THE TRADERS' MAGAZINE JANUARY 1994

TECHNICAL ANALYSIS OF STOCKS & COMMODITIES™

STOCK MARKET RISK
A month-to-month look 16

CHATTING WITH MARC CHAIKIN
An interview 20

THE HAURLAN INDEX
Signaling tops and bottoms 38

SMOOTHING DATA
With faster moving averages 42

TAKE ADVANTAGE OF TAKEOVERS
Using options 58

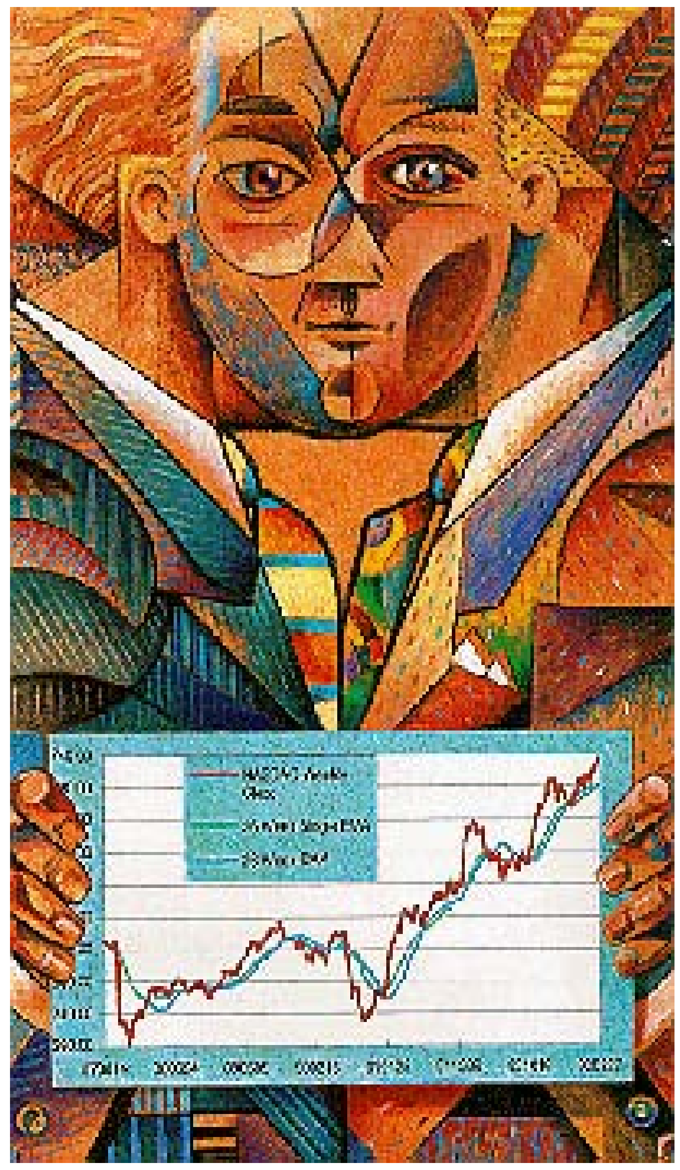
POLARIZED FRACTAL EFFICIENCY
An indicator derived from fractal geometry 76

USING THE TICK
In a short-term indicator 84

PRICE/OSCILLATOR DIVERGENCES
Generate trading signals 95

Smoothing Data With Faster Moving Averages

by Patrick G. Mulloy



Has the lag time of moving averages ever irritated you? Well, there is a way around it: a modified statistical version of exponential smoothing with less lag time than the standard exponential moving average that is used in securities technical analysis, a double exponential moving average. First-time STOCKS & COMMODITIES contributor Patrick Mulloy explains.

Moving averages have a detrimental lag time that increases as the moving average length increases. The solution is a modified version of exponential smoothing with less leg time

All moving averages smooth or reduce the noise level of a time series such as closing stock market prices by increasing the moving average (MA) length. But moving averages have an inherent detrimental lag time that increases as the MA length increases. The solution is a modified statistical version of exponential smoothing with less lag time than the standard exponential moving average (EMA) that is commonly used in securities technical analysis. Implementing this faster version of the EMA in indicators such as the moving average convergence/divergence (MACD), Bollinger bands or TRIX can provide different buy/sell signals that are ahead (that is, lead) and respond faster than those provided by the single EMA. In Figure 1, the MACD indicator is applied to the weekly closing price of the NASDAQ composite index. Using the standard MACD EMA lengths of 12, 26 and nine, the indicator generates 11 buy signals with six losses. Figure 2 uses the same filter lengths of 12, 26 and nine, but the filters are not EMAs but are derivations of one-parameter double exponential moving averages (DEMA1). This time, the indicator generated nine trades, with only three losses due to the increased response of the DEMA1 filter. Here are

FIGURE 1: WEEKLY NASDAQ AND MACD. *The MACD has 12 buy signals beginning in October 1988 with six whipsaws. The latest buy signal is still open.*

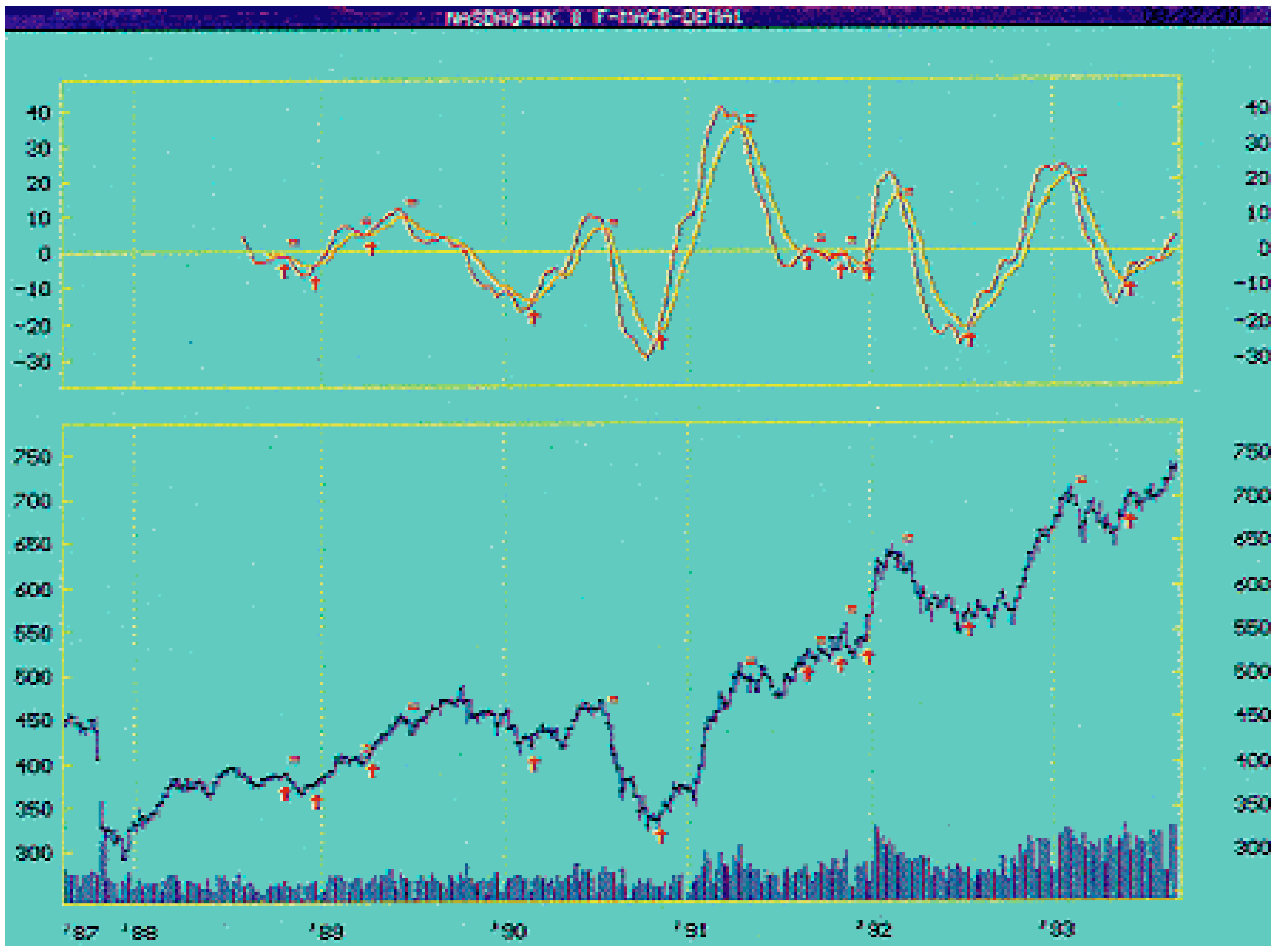


FIGURE 2: Weekly NASDAQ and MACD-DEMA1. *The MACD-DEMA1 (12,26,9) has fewer round-trips than the standard MACD and has almost twice the profit.*

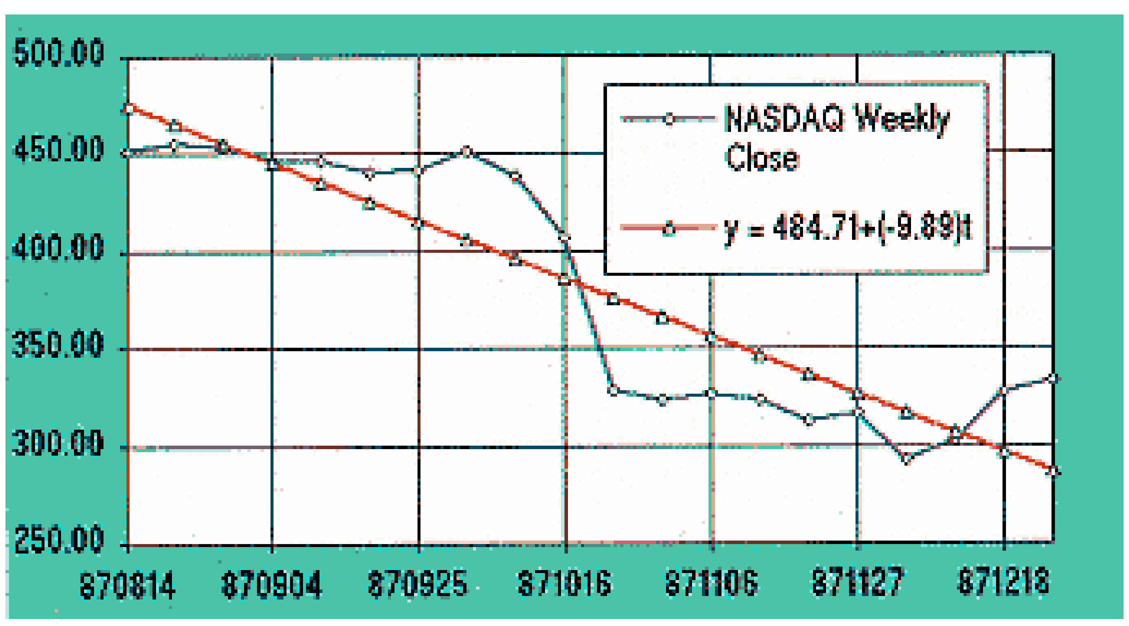


Figure 3: Weekly NASDAQ and Linear Regression. *Calculating a linear regression of the data, we see that β_0 (y-intercept) is 484.71 and β_1 (slope) is -9.89.*

the attributes of the DEMA1 filters and the methods by which to calculate the filters.

THE BASICS

The term *statistical* is used qualitatively here because exponential smoothing is not based on any formal statistical theory, and for that reason, these smoothing techniques are best regarded as descriptive rather than inferential in statistical terminology. With that in mind, data smoothing by using moving averages is a common methodology in the statistical world of time series forecasting. The moving average smoothing technique removes the rapid fluctuations in the time series so that the secular (that is, long-term) trend is more apparent. Exponential smoothing was originally developed to primarily forecast time series that can be represented by a polynomial function of time. Therefore, in the following descriptions it is assumed that the data is being modeled with the most appropriate regression polynomial of the form:

$$y_t = \beta_0 + \beta_1 t + 1/2\beta_2 t^2 + \varepsilon_t$$

where the β (beta) parameters are called the regression coefficients and ε (epsilon) is the random error in the data series. In a linear regression model as below, β_0 represents the y-intercept and β_1 represents the slope of the line at time t. For example, in Figure 3 we are modeling 20 weeks' worth of daily closing price data of NASDAQ using a linear regression:

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

The straight line through the data represents the linear regression with the y intercept $\beta_0 = 484.71$ and the slope $\beta_1 = -9.89$. In Figure 4, the linear regression is applied four weeks later and the new betas are $\beta_0 = 430.09$ and $\beta_1 = -6.88$. Note that the two lines have different slopes and different y-intercepts. The betas have changed over the two different time periods. The speed with which these betas change affects the type of smoothing filter we should apply to our data when developing trading indicators.

SMOOTHING WITH THE SMA

As a way of introduction, the first and most obvious smoothing method is the straightforward mean (arithmetic average) of the data over a selected period (window) of time *w*. The simple moving average (SMA) uses an equal weighting technique in that each value in the window is weighted by the same factor 1/*w*. The simple moving average is more effective when the parameters describing the time series are changing *very* slowly over time. It is most effective if the time series is effectively constant with time, that is, $\beta 1$ and $\beta 2$ are equal to zero, and so the time series can be represented by the mean of the entire database. The model reduces to:

$$y_t = \beta_0 + \varepsilon_t$$

where β_0 will be the mean of the data, not the y-intercept.

That the mean of the data over widely separated segments of time may vary slowly makes the moving average an effective tool. All technical analysis software packages provide the simple moving average as a default moving average. In mathematical terms, the SMA can be expressed as:

where:

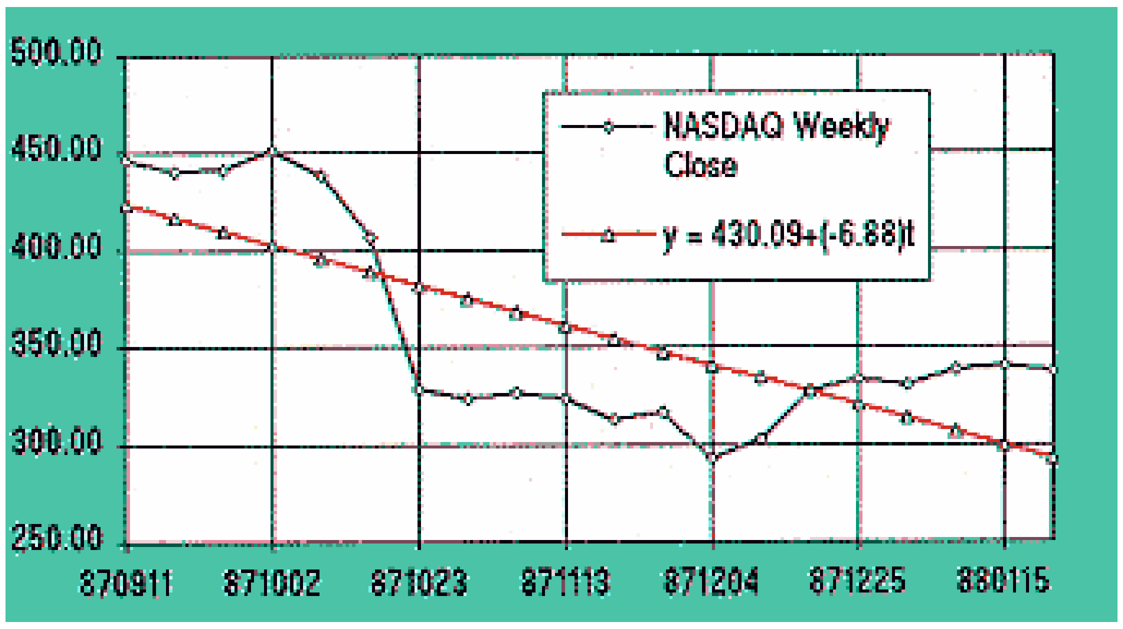


Figure 4: Weekly NASDAQ and Linear Regression. *Moving forward by four weeks and calculating a linear regression of the data, we see that β_0 (y-intercept) is now 430.09 and β_1 (slope) is -6.88. The betas (β) have changed.*

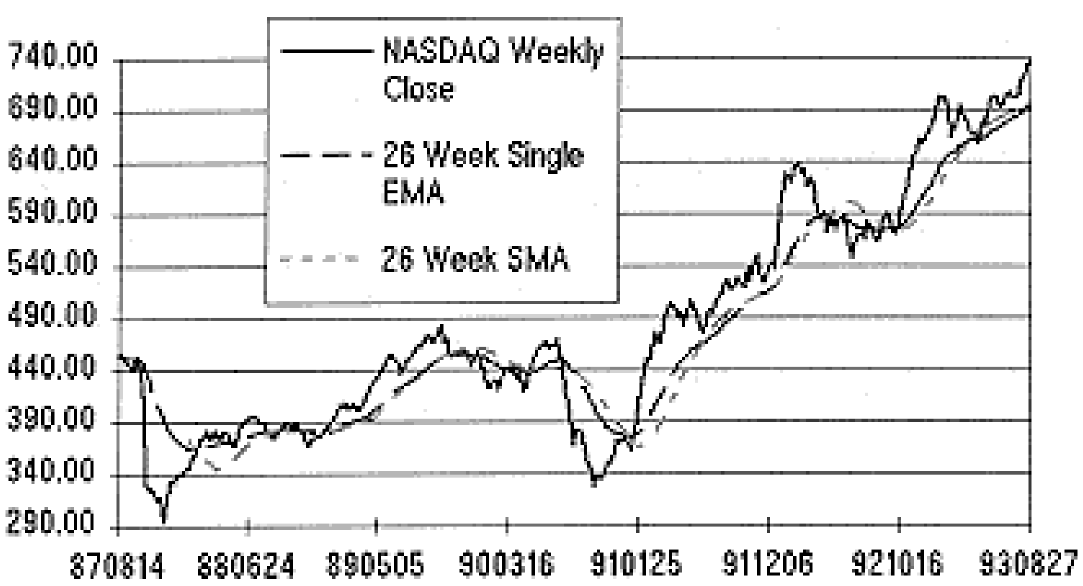


Figure 5: Weekly NASDAQ, 26-Week Single EMA and 26-Week SMA. *The simple moving average and the exponential moving average have similar plots. The exponential moving average is more sensitive to the most recent price action.*

N = Number of records in the time series

C = Closing price vector (range 0 to N - 1)

w = Moving average period

SMA data range: n = w - 1 .. N - 1

Window range: k = 0 .. w - 1

SMOOTHING WITH THE SINGLE EMA

A faster responding average, but not with less steady-state lag, is the single exponential moving average (EMA). The SMA drops off preceding values as it progresses through the time series, which can cause a distortion in the current plot point if a large, abrupt fluctuation occurred in the past. This does not happen with the EMA because its current value always includes a percentage of every preceding point. The smoothing constant or weight alpha (α) in the equation for EMA determines what percent to use of the current data value plus the remaining percentage ($1- \alpha$) to use for the previous smoothed value. The closer a is to 1, the closer the EMA follows the original data — no averaging. With $\alpha = 1$, the EMA will be a duplicate of the original data. In securities analysis, α may be expressed in more meaningful terms as a parameter (*w*) representing the period of time over which the data is averaged.

Exponential smoothing (even more so for the SMA) is most effective when the parameters describing the time series are changing slowly over time. For the single exponential moving average, it is also most effective if the time series is effectively constant with time, that is, β_1 and β_2 equal zero. The model is again:

$$y_t = \beta_0 + \varepsilon_t$$

In reality, the β_0 may be changing slowly over time, but the simple moving average that uses equal weighting may not be the most appropriate smoothing scheme; hence, the exponential moving average that applies unequal weighting is the better choice. More weight is applied to recent observations and thus will respond quicker to a slowly changing trend. Mathematically, the EMA is a recursive equation, meaning that its current value depends on a previously calculated value, as shown below in the definition for EMA:

$$EMA_m=\alpha C_m+(1-\alpha)EMA_{m-1}$$

where:

α = Smoothing constant, $2/(w+1)$

C_m = Closing price period *m*

EMA_{m-1} = Yesterday's EMA

For example, define a data range starting at period 1:

$m = 1 .. N - 1$

Choose MA period, $w = 26$,

Therefore a = 2/(26 +1)

$\alpha = 0.074$

This is our alpha for a 26-period EMA. The value of a, the smoothing constant, is always between zero and 1. Because of the EMA's recursive nature, a *seed* or initializing value must always be chosen for the value of EMA_0.

For the initial value of the EMA, we will substitute the first day's closing price (C_0) for yesterday's EMA calculation:

$$EMA_0 = C_0$$

$$EMA_0 = 451.61$$

We then begin the smoothing process with the second day's closing prices (C_1).

If the EMA formula is factored another way:

$$EMA_m = EMA_{m-1} + \alpha(C_m - EMA_{m-1})$$

This version gives a different insight into the meaning of the EMA. The new smoothed price is equal to the previous smoothed price, plus a percentage a of the difference between the current price and the previously smoothed price.

Typically, in time series forecasting, the smoothing constant a is between 0.01 and 0.30 (*w* = 5.7 to 199). Low values of a (high values of w) mean that the average level of the time series is not changing much over time. If values of a greater than 0.30 appear to be required (for example, greater than a 200-day MA), then you should consider using a different model to represent the data. Figure 5 displays a 26-week moving average using the SMA and the EMA on a plot of the weekly closing price for the NASDAQ index.

SMOOTHING WITH A DEMA1

The first extension from a model represented by the mean of the data:

$$y_t = \beta_0 + \varepsilon_t$$

is a linear trend model

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

and if the beta parameters are changing with time, then the equal weighting of the simple moving average is definitely not an adequate smoothing function. We will see that even the single exponential moving average can be improved upon. From the equation above, it is apparent that now two regression coefficients should be estimated when modeling the market, β_0 and β_1 instead of just β_0 when we look at simple moving averages. This leads to *multiple smoothing*, or in this model case, *double smoothing*.

