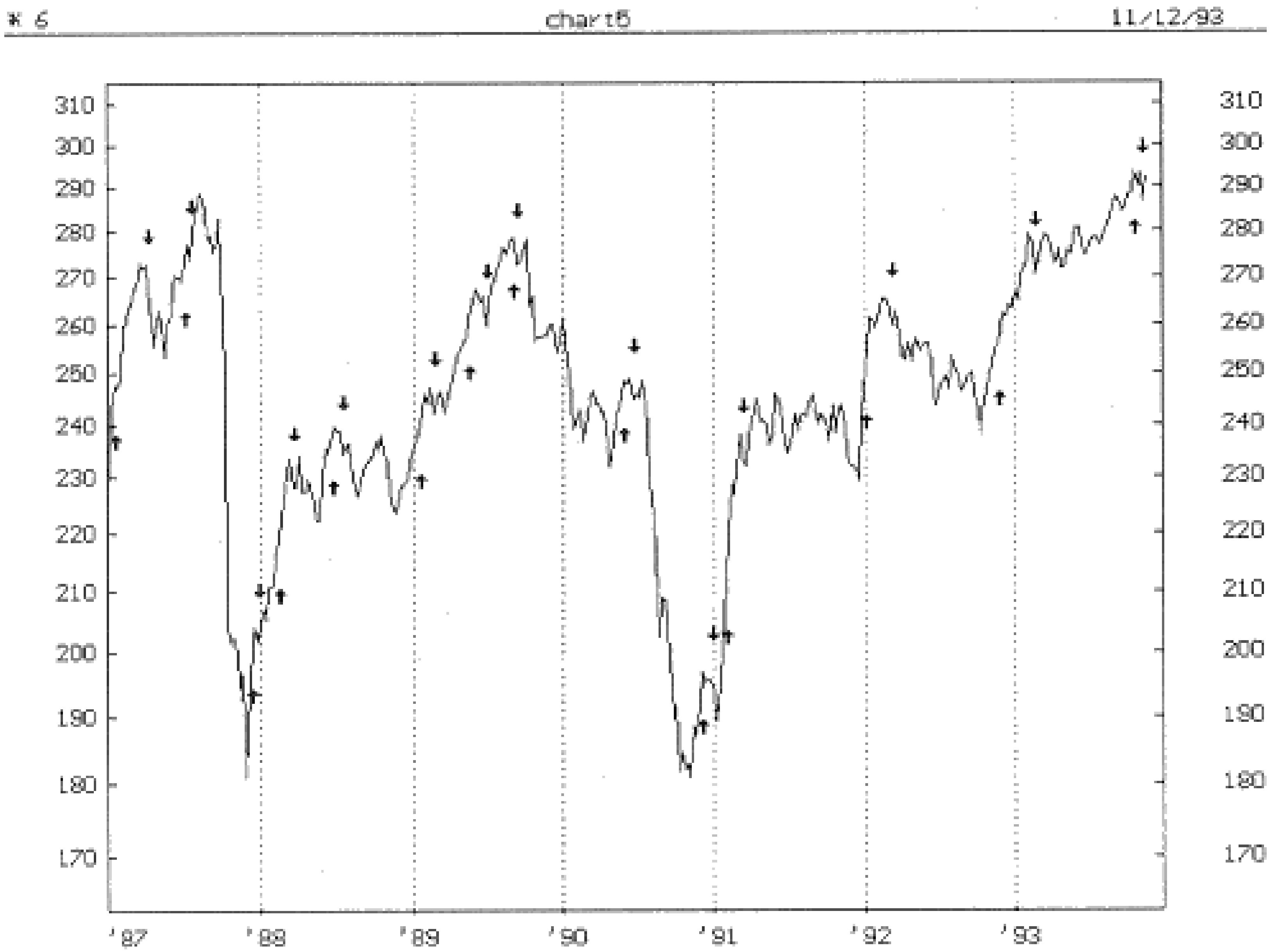

FIGURE 5: Value Line % Swing Model, January1987 - November 1993. *Here, you buy on a 7% swing up and sell on a 1% swing down. Although this was the least profitable of the 64 variants, you can see that the timing signals were quite good on the whole.*

outlook has grown in importance, reflecting the increased institutional presence in the market. Against this background, therefore, it may be fitting to enhance the 4% model with a monetary filter. Our purpose is to step outside the domain of price as a contributory variable and seek out the determinants of price. We want to capture some of the forces that create and sustain stock trends, not simply monitor those trends.

Here again we fall on the work of Ned Davis, a pioneer in the development of systematic timing methods. The present focus is an imaginative monetary indicator, the ratio of 90-day Treasury bill rates to the S&P 500 dividend yield. The data can be found in *Barron's*. When the ratio is high, it means that Treasury bills enjoy a clear yield advantage over stocks. Investors have an incentive to liquidate shares and move into risk-free liquid assets. Conversely, when the T-bill ratio is low, stocks gain a competitive advantage over cash. Investors seeking higher returns have new incentives to enter the stock market.

Our task is to combine the monetary filter with the 4% swing method. The personal computer is ideally suited to determining which signal combinations work best, but it is here that the risk of curve-fitting is greatest. A systematic optimization of multiple indicators can lead to highly misleading results. The model may be so contrived it can only predict the past. To counter the hazard of curve-fitting, we again rely on out-of-sample testing.

Initially, we test over a limited portion of the data. In this case, our base sample is the period covering 1961 to 1984. If results prove positive, we apply the same signals to 1985 to 1993. Our hope is that profitability holds up in the out-of-sample period; if so, this does not guarantee future performance. But strong out-of-sample gains would underscore the range and depth of our new derivation.

Although a number of findings emerged from initial testing, one simple point stood out: 4% buy signals worked better when the T-bill ratio was below the level of 1.80, while sell signals worked better when the T-bill ratio was above the level of 1.80. As a result of this filter, profits were measurably higher, and many of the false signals that plagued the earlier version were weeded out.

Next, we apply the same trading rules to the out-of-sample years, 1985 to 1993. Here, 4% buy signals would be valid only if the T-bill ratio was less than 1.80, while 4% sell signals would be valid only if the ratio was above 1.80. The results? Out-of-sample performance was all we might have hoped for. The enhanced model gained 278 Value Line points, compared with 221 for the original method and 94 for buy and hold. *Every* trading signal was profitable.

The power of the filter is best seen over the full range of the study, 1961 to 1993 (Figure 6). During these years, the Value Line rose by 186 points, while the original 4% model gained 626 points. By contrast, the filtered version gained 757 Value Line points, a significant improvement in either case. A $10,000 investment would have grown to $950,000 for a compound annual return of 15.3%. Under the original model, the same $10,000 would have grown to $610,000 for a 13.7% gain per annum. With a buy-and-hold policy, $10,000 would have grown to just $28,000, a 3.25% compound annual return.

Admittedly, such gains do not come without a penalty. The filtered version requires that two distinct entry conditions are satisfied. As a result, duly confirmed signals are quite rare. The paucity of trades sometimes makes it necessary to ride out temporary adverse price moves. The glaring example is the steep bear market of 1962.

On the other hand, the selective nature of the signals can also work in the model's favor, as can be seen in how winning percentage varies between the filtered and unfiltered models. Over the study, the original

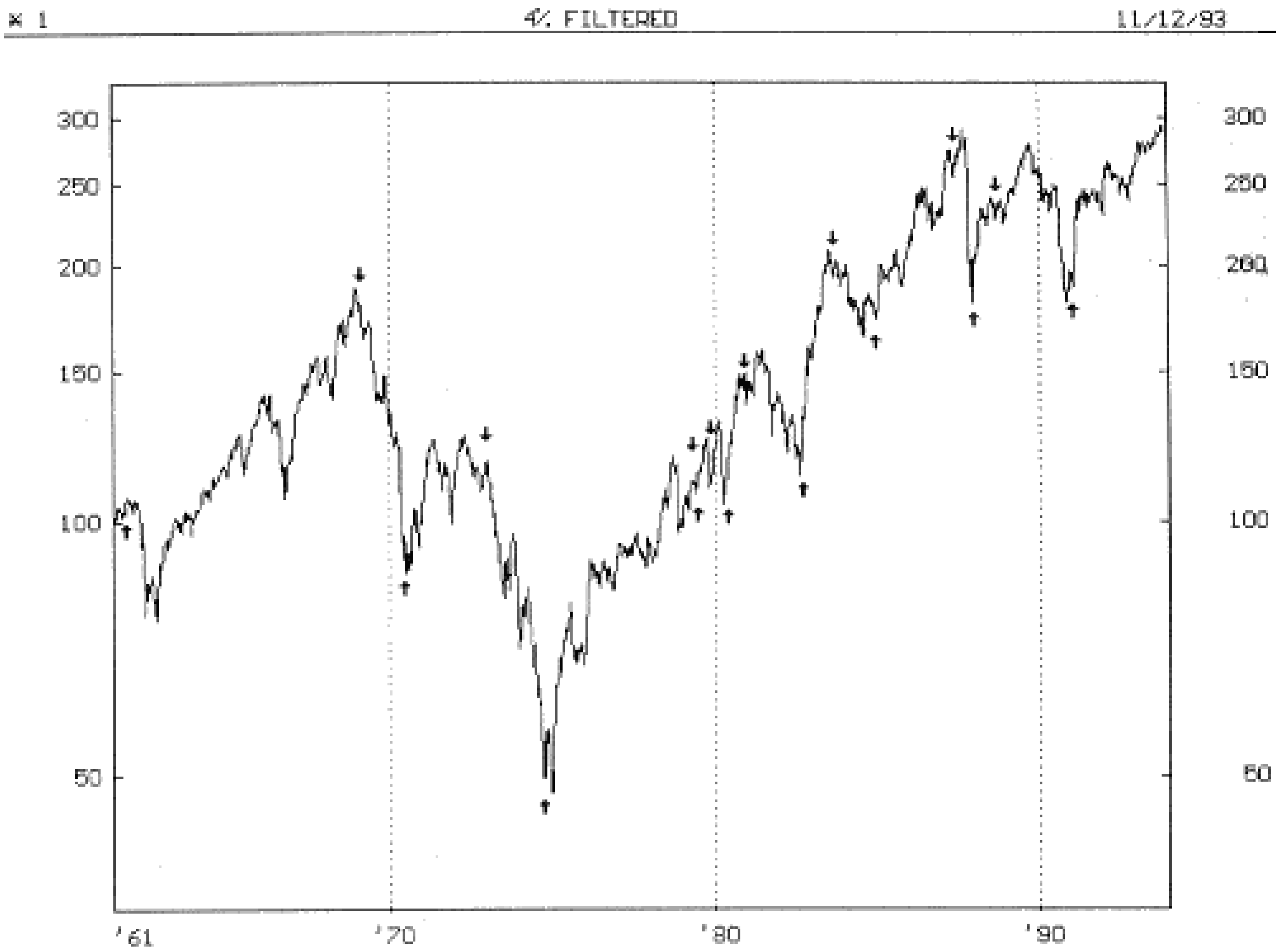

Figure 6: Filtered % Swing Model, July 1961 - November 1993. *The power of the filter is best seen over the full range of the study. The Value Line rose by 186 points, while the original 4% model gained 626 points. By contrast, the filtered version gained 757 Value Line points, a significant improvement in either case. Here, buy on 4% swing up if T-bill/dividend ratio is less than 1.80; sell on 4% swing down if T-bill ratio is greater than 1.80.*

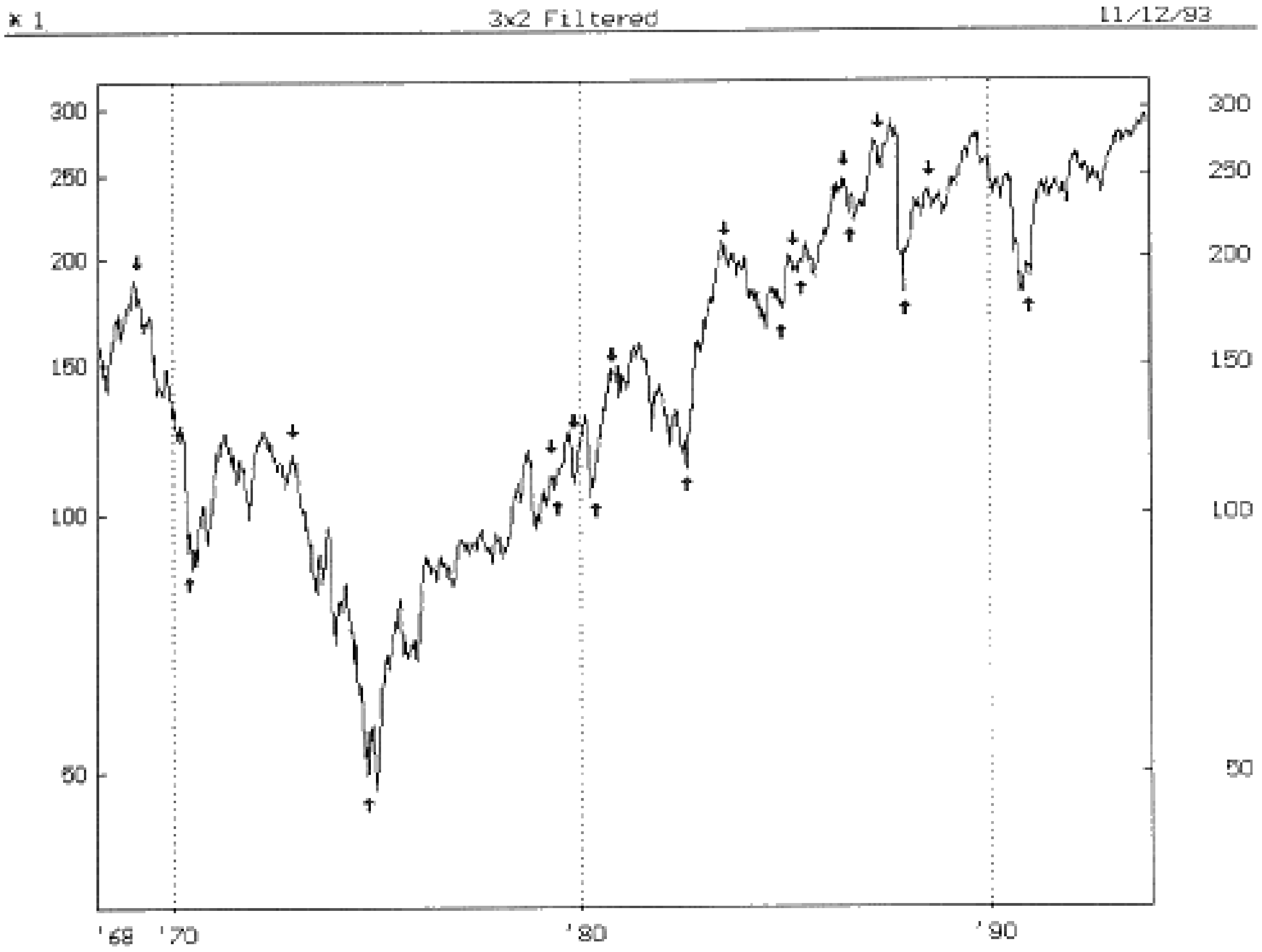

Figure 7: Filtered % Swing Model, January 1968 - November 1993. *Here, buy on 3% swing up if T-bill/dividend ratio is less than 1.80; sell on 2% swing down if T-bill ratio is greater than 1.80.*

4% model gave 147 signals, of which 60 were profitable (47%). In contrast, the filtered model produced 17 signals, of which 16 were profitable (94%). The sole loss was 0.95 Value Line points, less than 1% of the index at the time.

DATA EXERCISE

Earlier, we saw that the Value Line model is not dependent on an isolated 4% swing. Other percent swings worked just fine, and many combinations proved far more effective. What would happen if we applied our monetary filter to a variety of percent swings, much as before?

Time and space limitations preclude a comprehensive treatment of the subject here. The following should be regarded only as an exercise. The computer was allowed to range freely over the entire database, exploring a wide range of signals. Every percent swing from 2% to 8% was tested independently for long and short entries. Across a second dimension, six distinct monetary signals were blended in. Specifically, the T-bill ratio was tested in increments of 0.10, starting with 1.70 and progressing to 2.20 (Figure 7). More than 1,700 parameter sets were sampled.

If we were just starting to build our model, it would not be prudent to give the computer this much latitude, but a great deal of testing already supports the trading logic. In the context of previous findings, the exercise is instructive. One point that emerged early on is especially significant. Slight adjustments in the signals can produce surprising gains in performance.

For example, suppose you made the signals somewhat more sensitive. Instead of buying on a 4% swing up, you go long on a 3% advance. And instead of selling on a 4% swing down, you sell on a 2% swing down. The monetary filter remains exactly as it was before. Buy signals are valid only if the T-bill ratio is below 1.80, while sell signals are valid only if the ratio is above 1.80.

With these slight changes, profits climb from 757 to 840 Value Line points, an 11% improvement. A $10,000 investment would have grown to $1.3 million rather than just $950,000, working out to a compound annual return of almost 17% rather than 15%. Of 20 signals, 19 were profitable (95%). The sole loss was held to 1.2% (Figure 7).

Nor are the results unique to this particular signal mix. The computer produced literally hundreds of variants that showed similar performance. In some cases, the winning percentage might vary up or down. (Signal accuracy was shown to be 100% in 69 cases.) In other cases, the compound annual return might be higher or lower. You will find that the best percent swings are those between 2% and 6%. The best T-bill ratios are those between 1.7% and 2.0%. In the end, what the computer chiefly yielded was confidence in the underlying logic. Regardless of the precise numbers used, the percent swing method operates effectively by itself and even better with a carefully formulated filter.

Nelson Freeburg, is editor of FORMULA RESEARCH, a monthly report that develops and tests historically profitable trading systems.

ADDITIONAL READING

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The Inflation/Deflation Phases Of The Stock Market Cycle

by Martin J. Pring

Veteran analyst Martin J. Pring explains how the commonly known four-year stock market cycle actually contains lesser-known inflation/deflation phases, the knowledge of which would be very advantageous for asset allocation.

Many stock market participants are aware of the so-called four-year stock market cycle, which encompasses primary bull and bear markets. However, it is not commonly known that each cycle can be roughly divided into an inflationary phase and a deflationary phase — an important distinction for asset allocation.

In the deflationary stage, interest-sensitive and other defensive issues outperform the market, while in the inflationary stage, earnings-driven issues and inflation beneficiaries, such as natural resource producers, do well. The deflation phase begins after commodity prices peak and recessionary conditions gain the upper hand. The inflationary segment gets under way as excess economic capacity is used up, commodity prices rally and interest rates bottom out. The deflationary phase is associated with the late stages of a bear market and the early to middle part of a bull market, whereas the inflationary environment occurs late in the bull market and at the beginning of the bear phase.

Not all stocks fit into these inflationary and deflationary classifications, however, so this principle cannot be applied universally. However, knowledge of the current phase of the inflation/deflation relationship can still be useful for assessing the maturity of a bull or bear market.

IDENTIFY COMPONENTS

To identify the inflationary and deflationary components of the four-year stock market cycle, begin by constructing two indices, one from issues that tend to benefit from deflation and the other from inflation-sensitive issues. I call these the deflation and inflation group indices. The former is calculated

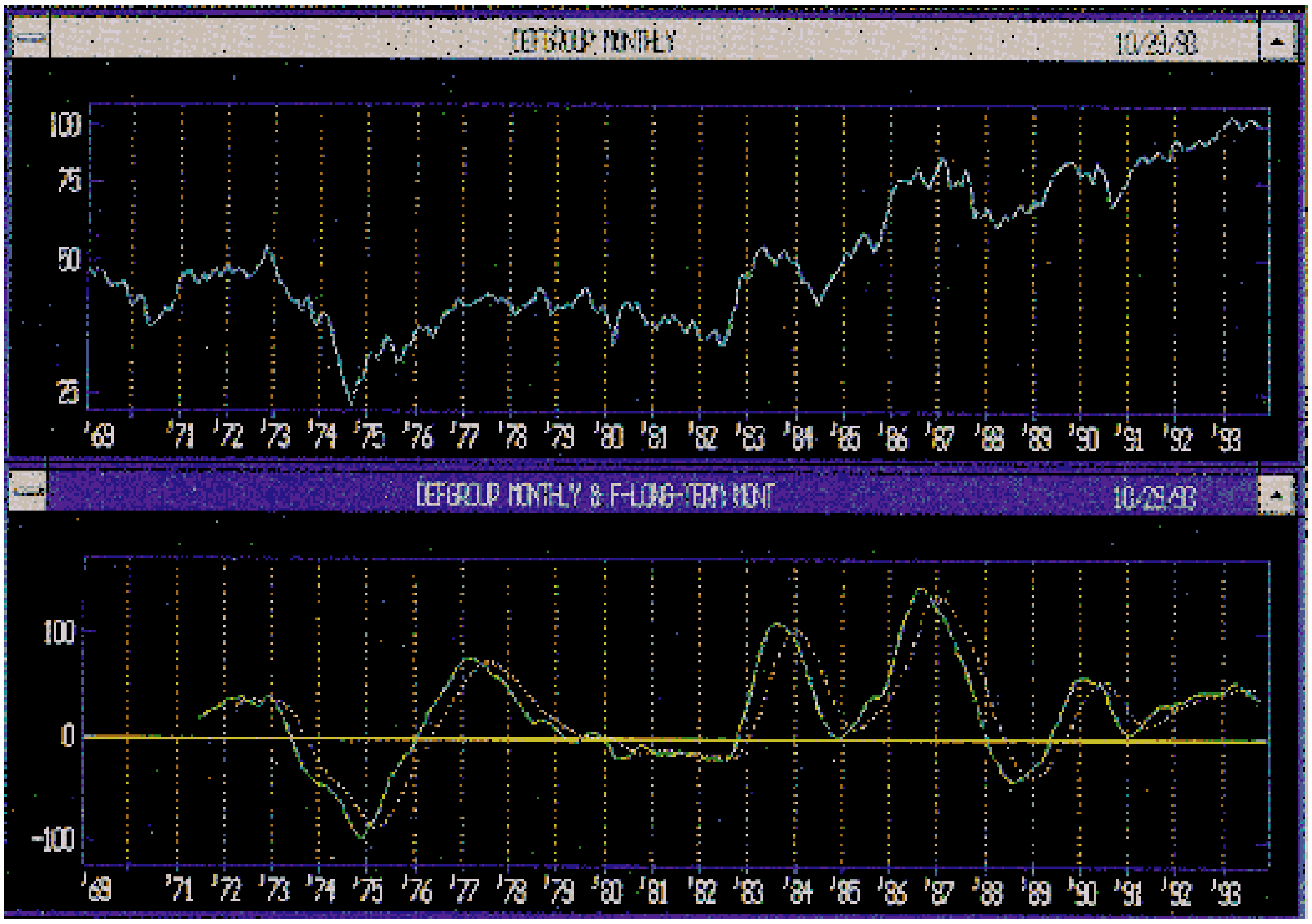

FIGURE 1: DEFLATION GROUP INDEX. *Note that the deflation series has been a stalwart performer over the last few years; the momentum indicator (KST) for the deflation index is overextended and has begun to roll over.*

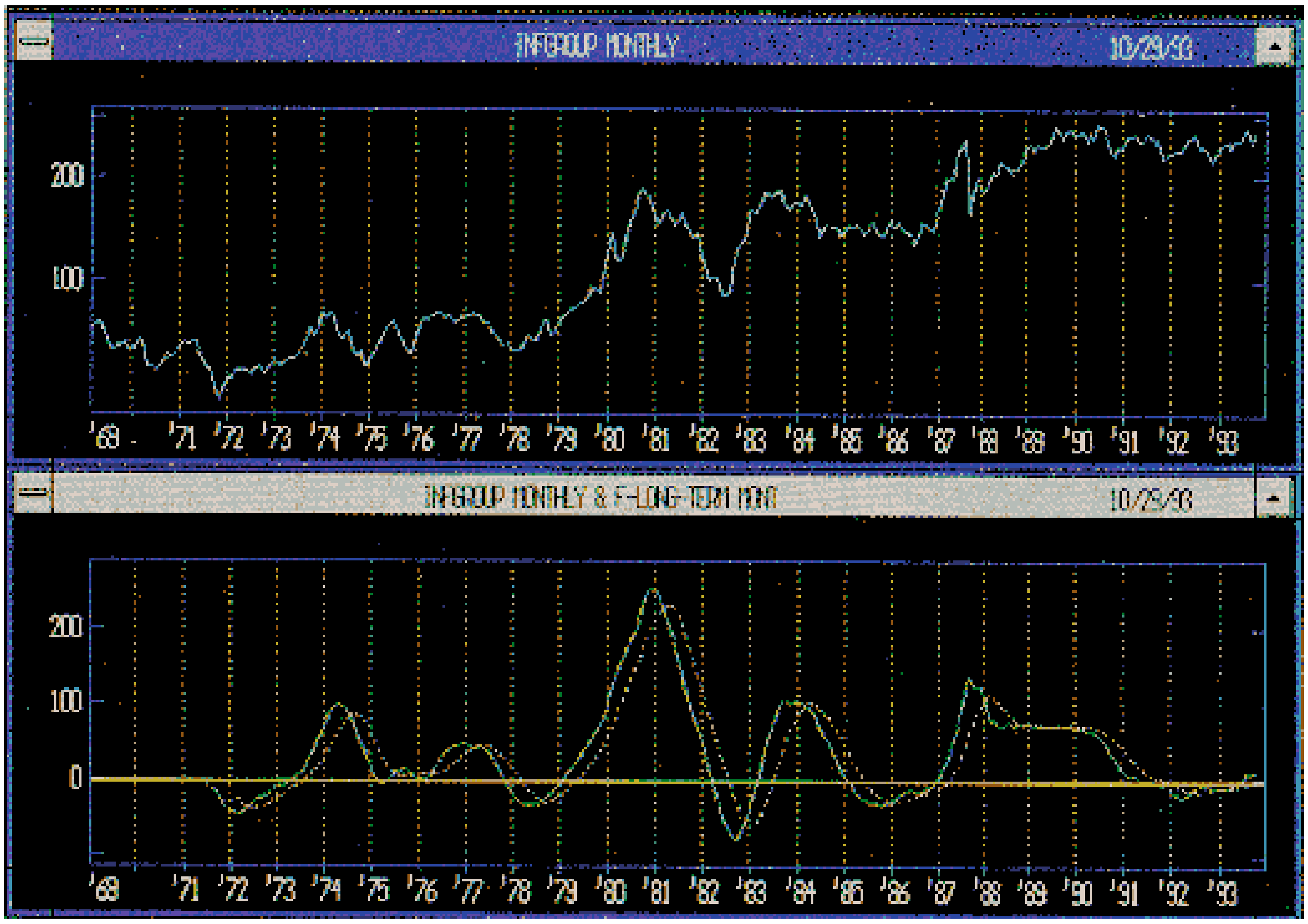

FIGURE 2: INFLATION GROUP INDEX. *The inflation group index, in contrast to the deflation counterpart, has moved sideways for the last four years. However, it now looks as though these roles are in the process of reversing. The technical position of the inflation group index is far more constructive; the KST is moderately oversold and rising.*

from an average of the following Standard & Poor's 500 groups: electric utilities, property and casualty, preferred stocks and savings & loans. The inflation series is calculated from gold, aluminum, miscellaneous metals and domestic oils. Combining a variety of issues is a better approach than taking an individual stock or group as a proxy for inflationary or deflationary forces, as they could be affected by special factors unrelated to the business cycle.