In time series forecasting literature, the one-parameter double exponential smoothing employs single- and double-smoothed statistics S1 and S2, computed as follows:

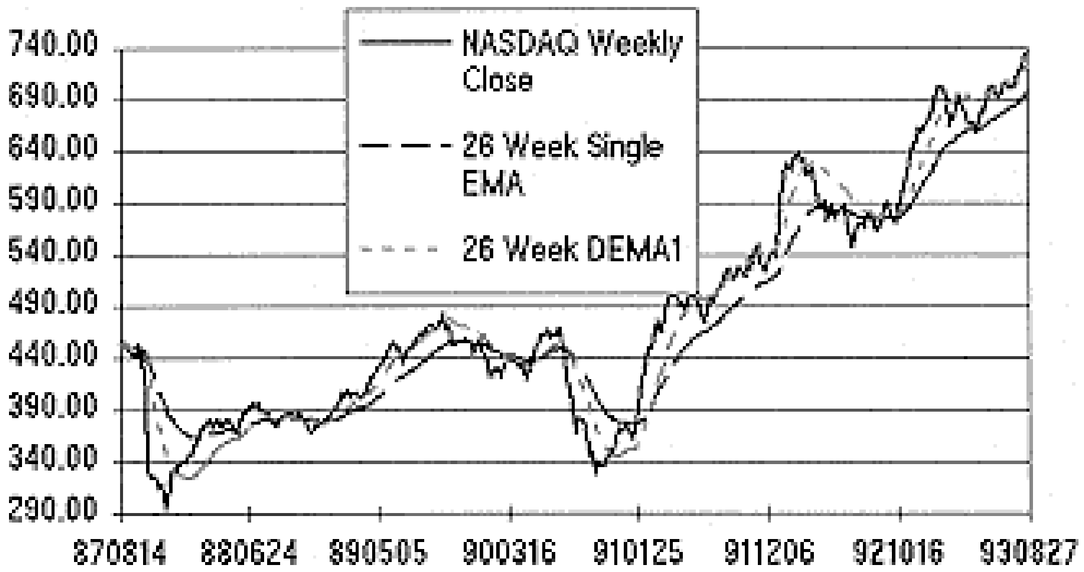


Figure 6: Weekly NASDAQ, 26-Week Single EMA and 26-Week DEMA1. *The DEMA1 shows higher response to the changing prices than the single EMA.*

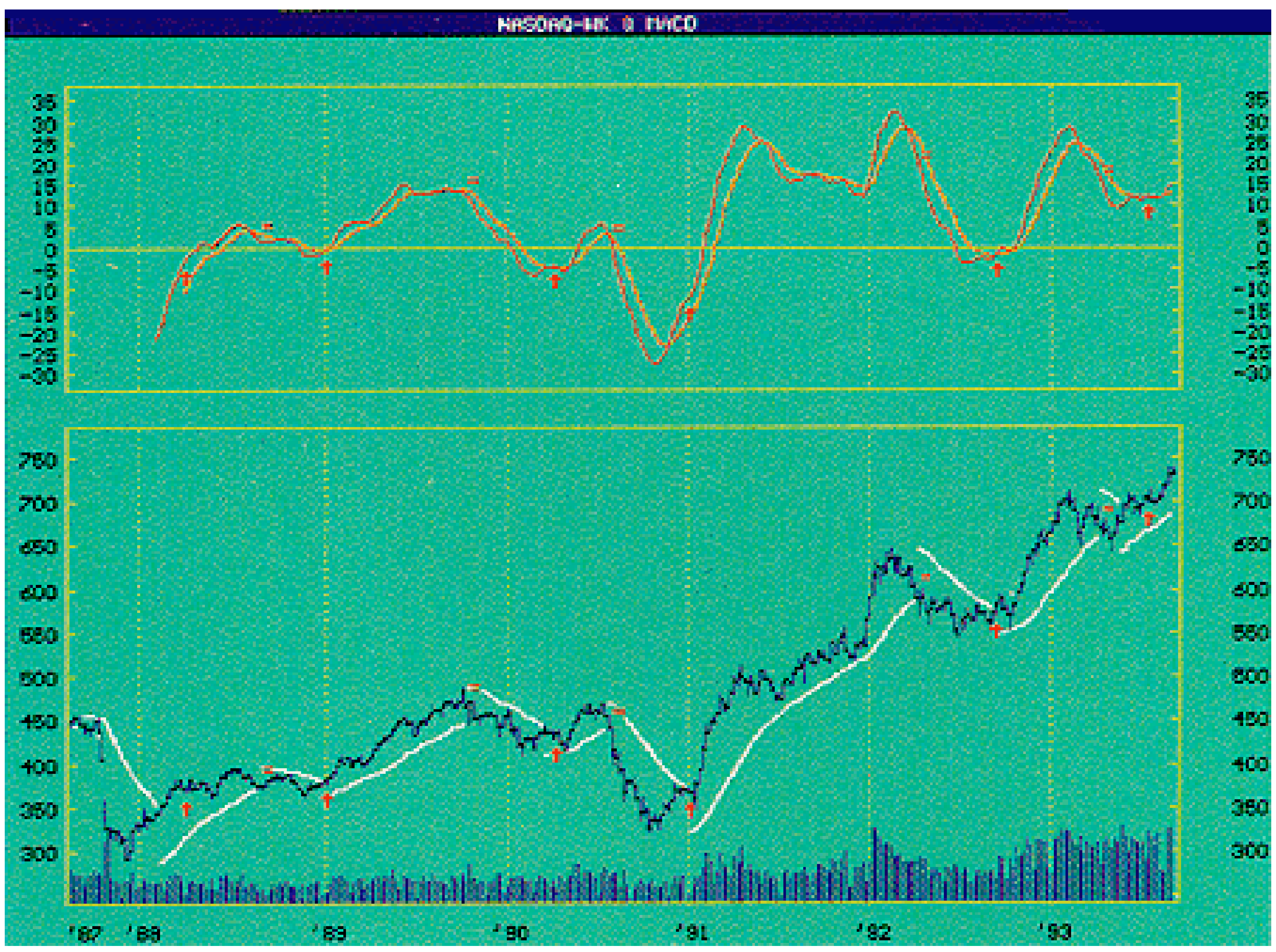


FIGURE 7: Weekly NASDAQ, MACD and Parabolic SAR (0.03/0.06). *The parabolic stop-and-reverse indicator can be used as a trailing stop loss mechanism.*

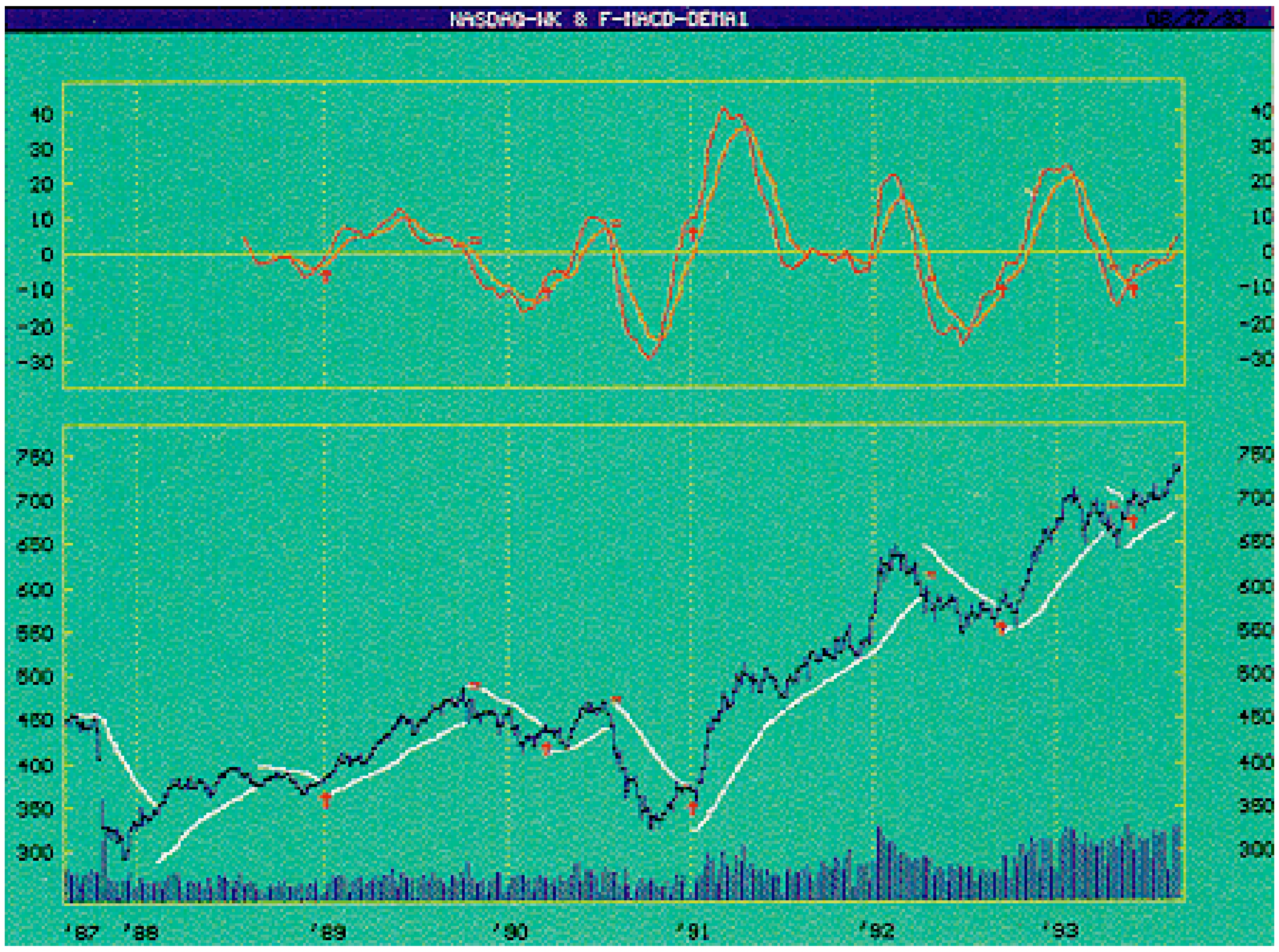


FIGURE 8: Weekly NASDAQ, MACD-DEMA1 and Parabolic SAR (0.03/0.06). *Adding another indicator as a qualifier greatly improved both MACDs, eliminating many whipsaws. MACD-DEMA1 (12,26,9) with stop-and-reverse (SAR) provided dramatically less loss for the correction in August 1990 than the standard MACD with SAR.*

$$S1_m = \alpha Cm + (1 - \alpha)S1_{m - 1}$$

$$S2_m = \alpha S1_m + (1 - \alpha)S2_{m - 1}$$

S1 is the single exponential moving average of the original data. S2 smoothes S1 exponentially, revealing that it is the double EMA. In formal time series forecasting, however, these two statistics are used to calculate the estimates b_0 and b_1 for the real regression coefficients b_0 and b_1 and then formulate the final forecasting equation for a forecast t time units in the future:

$$y_{t+\tau} = b_0 + b_1\tau$$

The coefficient b1 is used when forecasting at time $t + \tau$ and is not important here. The y-intercept for the trendline at time *t* is b0 and that is what is important. We will estimate the b0 using an improved (less lag-time) moving average (DEMA1), a derivation of the one-parameter double exponential moving average. Before proceeding let us rename S1 and S2 as EMA1 and EMA2 for consistency. The formula for DEMA1 is:

DEMA1 = 2EMA1 - EMA2

Here, we are multiplying the single EMA by two and then subtracting the double EMA. The derivation of DEMA1 is provided in sidebar "DEMA1 derivation." In addition, there is a spreadsheet version presented in sidebar "DEMA1 Excel spreadsheet."

The two components EMA1 and EMA2 each require values at time 0 to initialize the recursive calculations. For best results, the initial values are not the data value at time 0 (C_0). Specific equations have been derived in the literature to provide the initial values. The first thing that must be done is to calculate the coefficients for a linear regression over a subset of the database (typically, the first window period w), which are then used in the initialization equations. The tradeoffs in using the simpler C_0 value versus the initialization equations are discussed elsewhere. The following are steps used to calculate a 26-week DEMA1 using weekly closing prices of the NASDAQ index beginning with August 14, 1987, of 451.61.

Estimate regression initial values:

Given: I = 0 .. N - 1, $t_i = i$, k = 0 .. w - 1

Define variables for a linear regression from point 0 to *w*-1, $x_k = t_k$, $y_k = C_k$

Calculate regression coefficients using built-in functions intercept and slope:

u = Intercept(x,y) = 454.513

v = Slope(x,y) = -6.162

For a 26-week window:

$\alpha = 2/(26+1) = 0.074$

Initialization equations:

$$EMA1_0 = 454.513 - ((1-0.074)/0.074)(-6.162)$$

$EMA1_0 = 531.62$

$EMA2_0 = 454.513 - 2((1-0.074)/0.074)(-6.162)$

$EMA2_0 = 608.72$

Calculate EMA's with above initializations:

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

$EMA1_1 = (0.074)(455.20) + (1- 0.074)(531.62)$

$EMA1_1 = 525.96$

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

$EMA2_1 = (0.074)(525.96) + (1- 0.074)(608.72)$

$EMA2_1 = 602.60$

Calculate DEMA1:

$DEMA1_1 = 2EMA1_1 - EMA2_1$

$DEMA1_1 = (2)(525.96) - 602.60$

$DEMA1_1 = 449.33$

So even though a double exponential moving average (EMA2) is used in the formulation of DEMA1, the one-parameter double exponential smoothing as described here is *not* equivalent to the double EMA itself. Figure 6 displays the dramatic difference between DEMA1 and EMA.

This plot displays the considerable improvement in response by the DEMA1 to the closing price changes versus the standard EMA.

MACD IMPLEMENTATION OF DEMA1

Now that we have defined a new moving average, let us implement it into a standard technical indicator, MACD. 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. See Figures 1 and 2 for a comparison of a standard MACD with a DEMA1 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-DEMA1 actually has fewer buy signals (10) than the slower MACD (12) with almost twice (+90%) the total profit. The profit analysis was run using MetaStock's System Tester program and Mathcad. The MACD-DEMA1 had nine round-trip trades with three losses, while MACD had 11 trades with six drawdowns.

As all experienced technical investors know, you don't rely on just one indicator to determine your buy/sell signals. If the MACD is one of your trading indicators, you can experiment with a faster-responding MACD and make adjustments as needed to fit your investment philosophy. The simple addition of a parabolic stop-and-reverse (SAR) indicator (using a step value of 0.03 to a maximum of 0.06) as a second qualifier dramatically improves both MACDs (Figures 7 and 8). In particular, the two whipsaw losing trades in the August to November period of 1991 for both MACDs are eliminated. MACD-DEMA1 still provides the better overall performance; it exits one week earlier the correction in August 1990, decreasing the loss for that trade by more than a factor of 7, and it enters the last trade on the chart six weeks earlier than with the standard MACD.

Another obvious caveat in using the DEMA1 is that the MA periods being used may have to be lengthened because of the fast response of the indicator. There is always a tradeoff of choosing a long-enough MA period to swamp out random noise but still capture those meaningful shifts in trend early enough.

CONCLUSION

By simply extracting the estimate for the non-time related coefficient B_0 in the formal one-parameter double exponential moving average used in time series forecasting, it has been shown to be an effective modified EMA with much faster response during fluctuations than the standard single EMA. In addition, the DEMA1 is not just a double EMA with twice the lag time of a single EMA, but rather it is a composite implementation of single and double EMAs producing another EMA with less lag than either of the original two. For general use, the more accurate but more complicated initialization formulas can be obviated and replaced with the simple use of the initial database value at time 0.

Next time, I will present the next extension in multiple smoothing called the one-parameter triple exponential moving average (TEMA1) and a variation of double smoothing that includes a second smoothing constant for the trend — the two-parameter double exponential moving average (DEMA2).

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 his personal investments.

REFERENCES

Blau, William [1991]. “Double-smoothed momenta,” *Technical Analysis of* STOCKS & COMMODITIES, Volume 9: May.

Bowerman, B.L., and R.T. O'Connell [1993]. *Forecasting and Time Series: An Applied Approach*, 3rd edition, Duxbury Press.

Brown, Robert Goodel [1963]. *Smoothing, Forecasting and Prediction of Discrete Time Series*, Prentice-Hall.

Gross, C.W., and J.E. Sohl [1989]. "Improving smoothing models with an enhanced initialization scheme," *Journal of Business Forecasting*, Spring.

Hartle, Thom [1993]. “The parabolic trading system,” *Technical Analysis of* STOCKS & COMMODITIES, Volume 12: November.

Mathcad. MathSoft Inc., 201 Broadway, Cambrdige, MA 02139, 800 374-6075.

Mendenhall, W., and T. Sincich [1989]. *A Second Course in Business Statistics: Regression Analysis*, 3d edition, Dellen Publishing.

MetaStock. EQUIS International, 3950 South 700 East, suite 100, Salt Lake City, UT 84107, 801 265-8886.

Rothschild, Raymond [1992]. ìUnderstanding exponential moving averages,î *Technical Analysis of* STOCKS & COMMODITIES, Volume 10: August.

Tuma, Jan J. [1989]. *Handbook of Numerical Calculators in Engineering*, McGraw-Hill.

METASTOCK IMPLEMENTATION OF DEMA1 AND MACD-DEMA1

The DEMA1 moving average and the MACD-DEMA1 can be implemented in MetaStock version 3.x using the custom formulas feature.

DEMA1:

DEMA1 = 2*EMA1 - EMA2 therefore

(2*MOV(C,26,E)) - MOV(MOV(C,26,E),26,E)

MACD-DEMA1:

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

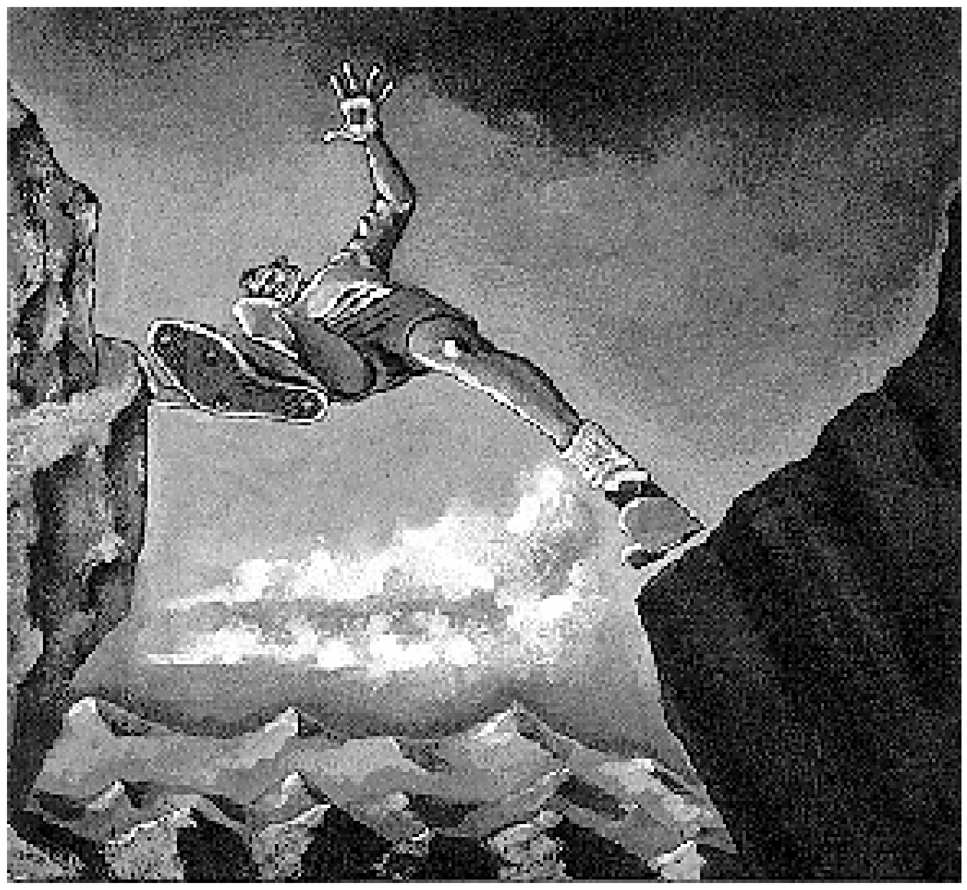
((2*MOV(C,12,E)) - MOV(MOV(C,12,E),12,E)) - ((2*MOV(C,26,E)) - MOV(MOV(C,26,E),26,E))

The true MACD uses smoothing constants (α) of 0.15 and 0.075, which equate to 12.3333 and 25.6667 in terms of time periods. These values can be substituted for the rounded-off periods if you wish.

—P.G.M.

Stock Market Risk: A Monthly Look

by John Kean



Have you ever wanted to know what the actual statistics of the month-to-month risk in the stock market are? STOCKS & COMMODITIES contributor John Kean looks at the question and formulates possibilities.

Most stock market analysis focuses on whether prices will rise or fall, with much less attention given to the question of drawdowns, or lows. Occasionally, however, even a month with a substantial stock index gain will have a draw down that is beyond many investors' stamina levels.

Now take a look at monthly drawdowns in the Standard & Poor's 500 stock index from 1965 on. All the data was calculated using daily close cash prices on a month-end basis. Drawdown is calculated here as the percentage difference between a month's daily close low and the previous month-end close. As such, some months have positive draw-downs in that their lows were higher than the preceding month's close. Risk will be discussed from the perspective of someone who is long stocks.

> **In the 344 months since January 1965, 83% of those months encountered drops to some degree from the previous month's close. The worst case, not surprisingly, occurred in October 1987, with a -30.14% drawdown.**

Lack of endurance in the face of drawdowns is usually due to overleveraging and/or underpreparation mentally for what could happen. In the 344 months since January 1965, 83% of those months encountered drops to some degree from/the previous month's close. The worst case, not surprisingly, occurred in October 1987, with a -30.14% drawdown. The average (mean) monthly drawdown over the 28.7-year period equaled -2.44%, while the median was -1.68%. In 22% of the months studied, drawdowns equal to or worse than -4% were encountered, which might give some pause to those considering the 10 to 1 leverage available in an S&P 500 futures contract. For months that closed up from the previous month, 19.4% still had drawdowns of -2% or worse. Keep in mind that if we were using intraday data instead of closing data, the numbers would be considerably more negative.

TIP-OFF

Can any factors be used to detect the likelihood of a sharp drop in the stock market? The two most commonly cited suspects are high price/earnings ratios and low yields. Figures 1 and 2 post monthly price/earnings and yields, respectively, against the next month's percentage drawdown (or low) in the Standard & Poor's 500. As previously noted, the period covers 344 months since January 1965. The October 1987 drawdown is noted and is obviously an outlier in the data fields.

Figures 1 and 2 indicate. that little or no prognostic value exists in either S&P 500 P/Es or yields vis-à-vis market drawdowns. While the 1987 crash occurred at a relatively high P/E and a noticeably low yield, numerous other severe drops occurred across a wide span of P/E and yield values.

Numerous other parameters also fall short, but one that does have some value can be seen in Figure 3. A competitive investment approach is at the source of the comparison of the ratio of S&P 500 yields divided by three-month Treasury bill rates, with drawdowns. When stock yields are far below short-term interest rates, resulting in a low ratio, money flows away from stocks. This increases the stock market's vulnerability to a sharp decline whenever any negative news occurs, whether real or hyped. Conversely, as stock yields approach the level of short-term rates, prices are supported.

A rough measure of the risk of a sharp drawdown versus the (yield/T-bill) ratio is given in Figure 4. A sharp draw-down is taken to be anything below -5.6%, which is one standard deviation below the mean drawdown. When the ratio is below 0.3999, historically, a sharp drop has occurred within the month 26.67% of the time. The risk of sharp drawdown declines to a low level as the ratio approaches 1.

DRAWDOWN OCTOBER

But how does October, that favorite of all drawdown months, fit in? For a given year, there is a tendency for short-term interest rates to increase as shown in Figure 5. This graph is based on grouping changes in three-month Treasury bill rates by month (1965-93). The average of each month's change over the period was then used to construct a typical cumulative change curve. There has been a tendency for short rates to rise acutely into the beginning of the last quarter of the year. This is exactly what happened in 1987, pushing the (yield/T-bill rate) ratio sharply downward, thus promoting a temporary flow of money away from stocks.

John Kean is a systems analyst and has been investing and trading more than 10 years. He consults on applying neural nets to trading and investment

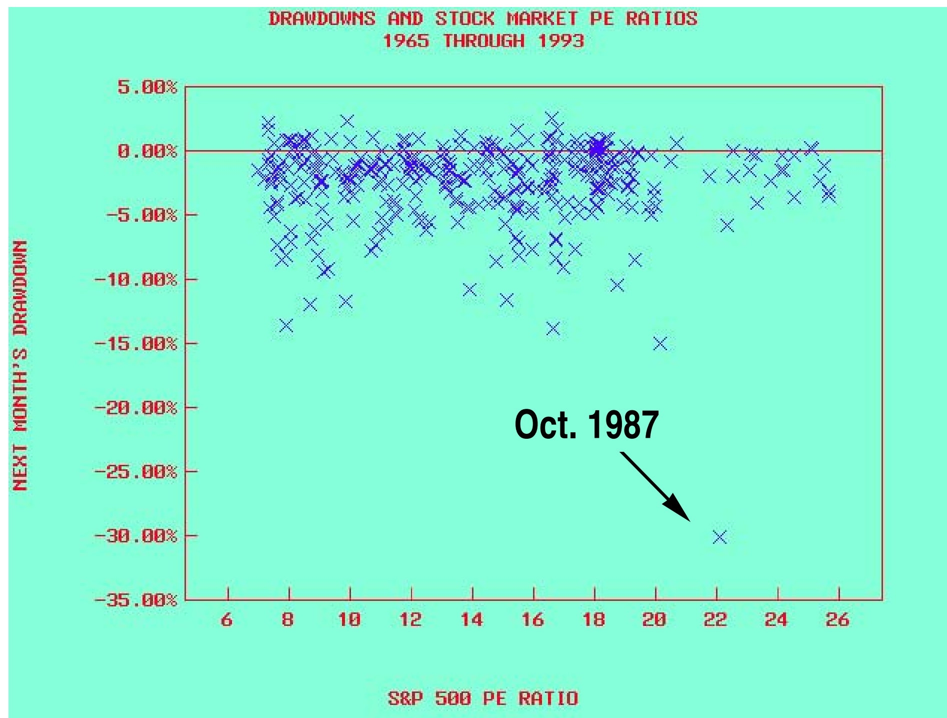


FIGURE 1: DRAWDOWNS VS. P/E RATIOS. Here, the P/E ratio is compared to the following percentage monthly drawdown. There does not seem to be an apparent relationship between high or low P/E ratios and the next month's drawdown of the S&P 500. The low value at the bottom right is the October 1987 closing percentage drawdown.

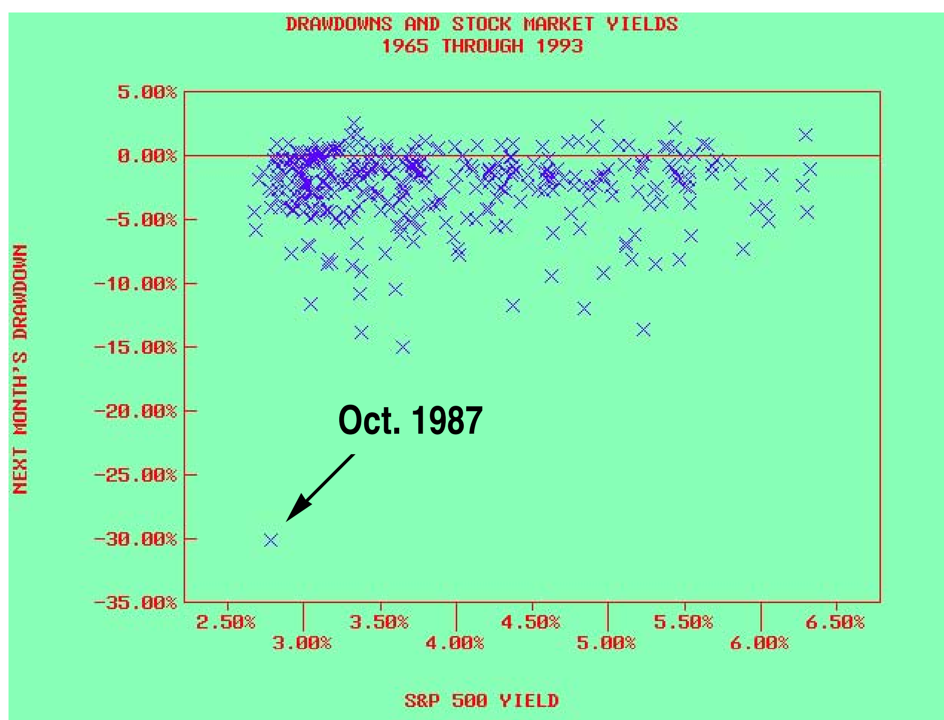


FIGURE 2: DRAWDOWNS VS. STOCK YIELDS. The stock market yield is compared to the following percentage monthly drawdown S&P 500. There does not seem to be an apparent relationship between high or low yields and the next month's drawdown. The low value at the bottom left is the October 1987 closing percentage drawdown.

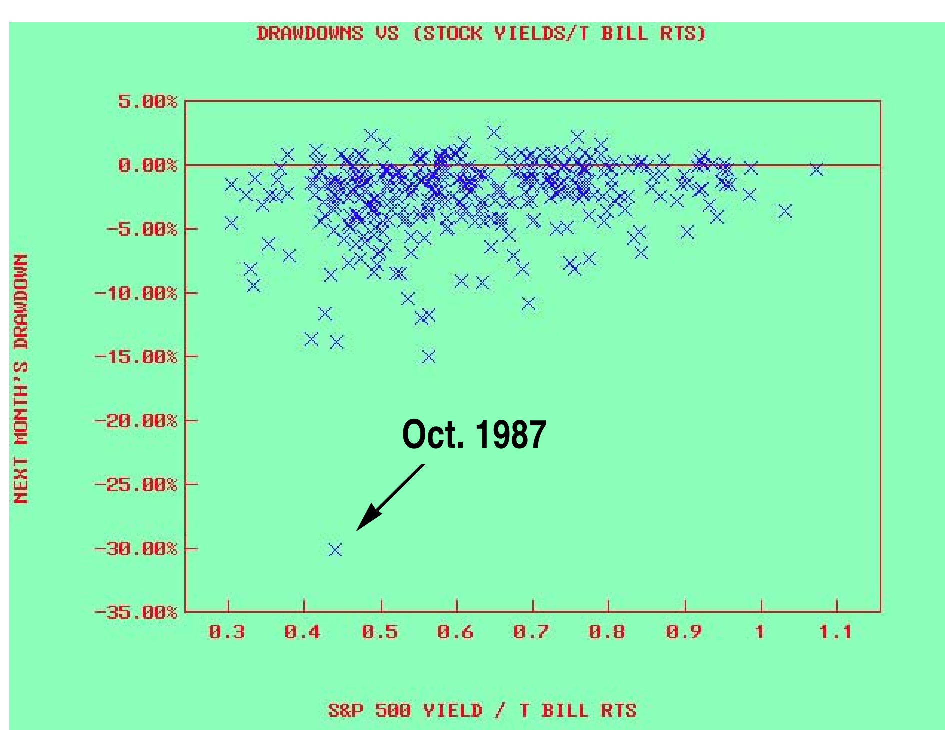


FIGURE 3: DRAWDOWNS VS. STOCK YIELDS/T-BILL RATES. The ratio stock market yield to T-bill rates are compared to the following percentage monthly drawdown S&P 500. There appears to be a slight relationship. If the ratio is close to one, the drawdowns are lower.

S&P 500 STOCK INDEX MONTHLY DRAWDOWNS VS. PREVIOUS MONTH'S (YIELD/T-BILL RATE) 1965-1993

Preceding S&P 500 yield/T-bill ratio	# of mos. in sample	# of mos. with drawdown worse than -5.6%	% of mos. with drawdown worse than -5.6%	Mean drawdown
0.3 to 0.3999	15	4	26.67%	-3.40%
0.4 to 0.4999	78	14	17.95	-3.53
0.5 to 0.5999	84	9	10.71	-2.46
0.6 to 0.6999	65	6	9.23	-2.31
0.7 to 0.7999	56	3	5.36	-1.52
0.8 to 0.8999	24	2	8.33	-1.78
0.9 to 1.074	21	0	0.00	-1.35

FIGURE 4: DRAWDOWNS VS. STOCK YIELDS/T-BILL RATES. *When the ratio is below 0.3999, there has been drawdown of more than 5.6% by the S&P the following month over 26% of the time.*

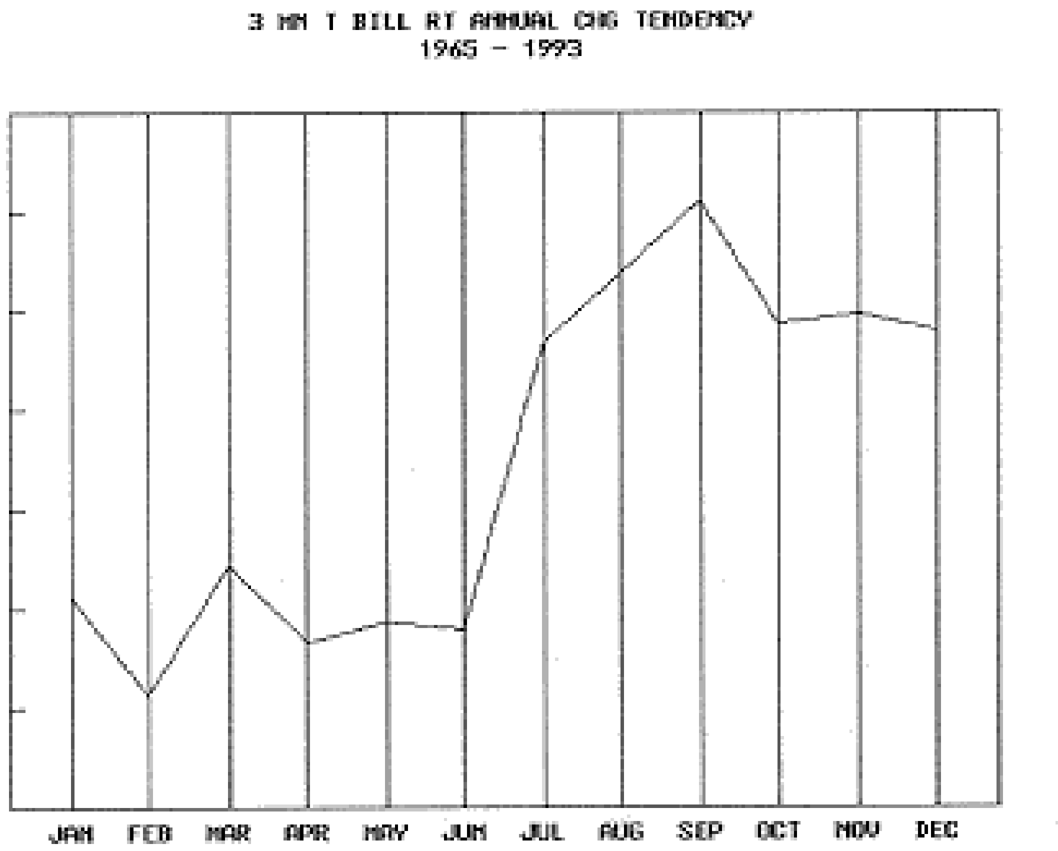
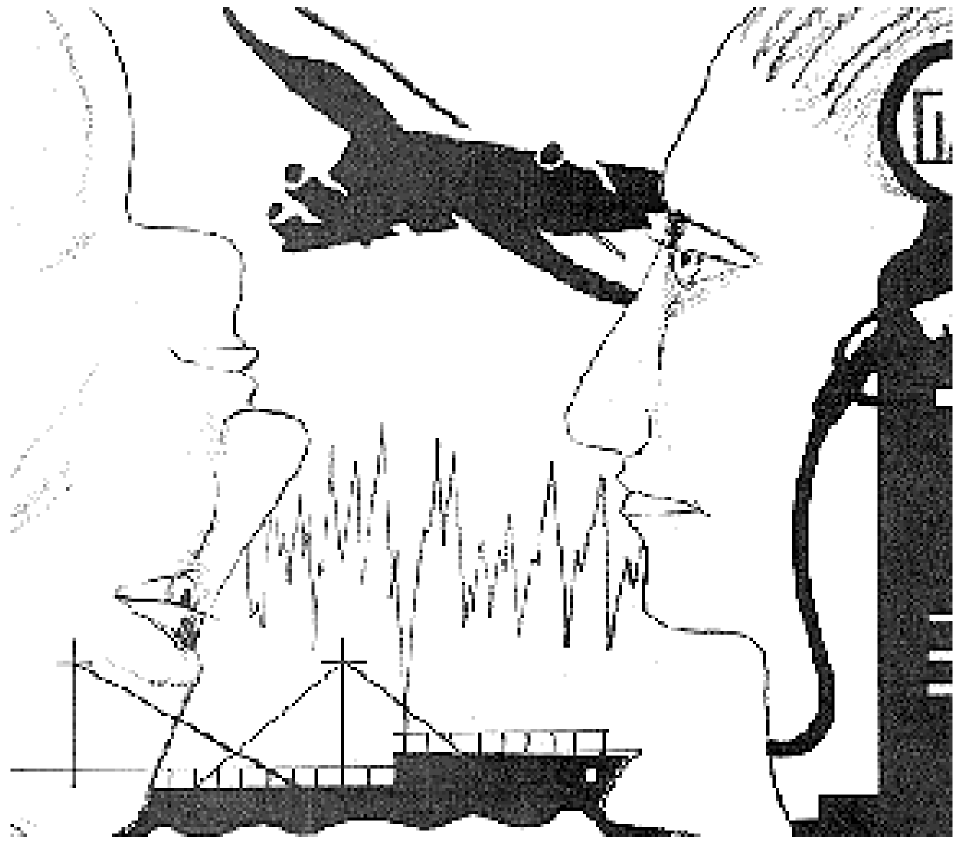


FIGURE 5: THREE-MONTH T-BILL RATE MONTH CHANGE. *The average of each month's T-bill rate change from 1965 to 1992 was used to create the curve. Notice the tendency for T-bill rates to rise approaching September, creating a possible competitive investment for stocks.*

The Haurlan Index

by Paul E. Carroll



The Haurlan index, which was originated by the Trade Levels, Inc., advisory service, has received comparatively little attention — unfortunate, as it has proved to be effective in signaling tops and bottoms. First-time STOCKS & COMMODITIES contributor Paul Carroll explains.

The number of advancing and declining stocks each day provides the raw data for a variety of breadth indicators and trading systems, among which are the advance-decline line, the McClellan oscillator, the Nicoski index (advancing stocks divided by declining stocks) and the Bolton-Tremblay indicator, to mention only a few. And then there is the Haurlan index.

I have found the Haurlan index to be quite effective in signaling market tops and bottoms. The index is essentially an exponential moving average of advancing stocks minus declining stocks. I use New York Stock Exchange (NYSE) daily breadth data in my calculations. Three variations of the Haurlan index are short, intermediate and long term. First of all, to seed this, start with today's breadth (that is, the number of today's advances minus the number of today's declines) and for the next day, take yesterday's breadth as yesterday's index. Calculate the short-term version by taking yesterday's index and adding to it a product of a smoothing constant and the difference of today's breadth minus yesterday's index. Mathematically, this would be:

Today's index = A + 0.5(P-A)

where A = Yesterday's short-term index and P = Today's breadth

This formula can be further simplified to:

$$\text{Today's index} = \frac{(A+P)}{2}$$

A three-day stabilization period is required if you are initiating the data.

Calculate the intermediate-term index the same way as the short-term index except the smoothing constant used is 0.1. Mathematically, this is:

Today's index = B + 0.1(P - B)

where B = Yesterday's index

A 20-day stabilization period is required if initiating the data.

Similarly, the long-term index is arrived at by using 0.01 as the smoothing constant or:

Today's index = C + 0.01(P - C)

where C = Yesterday's index

For the long-term index, a 200-day stabilization period is required. A stabilization period this long can be eliminated by assuming a random starting index. In this case, a starting long-term index of 50 is satisfactory.

All three indices will oscillate as the market breadth does, but all three tend to stay within relatively well-defined limits. The short-term index moves between +1,000 and -1,000. The intermediate index usually falls between +300 and -300, while the long-term index oscillates less and tends to trend with the market in a way similar to the advance-decline line.

Each index described will give basic buy and sell signals with the crossing of the zero line. A rise from below the zero line to above it will indicate a buy signal; conversely, a fall from above the zero line to below it will give a sell signal. In the case of the short-term index, the reading should remain above or below the zero line for two days to give a signal.

The short- and intermediate-term indices will indicate extremes in the market and generate corresponding buy and sell signals if certain levels are reached. I have found that -550 for the short term and -200 for the intermediate-term give buy signals. Similarly, +550 and +200 give sell signals. In this way, the short- and intermediate-term indices act as overbought and oversold indicators for the stock market.

The long-term index can also be used with trendlines to indicate future market action. Trendline breaks will tend to give good signals.

The short- and intermediate-term indices do not generate many signals, but the signals are timely and useful. For the past 12 months, the short-term index gave only five signals. Short-term signals tend to occur one to three days before the actual market bottom or top, giving enough time to act and not miss the resulting move in the stock market.

A TIMELY SIGNAL

A timely short-term buy signal was given on September 1992, with the Standard & Poor's 500 at 405 (Figure 1). Using the overbought/oversold method of interpretation, the short-term indicator fell below -550 (Figure 2), which was followed by a sell signal in late January 1993, with the S&P 500 reaching 449. The next signal was a buy in February 1993, following the rapid market decline to the S&P 500 level of 435. The market quickly rebounded to 455 on the S&P 500 and produced two closely spaced sell signals that I consider to be one signal due to their closeness. The following market pullback produced an early buy signal, with the S&P 500 in the low 440s during May 1993. The market further corrected to the

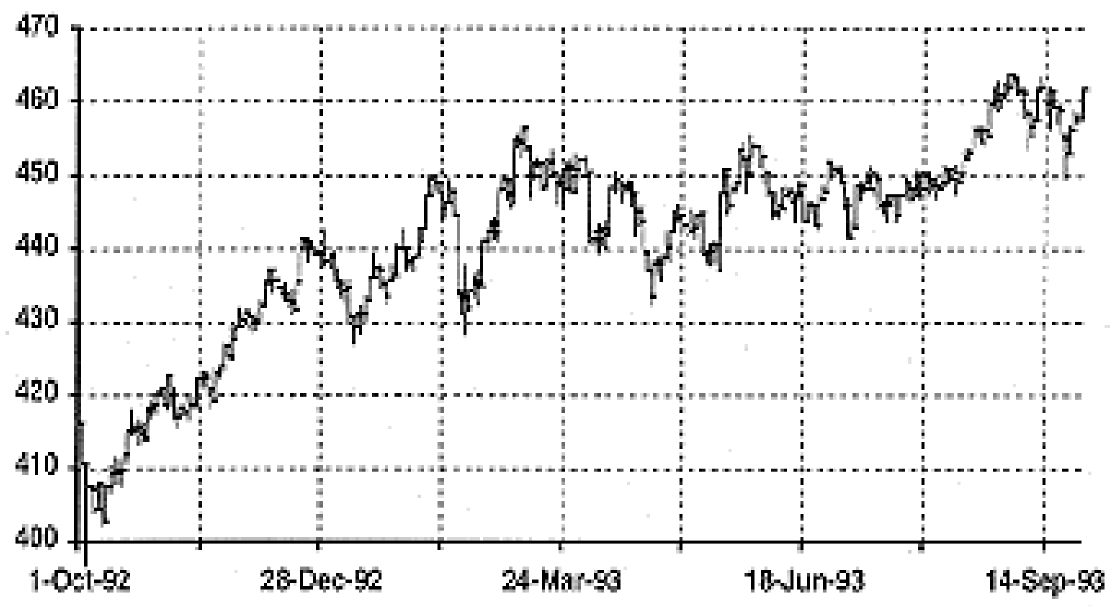


Figure 1: S&P 500. *The daily bar chart of the S&P 500 indicates that the stock market has been in an uptrend.*

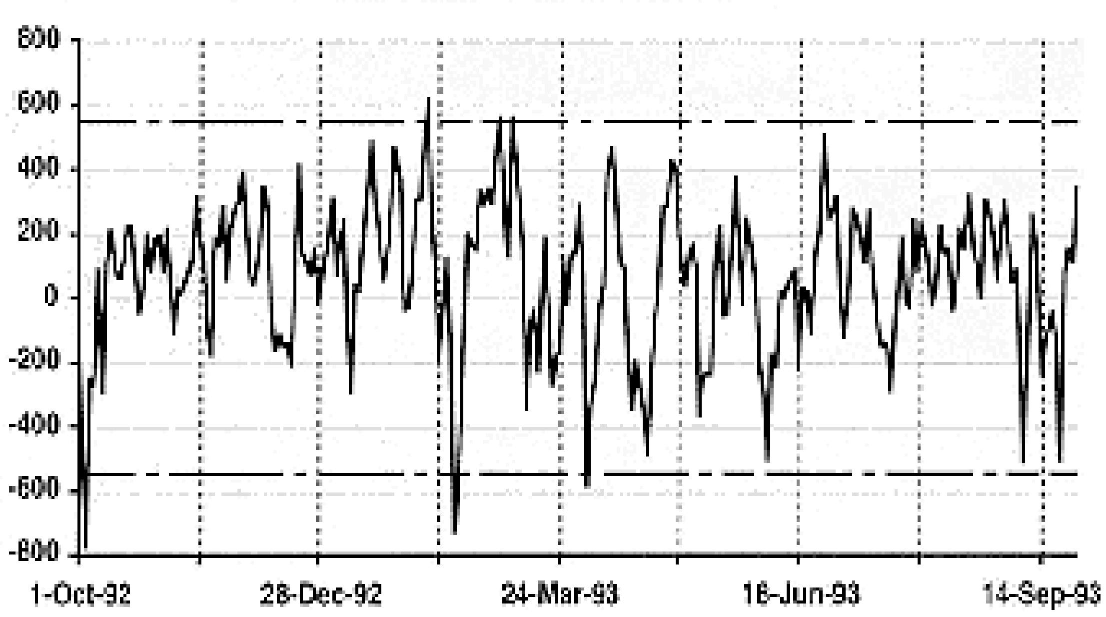


Figure 2: Haurlan index Short-Term Indicator. *Overbought levels are +550 and oversold levels are -550. The S&P 500 began a strong uptrend after the short term indicator reached very oversold levels in October 1992.*

435 level before turning upward. This was the last signal given during the past year. At that point, the short-term Haurlan index remained in a buy signal, with the market currently at 455 on the S&P 500.

The intermediate-term index gives fewer signals than the short-term index, but the intermediate tends to be more significant in meaning (Figure 3). For the past 12 months, only four signals have occurred, the first in September 1992 with the S&P 500 at 405. The intermediate-term index gave an early sell signal in late January 1993, with the S&P 500 at 440. The market continued on to 455 and produced two additional sell signals. As of this writing in October 1993, the intermediate index has not given another signal since March 1993 and remains in a sell mode.

The intermediate-term index gives fewer signals than the short-term index, but the intermediate tends to be more significant in meaning.

The long-term index bottomed in late September 1992 and followed the market to ever-higher levels until the market peaked in March 1993 (Figure 4). A sell signal was given when the uptrend line under the index was broken in February 1993. The long-term index then fell until late June 1993. A buy signal was produced when the trendline over the index was broken to the upside in April 1993. Then the long-term index headed higher, following the market's rise to all-time highs. A sell signal was given when the trendline was broken in early September 1993. In addition, the long-term index has failed to go to new highs when the market reached new highs. This is a negative divergence and indicative of general market weakness.

FINI

The Haurlan index, by most intents and purposes, appears to be quite effective in signaling tops and bottoms. Further study may prove that there are different effectiveness levels among the short-term, intermediate-term and long-term Haurlan indices, but for the most part, the index is one that may very well prove to be useful in the use of advances versus declines.

Paul Carroll is a marine engineer, currently working for Atlantic Richfield as a first assistant engineering officer, and trades in his spare time.

FURTHER READING

Appel, Gerald [1986]. *Winning Market Systems,* Trader's Press, Inc.

Colby, R.W., and T.A. Meyers [1988]. *The Encyclopedia of Technical Market Indicators,* Dow Jones-Irwin.

Dworkin, Fay [1990]. “Defining advance/decline indicators,” *Technical Analysis of* STOCKS & COMMODITIES, Volume 8: July.

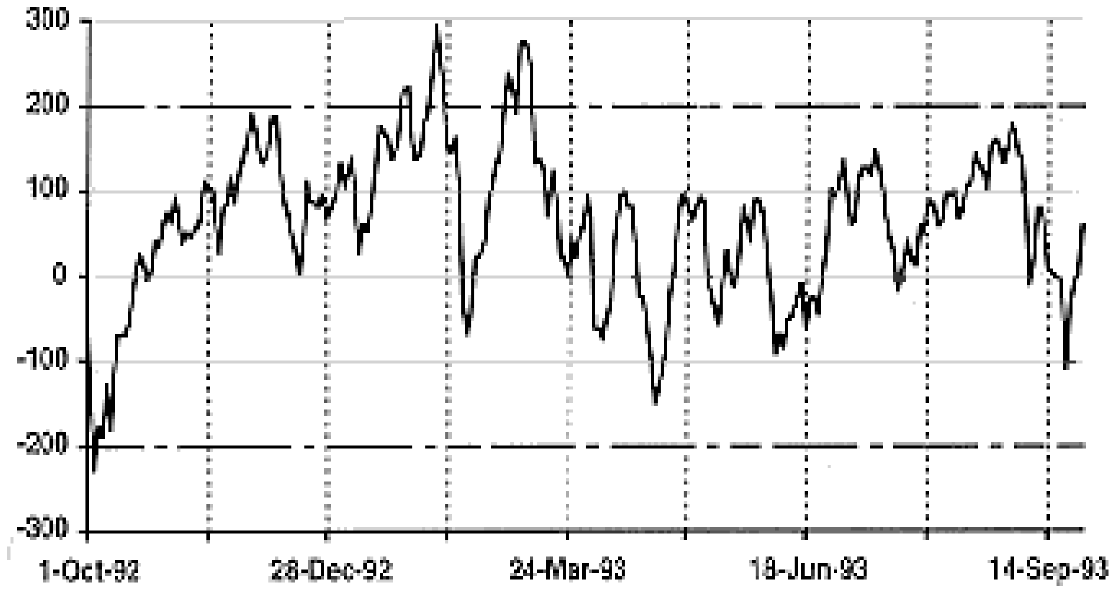


Figure 3: Haurlan index Intermediate-Term Indicator. *Overbought levels are +200 and oversold levels are -200. The intermediate-term indicator gave a sell signal in March 1993 and has been in a sell mode since.*

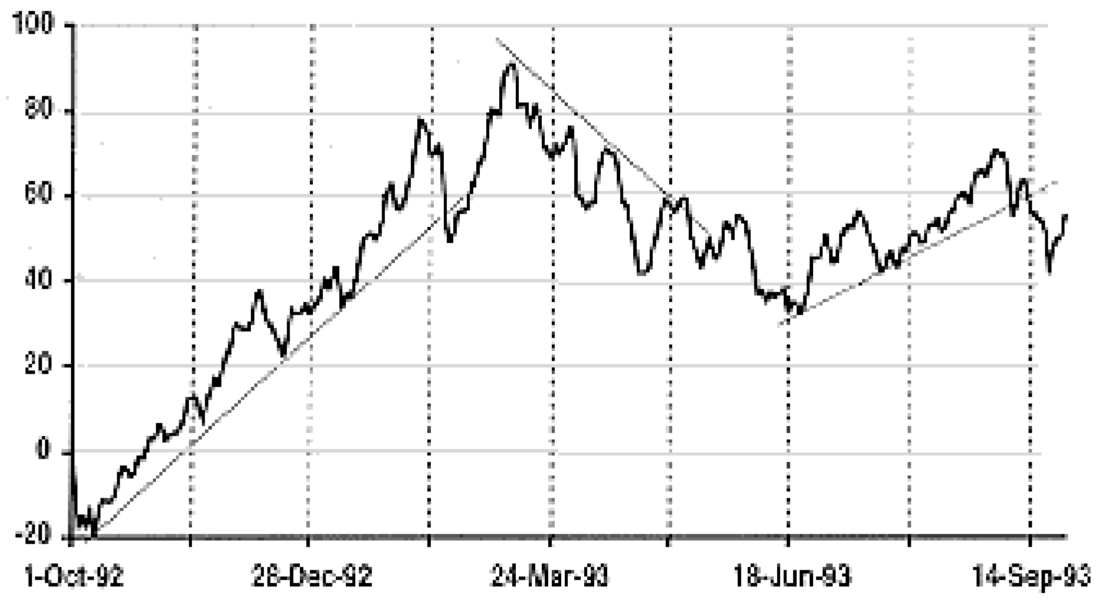
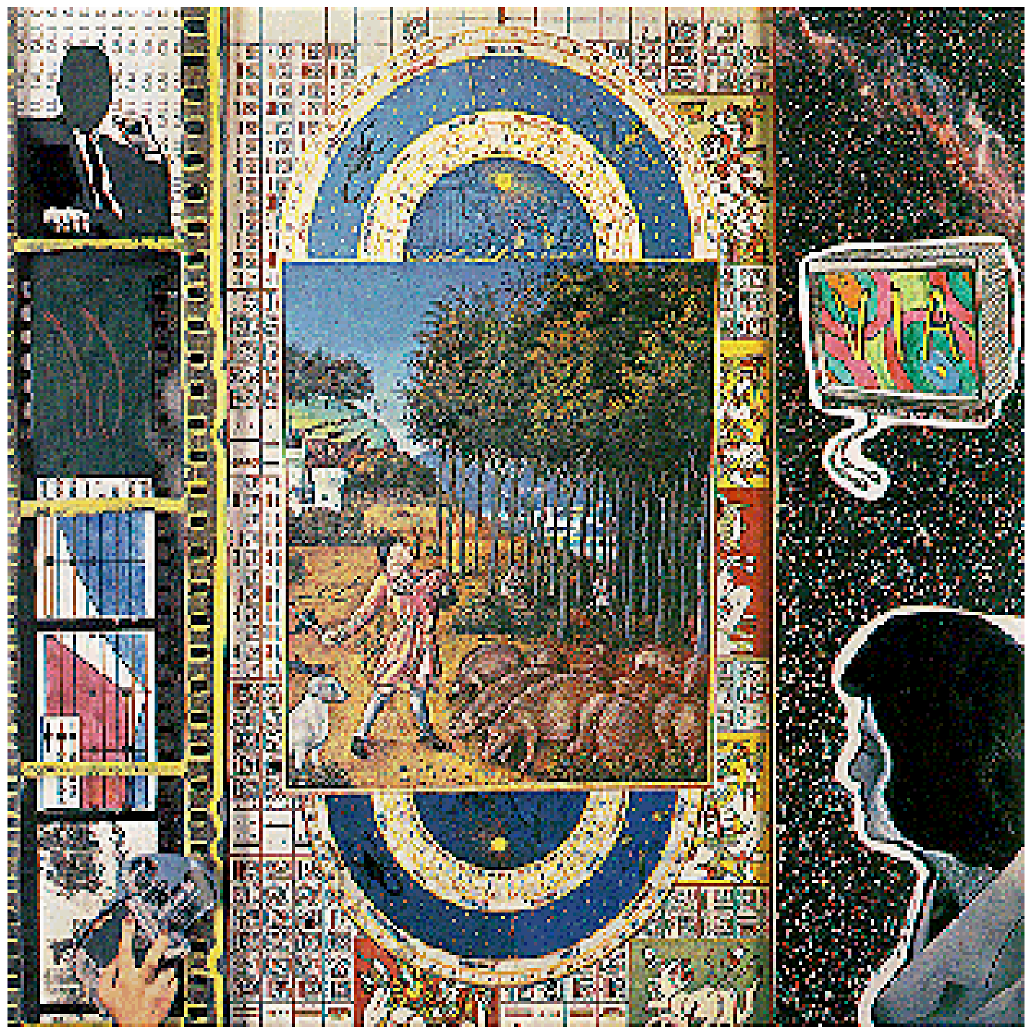


Figure 4: Haurlan index Long-Term Indicator. *Trendline breaks are used to signal changes in the direction of this indicator. The last signal was a sell due to the break of the uptrend line in September 1993.*

Using Options In Takeover Situations

by Lawrence G. McMillan



Sometimes, a takeover situation can be as absorbing as watching a professional tennis match or reading an exciting thriller. Can you take advantage of the situation as an observer? Well-known options expert Lawrence McMillan explains how you can use stock options to participate in the activity of the stocks that have become takeover candidates. Take a look.