The two indices are shown in Figure 1 and 2, together with a long-term momentum indicator. Note that the deflation series has been a stalwart performer over the last few years, whereas its inflation counterpart has moved sideways. However, it now looks as though these roles are in the process of reversing. The momentum indicator (KST) for the deflation index is overextended and has begun to roll over, whereas the technical position of the inflation group index is far more constructive; the KST is moderately oversold and rising.

The most useful aspect of this relationship arises when the two series are expressed as a ratio (Figure 3). A rising line is bullish for inflation-sensitive stocks relative to deflation-sensitive ones and bearish for inflation-sensitive stocks. Remember, in a bull market, both series could be rising, as they were in late 1982; in a bear market, each could be falling, as in late 1974. The ratio makes it possible to identify the broad cyclical swings between inflationary and deflationary forces, as reflected in market activity. No indicator works perfectly, but the current indication from the long-term KST is that the inflationary part of the current stock market cycle has begun.

The deflationary phase is associated with the late stages of a bear market and the early to middle part of a bull market, whereas the inflationary environment occurs late in the bull market and the beginning of the bear phase.

INFLATIONARY IMPLICATIONS

The beginning of an inflationary phase carries two implications. First, investors should weight their portfolios toward issues that benefit from inflation; second, investors should consider that the stock cycle has reached a more mature phase. In this respect, Figure 4 shows the inflation/deflation ratio together with the S&P composite index. The arrows show that the troughs in this indicator preceded peaks in the S&P. While the lead times vary, it is quite evident that once the ratio has bottomed, the clock starts to tick for the equity bull market. In most instances, a bottoming in the ratio signals that the stock market environment has become far more selective because most interest-sensitive issues have already peaked or are in the process of doing so.

Reversals in the long-term KST offer confirming evidence of cyclic lows in the ratio. Sometimes, confirming signals from the KST occur well after the fact and are of little timing use. But in the current situation, the KST has been quite timely, as it reversed fairly close to the final low in the ratio.

This analysis can be taken one step further. If we assume that stock market participants correctly assess this inflation/deflation relationship, then rallies in the ratio should be associated with rising bond yields and commodity prices and vice versa. Figure 5, which displays all three series, shows that this is true in a broad sense, because a good correlation can be seen between the inflation/deflation ratio and bond yields.

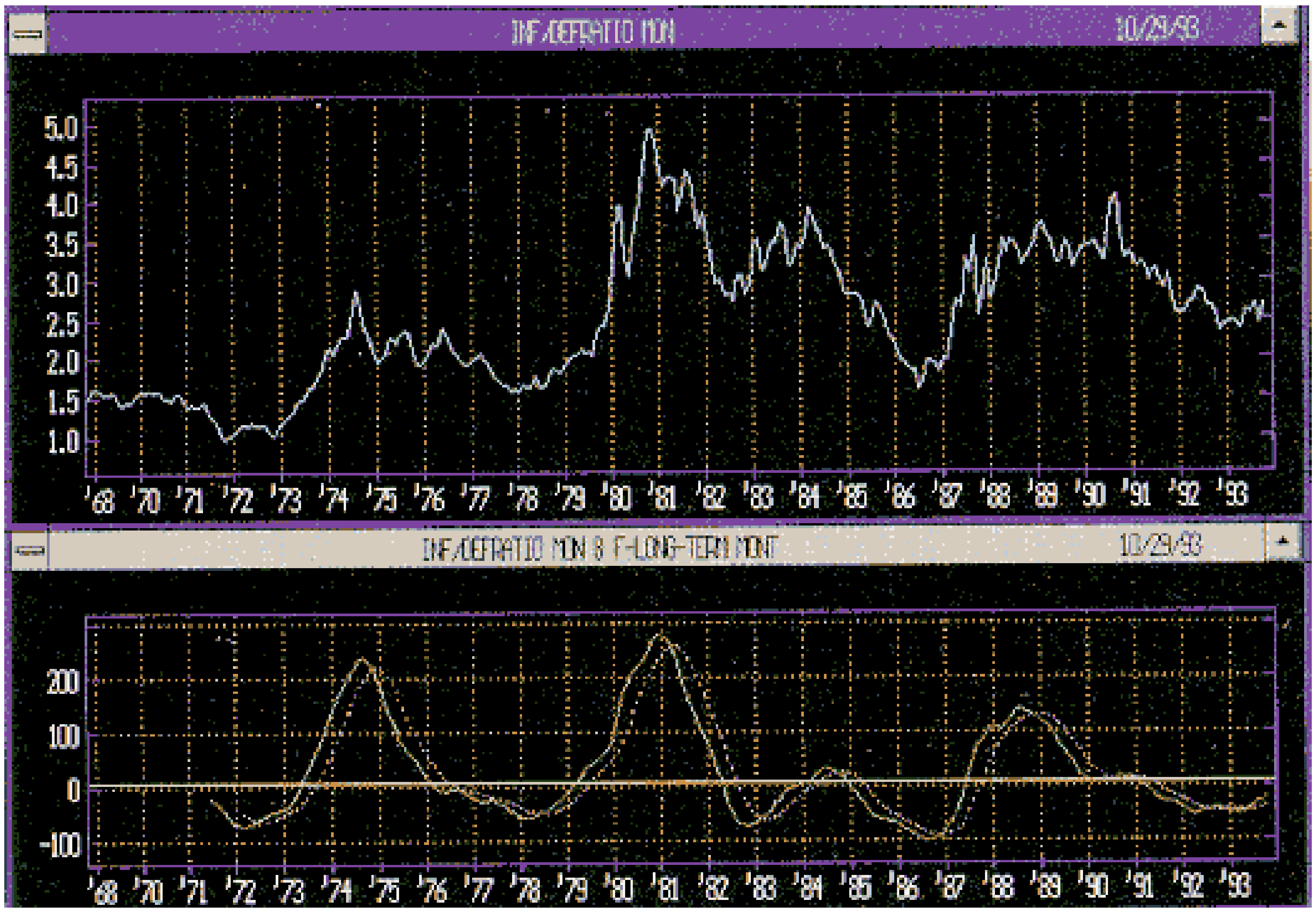

FIGURE 3: INFLATION/DEFLATION RATIO. *The two indices are expressed as a ratio. A rising line is bullish for inflation-sensitive stocks relative to deflation-sensitive ones and bearish for inflation-sensitive stocks. The ratio makes it possible to identify the broad cyclical swings between inflationary and deflationary forces, as reflected in market activity.*

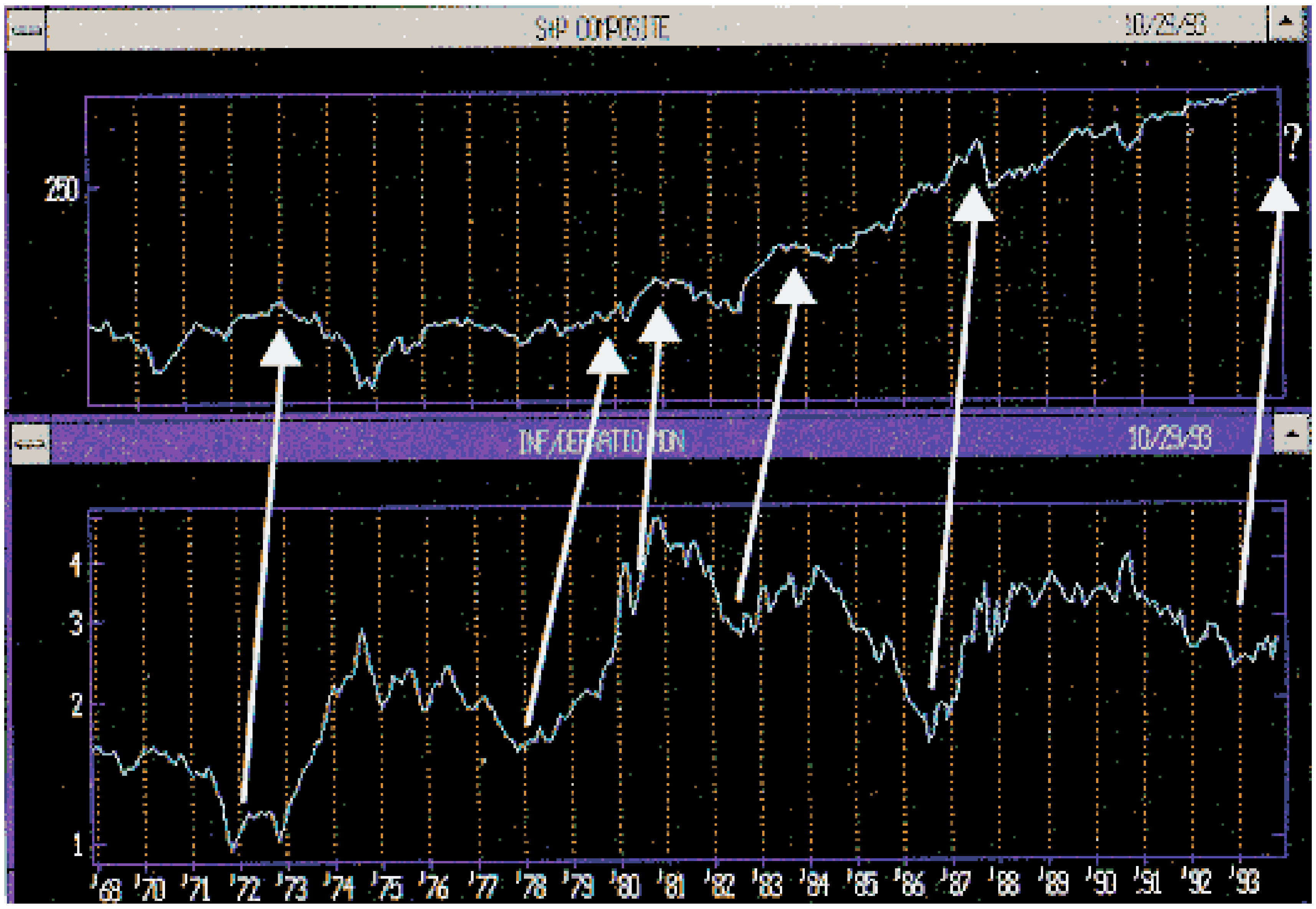

FIGURE 4: S&P COMPOSITE VS. INFLATION/DEFLATION RATIO. *Here is the inflation/deflation ratio together with the S&P composite index. The arrows show that the bottoms in this indicator preceded peaks in the S&P. In most instances, a bottoming in the ratio signals that the stock market environment has become far more selective because most interest-sensitive issues have already peaked or are in the process of doing so.*

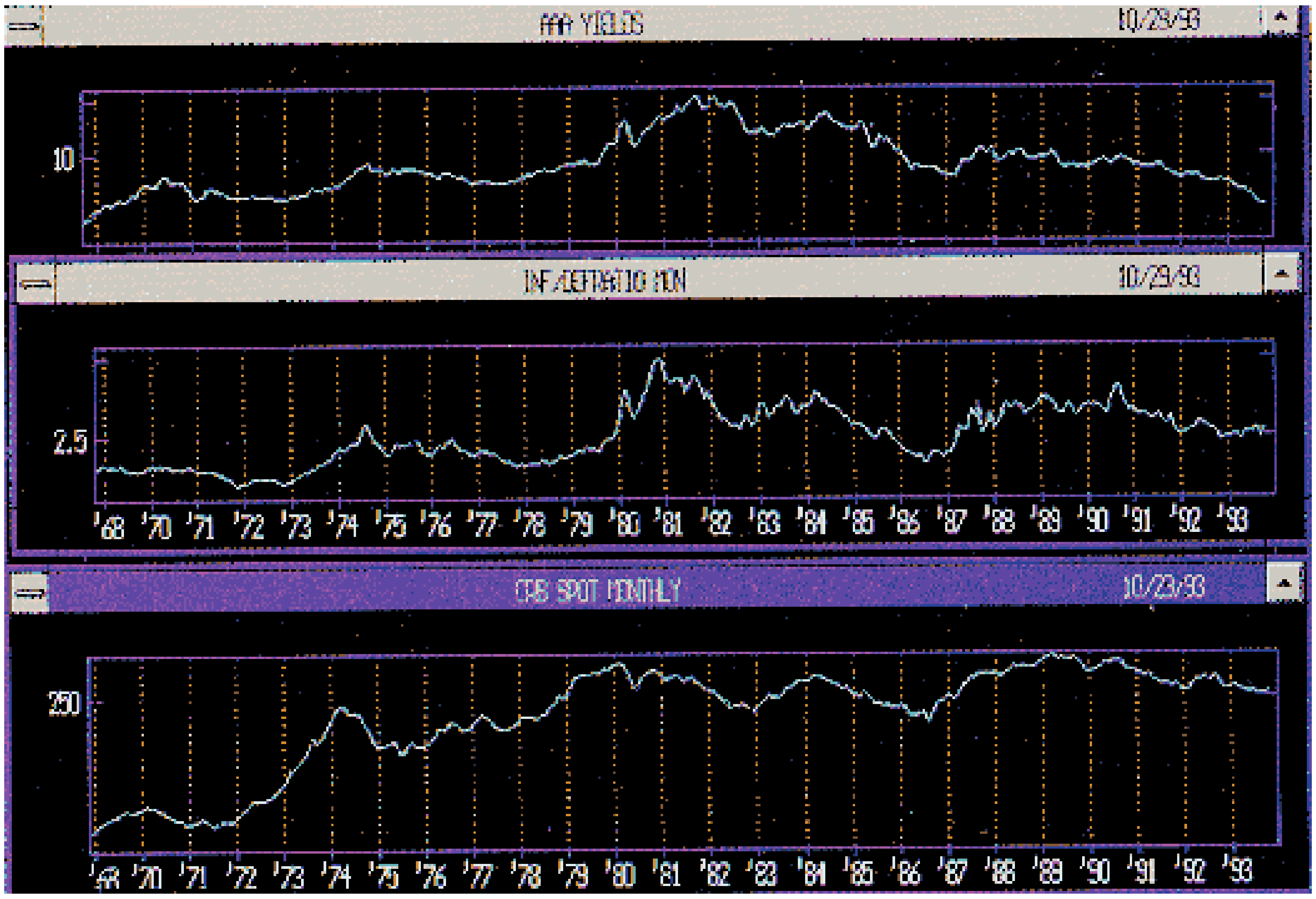

FIGURE 5: INFLATION/DEFLATION RATIO COMPARED WITH BOND YIELDS. *A good correlation can be seen between the inflation/deflation ratio and bond yields.*

STAYING ON TRACK

The concept of dividing the stock cycle into inflationary and deflationary parts is far from perfect. Nevertheless, it does represent a good starting point for assessing the current phase of the stock market cycle. The problem for most traders and investors is that these trend changes take time to materialize, and substantial patience and discipline are required to follow these changes through. Most of us find it easy to recognize a signal as it is given but find it more difficult to maintain our focus on the trend as it develops. All too often, we get blown off course by the latest news or rumors and miss out on the really big moves. Continual review of long-term charts, such as those shown here, can often help us not be unduly influenced by misleading actions and words of those around us by concentrating on those factors that have proved to be correct in the past.

Martin Pring is the author of a number of books, publishes "The Pring Market Review" and is a principal of the investment counseling firm Pring-Turner Capital Group.

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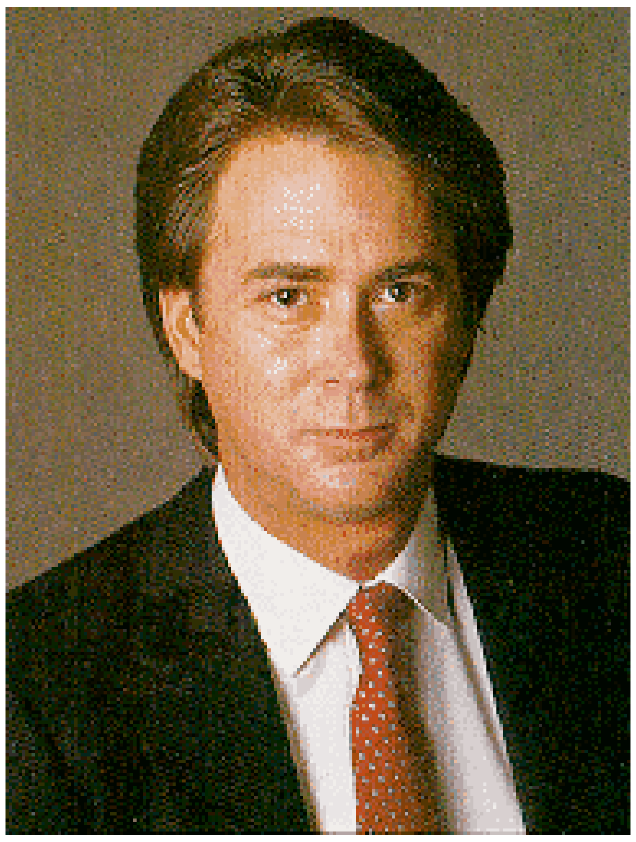
Neuro-Linguistic Programmer Charles Faulkner



I've been involved in NLP since 1981. I got into Neuro-Linguistic Programming because I was interested in modeling - specifically, modeling human excellence. That's what interested me most. I wanted to understand the structure of excellence and how you could transfer it from one person to another.
–Charles Faulkner

Whether you interpret the acronym NLP as Neuro-Linguistic Programming or natural learning process, the cognitive process of trading is what Charles Faulkner, of Chicago-based Mental Edge Trading Associates and a certified Neuro-Linguistic Programming trainer, studies. One aspect of Neuro-Linguistic Programming is a technique for overcoming mental impediments to success. A trader himself, Faulkner has studied successful traders extensively. By modeling the mindsets of successful traders, Faulkner seeks to help other traders follow those same successful patterns and help them manage their emotional states when trading. Faulkner, whom STOCKS & COMMODITIES *Editor Thom Hartle interviewed via telephone on November 24, 1993, shares his insights on applying successful trading skills.*

How did you get started with NLP and trading?

When I was in college, I was part of an independent research team trying to discover if there was any relationship between language and beliefs. We were making some headway in the study by having the volunteers ask particular questions of the callers to a crisis line.

And this was early preparation for Neuro-Linguistic programming?

Yes. Several years later, when someone dropped an early NLP book into my lap, I already knew what they were on to! I had been doing research independently with other people in the same area, the difference being that we knew something was there but we couldn't crack the code. Richard Bandler and John Grinder, on the other hand, had. I dropped what I was doing and went deeply into NLP training. That was 1981 and I've been involved ever since.

What was it specifically that drew you toward the study of Neuro-Linguistic Programming?

I got into NLP because I was interested in modeling — specifically, modeling human excellence. That's what interested me most. I wanted to understand the structure of excellence and how you could transfer it from one person to another.

Where did you go from there?

Before 1987, initially because it was convenient, I modeled accelerated language learning and intercultural communication. Later, I had the opportunity to model three kinds of physicians' decision strategy.

In 1987, I was approached by a young U.S. Treasury bond floor trader who questioned whether this kind of modeling could be applied to traders. At the time, he was working with Peter Steidlmayer, who had just founded the Market Logic School. The trader, my then business partner and I put together a proposal for Steidlmayer, but it was turned down. This trader was still interested enough to provide funding, and we did additional research of other successful traders.

What did this research lead to?

We put together a model of what these traders were doing, primarily on the emotional side of trading — that is, how they managed their emotional state. Since then, I've expanded that to include more work about what it is that successful traders look at in the markets. I've also studied what we might call the market behavior or the market indicators and, as I became more aware that trading success wasn't merely about having strategies, I studied the internal strategies and included things like trade size, money management, bet size and probability theory. The model was expanded further to include the kinds of beliefs that traders hold and how to recognize and change those beliefs.

Let's talk about beliefs and trading. How do beliefs affect traders?

There are three kinds of beliefs that are very important for successful traders. You have to believe you can succeed. First, great traders are confident about their trades before they go into them. I discovered that this was really more of a trading strategy than just raw confidence. As they would step into trades, they would imagine they had already taken them and, seeing them from the inside, would say, “Yes, this is a good trade to be in.”

Is it really that simple?

The ideas of beliefs, in fact, are much more complex than people had thought previously. Let's start with historical beliefs, which can be what you believe about yourself or what you believe you are capable of. Many people have beliefs about not bettering the success of their parents. They may not realize they have them, but these beliefs can inhibit them when they get close to doing better than their parents did, when they can afford things their parents couldn't afford.

What's another?

Another belief is the idea that somehow money is impure. What does it say about them as people the more money they earn? What's interesting about a belief is it's something you can't prove or disprove. Such a belief is tenacious. Are you a good person? How can you really prove or disprove that?

Are there other types of beliefs?

There is a whole other set of beliefs that are perceptual. One of the things that interests me is that most people have a couple of different biases. For instance, people have a bias toward the market going up or the market going down. It's interesting to take a chart, turn it upside down, and ask the trader, “How does it look now?” It's the same information, and yet many people have a bias, a belief that it's better to trade markets going up than going down. Then there's the whole idea of probability theory, of knowing what the probabilities of certain things are as opposed to what you intuit might be happening.

What would be an example of that?

An example I used when I spoke with Jack Schwager was regression to the mean. People think when their trading goes well, the trading system works, and when it doesn't, the system doesn't work. Yet by the principle of regression to the mean, any outstanding performance is going to be followed on probabilistic average, with a much less outstanding performance. The trader looks at that and says, “Wow, I was really on top last quarter, but now I'm not doing very well,” when in fact they're doing just fine. Having this knowledge is really helpful.

That's an interesting example. Do you have another way to reveal counterproductive beliefs?

Beliefs are very available to change, and yet no one really takes the time to deal with that. Look at the belief that gets reinforced after losing and winning trades. This is one of the most important beliefs, because it'll determine whether you do the next trade and whether you'll develop as a trader. How do you explain your success or lack of success in your previous trade?

How?

Take a look at some examples of these reasons, excuses or beliefs that people offer. Reasons like “Because I got a bad feeling, I didn't follow my plan.” These statements are, in fact, beliefs. They reveal how the person interprets their experience.

Intresting. Can you expand on that?