When Viacom (VIA) recently made a friendly takeover bid for Paramount Communications (PCI), Paramount stock soared (Figure 1) and Viacom stock took a beating (Figure 2), as the deal was proposed largely as an exchange of PCI shares for VIA shares, with some cash thrown in. Then QVC Networks (QVCN), a series of networks devoted to home shopping, launched a competing bid for Paramount, again involving an exchange of shares (Figure 3), but with more cash thrown in. The competing bids for Paramount, coupled with such high-profile mergers as Bell Atlantic and Telecommunications Inc. or AT&T and McCaw Cellular, have led many to believe that takeover fever may be burning again. (In case you were wondering where the fever went, it essentially cooled in October 1990, when UAL stock collapsed more than 100 points, taking the Dow Jones Industrial Average (DJIA) down 190 points with it.)

Often, an options trader is tempted to establish calendar spreads in takeover situations because of volatility skewing. The Octobers are so expensive compared with the Decembers, for example, that calendar spreads for low debits can be established.

Certainly, most investors are not privy to the machinations behind any of the companies in question and

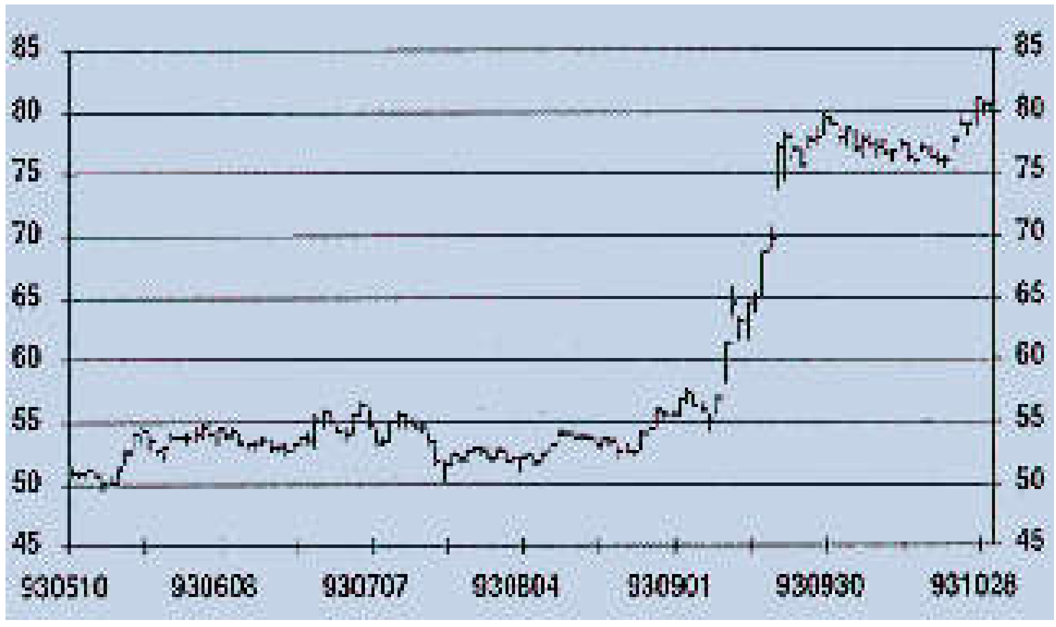


FIGURE 1: Paramount Communications. *The price of PCI stock soared when Viacom announced a takeover bid for Paramount.*

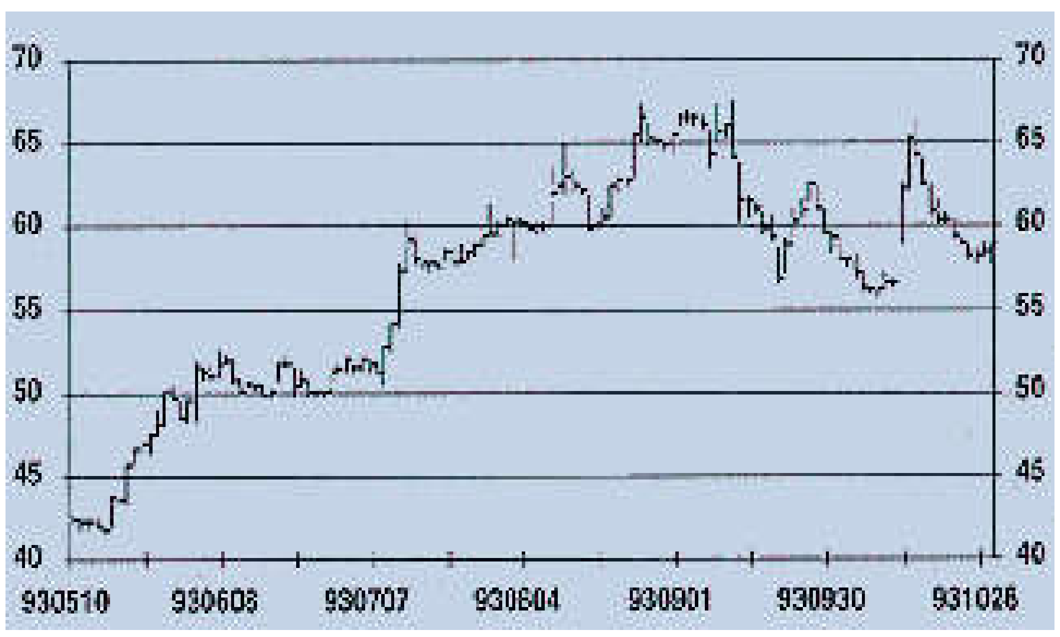


FIGURE 2: VIACOM. *The price of VIA stock suffered because the takeover could dilute current share values.*

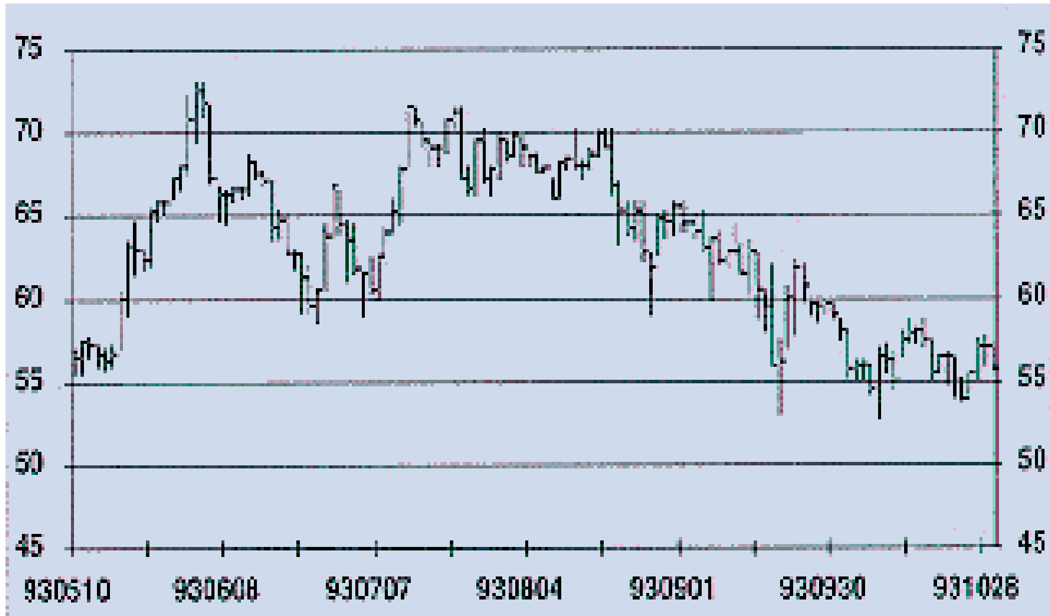


FIGURE 3: QVC NETWORKS*. QVC also launched a bid for Paramount.*

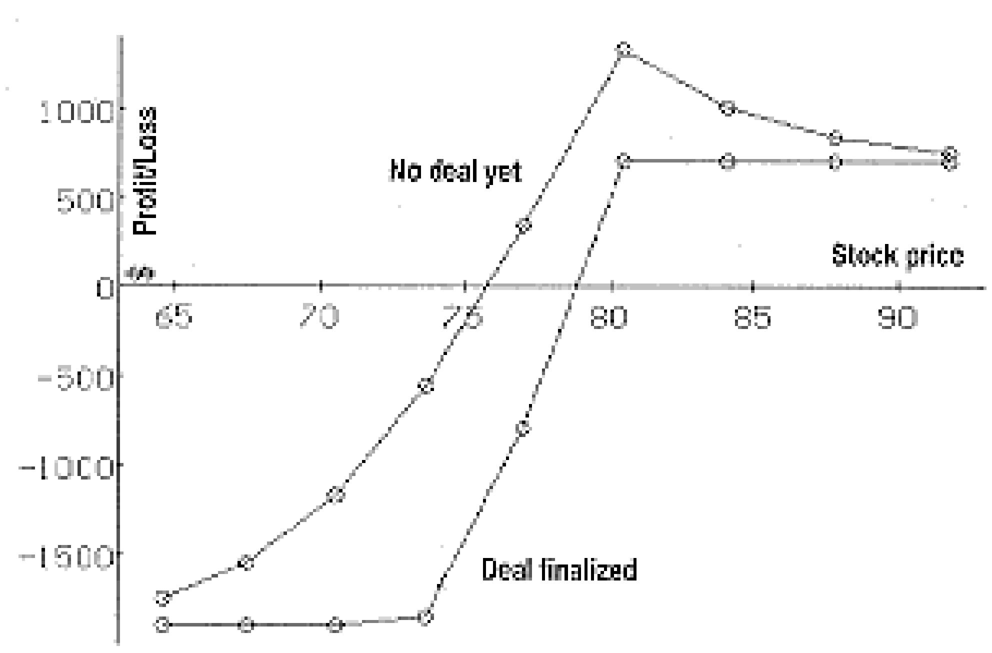


FIGURE 4: PROFIT GRAPH. *The lower profit curve on the graph represents the profitability if the deal is finalized and the November calls lose most of their time value premium. Note that the position still makes a notable profit in this case if PCI is over 80 at October expiration. The upper profit curve represents a more profitable scenario, especially considering the fact that, in this case, we could later sell November calls for additional profit opportunity.*

so cannot predict what will happen to an individual stock. Sometimes, however, both stocks and options give a hint as to what is occurring. Moreover, a risk arbitrageur can often use options to hedge risk. Thus, we are going to take a look at what options might tell us, as well as comment on which options strategies might work and which probably won't. This discussion is not intended to be an exhaustive dissertation on risk arbitrage, but the major points of arbitrage will be covered.

The first clue a trader has to eventual outcome is, of course, the prices of the stocks involved.

- ***Example:*** QVCN's bid exchanges one share of PCI for approximately 0.9 shares of QVCN, plus $30 in cash. With QVCN trading at 56, this would represent a total bid for Paramount of $80.40 ([0.9][56] + 30 = 80.4). However, PCI stock rallied all the way up to 76. Traders appear to expect the eventual price to be paid for PCI to be higher than 80.4, because a stock would not normally trade so close to the eventual takeover price so soon (regulatory delays, financing and so on can cause a takeover to take considerable time to complete).

In addition, where there are competing offers, stock prices of the companies involved often give a clue as to which the market expects will most likely be the eventual victor. When one company acquires another with its own stock, the stock price of the acquiring company (QVCN or VIA, in this case) normally drops in price because issuing more shares will dilute current share values. In the PCI situation, VIA stock was initially falling more than QVCN's after both had bid for Paramount; thus, it appeared that Wall Street expected Viacom to be the ultimate winner. However, as Q VCN lined up more financing, the market changed its opinion and showed it by buying VIA stock and continuing to sell QVCN.

In addition to the information that can be discerned from watching the stocks trade, clues can be found and interpreted about the price and timing of a deal by looking at the options. This is not to say that stock or option traders know what the terms will be and are therefore able to price the market; rather, the options reflect the entire market's perception of the probabilities of what might happen.

- ***Example:*** A clue to timing can often be garnered by looking at the calendar spreads in the company to be acquired. Again, the Paramount situation illustrates the point. Here are the implied volatilities of PCI options at the close of the day that QVCN made its competing bid:

Options	Implied volatility
October	50%
November	40
December	34
January	31

The October options were more expensive with respect to the others, especially the Decembers and Januarys. This type of pattern indicates that the option traders were of the opinion that the matter most likely would be resolved in October or November 1993 at the latest. This does not mean that options are indicating that the deal will be closed by that time, just that the winning bid will have been determined by that time.

CALENDAR SPREADS

Often, an options trader is tempted to establish calendar spreads in takeover situations because of volatility skewing. The Octobers are so expensive compared with the Decembers, for example, that calendar spreads for low debits can be established. While it might be possible to profit handsomely from a calendar spread, such situations should be carefully analyzed. The worst that could happen to the call calendar spread is for the deal to be finalized while both options still have time remaining. This would cause the calendar spread to collapse to nearly zero, for there would be only minimal time value premium in the longer-term call if the deal were finalized. Of course, if the bidding were to go on for a while and October expiration were to arrive before there was any final deal, the calendar spreader might profit handsomely.

- ***Example:*** This situation existed at the time of QVCN's bid. With PCI trading at 77, the October 75 call could have been sold for 5-1/4 and the December 75 call purchased for 6-1/2. Thus, a small debit of 1-1/4 points was all that was required to purchase this calendar spread. If PCI were near 77 at October expiration and no deal had been finalized, the October call would expire at 2 and the December call would not have lost much value at all, so the spread could widen to 3 points or more. This represents a very attractive reward potential for a calendar spread.

However, the risk is that the deal will be finalized. Suppose someone wins the bidding by deciding to pay $82 in cash for PCI, and the bid is made before October expiration. Then PCI stock would trade up to 80 or so and the October 75 call would be worth 5; unfortunately, the December 75 call wouldn't be worth much more than 5, since there would be no chance of PCI going above 82. The portion of the December 75 call's value that is normally represented by the upside potential of PCI stock would be worthless, for there would no longer be any upside potential in PCI stock. By the time the trader pays commissions to enter and exit the spread, there would almost certainly be a loss.

As it turned out, there was no winner by October expiration, so calendar spreads were winning strategies. In fact, if a trader had bought December options, he or she could then have sold November options to re-establish a calendar spread for another month.

SELLING PUTS

A strategy that often seems like an easy way to make money in takeover situations is to sell puts on the takeover candidate. As we should know by now, there is no such thing as free money, so the trader should analyze the risks of such a transaction before proceeding. There are three major scenarios under which put writers might lose. First, the deal could collapse and PCI stock could tumble dramatically, which is what happened to UAL in 1990. Second, a deal might occur that is valued at less than today's price. Suppose QVCN is unable to finance its proposed deal, and the bidding reverts to Viacom's original deal. That deal might only be worth about $65 for PCI, so anyone who had written puts with strike prices higher than 65 would probably lose money. Third, since the deals currently on the table are both exchanges for stock, anyone who writes puts on PCI is, in effect, writing puts on VIA or QVCN as well. If the winning bidder's stock falls dramatically, the put writer could lose money even though PCI was taken over. This is not to say that puts should never be written in a takeover situation, but there is plenty that can go wrong with the strategy.

AN INTERESTING HEDGE

The proper arbitrage hedge in a stock takeover is to be long calls or stock in the company to be acquired (PCI, in this case) and long puts or short stock of the acquiring company (VIA or QVCN, most likely).

However, another hedge that is not an arbitrage but is a hedged position can sometimes be profitable in such a situation: *Buy calls on all three stocks!* Sound crazy? Not necessarily, although it certainly has its risks. It is virtually impossible that all three stocks will advance (unless another bidder comes along and takes PCI), so at least one of the calls you purchase will be a loser.

- ***Example:*** Immediately after QVCN's competing bid, both QVCN stock and VIA stock were depressed. If a trader bought all three calls, the best scenario would be: 1) PCI goes much higher as the bidding escalates, so the call on PCI is a winner; and 2) the stock that loses the bidding will return to its former level, which was at least 5 to 7 points higher for either QVCN or VIA, so that call is a winner as well.

What are the risks in such a multiple-call purchase? First, the calls are being purchased at takeover-implied volatilities, which are higher than normal, and therefore the implied volatilities of all three calls may decrease substantially by the time the issue is resolved. Second, the issue may not be resolved by the time the calls expire. Third, the eventual terms of the deal may be such that none of the stocks moves far from its current levels, and an investor may profit on none or only one of the calls. For these reasons, in-the-money calls should be used in such a strategy, because they have the least time value premium. This strategy has limited dollar risk, and the risk can therefore be budgeted accordingly when the position is established.

AN ATTRACTIVE BULLISH STRATEGY

A compromise position can be reached by combining the advantages of the calendar spread with a bullish position. Using the option pricing on the day QVCN announced its competing bid, one could buy PCI November 75 calls for 6 and sell October 80 calls for 2-1/4.

This approach to the problem incorporates several attractive features. First, the more expensive October calls (50% implied volatility) are being sold and the cheaper November calls (40% implied volatility) are being bought. Second, the position has limited risk to the downside but can still make a nice return if PCI is over 80 at the October expiration. Even if a bid is finalized and the November calls lose their time value, the spread will still widen to 5 points (the difference in the strike prices) if PCI is over 80. Finally, a trader would have some leeway at the October expiration depending on the state of the takeover bids at that time; the trader may be able to sell November calls to replace the October calls as the latter expire. For example, if PCI were near 80 at October expiration but no final offer had been accepted, there would still be premium in the November 80 calls and a trader could buy back the October 80s and sell the November 80s sold in their place.

This is summarized in Figure 4. The lower profit curve on the graph represents the profitability if the deal is finalized and the November calls lose most of their time value premium. Note that the position still makes a notable profit in this case if PCI is over 80 at October expiration. The other profit curve represents a more profitable scenario, especially considering the fact that, in this case, the trader could later sell November calls for additional profit opportunity. Thus, this position is biased in favor of there being no resolution to the bidding war by the October expiration — October 15 — which was only three weeks away at the time of this writing. (*Editor's note:* And as it turned out, as this issue went to press there was *still* no end in sight for the situation.)

Lawrence G. McMillan, is author of Options as a Strategic Investment and publishes a semimonthly newsletter, "The Option Strategist," containing articles on options strategies and option trading

recommendations.

FURTHER READING

Eng, William F. [1988]. *Technical Analysis of Stocks, Options & Futures,* Probus Publishing.

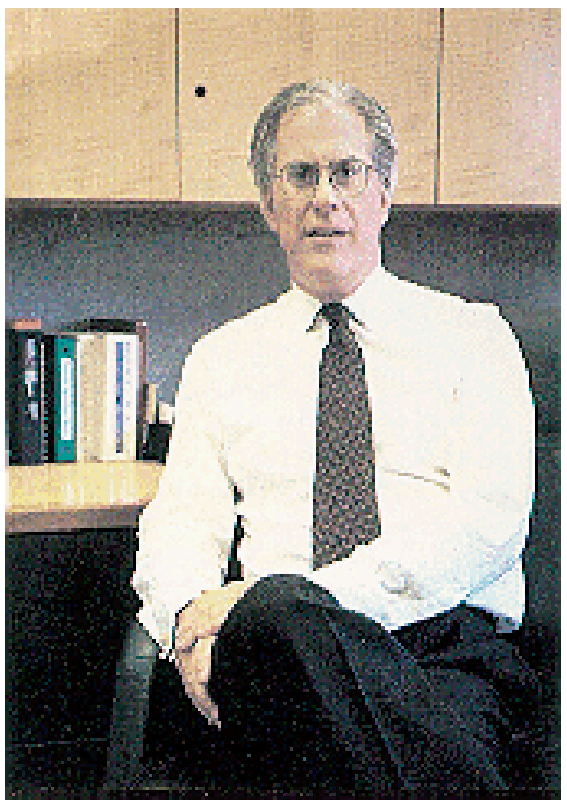
Gastineau, Gary L. [1984]. *The Options Manual,* 3d edition, McGraw-Hill Inc.

McMillan, Lawrence G. [1993]. ÒEquivalent option strategies,Ó*Technical Analysis of* STOCKS & COMMODITIES, Volume 11: November.

___ [1992]. *Options as a Strategic Investment,* 3d edition, Simon & Schuster/New York Institute of Finance.

Chatting With Marc Chaikin

Veteran technician Marc Chaikin, senior vice president of Instinet Corp., got started in the financial industry with most fortuitous timing: He was issued his stockbroker's license the very day that the bear market of 1966 ended. Over the years, Chaikin gravitated to trading, turning to technical research when fundamental research faltered and disappointed, and along the way devised the indicator that bears his name, today included in many software technical analysis packages. STOCKS & COMMODITIES Editor Thom Hartle interviewed Marc Chaikin on October 21, 1993, discussing such subjects as how he developed the Chaikin oscillator, how keeping track of money flow is crucial and why you should avoid timing the broad market on a short-term basis.



I became very interested in trading, but I wasn't using technical analysis then. For the first two years of my career, the concept never crossed my mind .Then I decided that there had to be a better way to guide buy and sell decisions than depending on fundamental analysis, so I started what's ended up being a 24-year research project in technical analysis. —Marc Chaikin

When did you start your career in the financial community?

In 1966 at Shearson Hammill, which was one of the early forerunners to the current Smith Barney Shearson Lehman Brothers. I was issued my license as a stockbroker the day the bear market of 1966 ended.

Great timing!

For the first two and a half years of my career, all I knew about were upticks. Shearson had a reputation as having a very good fundamental research department, so by following their recommendations, I made a lot of profits for people.

Were you trading, or buy and hold investing?

I became very interested in trading, but I wasn't using technical analysis at that time. For the first two years, the concept of technical analysis never crossed my mind. At that time, the management discouraged using charts because we were supposed to be passing on the firm's recommendations.

What changed?

In 1969, the market peaked and stocks started going down. The fundamental research turned out to be pretty worthless. Stocks would go down after a recommendation, but the stocks would stay on the buy list. Then the stocks would go even lower, but they would re-recommend them, and again the stocks would drop further. Finally, the analyst would throw in the towel and the stocks would be removed from the buy list, usually about 5% to 10% before hitting their lows. Then the stocks would turn back up again. I decided that there had to be a better way to guide buy and sell decisions than depending on fundamental analysis.

This led you to technical analysis?

I started what's ended up being a 24-year research project in technical analysis.

What did you first look at?

My first project was verifying the doctoral dissertation of Robert Levy, which looked at relative strength of stocks over a 26-week period and the tendency of strong stocks to continue strong over the ensuing six months. Then Prentice-Hall published his thesis as a book on a relative strength approach to investing. I set out to verify his analysis by expanding his work to include the performance of a universe of 1,000 stocks over an eight-year period.

I decided that there had to be a better way to guide buy and sell decisions than depending on fundamental analysis

How did you accomplish that?

I put the weekly prices on punch cards and took the cards to a local university computer, where a programmer wrote a program to test the relative strength concept. Actually, you measured the relative momentum of the stock.

What exactly is the relative momentum?

Take the closing price of the stock compared to a 26-week average and then rank the universe on a percentile basis based on that measurement.

What did you find?

I found that most of the time, relative strength did in fact work. If you focused on the top five percentile of stocks ranked by relative strength and developed an exit strategy so you would know when to get out, you could outperform the market. By taking Levy's work one step further, I found some interesting things. One of the problems that I encountered was that during bear markets, relative strength investing was as bad as using fundamental analysis.

Why is that?

At the bottom of bear markets, the current strongest relative strength stocks would not be the stocks that you would want to own or buy, because the strongest stocks would be defensive stocks such as tobacco, food and utility stocks. At the bottom of serious bear market declines, you want to look at stocks in the *middle* deciles of relative strength, not the strongest and *not* the weakest. The weakest stocks usually had some intrinsic problems, so those wouldn't recover, and the strongest would lag during the rally.

What about during bull markets? Do you have any insights to offer?

On a short-term basis, the relative strength concept can hurt you because a stock can become overextended and falter because it is overbought.

What else?

Another interesting aspect I found was a group theme that underlies the relative strength concepts. Stocks tended to move in packs. I also noticed that individual stocks had more in common than just similar relative price strength.

What did they have in common?

The stocks at the top of the relative strength list were also the stocks that had analysts raising their earnings estimates. It started becoming clear that earnings, or the perception of earnings, drove stock prices, and that fundamentals created price movement. But technical analysis was a good way to determine when there was a strong consensus about earnings and fundamentals.

So you need both the technical and the fundamental data?

In those days you didn't have access to that kind of fundamental data, unless you were an institutional investor, which I was not. So I wanted to develop technical indicators, which could serve as a proxy for earnings analysis. Price and volume data were available on 1,000 to 2,000 stocks, but earnings data wasn't accessible to the public the way it is today.

So you let the market tell you what the fundamentals are?

Clearly, monitoring relative strength was one way to tell when everybody had the same level of confidence for a company's prospects.

What did you do with this relative strength concept?

I developed the relative strength method into a quantitative strategy for managing money. I left Shearson in the summer of 1969 and started an investment partnership. I started the firm in the middle of a bear market. My timing was less than optimal.

How long did you do that?

A little less than two years. I did relatively well by staying in strong stocks during the bear market, but on an absolute basis I wasn't getting the return I wanted, so I went back into the brokerage business in late 1970 to market this research to institutions.

Did you continue to research other techniques?

I had already been looking more closely at using volume and demand supply analysis in particular. I became very familiar with the work of Larry Williams, Joe Granville, R.W. Mansfield and David Bostian. I started monitoring the Williams accumulation/distribution line and a three-day/10-day oscillator of that line. That was as good a technique as any for spotting short-term entry points and divergences between price action and volume on a daily basis.

What other indicators did you use?

I followed a couple of newsletter services that used three- and 10-day price oscillators — a moving average of the difference between the three-day moving average and a 10-day moving average of the closing price. It was an intermediate-term indicator.

How many stocks did you follow?

I was doing the computations by hand, which limited me to following only 20 to 30 stocks. It was a lot of work each day. If I went on vacation, it was just agonizing to get caught up after we got back. I ran into a problem in 1974, when the newspapers stopped carrying the opening price for stocks that I needed for some of the indicators. So I developed a new oscillator that didn't need the opening. This oscillator used volume and the relationship between the closing price and the day's price range. It became known as the Chaikin oscillator (see sidebar, "Chaikin indicators"), which is in most software technical analysis packages today.

The daily raw formula of the Chaikin oscillator is also used for your money flow indicator?

Right. Later on, I developed the money flow indicator, which is the 21-day sum of the raw daily accumulation/distribution indicator divided the 21-day sum of volume. Instead of calculating a running total, we are looking at an oscillator of money flow (Figure 1).

Okay. Now back to 1974. Were you satisfied with your approach in determining buy and sell points?

I thought that I had an approach that was fairly effective at finding stocks, determining whether they were attractive on a demand/supply basis and monitoring them for entry and exit points based on divergence analysis and the relationships between the oscillators and their moving averages. I was fairly confident that I had something really good. Then in 1977, I became involved in the options markets.

Was this with a new firm?

Yes. I was put in charge of the options department at Tucker Anthony and R.L. Day. At that time, people were focused on option premiums and fair value, but I was convinced that was irrelevant for the individual trader.

So what was important?

What was important was correctly determining the direction of the underlying stock. It didn't matter what the option premium was. I started a weekly technical analysis newsletter and daily hotline for the brokers. Then I met Earl Brian, who went on to start Financial News Network. At that time, Earl had a service bureau and a computer model in the options database. This model had the ability to perform technical analysis on a large universe of stocks — namely, the options universe. A lot of the model was similar to the work I was doing. Consequently, I became very focused on using an on-line computer to analyze a large universe of stocks.

How long did you stay with Tucker Anthony?

About five years. When I left Tucker Anthony, I no longer had access to a time-share computer to do the analysis, and there was no way I was going back to doing analysis by hand.

But there weren't many alternatives back then.

No, there wasn't, but I did learn about CompuTrac. I decided to attend a conference that CompuTrac was holding in New Orleans. I had a great time, met a number of people who were as interested in technical analysis as I was and who were willing to swap ideas.

Wasn't their focus on commodities and yours on stocks?

Yes, but CompuTrac was interested in both, so I used CompuTrac software to develop new indicators and ways to use commodity indicators for stocks.

Give me an example.

Well, one example is J. Welles Wilder's relative strength index (RSI). For the commodity market, you're supposed to use a 14-day RSI and the RSI values of 30 and 70 breakpoints for decisions. For trading stocks, I found that a nine-day RSI is much more effective with the 30 and 70 breakpoints for trading.

What else did you use CompuTrac software for?

I started combining on CompuTrac the supply/demand indicators that I used, such as the accumulation/distribution indicator, the Chaikin oscillator, momentum indicators such as the RSI and the commodity channel index (CCI). To this day, I think the CCI is the most powerful momentum, overbought/oversold indicator that I use.

How do you use the CCI?

I use it differently than the originator, Donald Lambert, first recommended. I use time frameworks of five to 45 days, with 13 days my favorite. I buy when the CCI crosses from below -100 to above -100 if other technical indicators support being long. I consider selling the crossover from above 100 to below. Though selling just because the indicator is above 100 is not necessarily automatic, because tops take longer to form than bottoms.

Were you still using relative strength as an initial screen for stocks?

No, CompuTrac software did a great job giving you the tools to analyze individual stocks, but at that time CompuTrac could not rank the stocks based on performance indicators, so I began to look at individual stocks discretely. That was good and bad.

How so?

You tended to learn the characteristics of individual stocks, but the universe of stocks that you picked from may not have been the stocks you should have been really focusing on. I started looking for additional software that could complement CompuTrac.

What did you try next?

I got in touch with Bill Schmidt of Tiger Software, who was doing very similar work to what I was doing in the area of trading bands and other indicators.

You were researching trading bands at the time?

I did a lot of work on developing trading bands as a timing tool. If you build the volatility of trading bands around a moving average, you can gain a sense of the normal fluctuations of a stock. I found that the 21-day moving average worked the best for intermediate-term trading.

Does the trading band itself vary with the instrument?

I looked at the Dow Jones Industrial Average (DJIA) back to 1919 and found that the proper trading bands were 4% above and below the 21-day moving average. You contained approximately 85% of the closing price movement. For the Standard & Poor's 500, a 3% band was most appropriate. But when I started looking at individual stocks, I couldn't find a generalized approach, because individual stocks had such a wide range of volatilities. In addition, most software then only let you use fixed bands — typically, a fixed percentage value above and below the moving average.

How is that a problem?

If the stock was in a strong rally, the price may hit the upper band but never fall back enough to touch a lower band. So I started exploring the idea of computing bands that were variable. My sons wrote software to compute variable-width bands based on volatility and that reflected the stock trend. We used a one-year measurement of the volatility and the stock trend to create variable-width trading bands that ultimately became known as Bomar trading bands (Figures 1 through 5). Bomar bands were good for two- to four-week timeframes but weren't that good for low volatility periods.

What* would *help you in lower volatility periods?

I really like Bollinger bands. Bollinger bands use the two standard deviations of the closing price over a 21-day period above and below the moving average. So if volatility decreases, the Bollinger bands narrow and the bands will be touched by the stock where the Bomar bands may not be reached.

Back to your research. Were you able to rank stocks based on the technicals?

Yes, now I had a collection of indicators that I thought complemented each other: Trading bands, supply/demand indicators and overbought/oversold indicators. I used Tiger software to look both at stocks and indicators graphically, *and* I had ranking capabilities. So I was back to my original idea of ranking a universe based on my set of indicators.

If you're ranking based on a combination of indicators, isn't it very important to pick indicators that don't overlap?

Yes, it is. When I lectured at CompuTrac user groups around the world, I stressed that you had to select indicators that were not all price-based. For example, if you were looking at a stochastics indicator and an RSI and a commodity channel index, you were kidding yourself. You were really looking at the same thing, only presented slightly differently.

What would be a good mix of indicators?

You could start with the relative strength line as an overall performance measure, where you compare the stock's performance to the broad market. Remember, I'm speaking of relative strength, not the RSI, which doesn't measure relative strength. In fact, in our own Instinet II workstation, we renamed RSI as *internal strength index* because RSI doesn't measure relative price movements to anything (Figures 1, 2 and 3).

Good point. What other indicators are a good mix?

Along with relative strength, look at trading bands, which represent volatility trading patterns. Then include a momentum indicator that'll identify overbought and oversold conditions along with divergence between the momentum indicator and the price. I like the CCI for that. Finally, include an indicator that measures demand and supply relationships using volume. Then you have a suite of indicators, a toolkit

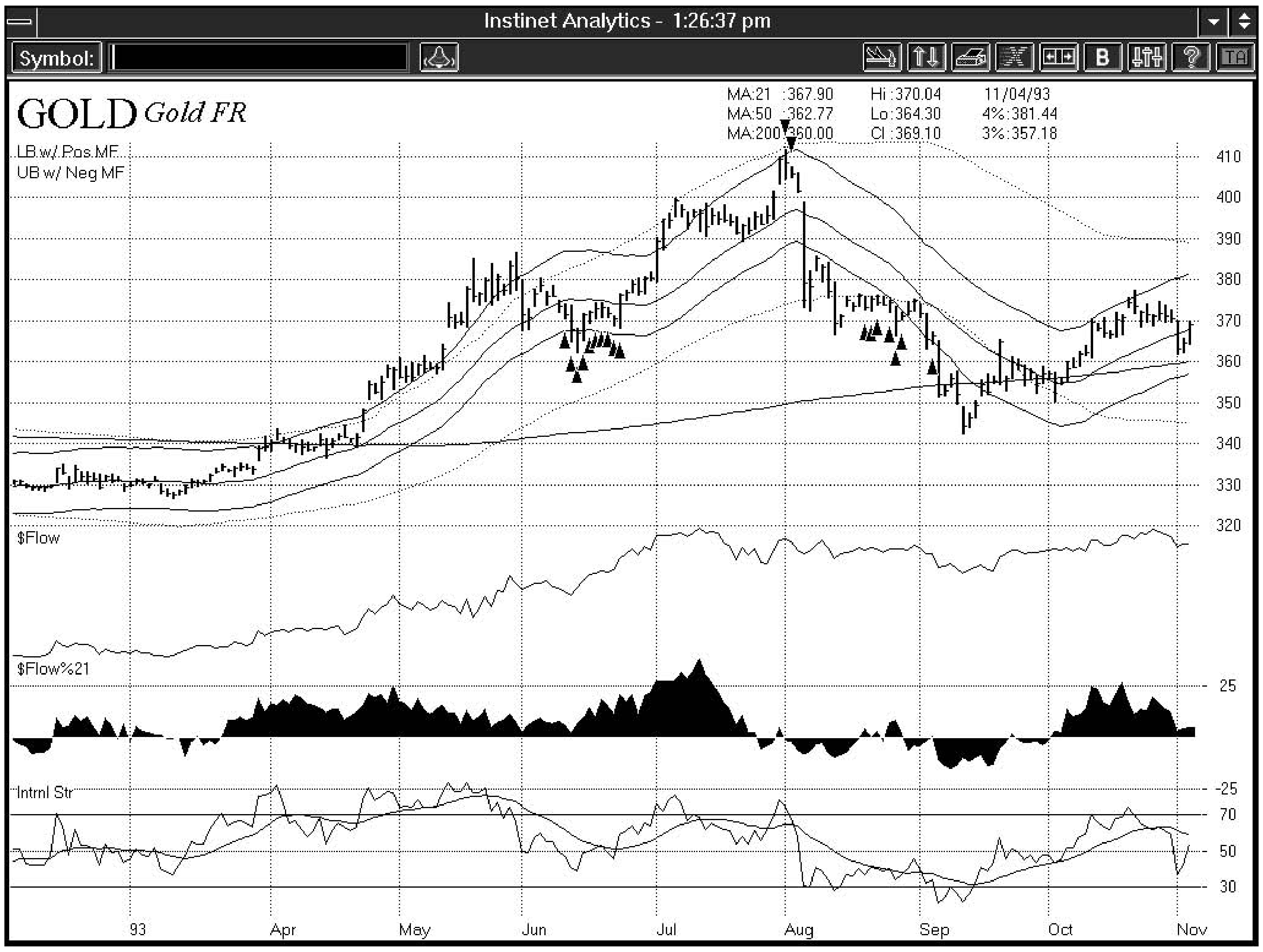


FIGURE 1: GOLD. The money flow oscillator turned negative prior to the price of gold falling.

FIGURE 2: COCA-COLA. During 1989, the money flow oscillator maintained a fairly consistent bullish reading during the price advance.

FIGURE 3: PARAMOUNT COMMUNICATIONS. During most of 1993 the cumulative money flow line was flat, while the money flow oscillator showed a persistently bullish reading.

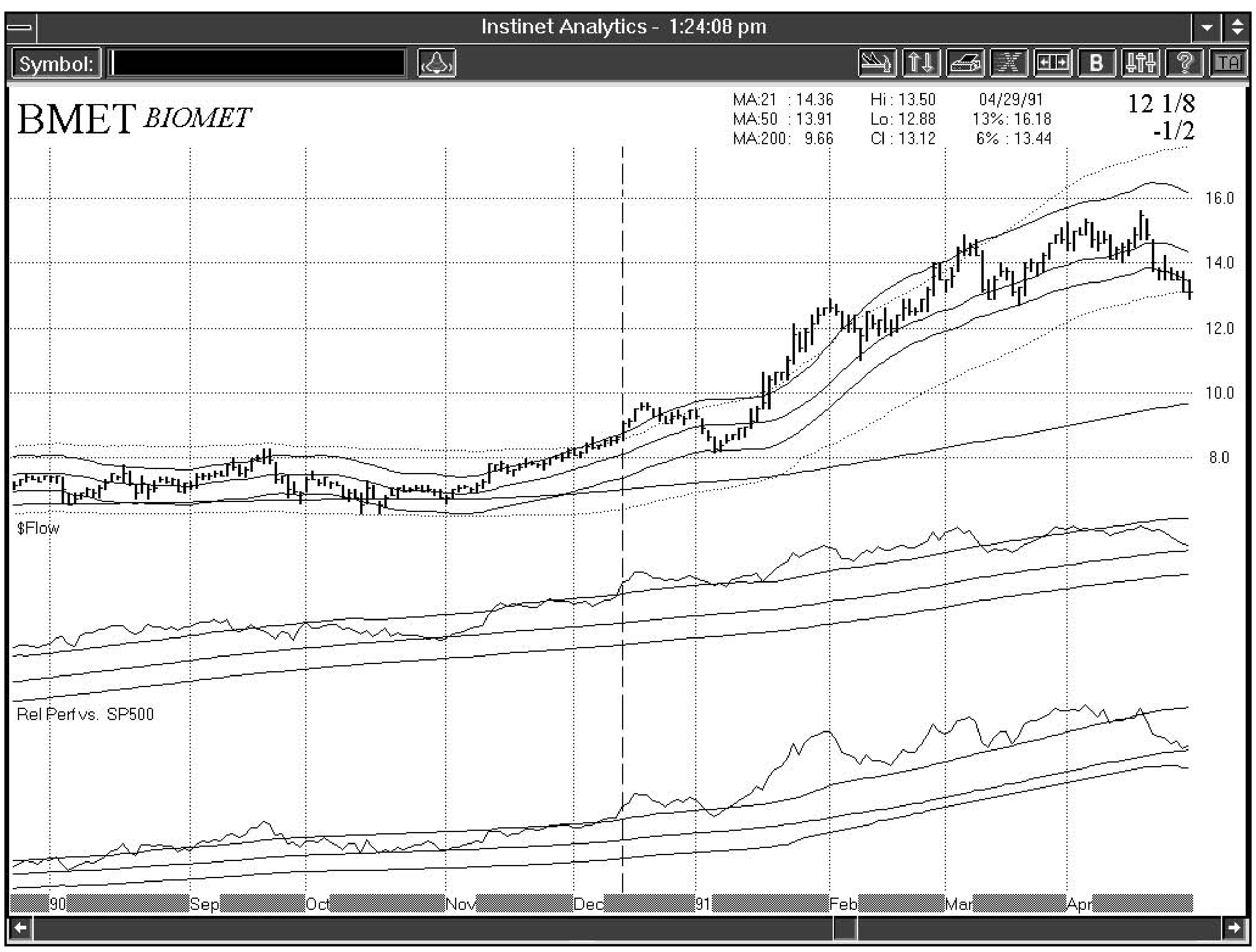


FIGURE 4: BIOMET. During late 1990, the cumulative money flow and relative strength line stayed above the 90-day moving averages and tended to move above the breakout bands, indicating strong demand.

FIGURE 5: CHEYENNE SOFTWARE. During fourth-quarter 1991, both the cumulative money flow and relative strength line moved above the 90-day moving averages and tended to move above the break out bands, verifying the upward trend.

Key to Figures 1 through 5. Figures 1, 2 and 3 show the daily high/low/close bars, the 21- and 50-day Bomar bands, and a 200-day moving average of the closing price. The indicator labeled $Flow is the cumulative money flow line (sometimes referred to as the volume accumulation/distribution line). The next indicator, labeled $Flow%21, is the money flow oscillator. The bottom indicator is the internal strength index (commonly known as the relative strength index). In Figures 4 and 5, the cumulative money flow line along with a 90-day moving average of the cumulative money flow line surrounded by the breakout bands are presented. The bottom indicator labeled the Rel Per vs. SP500 is the stock's relative strength line, an indicator that measures a stock's performance relative to the Standard & Poor's 500. There is a 90-day moving average and the breakout bands for the relative strength line.

that could be built into a decision matrix.

You will need rules to trade by based on the indicators, right?

Exactly. Unless you created decision rules, the toolkit would be worthless. You would more than likely suffer from paralysis through analysis.

But again the choice of indicators is crucial?

Sure. It's my view that you need to select one indicator from each of the groups — one from the volume-based groups, one from the momentum group and one from the trading band group. You need a set of trading rules. That's the key, because if you have to fall back on subjective interpretation, you're pretty much worse off than when you began. You have to keep your emotions in check. That's what trading bands and the money flow indicator do.

How do trading bands and the money flow indicator help manage your emotions?

I can explain that, if you'll give me a minute. Using the Tiger software and some modifications, I created the ability to look at a universe of stocks and started seeing the basis for a set of decision rules that could be put into a package that people could use. At that point I introduced a former associate of mine, Robert Brogan, to the Tiger- and Chaikin-type of technical indicators, and he started exploring the concept of meeting the needs of a portfolio manager monitoring up to 1,000 stocks for buy and sell signals.

That's a lot of stocks.

Initially, we couldn't track that many, but with some help from Bill Schmidt and some other software writers, we started a new company that marketed an end-of-day technical analysis package for institutional managers. That was about a month before the 1987 crash.

Was that good or bad?

I think it was good because after the crash people were very interested in tools that could have forewarned them of the possibility that the stock market was going to turn. One of the things that we did was create colored indicators (Figures 1, 2 and 3) that are visually compelling as well as mathematically sound. I think for a lot of people who are right-brain-oriented that is very important. If you create an indicator that is green when it is positive, then an individual who may be predisposed to turning bearish early will be inclined to be more patient as long as you are using indicators that are sound.

Such as trading bands and money flow?

Right. Using color can aid in providing a clearer visual representation of the technical information. For example, a stock could have a nine-day relative strength index of 30, indicating that the stock has had a fairly sizable decline, now oversold, and the money flow indicator could still be green.

Why does that happen?

Typically, for one of two reasons: either the volume on the down days was less than the volume on the up days, or the stock was closing down for the day but higher than the midpoint price for the day. That represents the fact that there are buyers around. The stock may be lower for reasons unrelated to stock fundamentals, such as a general market decline, or maybe sell programs knocked the stock down, but the money flow indicator being green indicates that there are buyers at these lower prices. Using color in these indicators can help manage your emotions.

Is this more of an intermediate-term indicator, then?

We found that truly strong stocks that are going to perform well over a six- to 12-month time period presented a green money flow indicator, even when other technical indicators may have been turning negative or were oversold in the short term.

This indicator sounds like a possible candidate for ranking or screening stocks.

It turned out that it was. Bob Brogan came up with a concept called persistency of money flow, which is the percentage of days in a six-month window that the money flow indicator was positive with no regard to magnitude. We looked at stocks with the highest number of positive days of money flow over the last 120 trading days.

What did you find?

Those stocks were in general good buys on weakness or were the best performers for the next six to 12 months. Originally, Bob was doing this by hand, chart by chart, one at a time. So we moved from a single-day money flow measurement to a concept of money flow persistency. Again, the highest-ranking stocks were generally the best performers six months out.

Did you compare this to relative strength rankings?

We did. In fact, it turned out that the stocks with the highest persistency of money flow rating were also the same stocks that ranked high in William O'Neil's institutional service and on *Investor's Business Daily* screens. They use a relative strength measurement and an earnings momentum analysis. Very often, the stocks that we identified as good buy candidates were the same stocks that had O'Neil's 90 relative strength and 90 earnings momentum readings. So here I was, back to the original work on the notion that technical analysis is really derived from fundamental analysis, that stocks are driven by earnings momentum and earnings surprises. Those stocks with high earnings momentum and consistently had positive earnings surprises also had high persistency of money flow.

Did you develop some decision rules out of this?

Yes. The simplest implementation is if a stock has a high persistency of money flow over a six-month period and trades down to its lower trading band, buy the stock. More than likely, this is a stock with strong earnings growth, increased estimates or earnings surprises that are positive. A short-term price weakness is an opportunity.

How do you know that the stock will stop at the lower trading band?

Our research shows that the stock is likely to hold 85% of the time. The bands are designed to contain 85% of the past price movement. However, 15% of the time, the stock will keep declining. In studying this, we found that if you monitor the 13-day commodity channel index (CCI) and use it as an overbought/oversold indicator, when it drops below -100 and turns back up above -100, then you should buy the stock. This additional technique will identify stocks that have more than likely stopped going down at the lower trading band. Very simple but effective. In our Instinet II workstation, we can monitor a large universe of stocks so that our clients are aware when this is happening during the day.

But if you have a buy signal during the day, couldn't that signal disappear by the close?

You do run the risk of a stock rallying during the day, the CCI moving above -100, and then the stock failing to hold the gains in the last hour. There is always a trade-off between intraday monitoring and end-of-day monitoring. Today, you have a lot of people monitoring rules like these on an overnight basis who'll see the same things overnight and try to do something on the opening. It's important to monitor these things through the course of the trading day so you can decide whether you want to act on them by the close.

The method that you've been describing is pretty straightforward.

Keeping it simple is going to be the most efficient. Trading stocks begins with what John Bollinger calls “rational analysis.” For me, that would start with a broad market overview. You want to avoid a situation where the technical situation of the stock market has dramatically deteriorated.

Timing the broad market?

No. Try to avoid timing the market on a short-term basis, but stay aware of when the technicals may have dramatically deteriorated. More important, look at the monetary and interest rate climate and then look at a universe of stocks. Find within the universe those stocks with strong earnings momentum and positive technical factors.

You mentioned avoiding timing the broad market short term but monitoring for dramatic technical deterioration. What are you looking for in the broad market for technical information?

I don't think you should worry about the short-term movement of the broad market, but there are technical indications to monitor on an intermediate-term basis.

For example?

Look for inflection points in the overall market. For example, the October to December 1990 decline or at the end of 1991, when the DJIA was down to its lower trading band, the RSI on the DJIA was at 30. The question to ask was, What stocks are showing technical signs of strength? What stocks will rally if the market has reached an intermediate-term bottom and turns around?

What do you find?

We found that if you look those stocks with high persistency of money flow and strong relative strength, those are the stocks that'll be the leaders on the rally. Now, this is if the market is at an intermediate decline during an ongoing bull market. You wouldn't want to buy strong relative strength stocks at the end of a bear market decline.

Do you smooth the money flow or relative strength line?

I use an 18-week average of the cumulative money flow line and the relative strength line. That's a 90-day average. In *The Encyclopedia of Stock Market Techniques*, there was an article by Sedge Coppock, who's one of the legendary creative forces in technical analysis, and he suggested that you use an 18-week average of the relative strength line.

How do you use the smoothed lines?

The first level of analysis is if the line is above the 90-day average, then that's positive, and if the line is below the 90-day average, that's negative. Those trends tend to persist. I went one step further and created a set of trading bands around the 90-day averages. I called these bands breakout bands. It was very significant when the relative strength line penetrated the breakout bands. The same thing holds for when the cumulative money flow line penetrates its breakout bands. It was a very powerful buy signal when both lines moved above their breakout bands. If you're in a bull market, then stocks with those two characteristics are going to move higher.

Is there an optimum time to look for that signal?

At the bottom of intermediate-term declines in the broad market. For example, at the bottom during October 1990, there were stocks with relative strength lines and cumulative money flow lines above their breakout bands. The stocks were down; after all, if the DJIA drops 500 points, it is pretty difficult for a stock to go up. However, these stocks were outperforming the market by going down less on a percentage basis. These stocks were the next leaders.

Do you have some specific examples?

Sure. In October 1990, a stock in the Standard & Poor's 500 called BioMet (BMET) was trading at $7 a share (Figure 4). The market had just come down 500 DJIA points because of the Kuwaiti crisis and BioMet had bottomed out earlier in the year between $4 and $5. In November, both money flow and relative strength were above their upper breakout bands. The stock was trading at $9 a share in December, and BioMet ended up being the best-performing stock of 1991, reaching 32-3/8. There are numerous examples from that time period.