This comes from Martin Seligman, who wrote a book called Learned Optimism. His original work was in learned helplessness. He discovered that how people explain things to themselves that would have them lean toward pessimism or optimism. You can hear it in their language; if it was a permanent state, in statements like: “It's all over, I'm always on the wrong side. I'm stupid.” Or if it were pervasive, in statements like, “I can't trade,” or personal, in statements like, “Well, I'm just lazy.” These kinds of belief statements were highly predictive of a person's future success or failure across a number of areas, whether politics or baseball, or success in a career. In this case, failure.

What do you have traders do to alter these beliefs?

Think of a trade that went badly and write down what reason you gave yourself for it happening that way. Productive beliefs have the form of temporary reason, such as “That time it didn't work” or a specific reason, like “This market would be easier if I could take a larger position,” or “My system isn't calling this market.” I also look for an external reason people would give so that they become, in a sense, less responsible for the specific action. In that way, instead of being an example of their whole trading career, it becomes just a specific trade at a specific time. In fact, that's the truth of the matter, but that's not what people very often perceive it as.

What else can traders focus on besides beliefs that will help them reach their goals?

My model of a successful trader has five elements. First and second, the model has a market indicator and a trading strategy that not only controls the actual decision making but also the money management, the probability and the bet size. Market indicators and trading strategies are the first two elements. The third element is to have beliefs, historical beliefs, perceptual beliefs, interpretive beliefs, not only about the markets but one's own ability, and even about money, as we'll discover. The fourth element is the mindsets or metaphors that hold together the beliefs, values and goals. The fifth and final element is managing your emotional state.

What do you mean by metaphors?

People have unconscious metaphors in their language, which almost everyone can hear if they listen. People say things like, “The market took a chunk out of me,” or “I really got beaten up today,” or something like that. These aren't colorful turns of phrase but actually describe the kinds of beliefs, values and mindsets that that the person has. I began to model which of those metaphors are useful in which kind of trading situations.

What would be some examples that are useful?

I began to chart all of these different types of metaphors and found that a number of them recurred. For instance, “wild animal” came up a lot. So did the metaphors of “war” and “games,” “puzzles” and “problems.” Also, referring to the market as a person, like, “she made me do something today,” or referring to the market as a machine or a business. As I looked at those, I found that while they were used a great deal by traders just starting out in the business, the further the successful trader got in terms of successes, the fewer of these types of metaphors I heard.

Then what did you find?

A lot of the floor traders I met used the “wild animal” and the “war” metaphors. Some would use the “game” metaphor. When you're in that kind of position, if you think of the market as being a wild animal, then what are you going to value? You're going to value having quick reflexes and able to react. In general, that's a good skill for a floor trader.

What about for off-the-floor traders?

A position trader has a different mindset. One floor trader who was very successful used the game metaphor. You yourself, in your Opening Position (on page 6 of any issue of STOCKS & COMMODITIES), often refer to trading as a game. Of course, the object of a game is to win and not to lose, which is very different from not getting eaten, as in the wild animal metaphor. If you've got it in your head that it's a game, then you're going to come back and play another day. If you believe that it's a game, then you're going to start to think strategically about how you can learn the skills of this particular game.

What other metaphors work?

Another way of thinking about the markets that's quite successful is thinking of the market as a puzzle. In that metaphor, you want to figure out how this all fits together, you're looking for the pattern of the market; what you're doing is solving the puzzle that is the mind of the market. Now, this is a really good one for someone who's not having to respond to the moment. An off-the-floor position trader would find that kind of metaphor very useful.

Was there any one metaphor that was on the top of the list?

It shifts depending on the kind of trading you're in. For the floor trader or discretionary trader, “game” is useful, for instance. Every one of the really successful traders referred to trading at least part of the time as a business; that is, they are there to win, yes, or to solve the puzzle, yes, and to make profits and avoid losses. They begin managing their activities for profit as opposed to for fun or excitement.

In your model of the successful trader, is there one element that is most important, or is there an even balance?

What I want to do is have people see exactly what's important in trading successfully. There's a synergy that's created among all of the elements that make up the successful trades and traders. When you look at these five areas individually, the relative importance of each to a regular trader, to what we call a “supertrader,” to systems sellers and to advertisers, is substantially different. From what I see, most of the effort has gone into studying market indicators and trading strategies, mostly market indicators but more and more is going into trading strategies.

What else?

Traders are beginning to focus on the importance of bet size, that you can have something that gives you strong market indicators, and yet, if you don't know how to bet the percentage on those indicators, you can actually lose money. So there's been an evolution in what's important in trading.

You use Neuro-Linguistic Programming for this. Could you explain NLP?

NLP is defined as the study of the structure of subjective experience, or to put it in English, it's the study of natural learning processes. The point is to study how people do what they do in their mind. The concept really comes through in contrasting those traders who are very successful and those who would like to be.

For instance?

For instance, take the word confidence. Very often, you'll read or hear that someone who's an exceptional trader is confident. As I talked to these traders personally, it wasn't so much confidence in themselves as confidence in what they observed or confidence in their ability to discover and exploit something they saw in the market. An example would be a floor trader, who knows the odds in the market. So he has very high confidence, not as in “I'm Supertrader,” but rather in the knowledge on which the trade is taken.

That situation may be based on intuition to some extent. For some of these traders or others, they've actually gone in and tested the data or method for probabilities. Is there a difference in that confidence?

There's the whole range of behavior. The more I look, the more I find that their confidence is based on very careful examination of the data and methods or strategy. Another form of confidence is consistency. A lot of younger traders look at consistency in profits and look for a consistent rise in profits, whereas the people I looked at who really succeed are looking for consistency in their approach.

Their ability to effectively implement their methods?

Yes. Whether a trader states that it's 25% of his or her trades that are winning trades or a trader says he makes all of his money from 5% of his trades, then it's not about making consistent profits off of each trade but rather the consistency to follow their approaches — which leads us right into the word discipline.

How do you view discipline?

Discipline, I've found, is something that young traders think they have to strain themselves to do, whereas among experienced people who are really successful, discipline is simply doing what you have to do. If you're not going to do that, you're not going to be a trader. There's a crucial difference in thinking between the less experienced traders, who want to totally eliminate losses, and the experienced traders, who know they will always need to take small losses.

What other differences do you see between young and older traders?

Most younger traders focus on whether their market indicators are giving them winning trades. If they wind up with losing trades, many traders talk about not taking the loss personally. On the other hand, experienced traders understand that whether a given market indicator is right some percentage of the time is practically irrelevant compared with having probability theory worked into their trading strategy. The experienced traders understand that they're playing probabilities.

That gets to the problem of taking a trading model and trying to determine whether a given model is one that can actually be implemented. How do you discover that without losing all your money first?

Obviously, you need to do backtesting on your market indicators and your model trading strategy. Then you begin by quantifying the mental side of trading. That's where the idea of the mindset underlying your trading is very important. Then there's the question of whether your trading system is matched to your information processing style. Without these taken care of, deliberately or not, your money is as good as lost.

What are some steps traders can take to get into a better frame of mind to view the market and deal with it to meet their goals?

First, notice how you currently think about it. In NLP, we know the brain thinks in specific terms. For example, if I said, “Think of a dog,” what comes into your mind? A specific dog or kind of dog comes to mind. It isn't just a generic dog; it's a specific kind of dog. In the same sense, if I say, “Think of a market,” even though all the markets can be charted in very similar ways, you'll see a specific market in your mind's eye.

I see your point. So what's the next step?

If you think about how “the market took a chunk out of me” or “the markets beat me up today,” the next step would be to look into your mind's eye and find out how that's represented — what kind of mental picture do you get? It may not be something that's immediately available to the conscious mind. This is what NLP means by *unconscious*; we don't mean that certain something lurking at the bottom of your brain stem. But it's something you hadn't thought about. It's like you know the color of your car, but you don't need to know it, until you go look for it in the parking lot. So until you *need* it the knowledge is unconscious. These ideas are there in the mind and you can even see them from time to time, but you hadn't thought about them.

What do you do then?

When you have the mental picture in your mind: a dog, a battlefield, a roulette table, whatever it is for you, think of the implications. What actions does it imply? What kind of a trader would do well with it? Everything in the mind is a resource of a certain situation. The question becomes, are you finding it a resource in this situation? If not, what *would* be a resource? Here's where it's useful to know some of the metaphors and the mindsets of very successful traders. For instance, “game” is a much more successful and proactive kind of metaphor to have in the mind. Or think of it as a puzzle or problem solving.

This could also tie into your beliefs.

Absolutely. Have those in mind, then think, “What kind of a person am I when I win?” This is where self-examination is useful. A proactive person likes to go after things and do things. Or do they like more to respond to things, which is more reactive? Proactive obviously is going to go with “games,” and reactive is more likely to be drawn to the idea of puzzles and problem-solving. Knowing that, you can do what sounds too simple initially, but you can send an image of games or puzzles into the current image in your mind's eye, along with what you would like it to become. Then you can let it come back to you as a more developed idea. In other words, it's more like fast-forwarding a movie in your mind and letting time and imagination change that image in your mind to one that's more beneficial. That's the mind-side of it.

How about more external methods?

Say you wanted to reinforce a particular idea — that is, that the market is more of a game, more of a puzzle, more of a business. If the trader has difficulty with taking a loss, then he or she obviously haven't got either the probabilities of it or that it is in fact a game. These traders would do well to get themselves into some low-risk betting situation they could get into regularly, like playing poker or blackjack. They really need to experience the idea that losing is part of the game.

How about the business metaphor?

To think of trading as business, the thing to do would be to keep accounts daily. You need to think about it and sit down and do those things that make a business a business. Then on both sides, the behavior and the ideas can meet.

These solutions all require a person to be able to identify areas of strengths and areas for development.

Yes. There's something that very successful traders agree on. How does one know oneself? The NLP approach and my “living metaphor” approach are a much more solid way of doing that, since there's no guesswork; you can see and hear them everyday. The metaphors are one side of the equation, while what NLP calls representational systems, or sensory systems, is the other. That is, how much of the world does the person take in visually and how much do they take in through words? How much is feeling or instinctive? This becomes significant in terms of the trader's strategy in that each of us, by background and experience, begin to rely on one of these sensory systems than others for getting along in the world and learning and making decisions.

How do traders differ from one another?

Traders with a more visual orientation on being given directions to, say, a party would prefer to get a map than just a list of instructions. On the other hand, traders who are more auditory oriented would want a list of streets and turns to get wherever it was they were going.

Is that all, or are there more choices?

Other traders might be more feeling oriented. They get feelings about the markets. They might not be able to describe where these came from. These three ways of processing information have very strong implications for the kind of market indicator that might be most successful for a given person. Traders are currently asking what kind of trading strategy would fit with his or her personality. Another way of thinking about this is determining the preferred way of processing information.

How about some examples?

A trader who is more visually oriented is going to be much more receptive to pattern recognition. They're going to see the relationship along different things. Pattern recognition is something that happens instantly; you either see it or you don't. You might take months learning it in some way, but it's the kind of thing where you put a template over a scene and develop an idea.

An auditory-oriented trader's approach would be different in that it would be rule-based. Auditory-oriented traders want actual rules that they can write down that will indicate what to do in what situations. These would be like expert systems, with their if-then rules.

How would this affect the indicators a trader would select or should select?

First, self knowledge of your information processing style is important. Are you more visual, auditory or instinct oriented? Do you prefer a map or a list or do you just get a feeling? How many times or how much time must pass before a market indicator makes sense to you, before you begin to respond to it? This is your *convincer strategy*, how you know you're convinced. In our culture, typically three times is a charm; when someone sees a pattern three times, it's a pattern. Whereas in some other cultures, they have to see it over a certain length of time.

Is that* always *true?

With some people, if they see something once, it's a pattern. If someone had that convincer, they need to develop another way to decide. More important, some people are never convinced, so they keep looking for an indicator, but they never find one that's exactly right, only almost. They need to realize that they're never going to be convinced, so they might as well act.

How about the idea that trading's not for everyone?

I don't get any thanks from people for helping them out of this business, and sometimes they just are not of the mind that really fits in with the markets and this type of work. If they insist this is really what they want to do, then being a trader is very similar to wanting to be an actor in this generation. If there's anything else you'd rather do, go do it. If you have to do it, you've come to the right place. It's interesting that when I got into this, I had the NLP mindset of wanting to figure this thing out and really working hard that way. Then I began to find out how hard these people were working.

Like trading.

In the markets, I've found some of the hardest-working people I've ever met. So when I talk to people wanting to get into this business and make a lot of money, and have a lot of time to hang out, it's just not real. This is not the kind of people I see succeeding. I see exceedingly bright people who are dedicated, passionate, obsessed about bringing out the best in themselves and in what they do in the markets.

It takes commitment.

There is a strong relationship between how the trader thinks about money and his or her success as a trader. You can't think about the money. The people who are attracted to this are attracted to the idea of winning the game. As Paul Tudor Jones said, “The market is a game and money is how we keep score.”

Or they want to solve the puzzle.

Right. The money is a way of measuring the score after the fact; it's not the actual thing. To say that money is not important would be ludicrous; of course it's important. I think of it as being to similar people who go into sports or the arts and how they deal with the ensuing fame. Some people, of course, want to go into them to be famous. The people who do exceedingly well in the markets would be doing this whether there was a lot of money in it or not. It's the way they live.

Thanks for your time, Charles.

You're welcome.

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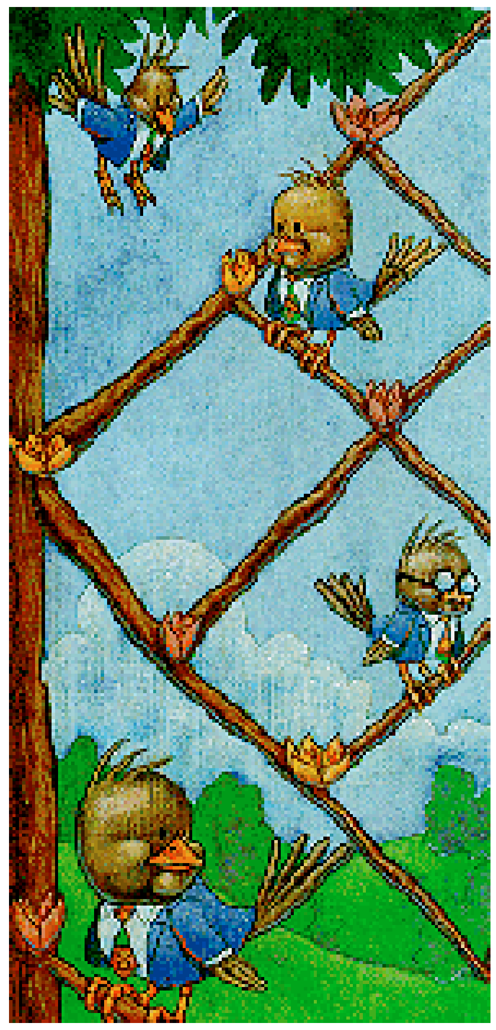
Lattice Trees

by Tushar S. Chande, Ph.D.



The lattice approach to option pricing is used to build a tree, so to speak, of futures prices. The price tree can be recomputed intraday to update the expected price range. These dynamic trees can be used for risk control via price simulations and can also be used for trading. STOCKS & COMMODITIES contributor Tushar S. Chande applies the various uses of lattice (or dynamic) trees to estimate prices for the Standard & Poor's 500.

Option prices can be calculated by any number of sophisticated mathematical models. All such models make certain assumptions about the underlying security's price behavior, and these models must also price the underlying stock before pricing the option. Thus, we can use these models to find price estimates that may be useful for trading.

A price index can be treated as a stock that pays dividends continuously. Therefore, options on stock indices and stock index futures can be priced using these assumptions. Mathematical models that price options on futures must first calculate the futures price. We will examine one such model to estimate prices for the Standard & Poor's 500 futures contract and then discuss how this approach can be used for trading and risk control.

LATTICE MODELS

The lattice approach to valuing derivative securities was suggested by Cox, Ross and Rubinstein. I will follow the discussion of their ideas in John Hull's work.

The binomial model of stock price movement assumes that over a short interval, the prices can go up to *Su* with a probability *p*. Or they can go down to *Sd* with a probability (1-*p*). The values of *p*, *u* and *d* are found from the underlying model of stock price behavior. A futures contract is treated as though it were a stock that paid dividends continuously. (See Hull's work for a detailed discussion of the model and calculations.) I will summarize the equations for *p*, *u* and *d* for a futures contract:

$$p = (a - d)/(u - d)$$

$$u = e^{\left(\sigma\sqrt{\Delta t}\right)}$$

$$d = e^{\left(-\sigma\sqrt{\Delta t}\right)}$$

$$a = 1$$

Here,

$$e = 2.718281828$$

the quantity σ is the annual volatility in percentages. The risk-free interest rate is r% per annum. The time interval is *t* expressed in years.

The annual volatility has the biggest influence on computed values for a given time interval; the risk-free interest rate has relatively little effect. Increasing the time slice for a given volatility and interest rate increases the range of estimated values. However, the time effect is only as the square root of its values. Increasing volatility for a given time slice and interest rate also increases the range of estimated values.

THE PRICE TREE

Now, assume a starting price *S*. The binomial price model says that the prices at the end of the first time interval can be *Su* or *Sd*. At the end of the second time interval, the prices can rise to Su^2 or decrease to *S*. The lower price can rise to *S* or fall to Sd^2. The price tree can be written as seen in Figure 1:

The time intervals can be adjusted to suit your trading horizon. The tree shows the possible range of values that the underlying security can reach. You can examine the sequence of outcomes by hopping from node to node of the tree.

"In the hierarchy of sellouts, where do you fit?"

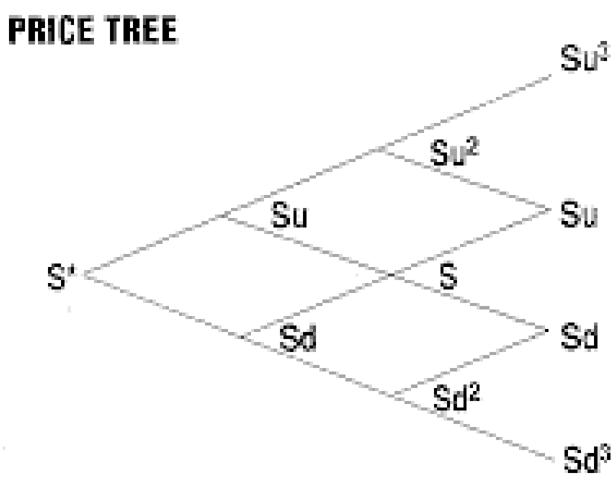


FIGURE 1: *Here's a binomial price model, which says that the prices at the end of the first time interval can be Su or Sd.*

	A	B	C	D	E	F	G	H
1	Start Value	462.5		Date: 09/16/93				
2	Volatility	0.1						
3	Interest %	0.04		SP Z3 Tree				
4	Delta t (hr)	1						
5	Delta t (yr)	0.0001142						
6								
7	u	1.001069						
8	d	0.9989321						
9	a	1.0000046						
10	p	0.5018698						
11	q	0.4981302						
12								
13	Close	AM 10:30	AM 11:30	PM 12:30	PM 1:30	PM 2:30	PM 3:30	Close
14								465.77
15							465.27	
16						464.78		464.78
17					464.20		464.28	
18				463.79		463.78		465.78
19			463.29		463.29		463.29	
20		462.79		462.79		462.79		462.79
21	462.30		462.30		462.30		462.30	
22		461.81		461.81		461.81		461.81
23			461.31		461.31		461.31	
24				460.82		460.82		460.82
25					460.33		460.33	
26						459.84		459.84
27							459.35	
28								458.88

FIGURE 2: LATTICE TREE FOR DECEMBER S&P 500 FUTURES, 9/16/93. *Here's the range of possible hourly closing quotes for the S&P contract based on a volatility of 10% and the closing price of 462.30 from 9/15/93.*

The calculated values are only as good as the volatility assumption. The volatility value can be estimated using historical data. Better yet, the most recent prices can be used from two successive intervals to back-fit the volatility. You would iterate through a range of values until you found one that produced the observed price change. In actual trading, the volatility is not static; it changes from day to day and even from hour to hour. As a result, you can develop dynamic trees by updating the volatility from recent prices over the desired time interval. The time interval could vary from minutes to hours to days.

The tree can be used to develop a risk estimate of your position. For example, you may short the S&P 500 futures contract and have a good profit on the close.

USING THE PRICE TREE

Volatility can be used to decide if you wish to trade at all. For example, you may decide not to trade if volatility decreases below 15%; this would keep you out of relatively quiet markets. You can also look for a volatility breakout in the direction of the price when the market quiets down. This may help you enter your position near the start of a rapid price move.

Price can be used to simulate different market conditions. You can work various price situations to develop price estimates for different volatility levels, which lets you develop some worst-case scenarios for trade planning. As a result, it can be a valuable tool for risk control.

The tree can be used to develop a risk estimate of your position. For example, you may short the S&P 500 futures contract and have a good profit on the close. You want to estimate your risk in the first hour of trading tomorrow. As a first estimate, you can calculate the volatility at the end of the day and then calculate how high the index could rise in the first hour. You can then vary the volatility in increments of 10% to get a range of values and so judge what the risk to your position might be. You can also develop a profit objective for the first hour by estimating how low prices could go.

As the trading day progresses, you can recalculate the volatility to get a more recent estimate and then recalculate your risk and reward targets. You can also estimate the effects of rising volatility.

Now, assume you expect a day of strongly trending prices with high volatility. The price tree can then be used to develop a map of the price progress during the trading day. You can develop an estimate of the target closing price and compare the price tree to actual prices during the day to observe time-price evolution.

The price tree can be used in many ways. Primary use is to develop a time-price diagram for different levels of volatility.

REAL LIFE

Now, we will illustrate the application of the lattice tree using the December 1993 S&P 500 futures contract data for September 16, 1993. On September 15, the market opened at 459.00 and fell to 457.20, off 3.75 points from the previous close in the first few minutes. The market went sideways for about an hour before rallying 5.1 points to close up 1.35 at 462.30. It was a fine day to be trading this market, worth more than $3,000 per contract for nimble traders. What would the market do for an encore the next day?

Now examine the spreadsheet shown in Figure 2. I expected a quiet day and assumed a volatility of 10% per annum; I assumed a risk-free rate of 4% per annum. I could have used 3% or 5% without making any significant difference to the calculations. I chose a calculation period (Δt) of one hour, which converts to (1/(24*365)) years or 0.000114 years. Calculate values of *u* and *d*:

$$u = e^{\left(0.1\sqrt{0.000114}\right)} = 1.001069$$

$$d = e^{\left(-0.1\sqrt{0.000114}\right)} = 0.998932$$

The slight differences from the spreadsheet are due to rounding errors. The probability of going up (p=0.50187) was slightly greater than going down (q=0.49813). For practical purposes, these numbers are relatively close to one another. Hence, we could say that the market was equally likely to go up or down, similar to a random walk hypothesis.

I calculated the tree by starting with the previous close of 462.30. The first-hour values of *Su* and *Sd* are as follows:

Su = 462.30*1.001069 = 462.79

Sd = 462.30*0.998932 = 461.81

The second-hour values are given by Su^2, S and Sd^2. In effect, we multiply Su*u and Sd*d. The calculations assume that u*d = 1. Thus, Su*d or Sd*u simply gives *S*, the previous close:

Su^2 = Su*u = 462.79*1.001069 = 463.29

Sd^2 = Sd*d = 461.81*0.998932 = 461.31

The rest of the tree is developed by stepping the numbers ahead one level at a time.

The lattice tree gives us a map of the price-time evolution. For example, our estimates for the close were from 465.77 to 458.86; this would occur if the volatility were constant and the market rose or fell steadily. A random walk of the market could be traced and arrive at different closing price estimates. For example, if the market went up for two hours (462.79, 463.29), went down the next three hours (462.79, 462.30, 461.81) and then up for the next two hours (462.30, 462.79), then the close would be at 462.79.

We could simulate the market price range for different levels of volatility. In the spreadsheet in Figure 3, I show the values for the first two hours of trading for volatility values of 0.1, 0.2, 0.3 and 0.40. For example, for a volatility of 0.30, the estimates of the close after one hour of trading (that is, 10:30 a.m.) ranged from 463.78 to 460.82. If I were long, the profit target would be +1.48 points and the risk -1.48 points. Thus, my risk would be about $750 if the volatility were to be 0.30. This would be true if I were long or short. Is this risk acceptable?

What actually happened in real time on September 16, 1993? The market opened down about a point. The SPZ3 contract was at 460.90 at about 10:30 a.m., not far from the risk target for a 30% volatility. I went back to the spreadsheet and found that a volatility of 0.284 gave me a forecast of 460.90, the actual value. I used it to forecast values for the next hour, to 11:30 a.m. This forecast, seen in the spreadsheet in

	A	B	C	D	E	F	G
1	Start Value	462.3			Date: 09/16/93		
2	Volatility	0.1					
3	Interest %	0.04		Volatility	Close	AM 10:30	AM 11:30
4	Delta t (hr)	1					
5	Delta t (yr)	0.0001142					463.29
6						462.79	
7	u	1.001069		0.1	462.30		462.30
8	d	0.9989321				461.81	
9	a	1					461.31
10	p	0.4997329					
11	q	0.5002671					
12				Volatility	Close	AM 10:30	AM 11:30
13							464.28
14						463.29	
15				0.20	462.30		462.30
16						461.31	
17							460.33
18							
19				Volatility	Close	AM 10:30	AM 11:30
20							465.27
21						463.78	
22				0.30	462.30		462.30
23						460.82	
24							459.35
25							
26							
27				Volatility	Close	AM 10:30	AM 11:30
28							466.27
29						464.29	
30				0.40	462.30		462.30
31						460.33	
32							458.37
33							

FIGURE 3: BINOMIAL TREE FOR SPZ3, 9/16/93. *In this spreadsheet are the values for the first two hours of trading for volatility values of 0.1, 0.2, 0.3 and 0.40.*

	A	B	C	D	E	F
1	Start Value	462.3		Date: 09/16/93		
2	Volatility	0.284				
3	Interest %	0.04		Close	AM 10:30	AM 11:30
4	Delta t (hr)	1				
5	Delta t (yr)	0.0001142				465.11
6					463.70	
7	u	1.003039		462.30		462.30
8	d	0.9969702			460.90	
9	a	1				459.50
10	p	0.4992414				
11	q	0.5007586				
12				AM 10:30	AM 11:30	PM 12:30
13						461.29
14					461.10	
15		Volatility	0.04	460.90		460.90
16					460.70	
17						460.51
18						
19				AM 11:30	PM 12:30	PM 1:30
20						462.60
21					461.85	
22		Volatility	0.15	461.10		461.10
23					460.35	
24						459.60
25						
26						
27				PM 12:30	PM 1:30	PM 2:30
28						460.65
29					460.50	
30		Volatility	0.03	460.35		460.35
31					460.20	
32						460.05

FIGURE 4: BINOMIAL TREE FOR SPZ3, 9/16/93. *Here's a forecast for a high value of 462.30 or a low value of 459.50. A new profit target and risk level can be calculated.*

	A	B	C	D	E	F	G	H
1	Start Value	462.3		Date: 09/16/93				
2	Volatility	0.1						
3	Interest %	0.04		SP Z3 Tree				
4	Delta t (hr)	1						
5	Delta t (yr)	=1/(365*24)						
6								
7	u	=EXP(B2*SQRT(B5))						
8	d	=EXP(-B2*SQRT(B5))						
9	a	=EXP(B3*B5)						
10	p	=(B9-B8)/(B7-B8)						
11	q	=1-B10						
12								
13	Close	AM 10:30	AM; 11:30	PM 12:30	PM 1:30	PM 2:30	PM 3:50	Close
14								=G15*$B$7
15							=F16*$B$7	
16						=E17*$B$7		=G15*$B$8
17					=D18*$B$7		=F16*$B$8	
18				=C19*$B$7		=E17*$B$8		=G17*$B$8
19			=B20*$B$7		=D18*$B$8		=F18*$B$8	
20		=A21*$B$7		=C19*$B$8		=E19*$B$8		=G19*$B$8
21	462.3		=B20*$B$8		=D20*$B$8		=F20*$B$8	
22		=A21*$B$8		=C21*$B$8		=E21*$B$8		=G21*$B$8
23			=B22*$B$8		=D22*$B$8		=F22*$B$8	
24				=C23*$B$8		=E23*$B$8		=G23*$B$8
25					=D24*$B$8		=F24*$B$8	
26						=E25*$B$8		=G25*$B$8
27							=F26*$B$8	
28								=G27*$B$8

FIGURE 5: LATTICE TREE FORMULAS. *Here are the formulas for developing a lattice tree.*

Figure 4, was a high value of 462.30 or a low value of 459.50. Again, I could calculate my new profit target and risk level at +1.40 or -1.40. So I got a chance to reassess my risk exposure.

At 11:30, the value of the SPZ3 was at 461.10; it had risen slightly from the 10:30 value. I recalculated the volatility to be 0.04, indicating volatility had fallen off sharply. My projections for 12:30 p.m. ranged from 461.29 to 460.90. The actual value of 12:30 p.m. was 460.35. In the spreadsheet, I needed a volatility of 15% to explain the move from 461.10 to 460.35, which would lead to a forecast for 1:30 p.m. of 461.10 to 459.60. The actual 1:30 p.m. value was 460.50, up just 0.15. Thus, the market was trading in a narrow range between 459.75 and 460.50.

I *could* close out my position, since the volatility had fallen to low levels. Returning to Figure 1, the 1:30 p.m. value for a 10% volatility was 460.33, not far from the actual value of 460.50. If the market went up, the value would be a bit above 460.82. The volatility was down again, so I could expect a close around 460.82. The actual close was 460.60, within the calculated range, and on track from the 1:30 close on a low volatility day.

TO SUMMARIZE

The lattice approach to pricing the futures contracts could be used to estimate the volatility and develop a price tree (Figure 5). The price tree can be used to estimate the risk and reward of holding a short or long position. The lattice tree can be used to simulate the effects of an increase or decrease in market volatility, and thus, it can be used to develop different scenarios for trade planning. This approach could be useful to options and futures traders both.

Tushar Chande, CTA, holds a doctorate in engineering from the University of Illinois and a master's degree in business administration from the University of Pittsburgh.

Additional reading

Cox, J.C., S.A. Ross and M.Rubinstein [1979]. "Option pricing: A simplified approach," *Journal of Financial Economics*, volume 7.

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Bonds Vs. Stocks: A Historical View

by Tim Hayes

Relative value is a familiar buzzword when it comes to comparing bonds and stocks. But is it accurate? There are criteria that must be specified for comparisons, as STOCKS & COMMODITIES contributor Tim Hayes of Ned Davis Research Inc. points out; for one, the time periods the comparisons are drawn from. Hayes explains.

So what's a better value, stocks or bonds? This common question is often answered by comparing relative yields. When bond yields are high relative to stock yields, they can be expected to eventually drop back toward a more normal level relative to the stock yields. Thus, bonds can be considered a relatively good value when bond yields are judged as being too rich and poised to drop.

But a significant question must be answered when such comparisons are made: What's the norm? In recent years, comparisons have been made using data starting in the early 1960s. Using Moody's Aaa bond yields to represent the bond yield and the Standard & Poor's 500 earnings yield to represent the stock yield, the mean bond yield to stock yield ratio since December 1959 has been 1.14 (Figure 1). With the current ratio at 1.60 as of October 1993, an argument could be made that bonds are close to losing their valuation advantage.

THE MESSAGE CHANGES

But the message changes dramatically when the data sample is doubled and the comparison is made back to the 1920s. The mean ratio has been 0.81 since March 1926, suggesting that the bond yield still has a long way to drop before reaching parity with the stock yield. Using the increased historical data, bonds are still a far better value than stocks are.

The reason for the differing ratios can be seen in Figure 1, which shows the mean ratio over three time periods — the full 67.6-year period, the period's first half and its second half. The ratio in the first half was just 0.48, thanks to a mean bond yield of just 3.45%. Whereas the October 31, 1993, bond yield of

Bond Valuation vs. Stock Valuation
Three Time Perspectives (Means)

Date Range	Years	Moody's Aaa Yield	S&P 500 Earnings Yield	Moody's Yield / Earnings Yield
3/31/26–10/31/93	67.6	5.84	7.87	0.81
3/31/26–12/31/59	33.8	3.45	8.21	0.48
12/31/59–10/31/93	33.8	8.21	7.52	1.14
Current (10/31/93)	—	6.67	4.17	1.60

FIGURE 1: BOND VALUATION VS. STOCK VALUATION. *The study uses month-end data for the Moody's Aaa corporate bond yield and the S&P 500's four-quarter total earnings. The earnings yield uses the S&P 500's monthly average. The means in each column are calculated independently (that is, the far right column is not a ratio of the mean).*

6.67% was 154 basis points *below* the average yield from December 1959 through October, it was a full 322 basis points above the average yield from March 1926 through December 1959. Moreover, it was also 83 basis points above the mean for the entire period.

In contrast to the bond yield, the average earnings yield for the first half was less than a percentage point different from the mean earnings yield for the second half. Using any of the three timeframes, the current earnings yield is far below the norm, indicating that the S&P 500 is overvalued.

THE LONG VIEW

In summary, a 67.6-year perspective allows the viewer to see a number of things, among which are that the bond yield is still well above its historical norm, the earnings yields is far below its historical norm and the ratio of the bond yield to the earnings yield is substantially higher than its historical norm (Figure 2). So the following arguments about the long-term outlook could be made: the bond yield should fall further, and thus bond prices should keep rising; the earnings yield should rise, and thus stock prices should fall; and the bond to earnings yield ratio should fall further, meaning that bonds should remain a better value than stocks. Does the message change when the ratio is compared with its linear regression line (Figure 3) rather than its mean? If it does, it doesn't by much Ñ the ratio is still well above the norm as represented by an upward-sloping regression line March 1926.

However, perhaps the most useful conclusion that can be drawn from this study is that on the question of value, it is almost always a good idea to consider as much time and data as possible.

Tim Hayes, a senior international strategist for Ned Davis Research, writes the "Stock Market Strategy" and "International Currents" institutional newsletters.

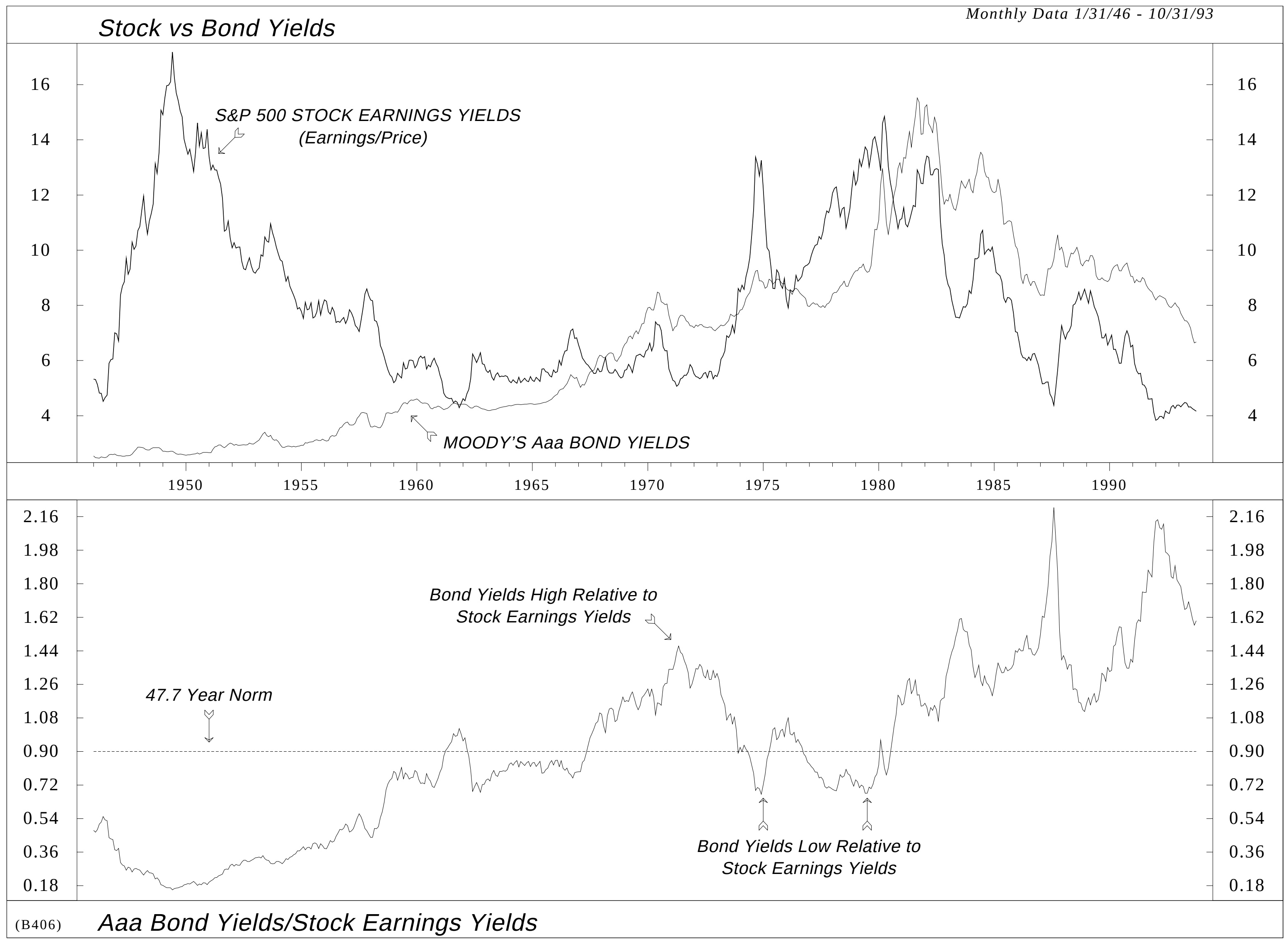


FIGURE 2: STOCKS VS. BOND YIELDS. Based on the last 47 years, the bond yields are still high relative to the stock earnings yields.

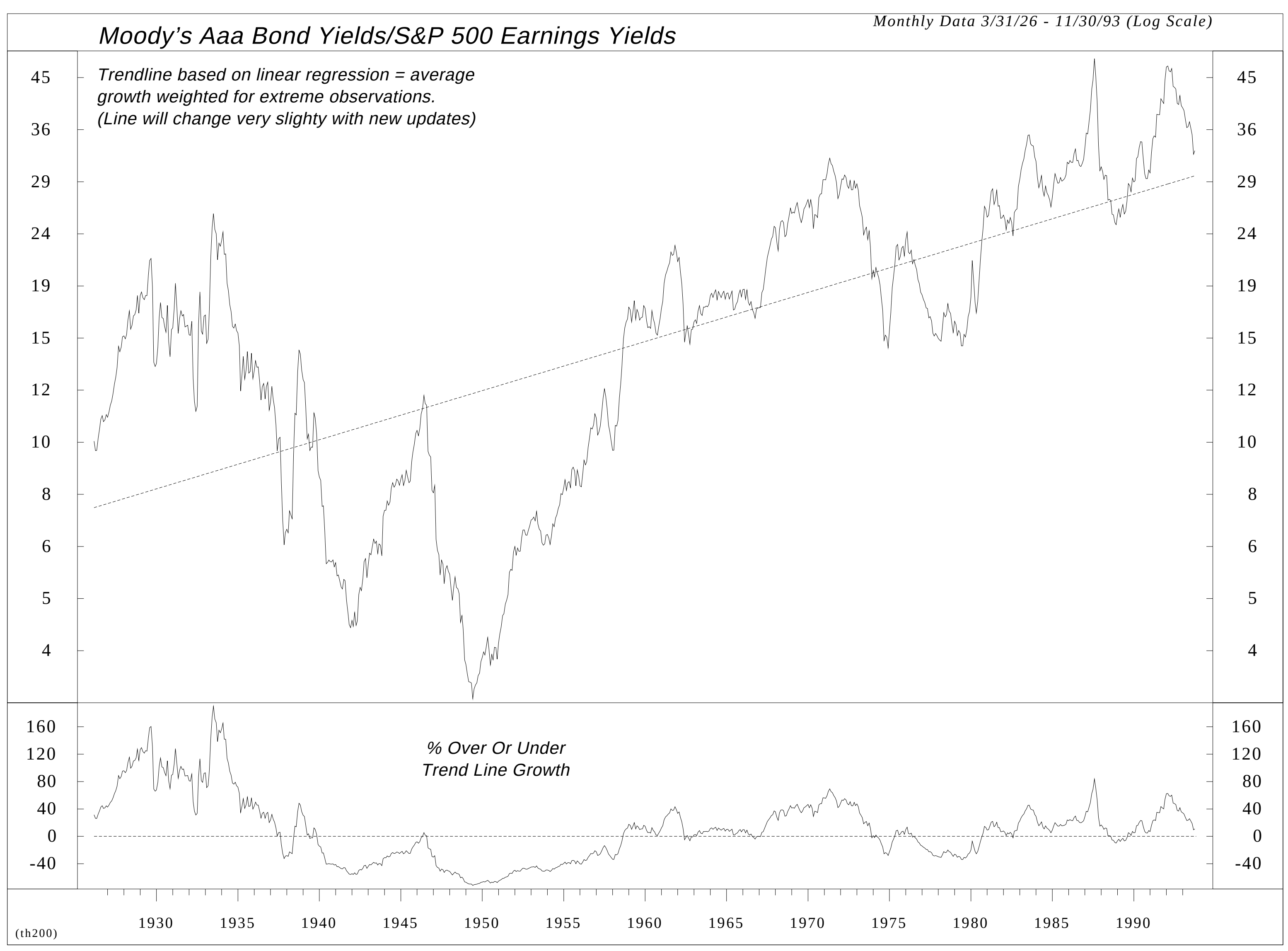
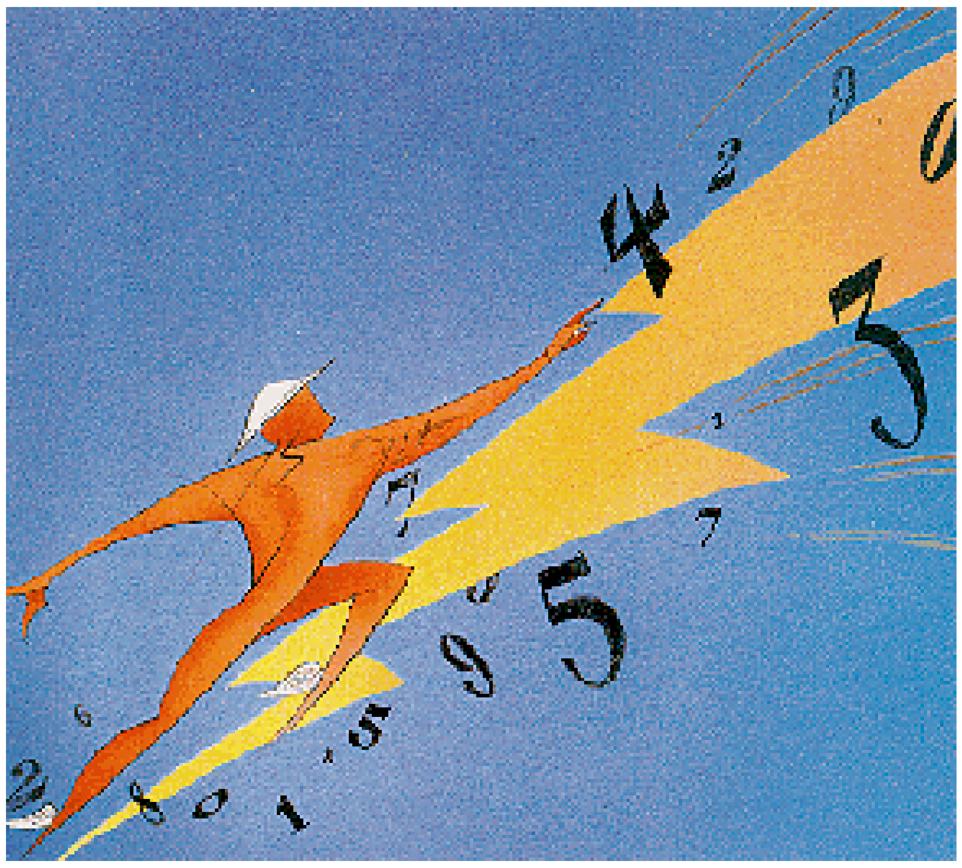


FIGURE 3: STOCKS VS. BOND YIELDS DETRENDED. Even subtracting the trend of the ratio indicates the ratio is above the norm.

Smoothing Data With Less Lag

by Patrick G. Mulloy



Last time, first-time STOCKS & COMMODITIES contributor Patrick Mulloy discussed basic moving averages, introduced a new filter called DEMA1 and demonstrated a method with which to utilize exponential moving averages. Mulloy also explained how this new filter could be used in the moving average convergence/divergence (MACD) indicator. Now, Mulloy summarizes with more filtering techniques for the MACD and trading the NASDAQ.

Two opposing properties are always at work in the standard moving average smoothing used in technical analysis, increasing the moving average (MA) length to cull more random fluctuations but in so doing thereby increasing the lag between the MA and the data. In my first article, I discussed the industry standards, the simple moving average (SMA, which is a straightforward moving mean of the data) and the faster-responding exponential moving average (EMA). Both the SMA and the EMA smoothing indicators have the same lag in the steady state long term, which is:

$$(1 - \alpha)/\alpha$$

where $\alpha = 2/(w+1)$ and *w* is the moving average period. In terms of the MA period *w*, the lag is:

$$(w-1)/2$$

A new exponential moving average called DEMA1 was introduced in the previous article, which eliminated this lag for the steady state (see sidebar “Calculating TEMA1 and DEMA1”).

Now, here are two other moving averages. One is known as TEMA1, which is an extension of the multiple smoothing technique using single, double and triple EMAs, while the other is a subset of a modification of the double-smoothing technique to include a second smoothing constant to smooth the trend of the data model, which I call DEMA2.

TEMA1

When the time series to be modeled is more complicated than a simple linear trend (curvilinear), multiple smoothing leads to the next progression in the polynomial model — the quadratic regression equation:

$$Y_t = \beta_0 + \beta_1 t + ½\beta_2 t^2 + \varepsilon_t$$

where the β (beta) parameters are the regression coefficients and ε (epsilon) is the random error in the data series. For example, in Figure 1 the weekly close of NASDAQ for the 26-week period beginning August 14, 1987, and ending February 5, 1988, is presented. The plot of the closing price is more complicated than a straight-line linear regression, and using a quadratic regression equation is an improvement over the linear regression to model the closing price. Consequently, using a quadratic regression equation involves using three regression coefficients, which leads to triple smoothing techniques.

Time series forecasting derives the estimates for the three model regression coefficients in a fashion similar to the linear model (DEMA1). As we are not forecasting, we are only concerned with the estimate for the nontime (*t*) related coefficient β_0, which involves three EMAS. The EMAS are as follows:

1 $EMA1_m = \alpha C_m + (1-\alpha)EMA1_{m-1}$

2 $EMA2_m = \alpha EMA1_m + (1-\alpha)EMA2_{m-1}$

3 $EMA3_m = \alpha EMA2_m + (1-\alpha)EMA3_{m-1}$

As you can see, the first EMA smoothes the closing price, while the second EMA smoothes the first EMA and the third EMA smoothes the second EMA. This process is known as *triple smoothing* as used in technical indicators such as TRIX, which can be found in technical analysis software.

Our first indicator is smoothed with a subset TEMA1 of the one-parameter triple exponential moving average. The formula for TEMA1 is:

$$TEMA1 = 3EMA1 - 3EMA2 + EMA3$$

As seen from the previous equations, EMA3 is the standard implementation of what is commonly known as a triple exponential moving average. However, the definition of TEMA1 is not a "simple" triple EMA, but rather a *composite* of a single, double and triple EMAS, which eliminates the lag when there is a trend. For example, the TRIX indicator is a standard triple EMA of the one-unit time percentage rate of change of the price. A faster-responding TRIX can be implemented with DEMA1 or TEMA1. Figure 2 presents a comparison between the one-parameter triple (TEMA1) and the double EMA (DEMA1).