What about the bottom in December 1991?

A good example was Cheyenne Software (CYE), which in December 1991 was trading at $7 with both money flow and relative strength trading above their breakout bands (Figure 5). By December 1992, Cheyenne was trading at $22 and moved above $40 in 1993. In fact, in December 1992, both the money flow and relative strength lines were above their upper breakout bands. This is the kind of analysis that people really don't do. People are more concerned with day-to-day predictions. The fact is, two to three times a year it is significant to focus on the broad market, such as during an intermediate-term price decline, to do a global search for those stocks with the characteristics we've discussed here and seize the opportunity.

What about tops in the market?

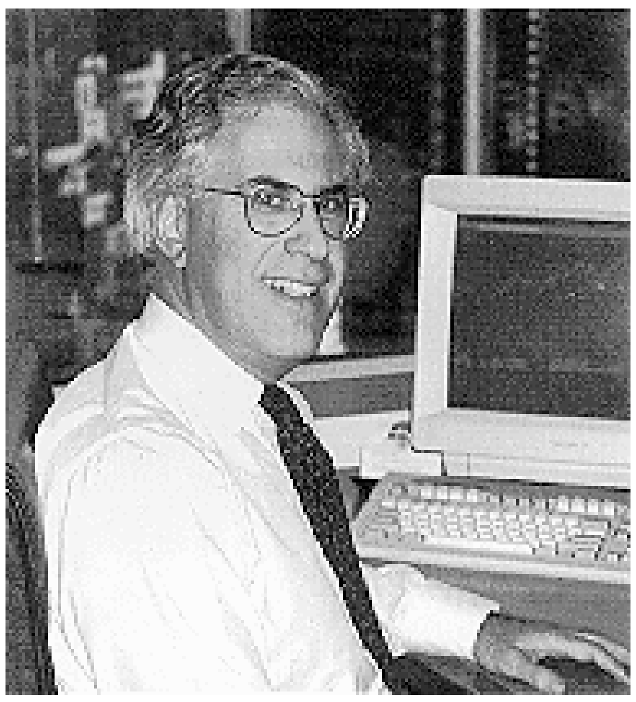
Justin Mamis came up with probably the most valuable piece of technical advice ever: “Never short a stock making a new high.” Look for stocks that aren't making new highs when the broad market's making new highs. Look for stocks not making new highs within a group making new highs. A warning that a stock may be starting to falter is if there is divergence between the stock price and the money flow line and the relative strength line. Stocks with their money flow lines and relative strength lines below their lower breakout lines are probably too late to be sell candidates.

What about money management?

The better the technical indicators you use, the higher the confidence level you'll have in those indicators. This is an excellent way to trade, but money management becomes more important because you may be too confident and the fact is, technical indicators can be wrong. There is no perfect indicator. So you need to predetermine at what point the indicators that you use misdiagnosed the stock trend, so you can limit your losses. Then you can go on to the next trade without having suffered too much of an equity drawdown and little psychological damage, because taking losses is a part of trading. Overconfidence can be dangerous; you have to accept the realities of the marketplace.

As we wind down here, what do you see for the future of trading and market analysis?

During the 1980s, the competition between the individual trader and the institutional money manager narrowed, because individual traders picked up very quickly on using personal computers to analyze markets using technical analysis, while the institutional managers did not. However, today the institutional manager has access to products like our Instinet II workstation, which can do the global searches, analyze stocks and respond quickly, because we provide the capability to execute instantaneously with electronic trading. Institutional investors are gaining an advantage because of the availability of these high-powered tools.



It started becoming clear that earnings, or the perception of earnings, drove stock prices, and that fundamentals created price movement. But technical analysis was a good way to determine when there was a strong consensus about earnings and fundamentals.

What should the individual trader do?

Disciplined trading is the key. Traders have to operate as efficiently as possible, do their analysis and execute their trades quickly. Traders have to be comfortable and take the emotions out of their trading decisions, because the tolerance for waiting and analyzing are a lot lower.

Thank you for your time, Marc.

You're welcome.

Reference

Bollinger, John[1993]."Using Bollinger Bands," *Technical Analysis of* Stocks & Commodities, Volume 11:Febrary

Hartle, Thom [1993]."John Bollinger of Bollinger Capital Management,"*Technical Analysis of* Stocks & Commodities, Volume 11:July.

Instinet Corporation, 875 3d Avenue, New York, NY 10022, 212 303-1992.

CHAIKIN INDICATORS

Click here to open spreadsheet. (File is in Lotus .wk1 format.)

The indicators developed by Marc Chaikin are built on and around a single day's observation of the relationship of the closing price to the price range of the day and then multiplied by the day's volume:

$$\left(\frac{(\text{Close}-\text{Low})-(\text{High}-\text{Close})}{(\text{High}-\text{Low})}\right) * \text{Volume}$$

Keeping a running total of this formula creates the indicator known as the cumulative money flow line, which is also known as the volume accumulation/distribution line. The Chaikin oscillator is the difference between the three-day simple moving average and the 10-day sirnple moving average of the cumulative line. The 21 -day money flow indicator is the 21 -day sum of the above formula divided by the 21-day sum of the day's volume.

Here are the Excel formulas for the Chaikin indicators using daily price data for Paramount. In column F, the single day's measurement of money flow is calculated. The formula is entered into cell F2 and copied down:

=(((D2-C2)-(B2-D2))/(B2-C2))*E2

The cumulative line is calculated in column G. Start with the first day's value of the single day's money flow by entering the following formula into cell G1:

=F2

Then start the running total in cell G2 by entering the following formula in cell G2 and copying down:

=F3+G2

The Chaikin oscillator is the difference between the three-period simple moving average and the 10-period simple moving average of the cumulative line. The three-period simple moving average is calculated in column H. The following formula is entered into cell H4 and is copied down

=AVERAGE(G2:G4)

The 10-period simple moving average of the cumulative line is calculated in column I. Enter the following formula into cell I11 and copy down:

=AVERAGE(G2:G11)

The Chaikin oscillator is calculated in column J. The following formula is entered into cell J11 and is copied down:

=H11-I11

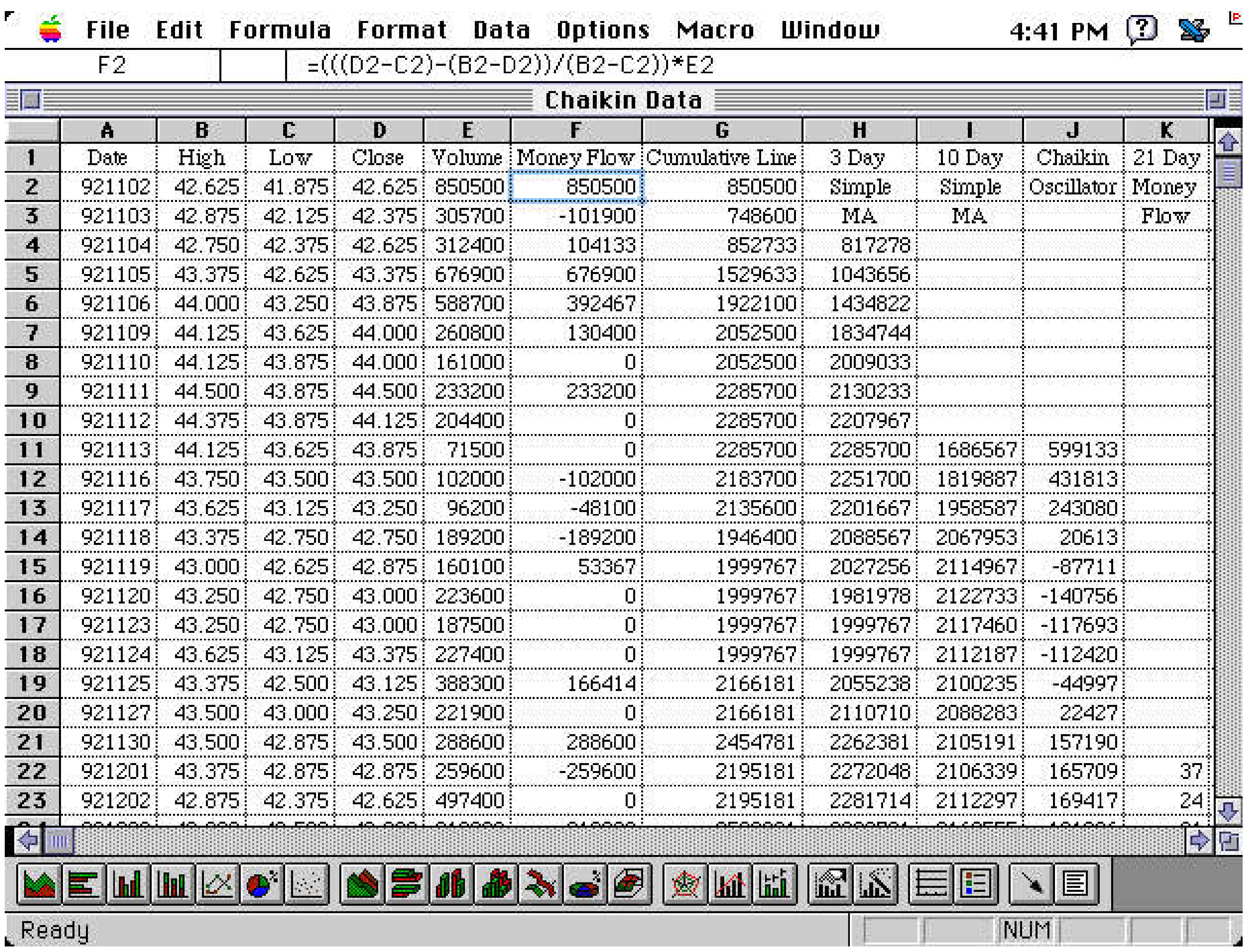
The Chaikin 21-day money flow indicator is the 21-day sum of the daily raw calculation divided by the 21-day sum of the volume. The indicator is calculated in column K. Enter the following formula into cell

K22 and copy down:

=((SUM(F2:F22))/(SUM(E2:E22)))*100

Chaikin also smoothed the 21-day money flow indicator with a 90 day simple moving average.

- Editor



	A	B	C	D	E	F	G	H	I	J	K
1	Date	High	Low	Close	Volume	Money Flow	Cumulative Line	3 Day	10 Day	Chaikin	21 Day
2	921102	42.625	41.875	42.625	850500	850500	850500	Simple	Simple	Oscillator	Money
3	921103	42.875	42.125	42.375	305700	-101900	748600	MA	MA		Flow
4	921104	42.750	42.375	42.625	312400	104133	852733	817278			
5	921105	43.375	42.625	43.375	676900	676900	1529633	1043656			
6	921106	44.000	43.250	43.875	588700	392467	1922100	1434822			
7	921109	44.125	43.625	44.000	260800	130400	2052500	1834744			
8	921110	44.125	43.875	44.000	161000	0	2052500	2009033			
9	921111	44.500	43.875	44.500	233200	233200	2285700	2130233			
10	921112	44.375	43.875	44.125	204400	0	2285700	2207967			
11	921113	44.125	43.625	43.875	71500	0	2285700	2285700	1686567	599133	
12	921116	43.750	43.500	43.500	102000	-102000	2183700	2251700	1819887	431813	
13	921117	43.625	43.125	43.250	96200	-48100	2135600	2201667	1958587	243080	
14	921118	43.375	42.750	42.750	189200	-189200	1946400	2088567	2067953	20613	
15	921119	43.000	42.625	42.875	160100	53367	1999767	2027256	2114967	-87711	
16	921120	43.250	42.750	43.000	223600	0	1999767	1981978	2122733	-140756	
17	921123	43.250	42.750	43.000	187500	0	1999767	1999767	2117460	-117693	
18	921124	43.625	43.125	43.375	227400	0	1999767	1999767	2112187	-112420	
19	921125	43.375	42.500	43.125	388300	166414	2166181	2055238	2100235	-44997	
20	921127	43.500	43.000	43.250	221900	0	2166181	2110710	2088283	22427	
21	921130	43.500	42.875	43.500	288600	288600	2454781	2262381	2105191	157190	
22	921201	43.375	42.875	42.875	259600	-259600	2195181	2272048	2106339	165709	37
23	921202	42.875	42.375	42.625	497400	0	2195181	2281714	2112297	169417	24

SIDEBAR FIGURE 1: EXCEL FORMULAS FOR THE CHAIKIN OSCILLATOR.

Dema1 Derivation

Here is a nonrigorous derivation of the one-parameter double exponential moving average (DEMA1), which assumes there is no noise and that the MAs have reached a steady-state value ($i > w$). The observed data will be defined as an exact linear process.

Define variables and data range:

$$N = 41,\ i = 0 .. N - 1,\ t_i = i,\ a = 25,\ b = 5$$

Here, we have renamed the *y*-intercept *a* instead of *u* and the slope *b* instead of *v* from the article to be consistent with outside literature.

Define linear database $y = a + bt$
Select averaging window *w*:

$w = 11,\ \alpha = 2/(w+1) = 0.167$

$Lag = (w - 1)/2 = 5$

Calculate initial values:

$EMA1_0 = a - \left(\frac{1-\alpha}{\alpha}\right)b$

$EMA1_0 = -3.553 * 10^{-15}$

$EMA2_0 = a - 2\left(\frac{1-\alpha}{\alpha}\right)b$

$EMA2_0 = -25$

$M = 1 .. N - 1$

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

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

In sidebar Figure 1, the linear, noise-free data *y* along with EMA1 and EMA2 of the data is presented. EMA1 lags the data *y* by five time periods and EMA2 lags EMA1 also by five. Both EMAs are linear lines parallel to the original data *y*.

The lag for an EMA is $(1 - \alpha)/\alpha$, or in terms of *w*, it is $(w - 1)/2$ and will be symbolized by *L*. As can be seen in sidebar Figure 1, the moving averages are straight lines parallel to the observed data *y* and shifted to the right by the amount of lag. If the data follow the relationship:

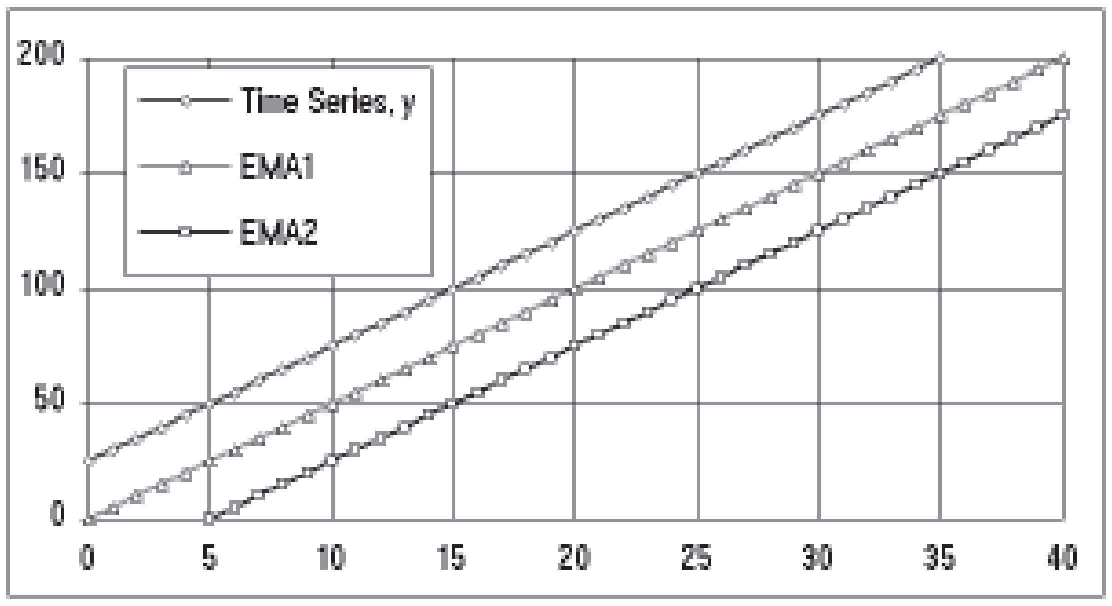
[Equation 1] $y = a + bt$

then the single exponential moving average that lags *y* in time by *L* can be written as:

[Equation 2] $EMA1 = a + b(t - L)$

[Equation 3] $EMA1 = a + bt - bL$

substituting for a + bt yields:



SIDEBAR FIGURE 1: DERIVATION. *Here, the linear, noise-free data y along with EMA1 and EMA2 of the data is presented.*

[Equation 4] EMA1 = y - bL

using the same logic for EMA2 (it lags EMA1 by L also) produces:

[Equation 5] EMA2 = EMA1 - bL

subtracting Equation [5] from Equation [4]:

[Equation 6] EMA1 - EMA2 = y - bL - (EMA1 - bL)

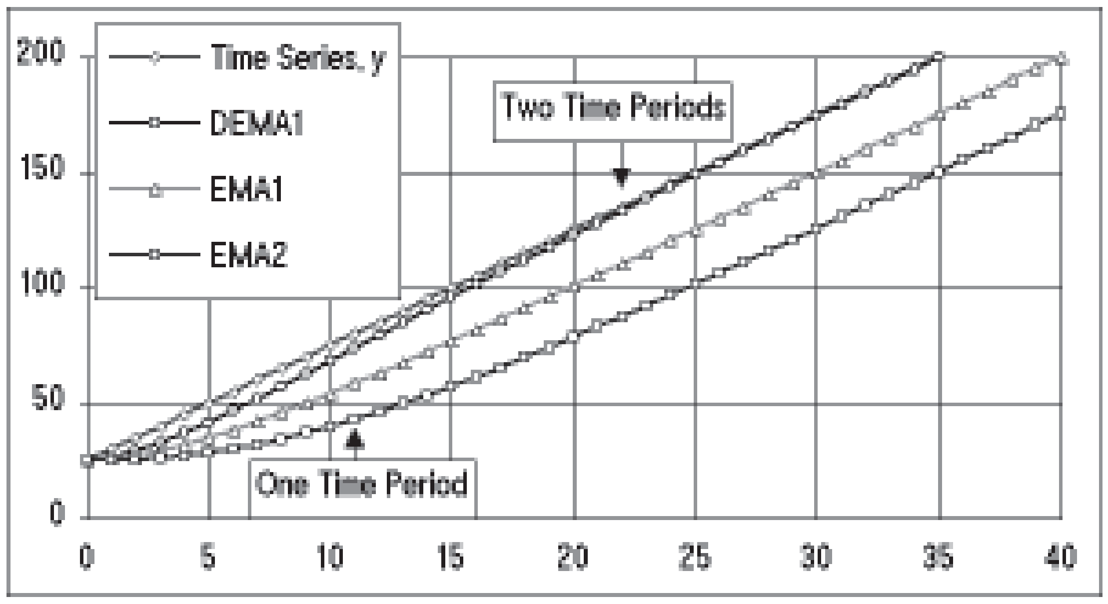
which, when simplified and solved for *y*, reduces to:
[Equation 7] y = 2EMA1 - EMA2

and finally, defining this new definition of *y* as DEMA1:
[Equation 8] DEMA1 = 2EMA1 - EMA2

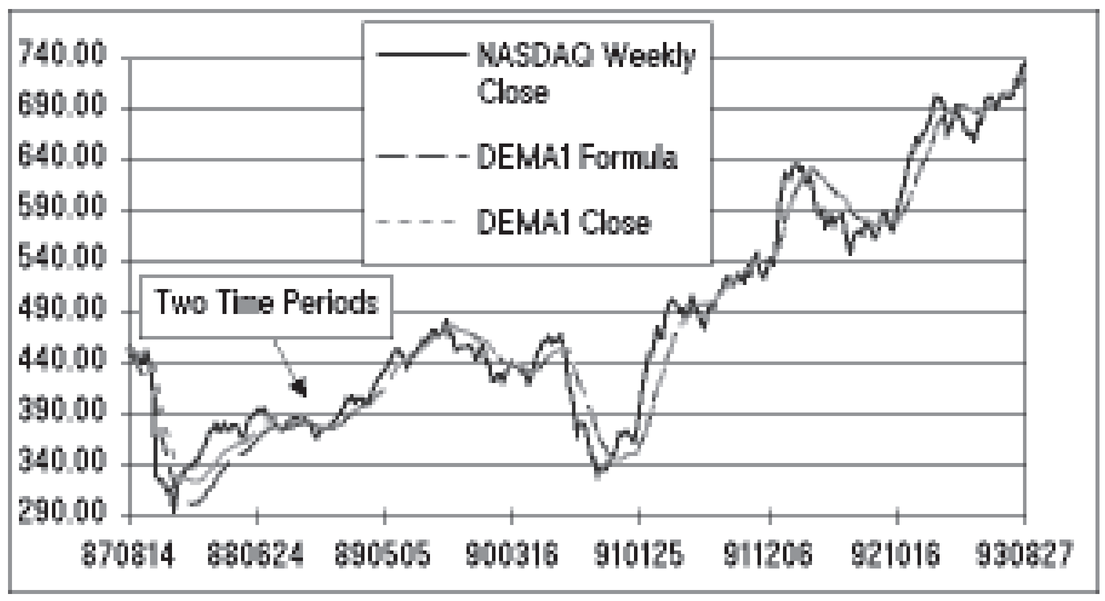
If DEMA1 were plotted in sidebar Figure 1, it would lay exactly on top of *y*, meaning DEMA1 equals *y* for all values of *t*, and so there is zero lag between *y* and DEMA1 for this model. In the discussion on initialization tradeoffs following, the lag is more apparent; it is always there when data fluctuation exists in practice.

Initialization tradeoffs. Initializing exponential moving average smoothing models appears to be an art versus a science at present because no uniform agreement exists as to what the initialization should be. While the primary driving force should be which initialization value or scheme provides the best results (that is, the best-fitting model to the observed data) sometimes the software available to the user will place practical limitations on implementation. A software program such as Mathcad — which is not dedicated to securities analysis — does not restrict the user, but the more ubiquitous program MetaStock — which is dedicated to securities analysis — does restrict the user in implementing EMA initialization values.

The single EMA as implemented in MetaStock uses the initial value of the data at time zero (the first value in the database). This is fine for the ordinary use of this indicator, but when it is used in the DEMA1 indicator, it falls short of the ideal initialization method. As described in the explanation of the DEMA1, formal theory requires it to use a linear regression on a subset of the database and then apply the initialization formulas to calculate the seed values for EMA1 and EMA2. If seed values can't be selected, a simple but graphic depiction of the impact can be shown by using the sample database used in the derivation of DEMA1. Sidebar Figure 2 is a replot of sidebar Figure 1 using the first value in the database



SIDEBAR FIGURE 2: DERIVATION. *In sidebar Figure 2, when the initial value of y_0 is used, DEMA1 is a very close approximation to y (much better than EMA1). After about two smoothing constant periods (2w), DEMA1 is essentially equal to y having only a -1.2% error.*



SIDEBAR FIGURE 3: *After approximately two moving average periods (2w), the difference between the two DEMA1 plots is insignificant.*

(as in MetaStock) as the initial value.

While EMA1 still lags the data *y* by five time periods and EMA2 lags *y* by 10, DEMA1 only lags *y* by about one time period at time *w* and after 2*w* time periods, there is no significant lag.

In sidebar Figure 1, DEMA1 is exactly equivalent to database *y* when the formal initialization equations are used. In sidebar Figure 2, when the initial value of y_0 is used, DEMA1 is a very close approximation to *y* (much better than EMA1). After about two smoothing constant periods (2*w*), DEMA1 is essentially equal to *y* having only a -1.2% error.

$y_{2w} = 135$
$DEMA1_{2w} = 133.34$
$y_N = 230$
$DEMA1_N = 229.903$

The crux of the matter is that there is a tradeoff between the size (length) of the database and the MA period *w* selected as the smoothing period. If a very small database is used and a large relative MA period is selected, then the DEMA1 indicator that is initialized with the database initial value will not be as effective. Thus, one has to be careful in making judgments about the efficacy of this indicator over the first couple of MA periods (2*w*).

After approximately two MA periods (2*w*), the difference between the two DEMA1 plots is insignificant (sidebar Figure 3). Unless you are trying to compare indicators over the entire database, determine historical buy/sell signals during the first two MA periods (2*w*), or working with a small database and large relative MA period, you can use the simplified initialization procedure of using the database initial value at time zero.

—P.G.M.

DEMA1 EXCEL SPREADSHEET

Click here to open spreadsheet (File is in Lotus .wk1 format.)