INITIALIZING TEMA1

As three regression coefficients must be estimated, there are three smoothed averages to calculate (EMA1, EMA2 and EMA3). Each of these EMAS requires an initial value for the basic recursive EMA equation. In a manner similiar to the DEMA1, TEMA1 also uses a regression polynomial over a subset of the data to use as values in the initialization formulas, but here it uses a quadratic regression. The TEMA1 initialization formulas are provided below. First, define some basic variables and ranges:

C = Closing price vector

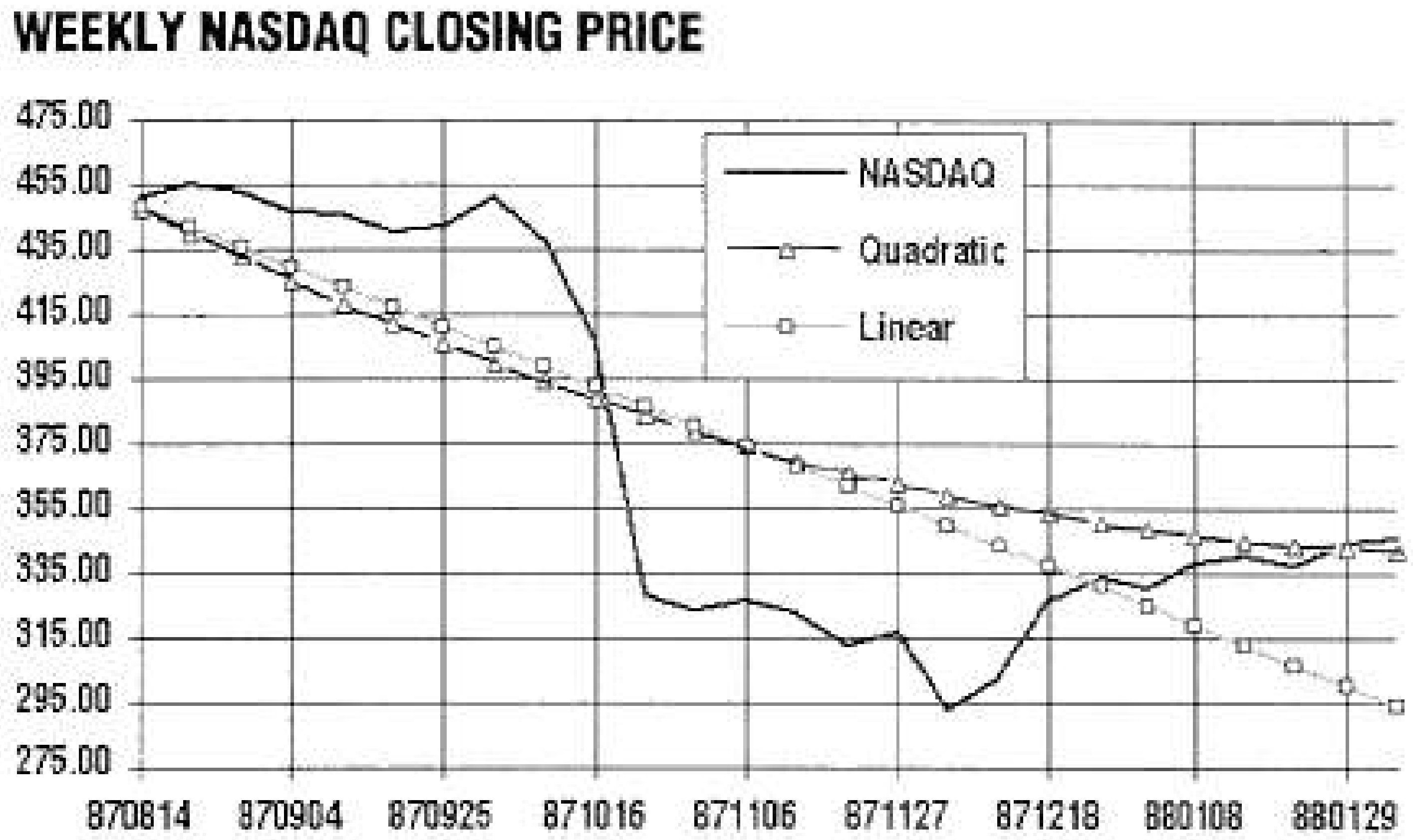


FIGURE 1: *Presented is 26 weeks of closing prices with a quadratic and linear regression of the prices. When the data is complicated, then a quadratic or multiple regression should be considered.*

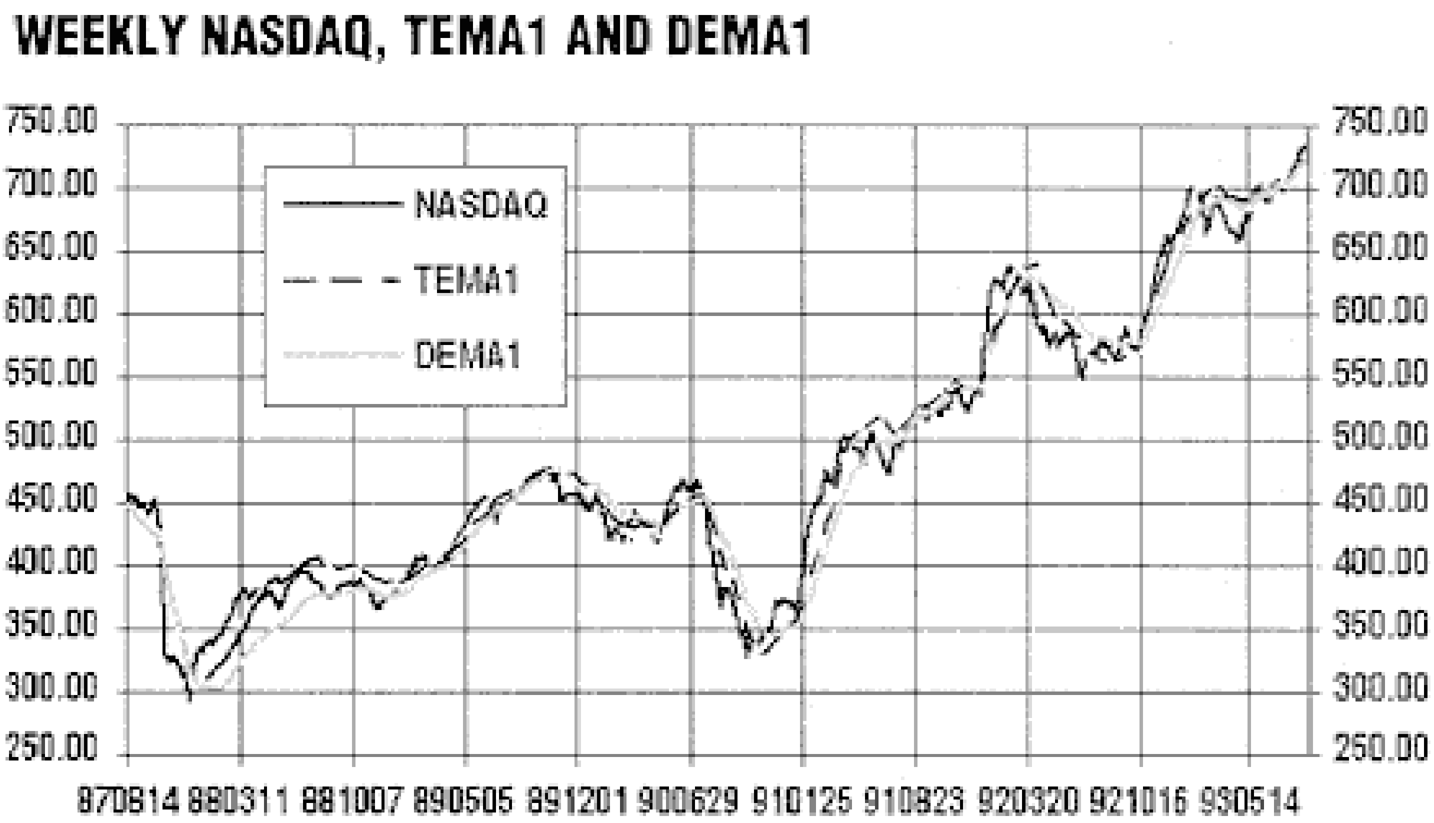


FIGURE 2: *Comparison of 26-week smoothing using TEMA1 and DEMA1 shows that TEMA1 has a closer approximation to the data than DEMA1 does, but it over- and undershoots more at major long-term trend changes.*

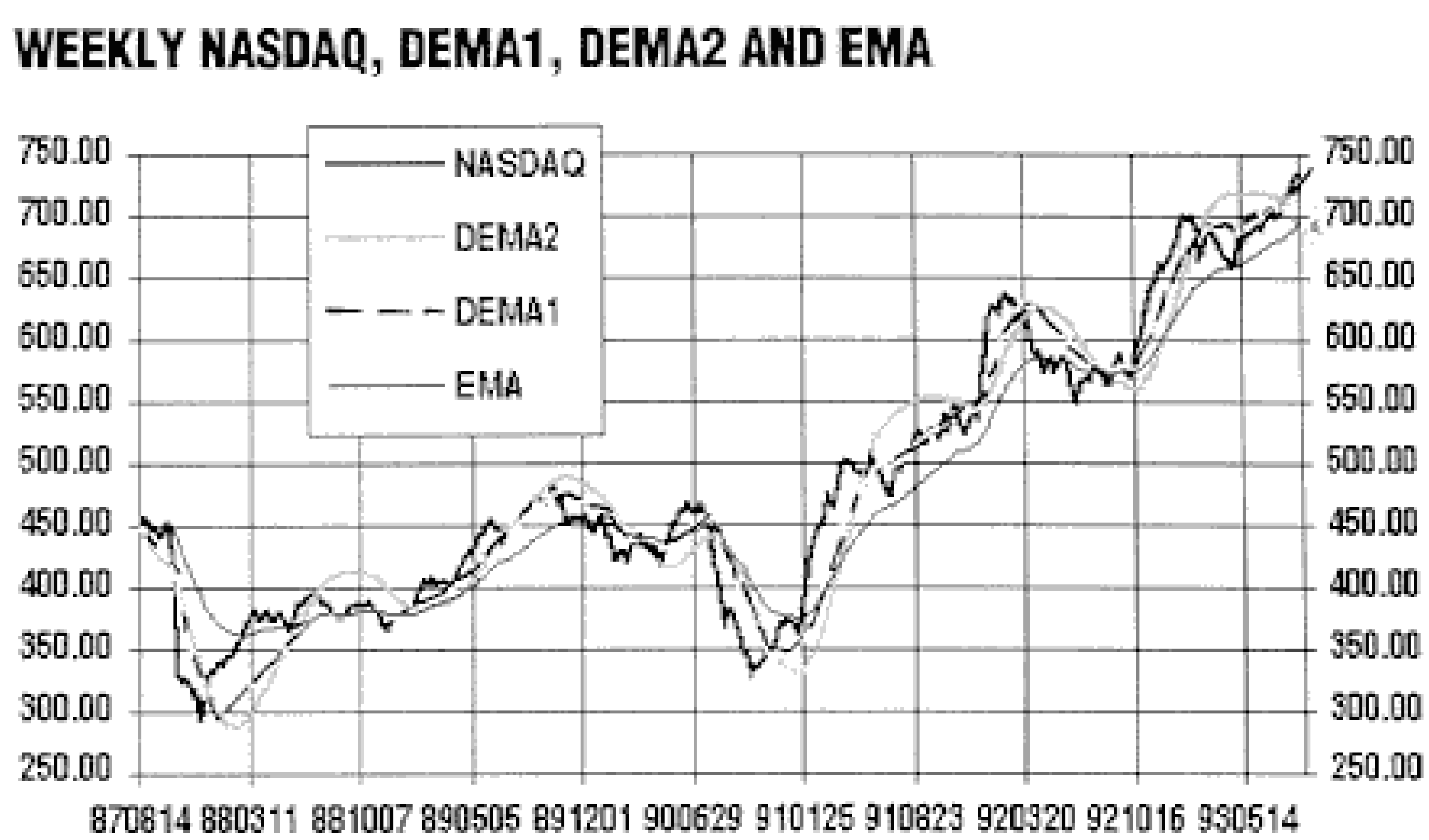


FIGURE 3: *With beta greater than alpha, DEMA2 shows high overshoot at the trend changes.*

$m = 1 .. N - 1$

$N = \text{length}(C) = 316$

$i = 0 .. N - 1$

$t_i = i$

$w = 26$

$k = 0 .. 2w - 1$

$\alpha = 2/(w+1) = 0.074$

Note we are starting at point zero as our starting point and not point 1. Next, estimate regression initial values using the variables for a quadratic regression:

Point 0 to 2w-1

$x_k = t_k$

$y_k = C_k$

Next, calculate regression coefficients using matrix algebra for a least-squares solution for a parabola $y = a_0 + a_1x + a_2x^2$ (for computations not shown, refer to sidebar "Calculating TEMA1 and DEMA1").

$a_0 = 447.753$

$a_1 = -7.876$

$a_2 = 0.146$

The initialization equations for each EMA using the coefficients from the least-squares solution are:

$$EMA1_0 = a_0 - \frac{1-\alpha}{\alpha} a_1 + \frac{(1-\alpha)(2-\alpha)}{2\alpha^2} a_2 = 569.926$$

$$EMA2_0 = a_0 - 2\frac{1-\alpha}{\alpha} a_1 + \frac{2(1-\alpha)(3-2\alpha)}{2\alpha^2} a_2 = 714.912$$

$$EMA3_0 = a_0 - 3\frac{1-\alpha}{\alpha} a_1 + \frac{3(1-\alpha)(4-3\alpha)}{2\alpha^2} a_2 = 882.712$$

Next, calculate EMAs with above initializations:

1 $EMA1_m = \alpha C_m + (1 - \alpha)EMA1_{m-1}$

2 $EMA2_m = \alpha EMA1_m + (1 - \alpha)EMA2_{m-1}$

3 $EMA3_m = \alpha EMA2_m + (1 - \alpha)EMA3_{m-1}$

Then, calculate $TEMA1_0$:

$TEMA1_0$ = 3EMA1 - 3EMA2 + EMA3

$TEMA1_0$ = 3(569.926) - 3(714.912) + 882.712

$TEMA1_0$ = 447.754

See sidebar “Calculating TEMA1 and DEMA1” for a spreadsheet version. Next, we will discuss smoothing with a subset of the Holt-Winters exponential model, also known as the two-parameter double exponential moving average.

DEMA2

This smoothing technique is an expansion of the one-parameter double exponential moving average (DEMA1) in that it explicitly recognizes the secular trend (long term) of the time series but at the same time includes a second smoothing constant specifically for the trend (hence a two-parameter model). The time series can be adequately described by a simple linear regression line:

$$y_t = \beta_0 + \beta_1 t + \varepsilon_t$$

where the beta parameters are slowly changing with time. The Holt-Winters two-parameter double exponential smoothing approach employs two smoothing constants (α and β, that is, two parameters) and two components (*S* and *T*) that are simultaneously smoothed (double smoothing). The first component *S* is the stationary or permanent component and is the estimate for the *y*-intercept β_0 (the component that we are concerned with). The second component *T* is the trend component, which is the estimate for the slope β_1. These two components are separate interrecursive equations that must be calculated simultaneously. Analogous to the single EMA, these two recursive equations require seed values for the iteration process to begin.

Although some latitude exists in choosing the initial values, the simple choice of the value of the time series at time zero is not the best. It is better to calculate the linear regression coefficients at the beginning of the series for a selected period (typically the same as the MA period *w*). Unfortunately, because of the recursive nature of the component equations, the Holt-Winters smoothing algorithm cannot be implemented in programs such as MetaStock. It can, however, be implemented in the following paragraphs with a mathematical program called Mathcad or in the Excel spreadsheet program.

To calculate DEMA2, the first step is to derive the seed values. The window range will be:

$$k2 = 0 .. w - 1$$

The variables for the linear regression are $x2_{k2} = t_{k2}$, $y2_{k2} = C_{k2}$ (C_i is a vector containing all the closing prices). Next, calculate the seed values using a linear regression:

S_0 = intercept(x2,y2) = 448.352 and

T_0 = slope(x2,y2) = -6.162

The two smoothing constants used in DEMA2, α and β, are user-selected depending on the amount of smoothing desired. Alpha is the same smoothing constant as defined earlier for a simple EMA, while beta is the smoothing constant for the trend portion. Both α and β are between zero and 1. In this case, β was

BUY/SELL SIGNALS USING THE MACD ON THE WEEKLY NASDAQ

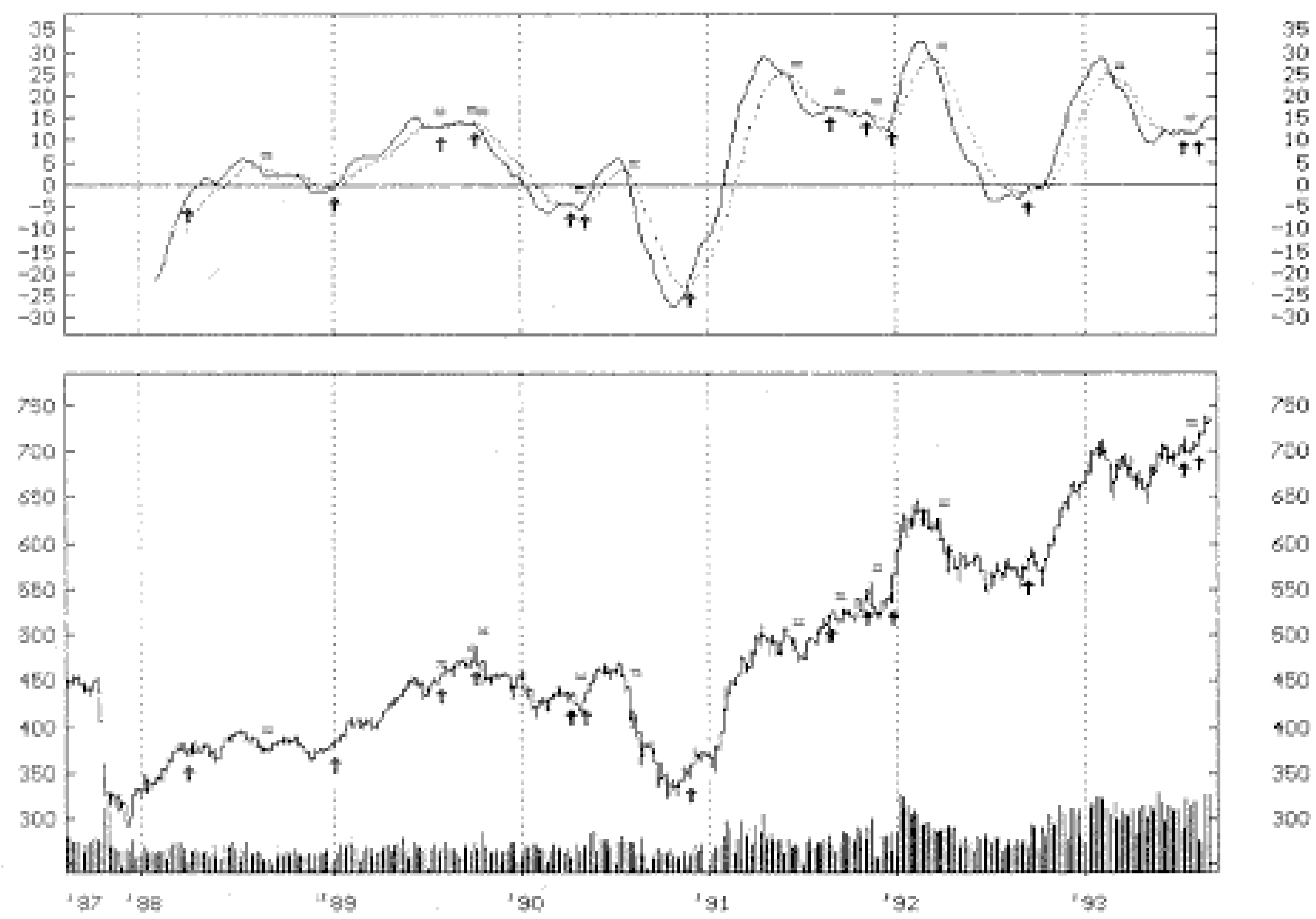


FIGURE 4: *The MACD has 12 buy signals starting from October 1988, with six whipsaws.*

BUY/SELL SIGNALS USING THE MACD-TEMA1 ON THE WEEKLY NASDAQ

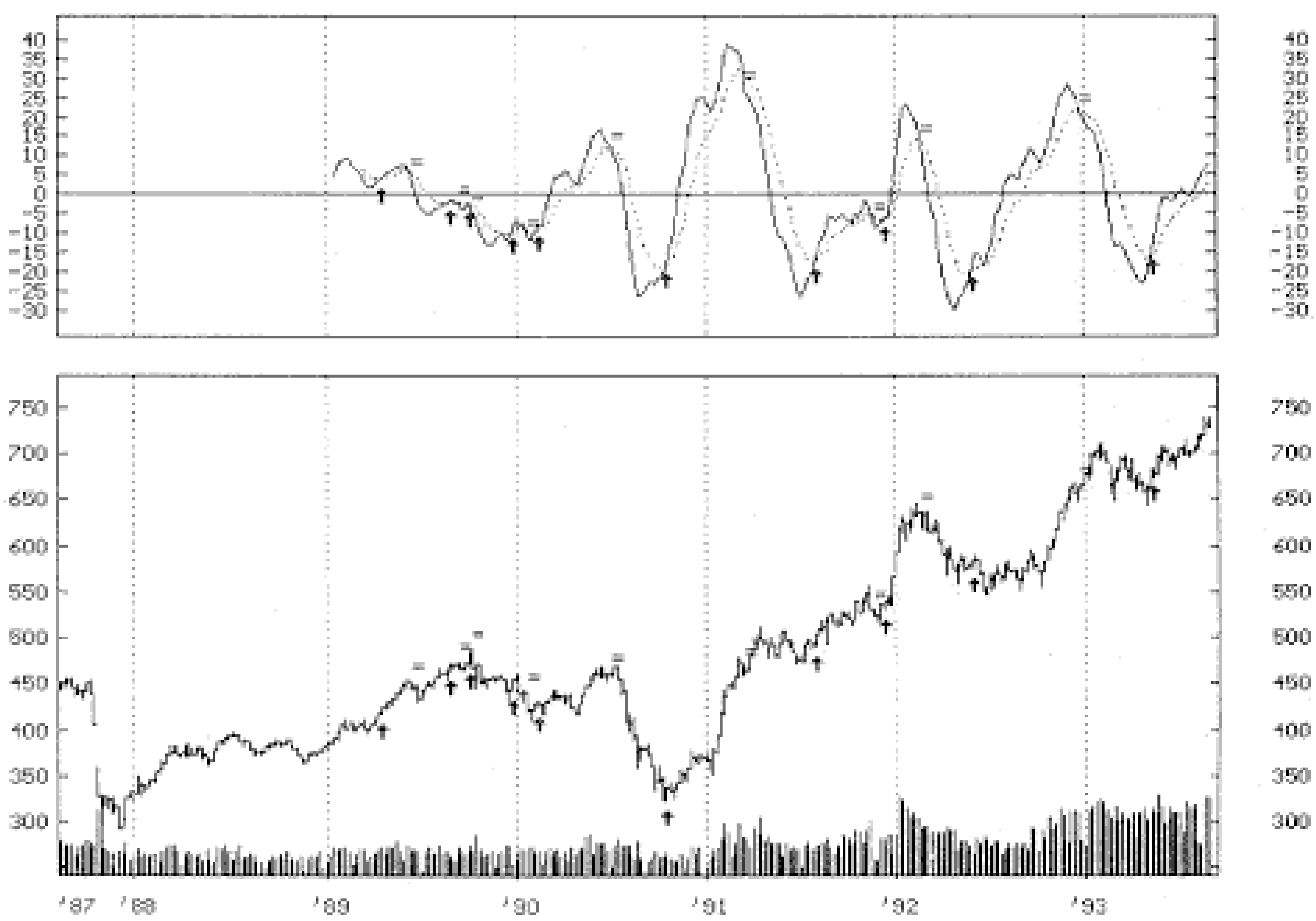


FIGURE 5: *The MACD-TEMA1 (12, 26, 9) has 11 round trips, just like the standard MACD, but with 50% more profit and two fewer drawdowns. Although not visible on the MetaStock plot of the MACD-TEMA1, the two preceding buy/sell signals were on 12/9/88, 3/17/89 and 9/30/88, 11/11/88 (available through Mathcad analysis). These trades are included in the analysis to keep the timeframe for all MACD comparisons the same (October 1988 to August 1993).*

chosen as a factor of α by means of the period *w*, but it does not have to be done that way. Thus, our constants are:

w = 26

$\alpha = 0.074$

Beta period is bw = (0.5)(26) = 13

$\beta = 2/(bw + 1) = 0.143$

The two components *S* and *T* are defined as

$$S_m = \alpha C_m + (1 - \alpha)(S_{m-1} + T_{m-1})$$

$$T_m = \beta(S_m - S_{m-1}) + (1 - \beta)T_{m-1}$$

The stationary component (S_m) is nothing more than an EMA of the time series data with the addition of a weighted adjustment for the previous smoothed trend value to provide for the growth or decay in the trend. From the last equation, one can see that the trend component *T* is a weighted average of the most recent change in the smoothed stationary value ($S_m - S_{m-1}$) and the trend estimate of the previous time component (T_{m-1}).

Through some simple algebraic manipulation, the above equation for T_m can be shown to be equivalent to:

$$T_m = \alpha\beta[C_m - (S_{m-1} + T_{m-1})] + T_{m-1}$$

The reason to do this is to get rid of S_m so that the two interrecursive equations can be formulated into an array for simultaneous calculation on a per-point basis. Before S_2 can be calculated, T_1 must be calculated and stored in memory and so on. Then the equations can be rewritten and expressed as an array:

$$\begin{pmatrix} S_m \\ T_m \end{pmatrix} = \begin{bmatrix} \alpha C_m + (1-\alpha)(S_{m-1} + T_{m-1}) \\ \alpha\beta\left[C_m - (S_{m-1} + T_{m-1})\right] + T_{m-1} \end{bmatrix}$$

In this case, the final moving average of interest is S_m. For sake of name recognition, the final MA will be redefined as DEMA2, which is S_m (see sidebar "Calculating DEMA2 and the MACD"), and Figure 3 displays a comparison of DEMA2, DEMA1 and an EMA:

DEMA2 = S

MACD IMPLEMENTATION OF NEW MAS

Now that the two new moving averages have been defined, let us implement them into one of the standard technical indicators, MACD (moving average convergence/divergence). The standard MACD is the difference between a 12-unit EMA and a 26-unit EMA with a nine-unit EMA of the difference superimposed as a trigger level for buy/sell signals. Figures 4 and 5 compare a standard MACD with a

TEMA1 implementation of the MACD. The arrows and equal signs show the points at which buy/sell signals occur from the crossovers by the nine-week EMA of the MACD.