This Excel spreadsheet (Figure 4) presents the calculation of the DEMA1 (column G) of the weekly closing price of the NASDAQ (column D). We will be using the regression coefficients for the initialization of the single exponential moving averages (column E) and the double exponential moving averages (column F). Column A is the date, column B is the high and column C is the low for the weekly NASDAQ. The first step in calculating DEMA1 will be calculating the linear regression of the closing price to determine the *v* (slope) and the *u* (y-intercept) of the regression line. The slope and y-intercept are calculated as an *array(*seeyour Excel manual for entering formulas in an array format) in cells H2 and I2. The formula for the calculation is:

{=LINEST(D2:D27,,,)}

The calculation of the seed for the single exponential moving average is performed in cell H5:

=I2-((1-0.074)/0.074)*H2

Notice that the first term in this formula is the cell I2, not the *number* 12. The The calculation of the seed for the double exponential moving average is performed in cell I5:

=I2-2*((1-0.074)/0.074)*H2

Again, *enter* cell I2, not the number 12 in the above formula. The single EMA in column E starts in cell E2. The value is copied from cell H5:

=H5

For cell E3, the following formula is entered and copied down the column:

=0.074*D3+(1-0.074)*E2

The double exponential moving average in column F starts at cell F2. The first value is copied from cell I5, cell F2:

=I5

For cell F3, the following formula is entered and copied down the column:

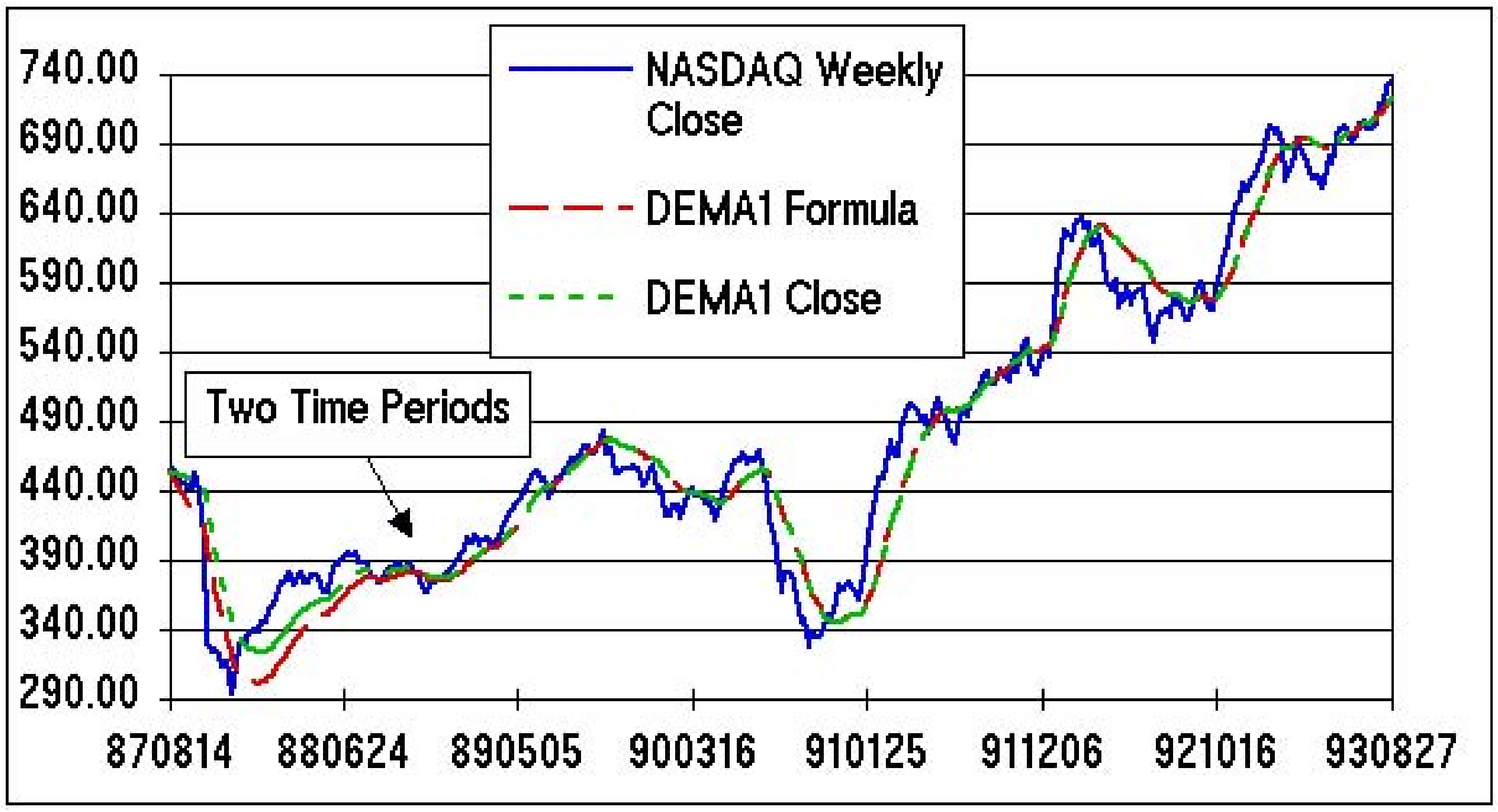
=0.074*E3+(1-0.074)*F2

The DEMA1 is calculated in column G. The following formula is entered and copied down the column:

=(2*E2)-F2

If you want to calculate DEMA1 without the regression formula initializations, then simply place the closing price from cell D2 in cells E2 and F2.

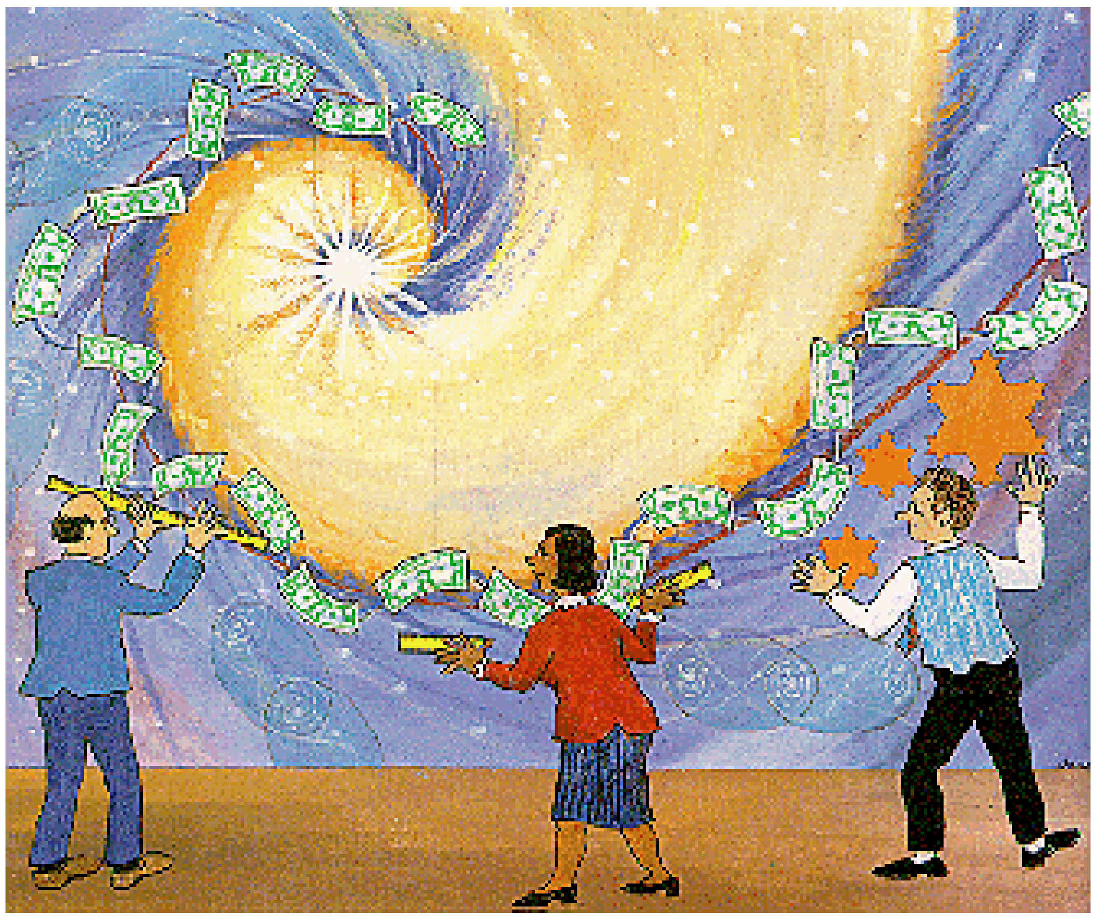
—Editor



SIDEBAR FIGURE 4: EXCEL SPREADSHEET. The DEMA1 filter is calculated in column G.

Polarized Fractal Efficiency

by Hans Hannula, Ph.D., C.T.A.



What is fractal geometry, anyway, and how do you use it? Well, you'll find out here. STOCKS & COMMODITIES contributor Hans Hannula of MicroMedia describes the construction and use of an indicator derived from fractal geometry, the mathematics that describe chaotic systems.

Most chaotic systems produce some form of graphic representation. For example, turbulent flow in a stream produces swirls, eddies and vortices. Early chaos researchers found that the triangles, squares, lines and cubes of Euclidean geometry simply did not help in describing, studying or understanding their research problems.

Fortunately, mathematician Benoit Mandelbrot recognized this problem and solved it by describing fractal geometry. As he studied various problems being researched, he realized that many of these problems had in common graphic representations of a very squiggly line. So he asked himself the profound question, "What *is* the dimension of a squiggly line?"

The problem can be represented as shown in Figure 1. A straight line has a dimension of one. A plane surface has a dimension of two. A squiggly line has a dimension between one and two, depending on how much it squiggles. The dimension of the line is not an integer like 1, 2 or 3 but can be a fraction, leading to the term *fractional* or *fractal dimension*. Mandelbrot discovered that many chaotic systems had a constant fractal dimension. Others discovered that systems with the same fractal dimension had other properties in common. Thus, fractal dimension became an important tool in chaos work.

APPLICATION TO PRICE MOTION

Fractal dimensions can be used to study price action in stocks and commodities. Used in a specific way, it can measure how trendy or congested price action is. To understand how to develop such a tool, let us look at a problem that interested Mandelbrot. The question posed was, "How long is a coastline?" The

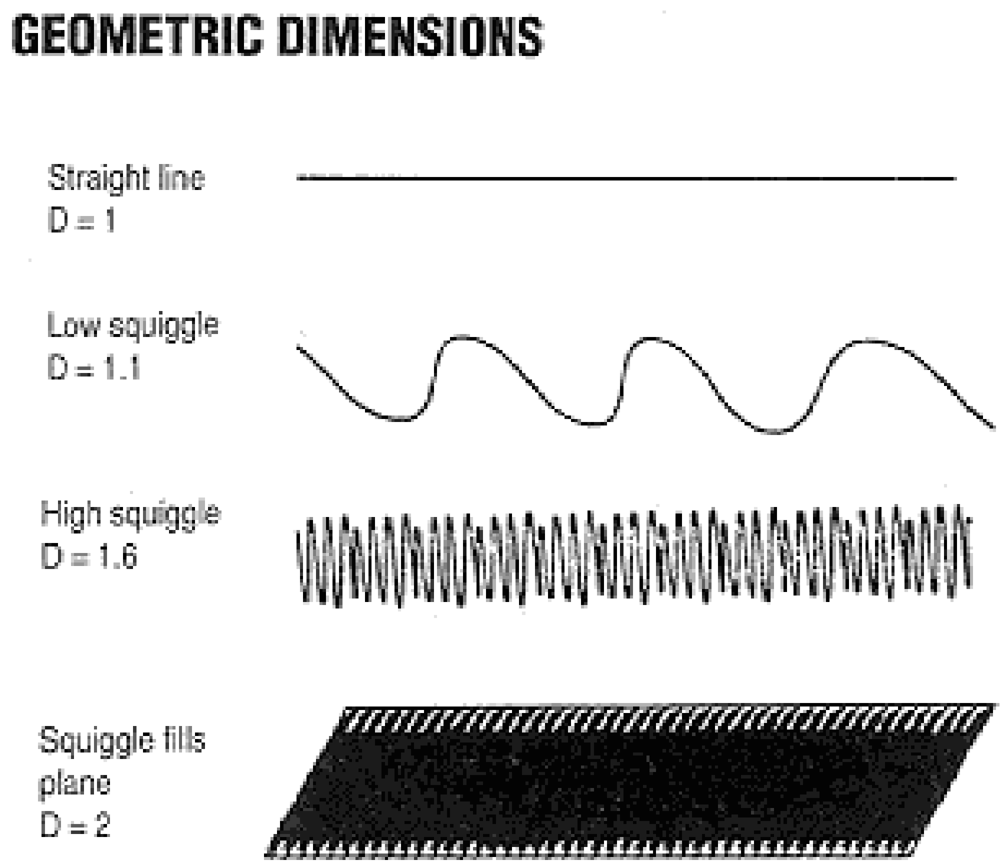


FIGURE 1: GEOMETRIC DIMENSIONS. *What is the dimension of a squiggly line? A straight line has a dimension of one. A plane surface has a dimension of two. A squiggly line has a dimension between one and two, depending on how much it squiggles. The dimension of the line is not an integer line 1, 2 or 3 but can be a fraction, leading to the term fractional or fractal dimension.*

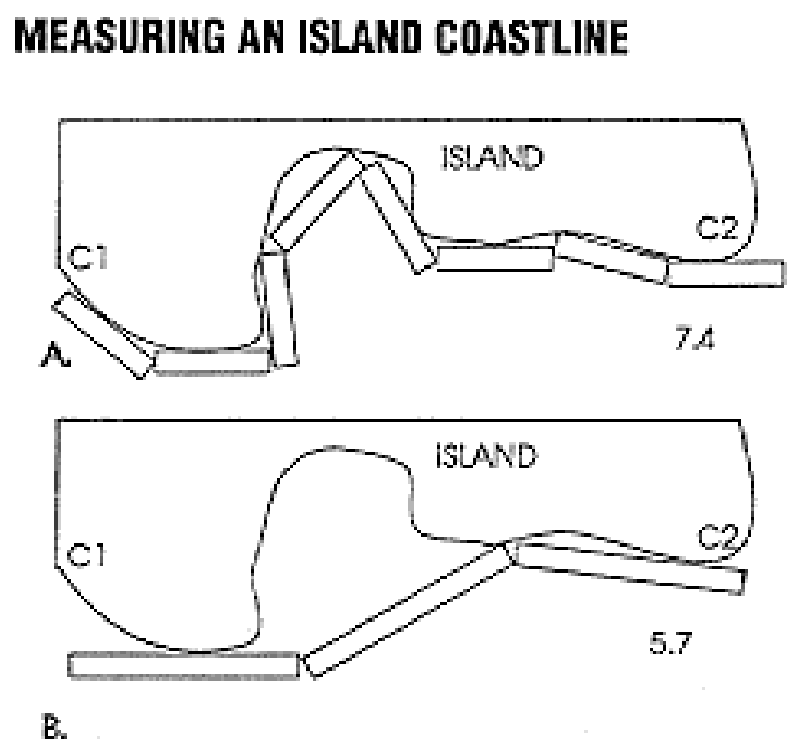


FIGURE 2: MEASURING AN ISLAND COASTLINE. *In A, a short ruler is used, flipped end to end along the coast, while in B, a longer ruler is used. Because the longer ruler does not fit into the coves of the coastline as well, it will meausre a shorter distance. So if one uses shorter and shorter rulers, one can theoretically get longer and longer distances.*

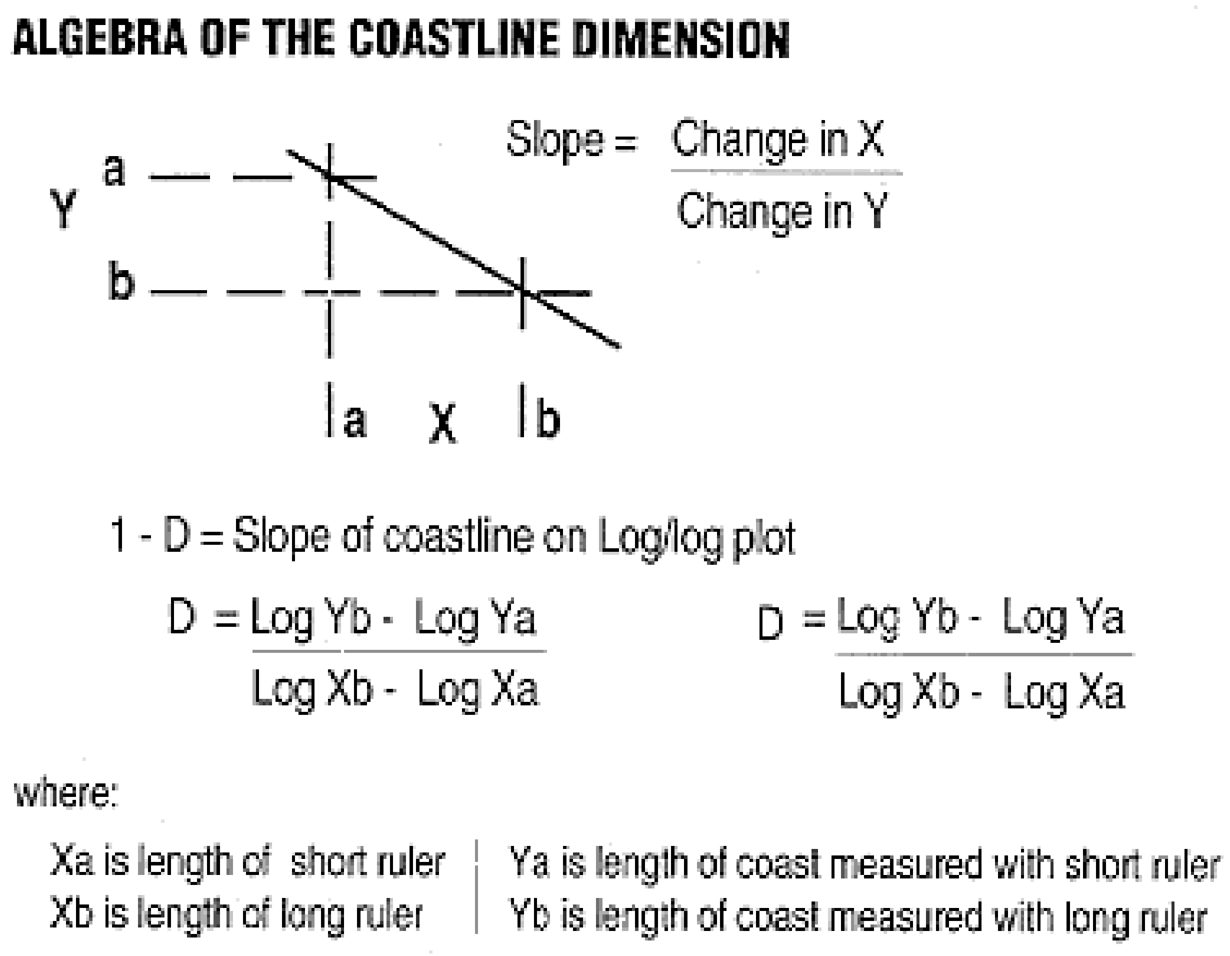


FIGURE 3: ALGEBRA OF THE COASTLINE DIMENSION. *The data used on Figure 2 was plotted on log-log charts, showing that for any given coastline, the relationship between the length of the ruler and the length of the coastline had a constant slope on a log-log chart, leading to the mathematatical relationships shown here.*

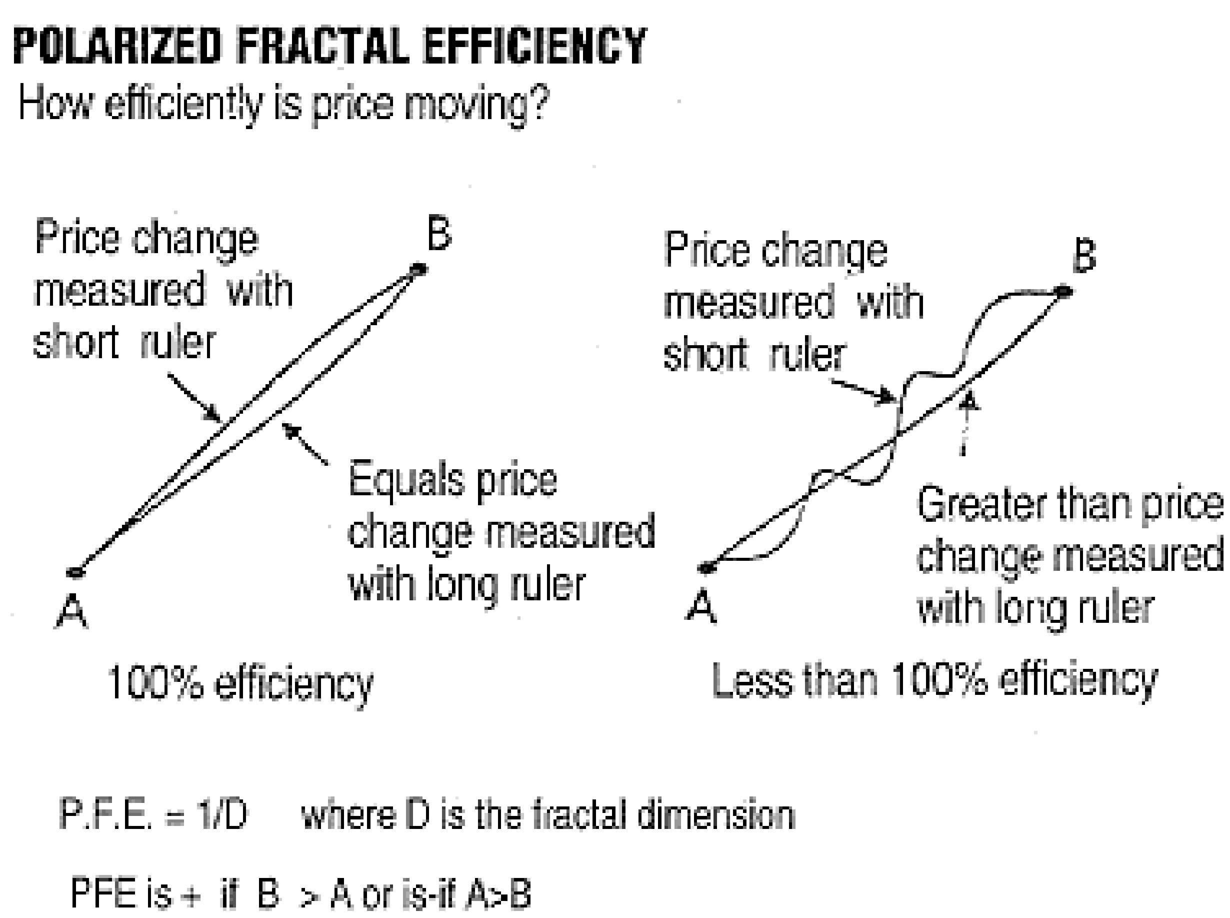


FIGURE 4: POLARIZED FRACTAL EFFICIENCY. *If price motion from A to B is seen, it can move in a straight line. But prices don't do that; they squiggle around, moving with less than 100% efficiency. This efficiency can be measured by dividing the length of the straight line by the length of the squiggly line. But measuring the line is the same problem as the coastline, so we need to use fractal dimension.*

answer, surprisngly, is, "As long as you want to make it!"

To illustrate, look at Figure 2, which depicts two ways to measure an island's coastline. In A, a short ruler is used, flipped end to end along the coast. In B, a longer ruler is used. Because the longer ruler does not fit into the coves of the coastline as well, it will measure a shorter distance. Ruler A might measure 7.4 and ruler B might measure 5.7 in going from point C1 to C2. So if one uses shorter and shorter rulers, one can theoretically get longer and longer distances!

The data on this was plotted on log-log charts, showing that for any given coastline, the relationship between the length of the ruler used and the length of the coastline had a constant slope on a log-log chart. Mandelbrot recognized that this slope was one minus the fractal dimension, leading to the mathematical relationships shown in Figure 3.

PRICES ARE LIKE COASTLINES

A common question is, "How much has price moved?" The expected answer *could* be something along the lines of "Up 2 points." Yet conceptually, the answer could be, "That depends on how I measure it." Such thinking led me to define *polarized fractal efficiency* (PFE) as shown in Figure 4. If one looks at price motion from point A to point B, it can move in a straight line. That is 100% efficient. But prices don't usually do this. They squiggle around, moving with less than 100% efficiency. This efficiency can be measured by dividing the length of the straight line by the length of the squiggly line. But measuring the line is the same problem as the coastline, so we need to use fractal dimension. If we divide the length of the straight line (100% efficient) by the length of the squiggly line, we have a measure of fractal efficiency. Finally, if we attach a plus sign when the move is down and a minus sign when the move is up, we have polarized fractal efficiency.

Figure 5 illustrates measuring the PFE on a stock or commodity bar chart. If we just use the closing prices, we can measure directly from C1 to C2 with a straight line to get distance B, or we can measure along the close-to-close path to get distance A. If distance B was nine and distance A was 25, the efficiency would be 36%. The fractal efficiency equation expresses this efficiency using logarithms. The close-to-close spacing represents our short ruler, while the first-to-last close spacing represents our long ruler.

Figure 6 shows the resulting mathematical equation for computing PFE. Each close-to-close line is treated as the hypotenuse of a triangle, the length of which is computed as the square root of the squares of the sides. Adding the close-to-close lengths together gives the length of distance A. Distance B is simply the hypotenuse of the triangle between the first and last close.

APPLYING THE PFE

To apply the PFE, one needs only to decide what number of bars to span and then compute the PFE. Minor smoothing with a five-period exponential moving average (EMA) removes noise caused by the sign changes as trends switch directions. Plotting the filtered PFE under price action provides a measure of how efficiently a market is moving. Figure 7 illustrates the PFE used on the OEX index. I found that a 10-day PFE provides a reasonable compromise between computational delay, which is half the span, and usability of the indicator information.