Starting from October 1988, the faster-responding MACD-TEMA1 had the same number of buy signals (12) as the standard MACD but more than a 50% increase in total profit. The profit analysis was run using MetaStock's System Tester and algorithms that I personally developed in Mathcad. The MACD-TEMA1 had 11 round-trip trades with four losses, while MACD had 11 trades with six losses.

Comparing the MACDs for TEMA1 with DEMA1 from my previous article, the one-parameter double EMA fared better than the one-parameter triple EMA. The DEMA1 MACD had two fewer trades, approximately a 20% improvement in overall profit, and one fewer drawdown. Experimenting with the MA periods for the MACD-TEMA1 showed that the 16, 39 pair was better than the 12, 26 pair and had eight round-trip trades with one drawdown but more than a 50% improvement in overall profit.

As mentioned previously, the DEMA2 indicator cannot be implemented in MetaStock, so instead it was calculated, plotted and system-tested (profit/loss per trade) with the program Mathcad. Figure 6 is a plot (done in Excel) of the weekly closing prices of NASDAQ along with the MACD-DEMA2, and it is marked with the corresponding buy/sell signals (buy = up arrow, sell = down arrow). For this plot, the initialization formulas were used for each MA — that is, 12 and 26. The MA periods used for the b smoothing constant were 6 and 13. The MACD-DEMA2 had five round-trip trades (starting with the October 1988 buy signal) with one drawdown in mid-1990 of 2.7% before commissions.

The total profit (including closing the open position) of the MACD-DEMA2 was 170% better than the standard MACD, 43% better than the MACD-DEMA1 and 74% better than the MACD-TEMA1. No optimization was conducted for the a MAs for the MACD-DEMA2. MA periods other than 12 and 26 would undoubtedly improve the results for this particular security index. The β MAs were optimized for this test and found to be close to the 1:2 ratio used in this model; however, the same ratio was used for both the 12 and 26 DEMA2. Further testing could possibly show an improvement if different ratios were used for the two DEMA2 indicators prior to subtracting to create the MACD.

Figure 7 provides a quick-look comparison among the MACDs tested in both this article and the first:

Index: Weekly NASDAQ Composite
Commission: 1% per transaction
Profit per $1,000 of initial investment
MACD Periods: 12, 26, 9
Period of comparison: 9/30/88 to 8/27/93

Indicator	Round-trip trades	Losses profit	Total
STD	12	6	441
TEMA1	11	4	689
DEMA1	9	3	838
DEMA2	5	1	1,196

INITIALIZATION TRADEOFFS

Potential users of TEMA1 need not be intimidated by the complexity of the initialization process as

BUY/SELL SIGNALS USING THE MACD-DEMA2 ON THE WEEKLY NASDAQ

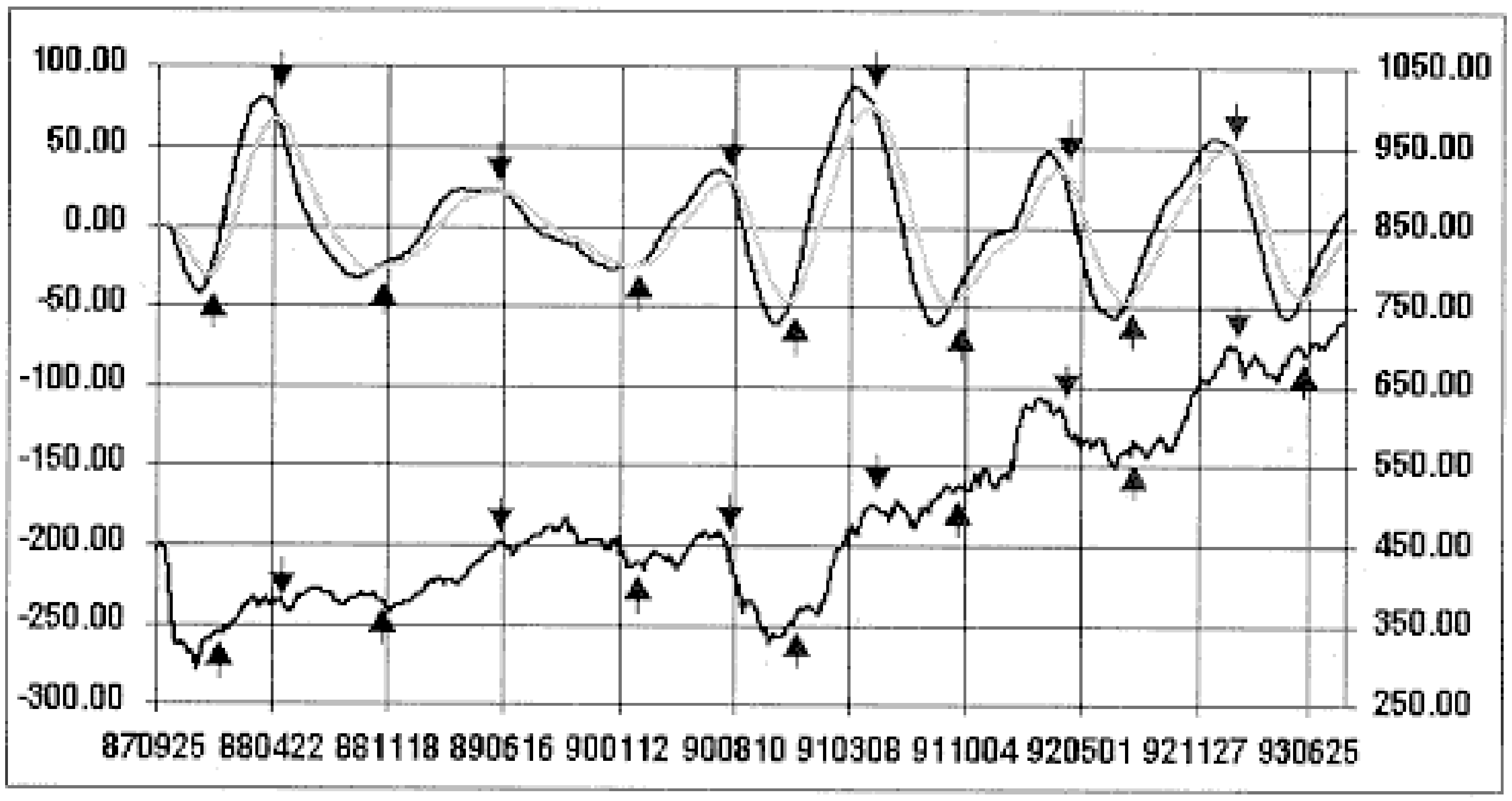


FIGURE 6: *The DEMA2 alpha MAs used are the standard 12 and 26 and the beta MAs are 6 and 13. This MACD shows itself as the best of the four with regard to total profit and only one drawdown in mid-1990. The up arrows are buy signals and the down arrows are the sell signals. This indicator, on its own, eliminated the four whipsaws that occurred in the 1989 and 1991 periods, as opposed to the standard MACD.*

presented here (it requires matrix algebra to solve for the coefficients of a quadratic equation). As demonstrated in my previous article, after approximately two w periods, the DEMA1 (or the TEMA1) indicator(s) will be essentially equal regardless of which initialization period is chosen. If the database of price is at least twice as long as your longest MA period (*w*), then the indicator value using the simple initial value of the database will be more than adequate. Typically, the database length will far exceed the longest w period and a current signal is the object of the search, so there will no detrimental effect by using the simpler initialization procedure.

As far as the DEMA2 indicator is concerned, since it cannot be implemented in MetaStock and another program must be used in any case, it makes the most sense to use the proper initialization of the linear regression. But if for some reason that is not possible, the same generalization holds as for the other two indicators. Use the database initial value at time 0 for S_0 and zero (0) for T_0. If you can approximate the initial trend value, then supply that value for T_0 instead of zero for a faster initial response.

CONCLUSION

Together, this article and the previous one have shown that some definite improvements can be gained in modifying the standard single exponential moving average (EMA). Time series forecasting has for years been using variations on the standard EMA to smooth data and generate forecasting equations. By simply using a subset of the forecasting equations, we have been able to build three new moving averages. The subset used is nothing more than the estimate for the nontime-related coefficient β_0 in the formal exponential moving average techniques used in time series forecasting.

These new MAs have a much faster response during fluctuations than the standard single EMA does and as was shown in the previous article, the lag during steady-state long-term trends can be eliminated. All three of the new MACD formulations acting alone performed better overall compared with the standard MACD. Also for practical applications, the more accurate but more complicated initialization formulas (especially for the TEMA1) can be obviated and replaced with the simple use of the initial database value at time zero.

The utility of the three new MAs presented is only limited by the technical investor's imagination (and time). My analysis with just the MACD implementation is not yet done; indeed, I have not even begun to investigate other indicator implementations such as trend channels.

Patrick Mulloy is an engineer whose current work involves instrumentation data analysis utilizing digital signal processing, regression modeling, statistical hypothesis testing and spectral data analysis. He uses technical analysis in personal investments.

ADDITIONAL READING

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METASTOCK IMPLEMENTATION OF TEMA1 AND MACD-TEMA1

The TEMA1 moving average and the MACD-TEMA1 can be implemented in MetaStock version 3.x using the custom formulas. The period for the example TEMA1 below was chosen as 26; however, this is user-selectable. As stated, the DEMA2 formula, unfortunately, cannot be implemented in MetaStock because of its interrecursive nature.

TEMA1

TEMA1 = 3 * EMA1 - 3 * EMA2 + EMA3 therefore

((3*MOV(C,26,E)) - (3*MOV(MOV(C,26,E),26,E))) + MOV(MOV(MOV(C,26,E),26,E),26,E)

MACD-TEMA1

MACD = EMA(12) - EMA(26) therefore

Formula 1 [TEMA1(12), the MetaStock custom formula number is user selectable]

((3*MOV(C,12,E)) - (3*MOV(MOV(C,12,E),12,E))) + MOV(MOV(MOV(C,12,E),12,E),12,E)

Formula 2 [TEMA1(26)]

((3*MOV(C,26,E)) - (3*MOV(MOV(C,26,E),26,E))) + MOV(MOV(MOV(C,26,E),26,E),26,E)

MACD-TEMA1

Formula 3

fml(#1) - fml(#2)

The MACD-TEMA1 indicator can be written as one equation in one custom formula, if you like; however, be sure to enclose each individual formula in a set of parentheses before subtracting them.

The true MACD uses smoothing constants (α) of 0.15 and 0.075, which are equal to 12.3333 and 25.6667 in terms of periods. These values can be substituted for the rounded-off periods, if you so desire. Because of the high speed of response of this indicator, you may want to experiment with other values for the two MAs.

—P.G.M.

Calculating DEMA2 AND THE MACD

Click here to open spreadsheet. (File is in Excel .xls format.)

This Excel spreadsheet (sidebar Figure 3) presents the DEMA2 along with the MACD using DEMA2 as the smoothing filters. Column B (labeled X value) is the time t. This column could be elsewhere, as the values are not needed after the EMAS are initialized using a linear regression. Coulmn C is the weekly closing price for NASDAQ. The first linear regression is calculated in cells J2 and K2. This regression is a 26-week regression. Enter the following formula into cells J2 and K2 as an array:

{=LINEST(C2:C27,B2:B27,,)}

The next linear regression is a 12-week regression. Enter the following formula into cells J5 and K5 as an array:

{=LINEST(C2:C13,B2:B13,,)}

DEMA2 is a two-parameter filter with two smoothing constants (alpha and beta). Because we are using the MACD default period values, we will use alpha for a 26-week period. Enter the following formula into cell H2:

=2/(26+1)

The beta is calculated in cell I2. Enter the following formula into cell I2:

=2/((0.5*26)+1)

The above constants are for the 26-period EMA. The MACD uses a 12-week period EMA in addition to the 26-period EMA. The following formulas should be entered into cell H5:

=2/(12+1)

and cell I5:

=2/((0.5*12)+1)

Column D is S_m or DEMA2 (26 weeks). To initialize, enter the y intercept (which is in cell K2) into cell D2:

=K2

The S_m is calculated in column D. Enter the following formula into cell D3 and copy down:

=$H$2*C3+(1-$H$2)*(D2+E2)

Cell E2 is the slope. Enter the following formula into cell E2:

=J2

The 13-week T_m is calculated in column E. Enter the following formula into cell E3 and copy down:

Nasdaq DEMA2

	A	B	C	D	E	F	G	H	I	J	K
1	Date	X Value	NASDAQ	SM, w=26	TM, 0.5w=13	SM, w=12	TM, 0.5w=6	Alpha (w=26)	Beta (0.5w)	Slope	Y Intercept
2	870814	0	451.61	448.35	-6.16	479.48	-10.15	0.074	0.143	-6.16	448.35
3	870821	1	455.20	443.15	-6.02	467.15	-10.77				
4	870828	2	453.29	438.33	-5.85	455.90	-10.91	Alpha (w=12)	Beta (0.5w)	Slope	Y Intercept
5	870904	3	446.48	433.51	-5.70	445.22	-10.84	0.154	0.286	-10.15	479.48
6	870911	4	446.17	429.17	-5.51	436.19	-10.33				
7	870918	5	440.86	424.93	-5.33	428.17	-9.67	MACD	9 Period EMA		
8	870925	6	441.88	421.25	-5.09	422.10	-8.64	0.85	0.85		
9	871002	7	451.61	418.79	-4.72	419.33	-6.96	0.55	0.79		
10	871009	8	438.43	415.87	-4.46	416.38	-5.82	0.51	0.73		
11	871016	9	406.33	411.04	-4.51	409.91	-6.00	-1.13	0.36		
12	871023	10	328.45	400.74	-5.34	392.30	-9.32	-8.44	-1.40		
13	871030	11	323.30	390.06	-6.10	373.80	-11.94	-16.26	-4.37		
14	871106	12	326.39	379.69	-6.71	356.40	-13.50	-23.29	-8.16		
15	871113	13	322.97	369.28	-7.24	339.83	-14.38	-29.45	-12.41		
16	871120	14	312.49	358.37	-7.77	323.46	-14.95	-34.91	-16.91		
17	871127	15	316.47	348.07	-8.13	309.74	-14.60	-38.34	-21.20		
18	871204	16	292.92	336.46	-8.62	294.80	-14.70	-41.67	-25.29		
19	871211	17	302.57	325.97	-8.89	283.56	-13.71	-42.41	-28.71		
20	871218	18	326.91	317.80	-8.79	278.63	-11.20	-39.17	-30.81		
21	871225	19	333.19	310.81	-8.53	277.55	-8.31	-33.26	-31.30		
22	880101	20	330.47	304.36	-8.23	278.66	-5.62	-25.71	-30.18		
23	880108	21	338.47	299.27	-7.79	283.11	-2.74	-16.16	-27.37		
24	880115	22	340.14	295.09	-7.27	289.56	-0.11	-5.52	-23.00		
25	880122	23	337.59	291.50	-6.74	296.85	2.00	5.35	-17.33		
26	880129	24	344.66	289.20	-6.11	305.90	4.02	16.71	-10.53		
27	880205	25	345.75	287.73	-5.45	315.43	5.59	27.70	-2.88		
28	880212		353.27	287.54	-4.70	325.98	7.01	38.44	5.38		
29	880219		357.12	288.35	-3.91	336.70	8.07	48.36	13.98		

SIDEBAR FIGURE 3: EXCEL SPREADSHEET FOR DEMA2 AND THE MACD.

=$I$2*(D3-D2)+(1-$I$2)*E2

The 12-week S_m is calculated in column F. Enter the y intercept into cell F2 to seed the filter:

=K5

Calculate the 12-week S_m by entering the following formula into cell F3 and copy down:

=$H$5*C3+(1-$H$5)*(F2+G2)

The six-week T_m is calculated in column G. To seed the filter, enter the following formula into cell G2 :

=J5

The six-week T_m calculation for cell G3 is entered and copied down:

=$I$5*(F3-F2)+(1-$I$5)*G2

The MACD is the difference of 12-week and 26-week filters, plus an additional nine-period EMA of the MACD. The MACD begins with cell H8. Enter the following formula and copy down:

=F8-D8

The MACD is smoothed with a nine-period EMA. Start with the value in cell H8 and copy to cell I8. Then enter the following formula into cell I9 and copy down:

=0.2*H9+(1-0.2)*I8

—Editor

CALCULATING TEMA1 AND DEMA1

Click here to open Excel spreadsheet.

These Excel spreadsheets (sidebar Figures 1 and 2) present the calculation of TEMA1 (column H) and DEMA1 (column N). TEMA1 uses a multiple linear regression over a 52-week period of closing prices to calculate the coefficients a_2, a_1 and a_0 in cells I2, J2 and K2, respectively. The weekly closing price for NASDAQ is in column B. Column C has the values for X (representing the value *t*) and column D is X^2 (representing *t*^2) for the regression formula. The following formula for column D is entered into cell D2 and copied down:

=C2^2

Before we can start calculating the EMAs, we need to run the regression to calculate the coefficients for the initilization of the EMAs. The regression is calculated as an array in cells I2, J2 and K2. Enter the following formula as an array in the above cells.

{=LINEST(B2:B53,C2:D53,TRUE,TRUE)}

The alpha for the smoothing constants in the EMAs is calculated in cell I5. Enter the following formula into cell I5:

=2/(26+1)

Be very careful in recognizing that cell I5 is used in a number of formulas and that you enter *cell* I5 and not the *number* 15. Next, initialize the EMA1 in cell E2 and enter the following formula into cell E2:

=K2-((1-I5)/I5)*J2+((1-I5)*(2-I5))/(2*I5^2)*I2

Now we start EMA1 in column E. Enter the following formula into cell E3 and copy down:

=$I$5*B3+(1-$I$5)*E2

Next, initialize EMA2 in cell F2 and enter the following formula into cell F2:

=K2-2*((1-I5)/I5)*J2+(2*(1-I5)*(3-2*I5))/(2*I5^2)*I2

Now start EMA2 in column F. Enter the following formula into cell F3 and copy down:

=$I$5*E3+(1-$I$5)*F2

Next, initialize EMA3 in cell G2 and enter the following formula into cell G2:

=K2-3*((1-I5)/I5)*J2+(3*(1-I5)*(4-3*I5))/(2*I5^2)*I2

Now start EMA3 in column G. Enter the following formula into cell G3 and copy down:

=$I$5*F3+(1-$I$5)*G2

Now calculate TEMA1 in column H. Enter the following formula into cell H1 and copy down:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Date	NASDAQ	X	X^2	EMA1	EMA2	EMA3	TEMA1	a2	a1	a0	EMA1	EMA2	DEMA1
30	880226	363.40	28	784	376.18	453.53	567.98	335.93				371.02	429.78	312.26
31	880304	373.37	29	841	375.97	447.78	559.07	343.64				371.19	425.44	316.95
32	880311	375.48	30	900	375.94	442.46	550.44	350.86				371.51	421.44	321.58
33	880318	381.58	31	961	376.35	437.57	542.08	358.44				372.25	417.80	326.71
34	880325	372.54	32	1024	376.07	433.01	534.00	363.18				372.28	414.43	330.13
35	880401	374.64	33	1089	375.97	428.79	526.20	367.75				372.45	411.32	333.59
36	880408	381.83	34	1156	376.40	424.90	518.70	373.19				373.15	408.49	337.80
37	880415	373.90	35	1225	376.22	421.30	511.48	376.24				373.20	405.88	340.53
38	880422	374.04	36	1296	376.05	417.95	504.56	378.88				373.26	403.46	343.07
39	880429	379.23	37	1369	376.29	414.86	497.91	382.20				373.71	401.26	346.16
40	880506	379.42	38	1444	376.52	412.02	491.55	385.05				374.13	399.25	349.01
41	880513	372.48	39	1521	376.22	409.37	485.46	386.02				374.01	397.38	350.64
42	880520	366.03	40	1600	375.47	406.86	479.64	385.47				373.42	395.60	351.23
43	880527	366.66	41	1681	374.81	404.48	474.07	385.06				372.92	393.92	351.91
44	880603	376.86	42	1764	374.97	402.30	468.76	386.76				373.21	392.39	354.03
45	880610	386.25	43	1849	375.80	400.34	463.69	390.09				374.17	391.04	357.31
46	880617	386.92	44	1936	376.63	398.58	458.86	393.00				375.12	389.86	360.38
47	880624	391.62	45	2025	377.74	397.03	454.28	396.39				376.34	388.86	363.82
48	880701	394.69	46	2116	378.99	395.70	449.95	399.83				377.70	388.03	367.37
49	880708	394.33	47	2209	380.13	394.55	445.84	402.59				378.93	387.36	370.51
50	880715	394.59	48	2304	381.20	393.56	441.97	404.90				380.09	386.82	373.36
51	880722	387.35	49	2401	381.65	392.67	438.32	405.26				380.63	386.36	374.90
52	880729	387.33	50	2500	382.08	391.89	434.88	405.43				381.13	385.97	376.28
53	880805	387.71	51	2601	382.49	391.19	431.64	405.54				381.61	385.65	377.58
54	880812	378.95			382.23	390.53	428.60	403.70				381.42	385.34	377.50
55	880819	377.42			381.87	389.89	425.73	401.69				381.12	385.02	377.22
56	880826	374.43			381.32	389.25	423.03	399.23				380.62	384.70	376.55
57	880902	376.51			380.97	388.64	420.48	397.46				380.32	384.37	376.27

SIDEBAR FIGURE 1: TEMA1 AND DEMA1.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Date	NASDAQ	X	X^2	EMA1	EMA2	EMA3	TEMA1	a2	a1	a0	EMA1	EMA2	DEMA1
2	870814	451.61	0	0	569.93	714.91	882.71	447.75	0.146	-7.876	447.753	525.37	602.39	448.35
3	870821	455.20	1	1	561.43	703.54	869.44	443.09				520.17	596.30	444.05
4	870828	453.29	2	4	553.42	692.42	856.33	439.31	Alpha (w=26)			515.22	590.30	440.14
5	870904	446.48	3	9	545.50	681.54	843.38	435.25	0.074			510.13	584.36	435.90
6	870911	446.17	4	16	538.14	670.92	830.61	432.27				505.39	578.51	432.27
7	870918	440.86	5	25	530.93	660.55	818.01	429.16	Slope	Y Intercept		500.61	572.74	428.48
8	870925	441.88	6	36	524.34	650.46	805.60	427.23	-6.16	448.35		496.26	567.07	425.45
9	871002	451.61	7	49	518.95	640.72	793.38	428.08				492.95	561.58	424.32
10	871009	438.43	8	64	512.98	631.25	781.37	426.56				488.91	556.20	421.63
11	871016	406.33	9	81	505.08	621.91	769.56	419.09				482.80	550.76	414.83
12	871023	328.45	10	100	492.00	612.29	757.91	397.06				471.36	544.88	397.85
13	871030	323.30	11	121	479.50	602.45	746.40	377.56				460.40	538.62	382.17
14	871106	326.39	12	144	468.16	592.50	735.00	361.97				450.47	532.09	368.85
15	871113	322.97	13	169	457.41	582.50	723.70	348.43				441.03	525.35	356.70
16	871120	312.49	14	196	446.67	572.43	712.50	335.21				431.50	518.40	344.61
17	871127	316.47	15	225	437.03	562.40	701.38	325.25				422.98	511.33	334.64
18	871204	292.92	16	256	426.35	552.33	690.34	312.42				413.35	504.07	322.63
19	871211	302.57	17	289	417.18	542.32	679.37	303.98				405.14	496.74	313.54
20	871218	326.91	18	324	410.50	532.55	668.50	302.33				399.35	489.53	309.17
21	871225	333.19	19	361	404.77	523.09	657.73	302.78				394.45	482.49	306.41
22	880101	330.47	20	400	399.27	513.91	647.07	303.13				389.71	475.61	303.80
23	880108	338.47	21	441	394.76	505.09	636.56	305.58				385.91	468.97	302.86
24	880115	340.14	22	484	390.72	496.62	626.19	308.49				382.52	462.56	302.48
25	880122	337.59	23	529	386.78	488.48	615.99	310.89				379.19	456.39	302.00
26	880129	344.66	24	576	383.66	480.72	605.97	314.80				376.64	450.48	302.79
27	880205	345.75	25	625	380.85	473.32	596.14	318.75				374.35	444.84	303.85
28	880212	353.27	26	676	378.81	466.32	586.53	324.00				372.79	439.50	306.07
29	880219	357.12	27	729	377.20	459.72	577.13	329.59				371.63	434.48	308.78

SIDEBAR FIGURE 2: TEMA1 AND DEMA 1.

=3*E2-3*F2+G2

To calculate DEMA1 (column N), we need to do a simple linear regression over a 26-week period of closing prices to seed the EMAs. The linear regression is entered as an array into cells I8 and J8:

{=LINEST(B2:B27,C2:C27,TRUE,TRUE)}

First, we initialize EMA1 in cell L2. Enter the following formula into cell L2:

=J8-((1-I5)/I5)*I8

Now, start EMA1 in column. Enter the following formula into cell L3 and copy down:

=$I$5*B3+(1-$I$5)*L2

Next, initialize EMA2 in cell M2. Enter the following formula into cell M2:

=J8-2*((1-I5)/I5)*I8

Now, start EMA2 in column M. Enter the following formula into cell M3 and copy down:

=$I$5*L3+(1-$I$5)*M2

DEMA1 is calculated in column N. Enter the following formula into cell N2 and copy down:

=2*L2-M2

You can calculate all of the above EMAs without using the regression formula initializations. Just place the closing price from cell B2 into cells E2, F2, G2, L2 and M2.

—Editor

FORMULAS

MetaStock

Custom formulas: Each requires one formula slot.

1 MACD histogram

OSCP (10,20,E,$)-MOV(OSCP(10,20,E,$),10,E)

2 MACD momentum

MOV((FML(MACD Histogram)-REF(FML(MACD Histogram),-10)),3,S)

COMPUTRAC TRADE PLAN

Thomas Aspray supplied the following trade plan for the MACD histogram and MACD momentum oscillator. His current trade plan no longer includes the three-unit smoothing of the MACD momentum oscillator that was part of the original calculation.

—B.S.

Type	Name	Definition	Format
DATA	item	"T-Bonds"	
DATA	date	DATA (date, first, last, item)	
DATA	open	DATA (open, item)	-5
DATA	high	DATA (high, item)	-5
DATA	low	DATA (low, item)	-5
DATA	close	DATA (close, item)	-5
DATA	vol	DATA (vol, item)	0
DATA	oi	DATA (oi, item)	0
STUDY	macd	MACD (close, 0.15, 0.075)	2
STUDY	signal	Signal (macd, 0.20)	2
STUDY	macdhis	Spread (macd, signal)	2
STUDY	macdmo	Momentum (macdhis, 10)	2

20 QUESTIONS ABOUT GAMBLING (TRADING) BEHAVIOR

In 1980, Gamblers Anonymous in Los Angeles published a list of 20 questions about gambling behavior. I took the liberty of inserting the word trading to help you translate your answer to your own trading.

1 Did you ever lose time from work due to gambling (trading)?

2 Has gambling (trading) ever made your home life unhappy?

3 Did gambling (trading) affect your reputation?

4 Have you ever felt remorse after gambling (trading)?

5 Did you ever gamble (trade) to get money with which to pay debts or otherwise solve financial difficulties?

6 Did gambling (trading) cause a decrease in your ambition or efficiency?

7 After losing, did you feel you had to return to the scene of your loss as soon as possible and win back your losses?

8 After a win, did you have a strong urge to return and win more?

9 Did you often gamble (trade) until your last dollar was gone?

10 Did you ever borrow to finance your gambling (trading)?

11 Have you ever sold anything to finance gambling (trading)?

12 Were you reluctant to use "gambling (trading) money" for normal expenditures?

13 Did gambling (trading) make you careless of the welfare of yourself and your family?

14 Did you ever gamble (trade) longer than you had planned?

15 Have you ever gambled (traded) to escape worry or trouble?

16 Have you ever committed, or considered committing, an illegal act to finance gambling (trading)?

17 Did gambling (trading) cause you to have difficulty in sleeping?

18 Do arguments, disappointments or frustrations create within you an urge to gamble (trade)?

19 Did you ever have an urge to celebrate any good fortune by a few hours of gambling (trading)?

20 Have you ever considered self-destruction as a result of your gambling (trading)?

Some of these questions may be more applicable to gambling than to trading, and there is a presumption that gambling will produce loss. However, the parallel is interesting. The gamblers who created this list say that an affirmative answer to four or more questions is a reliable indication that you may be a problem gambler (trader) and no longer normally in control of your gambling (trading) behavior.

The MACD Momentum Oscillator

by Barbara Star, Ph.D.

The moving average convergence/divergence (MACD) is one of the most popular indicators around. Here, STOCKS & COMMODITIES contributor Barbara Star reviews and updates ways to use it.

At present, virtually every charting software package contains Gerald Appel's moving average convergence/divergence (MACD) indicator. The indicator is composed of two lines: the MACD line, which is the difference between two exponential moving averages (usually a 12- and 26-period EMA), and the signal line or trigger, which is an exponentially smoothed moving average, usually a nine-period EMA, of the MACD line often displayed as a dotted line. When the MACD line and the trigger line cross, a potential change in trend is signaled (Figure 1). Thomas Aspray provided a variation on the MACD for trading stocks and commodities in STOCKS & COMMODITIES articles in 1988.

While experimenting with the MACD, Aspray found that its signals often lagged when used with weekly data, causing late entries or exits. He also discovered that an MACD based on a shorter-length EMA was more responsive to price turns than the original 12- and 26-period EMA. Like most traders, however, Aspray wanted more than an indicator that caught trend changes; he wanted one that could anticipate potential changes in MACD turning points.

To achieve that goal, the MACD required two modifications. First, an MACD histogram was required. A histogram is a line style that reflects changes in the indicator as individual vertical lines above and below a zero point. It is often easier to see changes develop when using a histogram instead of the usual solid line style.

The MACD histogram, however, is more than a visual change in line style; it measures the difference (or

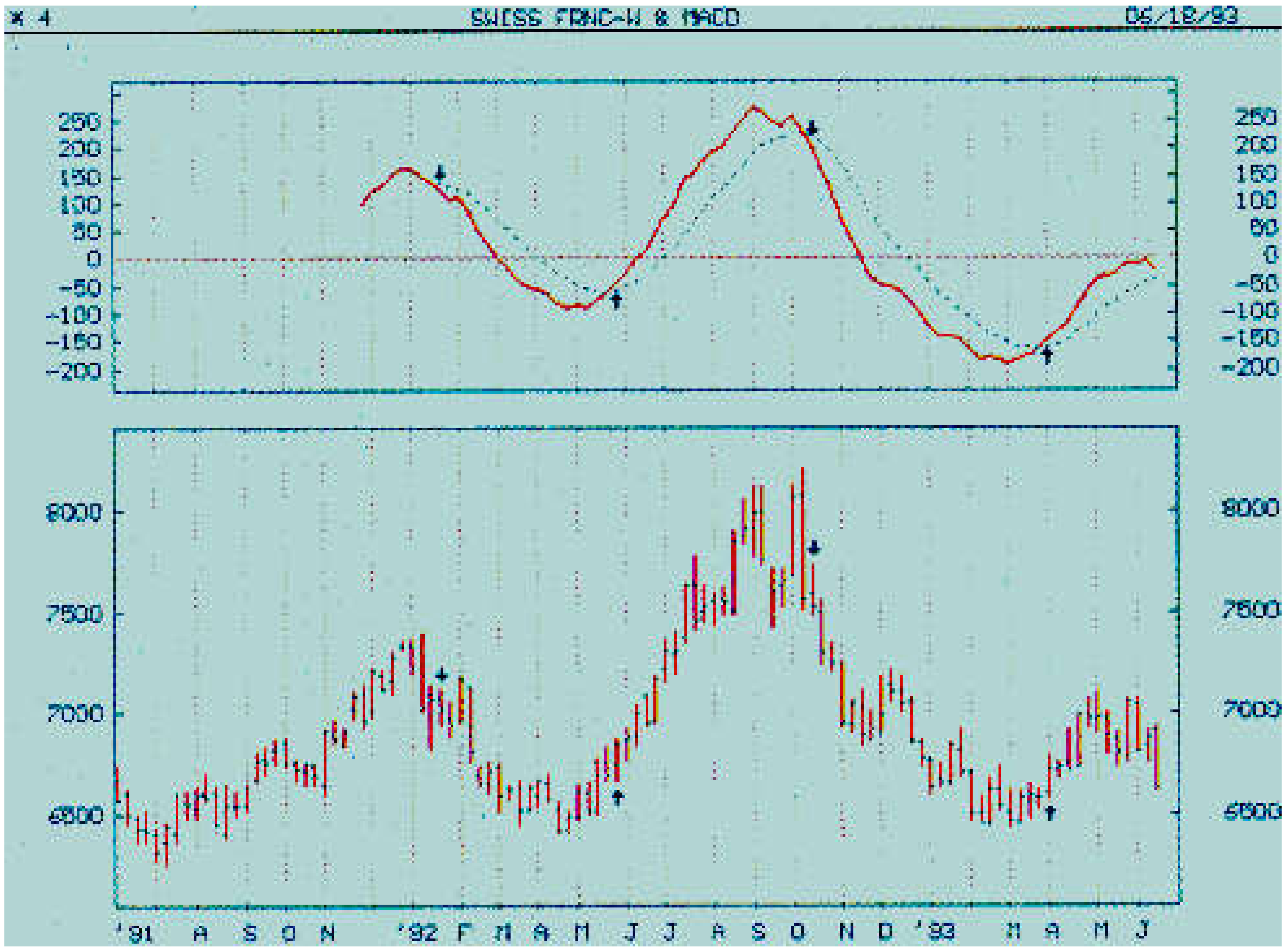

Figure 1: Weekly Swiss Franc and MACD. *The MACD oscillator moves above and below a zero line. The solid line represents the difference between a 12-unit exponentially smoothed moving average and a 26-unit exponentially smoothed moving average. The dotted line is a nine-unit exponentially smoothed moving average of the solid line. Crossing above or below the trigger line generates buy and sell signals, as shown by the arrows.*

space) between the MACD line and the trigger line. For his MACD histogram, Aspray began with the difference between a 10- and 20-period exponentially smoothed moving average to produce the MACD line. He then calculated the difference between that MACD line value and a 10-period exponentially smoothed moving average (the trigger line) of the MACD line to obtain the histogram value that is plotted using a histogram line style.

Once the histogram was constructed, the second step was to create an MACD momentum oscillator based on the 10-period momentum (with a three-period smoothing) of the histogram. This is done by subtracting the current MACD histogram value from its value as of 10 periods ago and then smooth the result with a three-period simple moving average. The MACD momentum oscillator is plotted as a solid line, which also moves above and below its own zero point. The MACD histogram and momentum oscillators are shown in Figure 2 with the Swiss franc.

MACD MOMENTUM INTERPRETATION

In general, the MACD momentum oscillator serves as a leading indicator, while the histogram acts to confirm the change in momentum. Actual buy and sell signals are given when the histogram crosses above or below its zero line in the direction suggested by the momentum oscillator.

Interpreting the MACD momentum oscillator depends on whether daily or weekly price charts are used. When trading with weekly price charts, the most important consideration is the direction of the indicator — that is, whether it is rising or falling. The second consideration is to look for crossovers above or below the zero line signaling possible upcoming buy or sell signals. The third and final consideration is whether the indicator is deeply oversold or overbought in relation to the MACD histogram. Longer-term divergence of four to six months on the momentum oscillator indicates the potential for a major change in trend.

The weekly Treasury bond chart in Figure 3 illustrates several of the trading rules. At point A, the MACD momentum oscillator was rising, warning of a potential trend change. Midway between points A and B, the momentum oscillator crossed above its zero line, and a few weeks later, the MACD histogram confirmed the up move by crossing above its zero line and generating a buy signal. At point B, the momentum oscillator peaked and began to turn down, but the histogram continued to move up. Four months later, the momentum oscillator crossed below its zero line. By then, both the momentum oscillator and the histogram exhibited bearish divergence, signaling a trend reversal. (See sidebar, “Formulas.”)

That downward reversal was confirmed the following week, when the histogram fell below its zero line; however, this turned out to be a relatively minor correction. At point C, the momentum oscillator was in deeply oversold territory in relation to the histogram and reversed to the upside. Both the momentum oscillator and the histogram crossed their respective zero lines during the same week in December 1992.

However, while the momentum oscillator climbed toward point D, the histogram briefly dipped below its zero line before resuming its upward move. At point D, the momentum oscillator was very overbought in relation to the MACD histogram and began to lose power, while the histogram continued to inch up. The momentum oscillator was also forming a double top with point B. This time, price corrected before the momentum oscillator crossed below its zero line. The histogram confirmed the down move two weeks later, even though price remained in a trading range, and instead of moving down, price rose above the sell price signal.

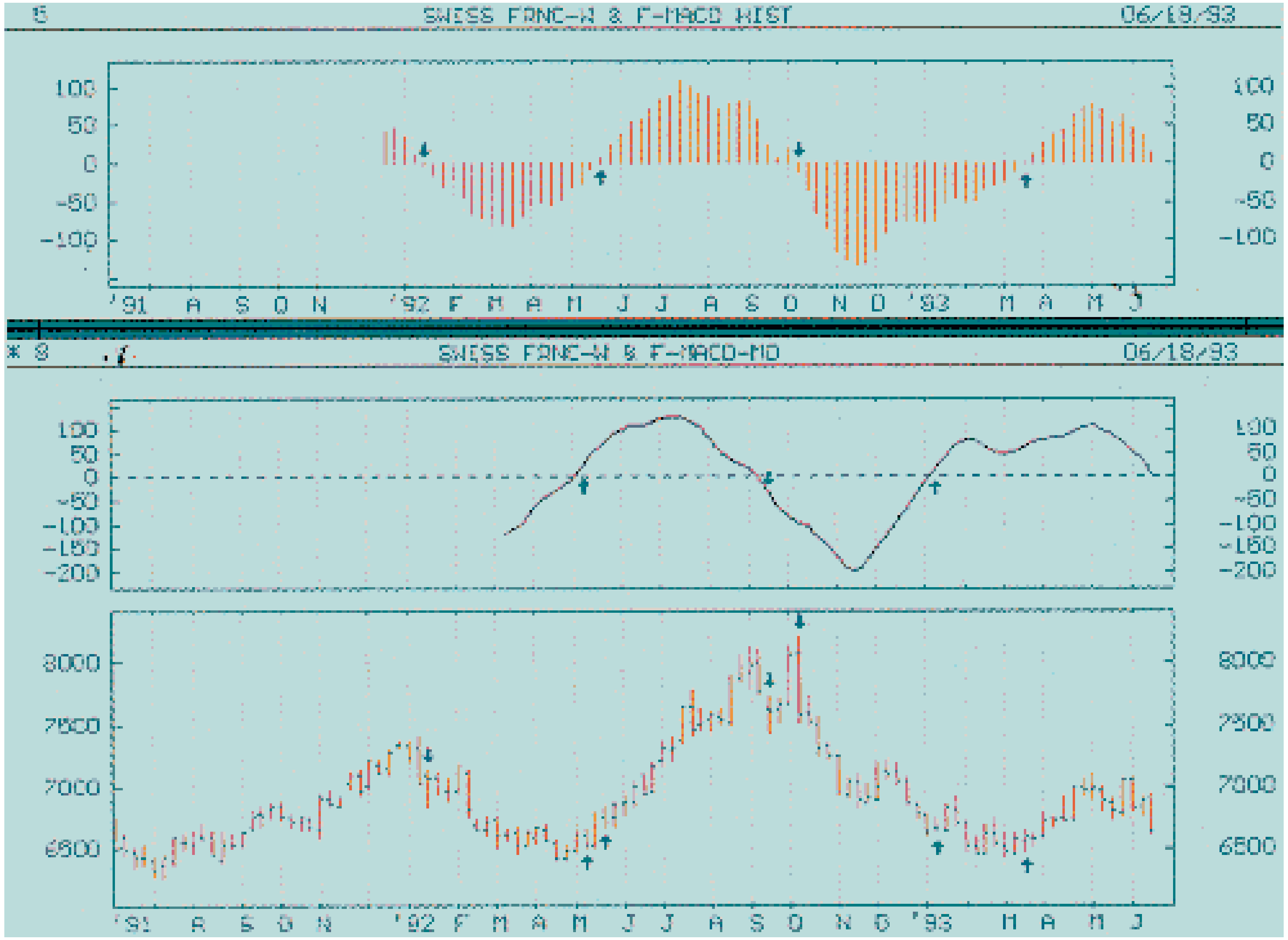

Figure 2: Weekly Swiss Franc, MACD Histogram and MACD Momentum Oscillators. *The MACD histogram in the top panel is the difference or space between the solid MACD line and its trigger line. The MACD momentum oscillator in the middle panel shows the manner in which the histogram is moving. Each indicator moves above and below its own zero line. MACD momentum acts as a leading indicator of a potential buy or sell when it crosses its zero line. The actual buy/sell signal occurs when the MACD histogram crosses its zero line in the same direction as the MACD momentum.*

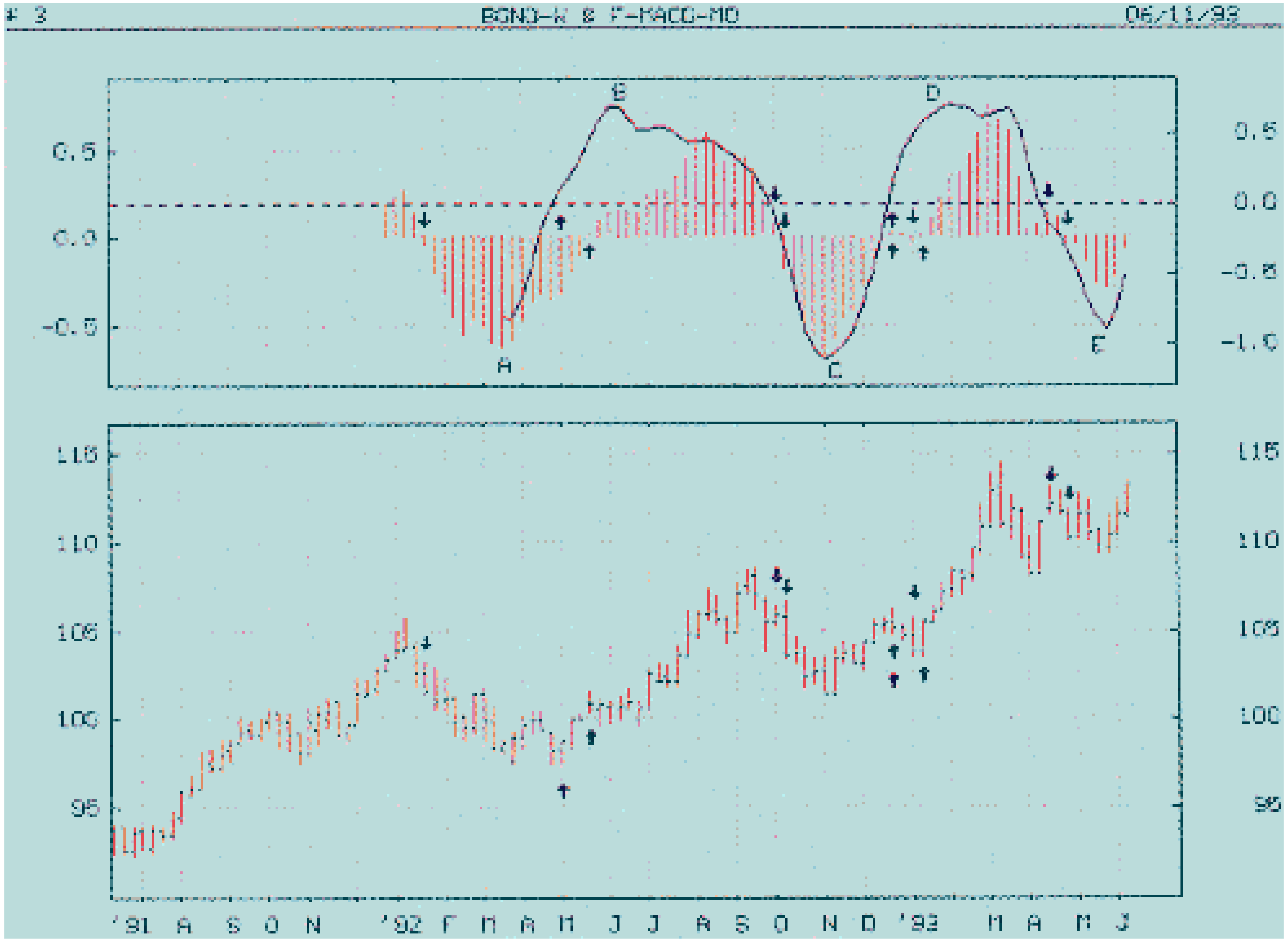

Figure 3: Weekly T-Bonds, MACD Histogram and MACD Momentum Oscillators. *It is often easier to see the relationship between the MACD histogram and MACD momentum oscillators when one is overlaid on the other, as in the top panel. The scale for the histogram is on the left and the scale for the MACD momentum is on the right. The dotted line denotes the zero line for MACD momentum. Momentum leads the way up and down and should be confirmed by a buy or sell signal on the histogram within two to five weeks.*

In general, the MACD momentum oscillator serves as a leading indicator, while the hisogram acts to confirm the change in momentum.

Note the MACD momentum oscillator led the way up or down on all major changes of trend, even in a strongly uptrending market. However, this example also shows that the indicator is not infallible. Sometimes, price may go against the trader, as it did at the signals between points C and D and again between D and E. Aspray suggests either waiting for price to retest the entry signal before buying or selling or using additional indicators to confirm the signal.

MOMENTUM OSCILLATOR, DAILY PRICES

Slightly different rules apply when interpreting the MACD momentum indicator with daily price data. First, study the weekly data to determine the intermediate trend. If both the weekly MACD histogram and MACD momentum are above their zero lines, then use dips in the MACD momentum on daily data charts as a signal to enter long positions. If both weekly MACD indicators are below their zero lines, then use peaks in the MACD momentum indicator on daily price charts to initiate short-term sell positions. In short, trade in the direction of the intermediate trend. If the weekly MACD momentum indicator is declining but the weekly MACD histogram is still above its zero line and rising, then give more weight to the MACD histogram.

Because MACD momentum acts as an early warning system rather than a separate buy/sell indicator, crosses above or below its zero line should be confirmed in two to five days by the histogram crossing its zero line in the same direction as the momentum oscillator. The MACD histogram's failure to confirm MACD momentum indicates a technical rebound rather than the start of a new move to the upside. Longer-term divergences (say, four to eight weeks) on daily price charts indicate a potential trend change.

The gold charts, Figures 4 and 5, embody many of the suggested rules when daily price charts are used. The daily price chart of June 1993 gold flashed a buy signal in mid-January 1993 when both the daily MACD momentum oscillator and histogram crossed above respective zero lines. However, on the weekly price chart during that time frame, the momentum oscillator was nearing but had not yet crossed its zero line and the histogram was still well below its zero line. Because the weekly chart did not confirm the signal given on the daily price chart, the daily signals would be interpreted as a countertrend rebound rather than the start of a bull market trend change.

This interpretation proved correct when daily prices and the daily MACD indicators turned negative in February 1993. Another buy signal appeared on the daily charts in March. This time, the weekly price chart confirmed the daily buy signal because both the weekly MACD momentum and histogram indicators were above their zero lines. The sell signal in April 1993 on the daily chart indicated a correction rather than an intermediate change in trend because the indicators on the weekly charts were still above their zero lines. On the other hand, the dips below and near the zero lines in April and May marked additional buying opportunities.

The first sign of trouble occurred on the daily chart in late May, when both the MACD momentum oscillator and the MACD histogram showed bearish divergence as prices made new highs. This suggested the possibility of a deeper price correction than before as well as a prudent time to raise stop levels to the

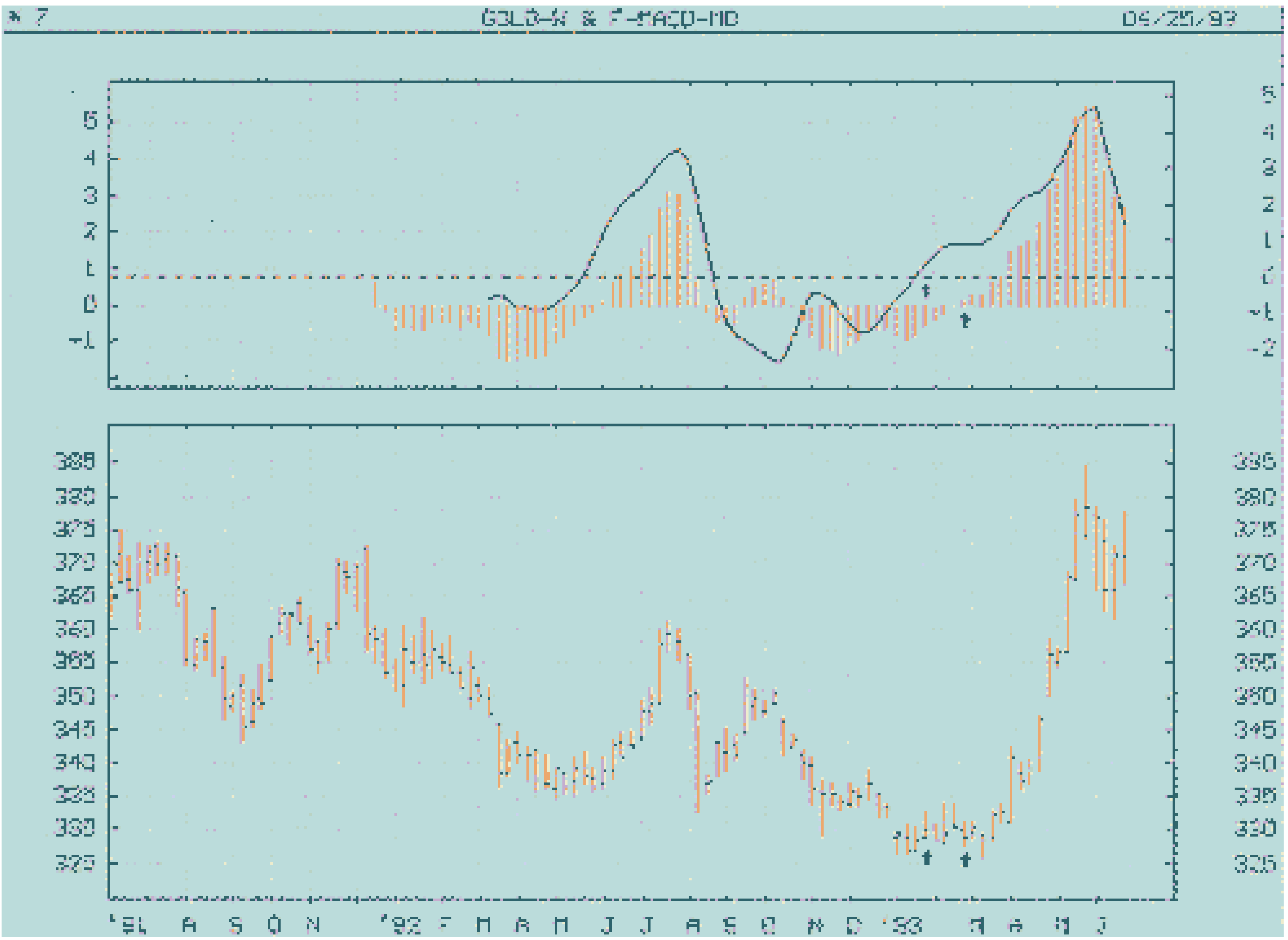

Figure 4: Weekly Gold, MACD Histogram and MACD Momentum Oscillators. *When using the MACD histogram and momentum oscillators with daily price data, it is best to check the direction of the indicators on a weekly price chart before entering a market to trade in the direction of the intermediate-term trend. Here, the first time both indicators were above their zero lines was toward the end of February 1993.*

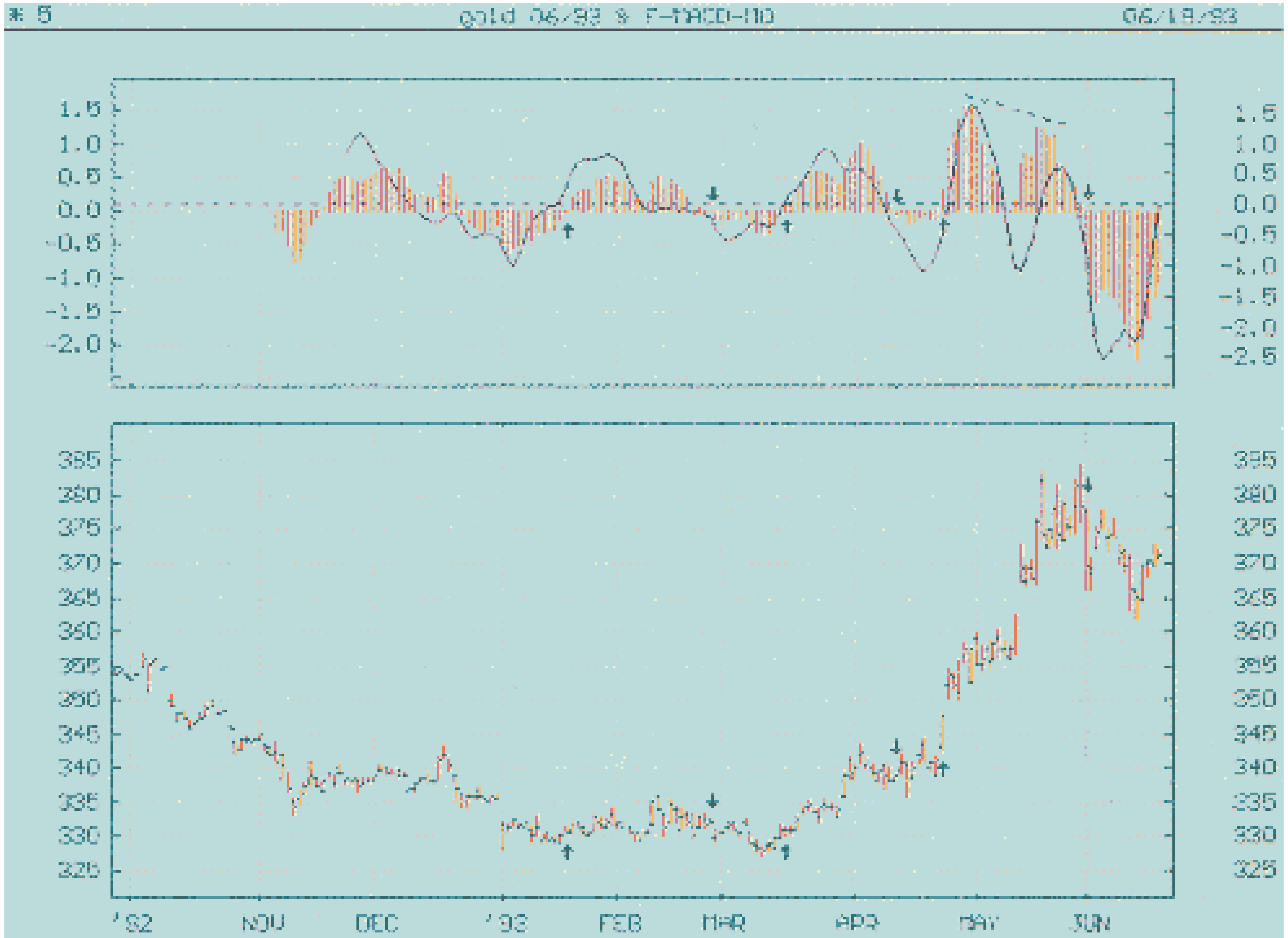

Figure 5: Daily Gold, MACD Histogram and MACD Momentum Oscillators. *Since the weekly MACD oscillators were in positive territory, the March 1993 buy signal on the daily June gold chart was a high probability trade. Divergence on the daily chart in the April-May time frame warned of the correction that occurred in June.*

vicinity of the earlier May correction to protect profits. However, according to the trading rules, with both weekly momentum and histogram indicators well above their zero lines, the uptrend should resume once the correction ended.

ADDITIONAL IDEAS

Aspray uses the MACD momentum oscillator to track commodities, but the indicator can also work with stocks to act as leading indicators. The MACD momentum seems to produce more reliable signals when used with weekly price data rather than with daily data. In addition, it should be used with other indicators such as the regular MACD and Bollinger bands, as illustrated by American Express in Figure 6. The MACD and the Bollinger bands both confirmed the divergence exhibited by the MACD momentum oscillator seen at the 1989 top that led to the 1990 decline. The downturn of the countertrend rally in 1990 was signaled by the MACD momentum oscillator and confirmed when prices were turned back at the zero line of the regular MACD and the upper Bollinger band. The rally from late 1990 into early 1991 suggested by the upmove of the momentum oscillator was confirmed by a crossover of the regular MACD trigger line and a retest of the lower Bollinger band.

The importance of waiting for confirmation is best seen during the price rise beginning in late 1992 and continuing into 1993. Throughout that time, both the MACD momentum oscillator and MACD histogram were fluctuating above and below their zero lines, producing numerous buy and sell signals. However, these fluctuations were not confirmed by the regular MACD, which stayed above its zero line, or the Bollinger bands, which showed that prices remained above both the lower band and the middle band. Waiting for confirmation prevented the trader from being whipsawed.

TRADING TIPS

Even though the MACD momentum oscillator is a good leading indicator, it often produces false signals. This indicator should be used with at least one other indicator to determine if the trend has actually changed. Aspray suggests using the Herrick payoff index, the demand oscillator or on-balance volume for confirmation. Figure 7 shows the momentum oscillator and on-balance volume indicators with March 1993 cocoa. The MACD momentum oscillator and MACD histogram indicated a bearish divergence at the price high in August. The August sell signal was confirmed by the downturn in on-balance volume below its zero line. Despite the numerous buy signals given by the momentum oscillator throughout 1992, the on-balance volume indicator remained below its zero line, meaning that rallies should be sold. Signs of potential trend reversals came with the bullish divergences of both the MACD momentum oscillator and on-balance volume at the March 1993 price lows.

Barbara Star, is a university professor and part-time trader. She leads a MetaStock support group and is a board member of the Market Analysts of Southern California. Technical support was provided by Allan McNichol of Equis International, Inc. Thomas Aspray, 509 838-0434, is the senior partner of Aspray, Parsons & McClintock Asset Management, located in Spokane, WA.

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Aspray, Thomas [1988]. “MACD momentum, parts 1 and 2,” *Technical Analysis of* STOCKS & COMMODITIES, Volume 6: August and September.

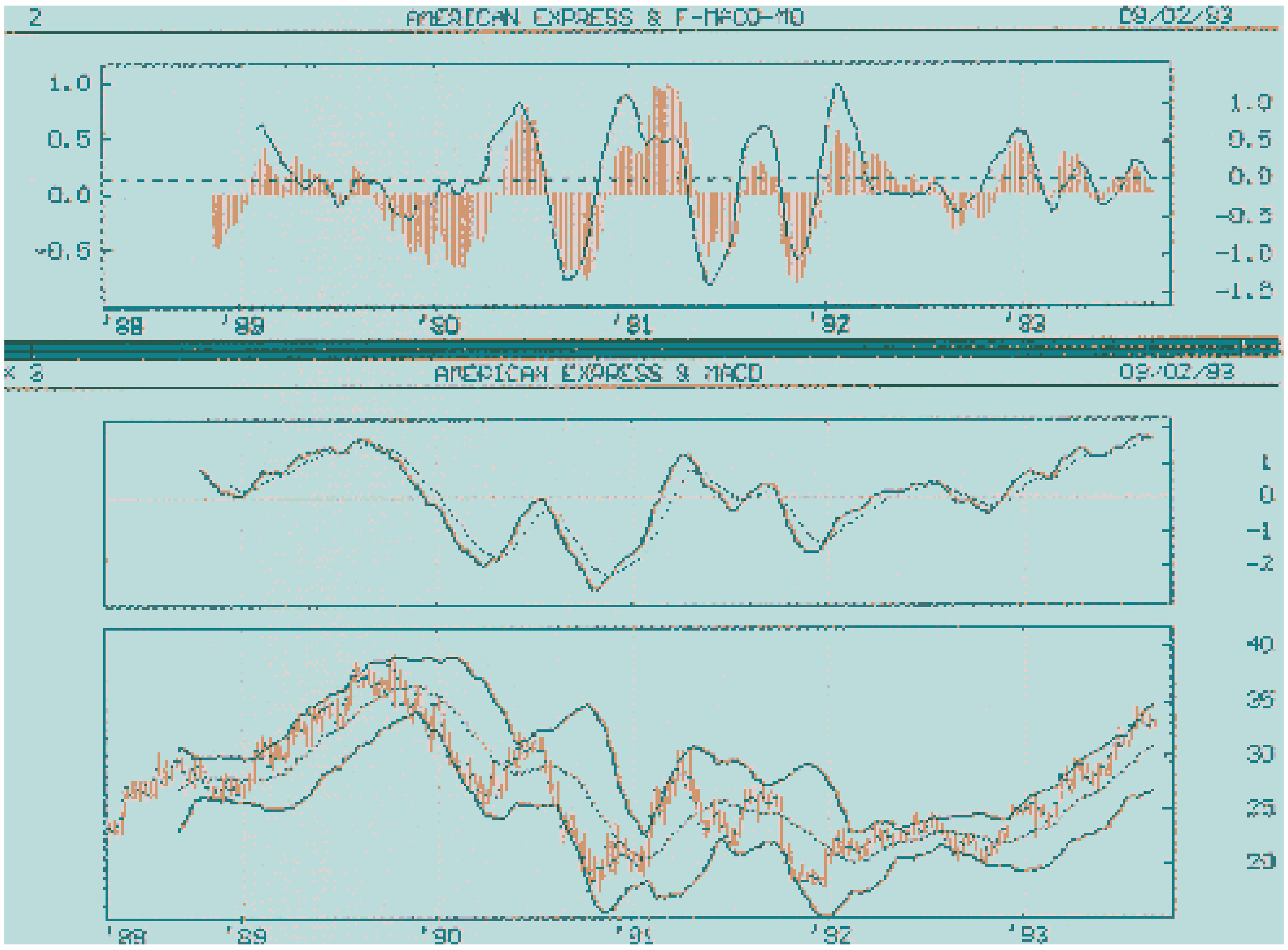

FIGURE 6: WEEKLY AMERICAN EXPRESS, MACD MOMENTUM OSCILLATOR, THE ORIGINAL MACD AND BOLLINGER BAVDS. *If used with other indicators and weekly price charts, the MACD momentum oscillator also can be applied to stocks. Both the Bollinger bands (lower panel) and the regular MACD (middle panel) helped to confirm the sell signal in American Express stock given by the momentum oscillator at the 1989 high and the buy signal toward the latter part of 1992.*

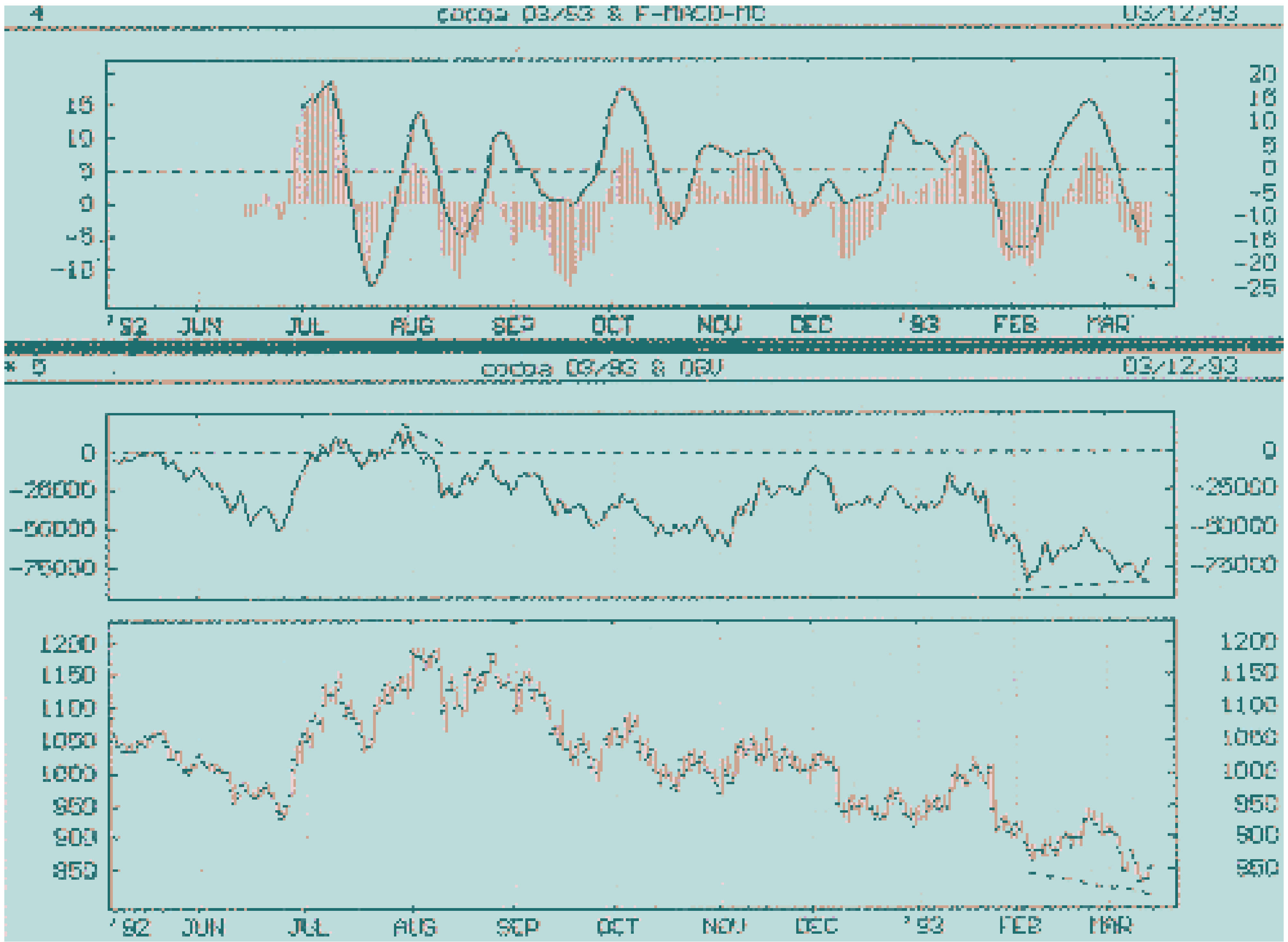

FIGURE 7: MARCH 1993 COCOA, MACD HISTOGRAM AND MACD MOMENTUM OSCILLATORS AND ON-BALANCE VOLUME. *It is always best to use other indicators that confirm the signals given by the MACD momentum oscillator. Here, on-balance volume shows that the trend in March cocoa was down. Therefore, MACD momentum buy signals would be considered countertrend rallies. The bearish divergence on the MACD momentum oscillator from the July and August 1992 peaks was confirmed by a down move in on-balance volume. The first sign of a potential change in trend did not occur until a bullish divergence on both indicators appeared in the February-March 1993 time frame.*

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Trading And Gambling

by Ruth Roosevelt

Gambling is an ancient behavior. Humans have wagered on the outcomes of chance events since prehistoric times. STOCKS & COMMODITIES *contributor Ruth Roosevelt, director of the Wall Street Hypnosis Center, explains how trading and gambling have certain characteristics in common — and how not to let them become examples of problem behavior.*

Gambling is an old and universal behavior, and with it comes problem gambling. History abounds with examples of problem gambling. The inability to control the impulse to gamble and to continue to do so despite the amount of money won or lost has existed for a very long time.

We've all known traders who at one time or another experience a trading loss and try frantically to recoup that loss by increasing the size and frequency of their trading. And we've known traders who after a large win will trade carelessly or excessively until they lose their winnings. This behavior is classic with *problem* gamblers. *Pathological* gamblers, however, often scramble to get additional funds to keep gambling. They may borrow, lie or even steal to keep gambling.

A LOOK AT THE COIN

What is the difference between trading and gambling? For many, the difference is simply that of probabilities. If your methodology and skill and the probabilities put the odds in your favor, you're not gambling. The casino itself is not gambling, because the odds are in the house's favor and it has strict rules by which the odds are consistently in its favor. Note that while the casino has a 2-1/2% advantage in many games (and more in slot machines), in trading, the floor or specialist or market maker often takes a much larger percentage through the bid and the asked. When commissions and slippage are tacked on, the average trader starts by facing formidable odds that must be overcome.

For others, the difference between trading and gambling is style. The trader presses the market when he's ahead; the gambler presses when he's behind. The gambler takes random chances, while the trader prepares, studies and waits for the appropriate signal, preferably taking only high-probability trades.

For still others, the difference lies in the vehicle of chance. Cards, dice, slot machines and betting on sports are examples of gambling. Stocks, futures and real estate, on the other hand, are trading or investing.

Whether you call it trading or gambling, society accepts the behavior as long as you win and/or keep it under control. Some individuals, however, can't stop until they seemingly have no other choice but to seek help. While society is concerned about pathological gambling, however, traders are concerned about unprofitable trading. What can we learn from gambling gone wrong to avoid pitfalls in our own trading?

What *is* the difference between trading and gambling? For many, the difference is simply that of probabilities. If your methodology and skill and the probabilities put the odds in your favor, you're not gambling.

In *Pathological Gambling*, Martin C. McGurrin writes of three features that distinguish pathological gamblers' behavior from normal recreational gambling: A compulsion to gamble; an increasing physical and psychological tension prior to gambling; and a pronounced level of pleasure associated with the relief of tension achieved by active involvement in gambling behavior.

McGurrin describes five common characteristics of pathological gamblers. First, they vacillate between periods of extreme confidence in gambling as well as life and periods of acute self-doubt, anxiety and depression. Second, they tend to view reward and achievement through gradual, sustained effort and delayed gratification as an inferior means of financial self-support and accomplishment. Third, they typically have difficulty maintaining intimate, emotionally expressive and supportive relationships when involved in active gambling. Fourth, many pathological gamblers exhibit narcissism manifest in a grandiose sense of self-importance, hypersensitivity to criticism, fragile self-esteem and a lack of empathy for others. As a result, they use primitive defense mechanisms to guard against feelings of powerlessness and lack of self-worth. Finally, these gamblers tend to view many life events — not just gambling — as being externally controlled.

In crisis situations, problem gamblers tend to respond without forethought and with a relative inability to delay gratification. It goes without saying they don't use good money management techniques and they don't have a well-thought-out, low-risk plan. Problem gamblers don't discipline themselves to look for high-probability opportunities, don't self-regulate and don't utilize good risk control, and they tend to gamble with money they can't afford to lose. How much does it take to translate this into trading?

The problem gambler also has no model for winning. The restlessness persists in winning or losing situations. Do you feel deep down that you deserve to win money and to keep it? Do you hold an image of yourself as successful and wealthy?

Problem gamblers are looking for an intensity that eludes them elsewhere. This sense of the action, of being a part of things, draws them far more than simply making money. Why are *you* trading?

If you're looking for thrills, look for it outside the trading arena. Go rock climbing, fly a plane, take up downhill ski racing, or any other exciting and slightly dangerous sport. Keep it out of the market! If you get bored following an effective trading strategy, start a small play account, where you can put all your impulsive and playful trades. Keep it out of your *serious* trading.

Many traders are very good analysts and systems developers, but when they start to trade, they can't seem to replicate their system. They freeze upon receiving the signal; they hesitate, only to see the market moving without them; they jump in late; they jump out early. They fail to put in stops; they let a loss get out of hand; they sit there hoping for the market to come back. These people don't have the impulse to gamble, but strangely, they end up gambling more than they would if they just followed their well-devised trading strategy. These nongamblers end up gambling wildly and randomly! This is a perfect example of how you bring the thing you most fear upon yourself.

THE BOTTOM LINE

The most important question is the bottom line. Do you make money trading? Or, how long has it been since you've made money trading? Become attuned to the feedback from your trading and ask yourself: What can I learn from my trading behavior? Remember: you rarely see rich gamblers. You may see rich people who gamble, but that's not how they get their money.

Human behavior is motivated by pain and pleasure, by the rewards and punishments we get. Behavioral researchers have found that random rewards are more effective than consistent earned rewards. Dolphins will jump for an offered fish, but if every so often they are given a jackpot of five fish, they will consistently jump higher. A very appropriate allegory for gambling or trading!

There is also something called *learned helplessness*. Caged dogs with high walls around them who are repeatedly given shocks will learn helplessness so that when the walls are lowered and they could easily jump over, they will instead lie down and whimper. If, however, any opportunity presents itself to escape during the learning process, the dogs demonstrate resourcefulness in avoiding the pain. In trading, we need to be resourceful to avoid massive pain, and ironically, that path often leads us first to accept lesser pain through discipline so that we can avoid the greater pain.

As we trade and live, we seem to be involved in a fundamental struggle with fate. Instead, we need to bring the control back to ourselves and deal effectively with these inexorable external forces. *Internal control and sensitivity to feedback* may well be the difference between gambling and trading or between effective trading and problem trading.

Ruth Roosevelt is the director of the Wall Street Hypnosis Center.

Additional reading

McGurrin, Martin C. [1992]. *Pathological Gambling: Conceptual, Diagnostic, and Treatment Issues, Professional Resource Press.*