In Figure 7, note that the PFE tends to have a maximum efficiency of about 43%, either going up or down. This has been found to be true for all stock indices. Other stocks and commodities tend to have slightly

MEASURING PFE ON A CHART

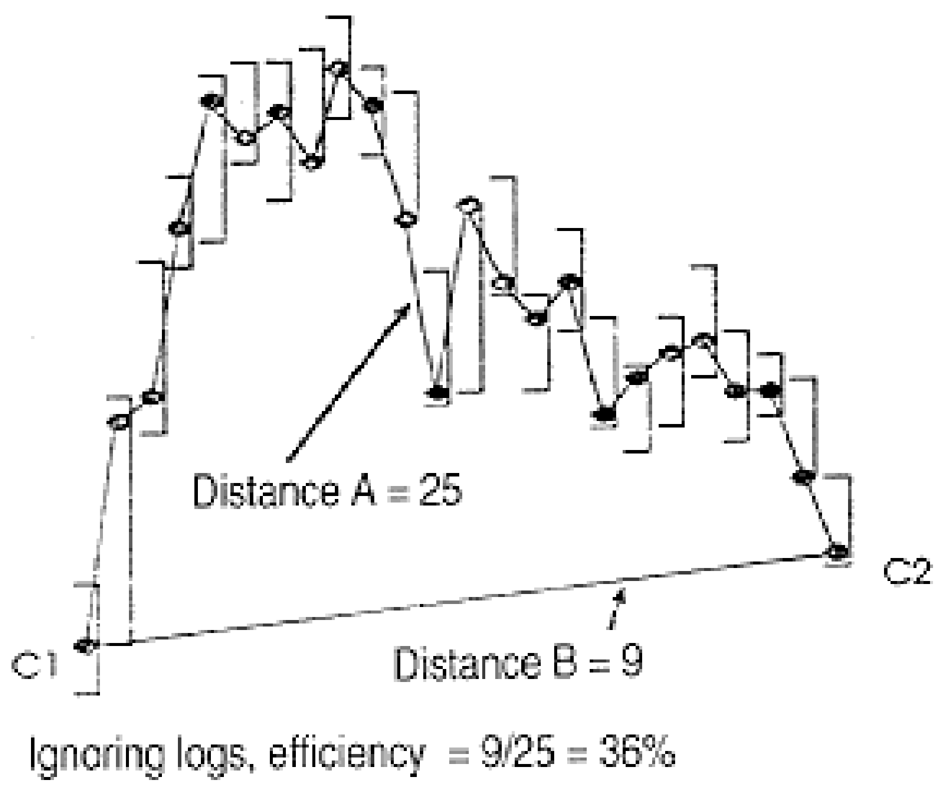


FIGURE 5: MEASURING PFE ON A CHART. *If we just use the closing prices, we can measure directly from C1 to C2 with a straight line to get distance B, or we can measure along the close-to-close path to get distance A. If distance B was nine and distance A was 25, the efficiency would be 36%. The fractal efficiency equation expresses this efficiency using logarithms. The close-to-close spacing represents our short ruler, while the first-to-last close spacing represents our long ruler.*

COMPUTING PFE

$$PFE = \frac{[\text{Sign}]\sqrt{(\text{Close}_n - \text{Close}_1)^2 + n^2}}{\sum_{i=2}^{n} \sqrt{(\text{Close}_i - \text{Close}_{i-1})^2 + 1}}$$

where:
Sign is plus if $CLOSE_n$ is higher than $CLOSE_1$ and minus if $CLOSE_n$ is lower than $CLOSE_1$

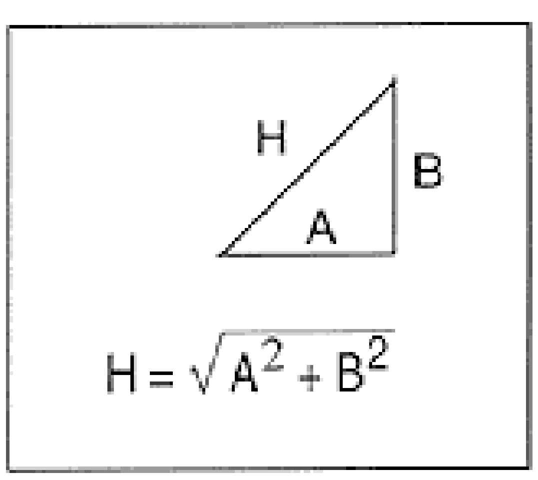


FIGURE 6: COMPUTING PFE. *Here are the resulting mathematical equation for computing Pfe. Each close-to-close line is treated as the hypotenuse of a triangle, the length of which is computed as the square root of the squares of the sides. Adding the close-to-close lengths together gives the length of distance A. Distance B is simply the hypotenuse of the triangle between the first and last close.*

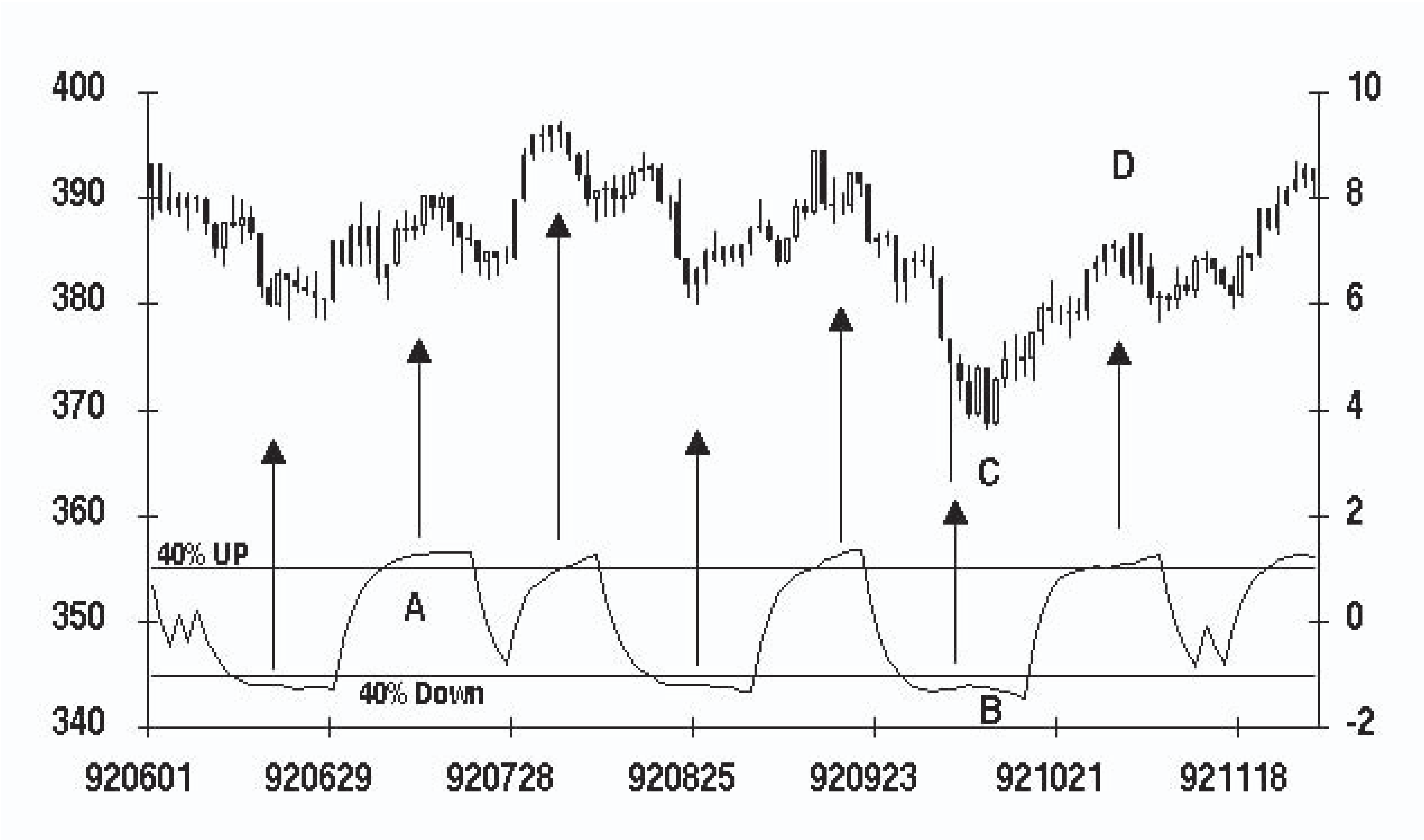


FIGURE 7: OEX AND 10-DAY POLARIZED FRACTAL EFFICIENCY. *PFE tends to have a maximum efficiency of about 43%, either going up or down. This has been found to be true for all stock indices. Other stocks and commodities tend to have slightly different maximums, but the maximum has always been observed. Also note that the transition from trending up to trending down is usually smooth. However, the efficiency may bounce off the zero line or oscillate around it for a time. This middle region is a balance of supply and demand and, thus, a congestion point.*

different maximums, but the maximum has always been observed. Also note that the transition from trending up to trending down is usually smooth. However, the efficiency may bounce off the zero line or oscillate around it for a time. This middle region is a balance of supply and demand and, thus, a congestion point.

PFE also exhibits two other behaviors of interest. Once it passes 66% (for the OEX), it tends to jump sharply to 80%. It seems to lock into being efficient. Often, but not always, the time from this lock-in point to the next top or bottom is a constant time interval, shown by the lock-in points and vertical lines such as the one marked A. This phenomenon suggests that maximum price velocity can only last so long, like a short-distance runner who can only sprint until he runs out of surplus oxygen.

The other behavior useful to traders is that usually right before the end of an efficient period, a hook to maximize efficiency occurs. See point B. This hook usually comes too late in the PFE to be tradable, but it does show up when candlesticks are used. At points C and D, tall candles of opposite colors mark the hooks on the price chart. In this way, the PFE can act as a filter for candlestick patterns.

CAVEAT

Traders should be warned: The PFE measures and reflects only what price has been doing in the past; it does not predict. The safe way to trade the periods of maximum efficiency is to enter by following price action with a trailing stop. Once entered, place a stop above or below the extreme of the hook and watch as the PFE approaches zero. If it crosses cleanly, stay in until PFE reaches maximum efficiency in the other direction. If price congests near zero, exit the trade and then wait for a new maximum efficiency entry.

FRACTAL FINI

Fractal dimension, the new and intriguing way of studying price motion, provides insight into market behavior in ways not found in other indicators. Fractal dimension has been found to be very useful in trading both stocks and commodities. This indicator is one way in which you can begin incorporating knowledge of chaos into your own trading.

Hans Hannula is an engineer, programmer and trader with more than 30 years' market experience. This article is excerpted from his Cash In On Chaos course.

REFERENCES

Anders, Bernd [1989]. "Chaos theory," *Technical Analysis of* STOCKS & COMMODITIES, Volume 7: November.

Gleick, J. [1987]. Chaos: Making a New Science, Viking Press.

Hannula, Hans [1990]. "Making money with chaos," *Technical Analysis of* STOCKS & COMMODITIES, Volume 8: September.

Mandelbrot, Benoit B. [1977]. *The Fractal Geometry of Nature*, W. H. Freeman, San Francisco.

Peters, Edgar E. [1991]. *Chaos and Order in the Capital Markets,* John Wiley & Sons.

POLARIZED FRACTAL EFFICIENCY SPREADSHEET

The first step to calculate the 10-period polarized fractal efficiency (PFE) on a percentage basis is to calculate the first-to-last close spacing. This is performed in column F. The following formula is entered into cell F11 and copied down:

=SQRT((E11-E2)^2+10^2)

Next, we calculate the close-to-close spacing. Enter the following formula into cell G11 and copy down:

=SQRT((E11-E10)^2+1)+SQRT((E10-E9)^2+1)+SQRT((E9-E8)^2+1)+SQRT((E8-E7)^2+1)+SQRT((E7-E6)^2+1)+SQRT((E6-E5)^2+1)+SQRT((E5-E4)^2+1)+SQRT((E4-E3)^2+1)+SQRT((E3-E2)^2+1)

Next, assign the direction to the daily value. Enter the following formula into cell H11 and copy down:

=(IF((E11-E2)>0,F11/G11,-F11/G11))*100

Column H is the five-period exponential smoothing (EMA) of the daily value. First, enter “=H11” into cell I11; then enter the following formula into cell I12 and copy down:

=0.333*H12+(1-0.333)*I11

To calculate the PFE using the formulas for the fractal dimension, enter the following formula into cell J11 and copy down:

=1+((LOG10(G11)-LOG10(F11))(LOG10(10)-LOG10(1)))

Note the denominator does not have a second term because the value will be zero in our example. Column K assigns the direction, positive or negative, to the daily value. Use the following formula in cell K11 and copy down:

=IF((E11-E2)>0,J11,-J11)

To smooth the daily values with a five-period EMA, enter “=K11” into cell L11 and this formula into L12 and copy down:

=0.333*K12+(1-0.333)*L11

—Editor

File Edit Formula Format Data Options Macro Window 1:18 PM

A1 | Date

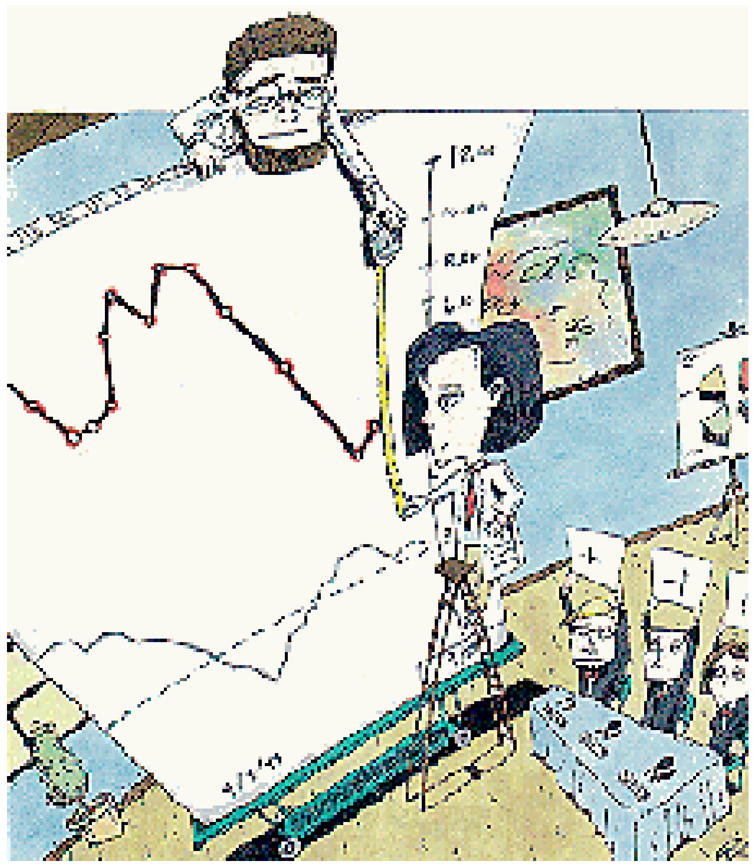
OEX Index Ranula

	A	B	C	D	E	F	G	H	I	J	K	L
1	Date	Open	High	Low	Close	10 Period	1 Period	Fractal	5 Period	Fractal	Direction	5 Period
2	911125	352.25	353.33	349.90	351.49	Observation	Observation	Efficiency	EMA	Dimension	Indicator	EMA
3	911126	351.49	354.50	347.56	353.82			#	#			
4	911127	353.82	354.38	352.14	352.78							
5	911129	352.78	352.86	351.00	352.01							
6	911202	352.01	357.20	347.83	357.20							
7	911203	357.20	357.27	355.49	356.04							
8	911204	356.04	356.35	353.21	354.84							
9	911205	354.84	355.00	351.49	352.32							
10	911206	352.32	357.85	350.42	354.16							
11	911209	354.16	356.15	351.76	352.72	10.08	20.18	50	50	1.30	1.30	1.30
12	911210	352.72	354.33	351.15	352.94	10.04	18.67	-54	15	1.27	-1.27	0.45
13	911211	352.94	354.54	349.86	353.19	10.01	18.25	55	29	1.26	1.26	0.72
14	911212	353.19	357.01	353.19	356.44	10.94	20.39	54	37	1.27	1.27	0.90
15	911213	356.44	359.82	356.43	359.02	10.16	17.87	57	44	1.25	1.25	1.02
16	911216	359.02	360.42	358.61	358.79	10.37	17.37	60	49	1.22	1.22	1.09
17	911217	358.79	359.69	357.31	357.95	10.47	17.11	61	53	1.21	1.21	1.13

Ready NUM

Using The Tick In A Short-Term Indicator

by Daniel E. Downing



The tick index, the net difference of the numbers of stocks last traded on an uptick from those last traded on a downtick , is a well-known indicator, but it's got a problem. The raw number result is volatile, perhaps too volatile for some. What to do? here, then, is a way to smooth out the noise to identify short-term trading opportunities.

The tick is a basic unit for the markets, watched with fascination during periods of turmoil and periods of enthusiasm. It is quoted throughout the day on most quote services. In addition, the closing tick value can be found on the market statistics pages of financial newspapers such as *Barron's* and *The Wall Street Journal*. Let me present, then, the *tick line momentum oscillator*, which is based on the closing value for the New York Stock Exchange (NYSE) tick indicator. The oscillator has been shown to have a good track record of determining when the NYSE is overbought or oversold on a short-term basis. The formula for the tick line momentum oscillator is simple and can be easily calculated without a computer, although a spreadsheet version can be found in the sidebar, "Tick line momentum." Finally, the oscillator is straightforward and simple to apply.

LAYING THE GROUNDWORK

The first step in constructing the tick line momentum oscillator is to record the closing value of the tick on a daily basis for the NYSE. The next step is to calculate the 10-day simple moving average of the closing tick. This simple moving average value is used to start calculating a 10-day exponentially weighted moving average. This is accomplished by:

1. Subtracting yesterday's 10-day moving average of the tick from today's closing tick.
2. Multiplying the result of step 1 by 0.182.
3. Adding the results of step 2 to yesterday's moving average.

The result of step 3 is the new exponentially weighted average of the closing tick.

After making these calculations for five days, your data should be smoothed enough for the next step. Now, compare the closing value of the tick of today with the 10-day exponentially weighted moving average (EMA) of the day before. If today's closing value of the tick is greater than the value of yesterday's EMA, then assign a reading of +1 to today's tick. If today's closing value tick is less than the previous day's EMA, then assign today a reading of -1. Of course, if the two values are equal, then assign a value of zero today. Keep a running total of the +1s, zeroes and -1s for each day. This running total is called the *on-balance tick line*. After six days of the on-balance tick line has been compiled, we construct a five-day momentum oscillator of the on-balance tick line. The five-day momentum is the five-day difference of the on-balance tick line.

This oscillator is constructed by taking the value of the on-balance tick line today and subtracting the value of the line as of five days ago. For example, if today was day 6, we would subtract the value of day 1 from today. If today was day 7, we would subtract the value from day 2. The five-day momentum line is still too volatile, so we will smooth this line with a five-day exponentially weighted moving average. First, calculate the first five days' simple moving average of the five-day momentum line. Next, subtract yesterday's five-day momentum line average from today's five-day momentum. Then multiply the result of the subtraction by 0.333 and add the resulting value to yesterday's moving average. The result is the tick line momentum oscillator. After three days, the data will be smoothed enough to be considered valid.

> **Figure 1 shows the plot of the smoothed tick momentum line below the DOW Jones Industrial Average (DJIA). The peak in prices by the DJIA was accompanied by a reading greater than +2.50.**

The rules for the tick line momentum oscillator are as follows:

- If readings are equal to or greater than +2.50, the market is overbought. Expect a correction within four trading days (on average).
- If readings are equal to or less than -2.00, the equity markets are oversold short term. Expect a rally within two market days (on average).
- If readings are between -2.00 and +2.50, the markets are neutral.

Figure 1 shows the plot of the smoothed tick momentum line below the Dow Jones Industrial Average (DJIA). The peak in prices by the DJIA was accompanied by a reading greater than +2.50.

As always, we recommend that a trader use any indicator as one tool in a toolbox. Successful investors have several reliable tools that they can use at any time. Properly using an indicator as a tool means matching the tool to the job. Overall, the correct match for this tool is solving the problem of short-term market timing.

Daniel E. Downing is a partner of Downing & Associates Technical Analysis, established in 1981.

ADDITIONAL READING

Downing, Daniel E. [1991]. "Take a look at the Dow," *Technical Analysis of* STOCKS & COMMODITIES, Volume 9: June.

___ [1991]. "On-balance volume and the Dow Jones Utility Index," *Technical Analysis of* STOCKS & COMMODITIES, Volume 9: March.

Merrill, Arthur A. [1992] "Closing tick," *Technical Analysis of* STOCKS & COMMODITIES, Volume 10: February.

Ord, Tim [1992]. "Market turns and continuation moves with the tick index," *Technical Analysis of* STOCKS & COMMODITIES, Volume 10: December.

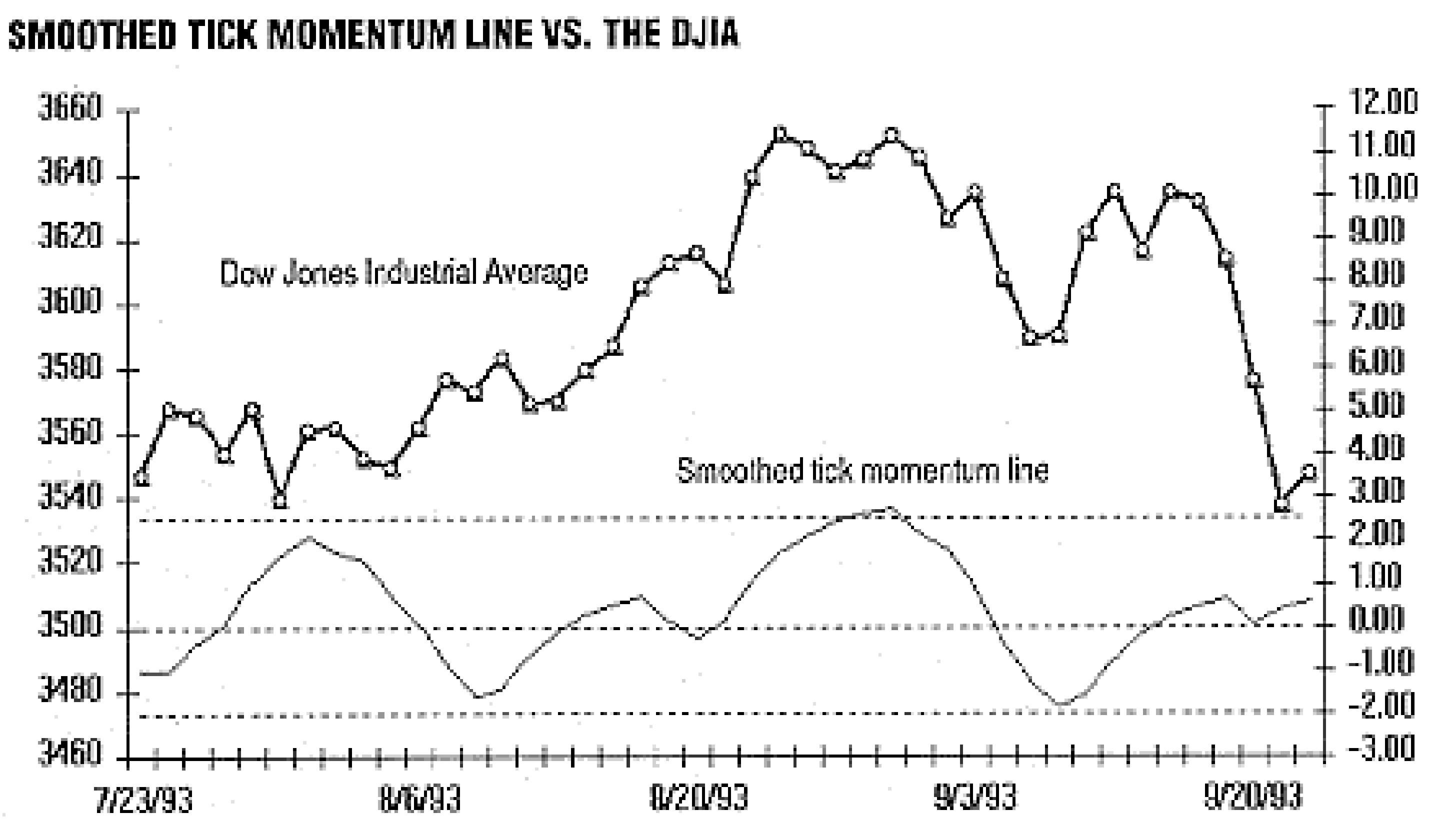


FIGURE 1: *The peak in prices by the DJIA was accompanied by a reading of greater than +2 50.*

TICK LINE MOMENTUM

The daily closing tick is collected in column C in sidebar Figure 1. The first step is to smooth the daily closing values using a 10-period exponentially weighted moving average. To start this process, we need to calculate the 10-day simple moving average, which is done in cell D11. The formula for cell D11 is:

=TRUNC(AVERAGE(C2:C11))

The TRUNC reference is an instruction to drop the values after the decimal place so we can compare the moving average and the daily closing tick. Otherwise, the moving average will almost always have values after the decimal place, and the closing tick does not. This is not critical, but it will permit a neutral rating in the rating step. Next, we begin calculating the 10-day exponentially weighted moving average (EMA). This process starts with cell D 12 and the formula is copied down:

=TRUNC(0.182*(C12-D11)+D11)

Column E is the rating of the closing tick with the 10-day EMA. If the closing tick is greater than yesterday's EMA, a 1 is returned; if the closing tick is less than yesterday's EMA, a -1 is returned; and if the closing tick is equal to yesterday's EMA, a zero is returned. The following formula is placed in cell E15 and copied down:

=IF(C15>D14,1,(IF(C15=D14,0,(1F(C15<D14,-1)))))

Next, the on-balance tick line is calculated. This is a running total of the daily values from column E. Place a 1 in cell F15 to start and then enter the following formula in cell F16 and copy down:

=E16+F15

The five-day momentum is calculated in column G. The following formula is entered into cell G20 and copied down:

=F20-F15

The momentum is smoothed with a five-period EMA. The first step is to calculate a five-day simple moving average. The following formula is entered into cell H24:

=AVERAGE(G20:G24)

Then, the following formula for calculating the EMA is entered into cell H25 and copied down:

=0.333*(G25-H24)+H24

This is the tick line momentum oscillator.

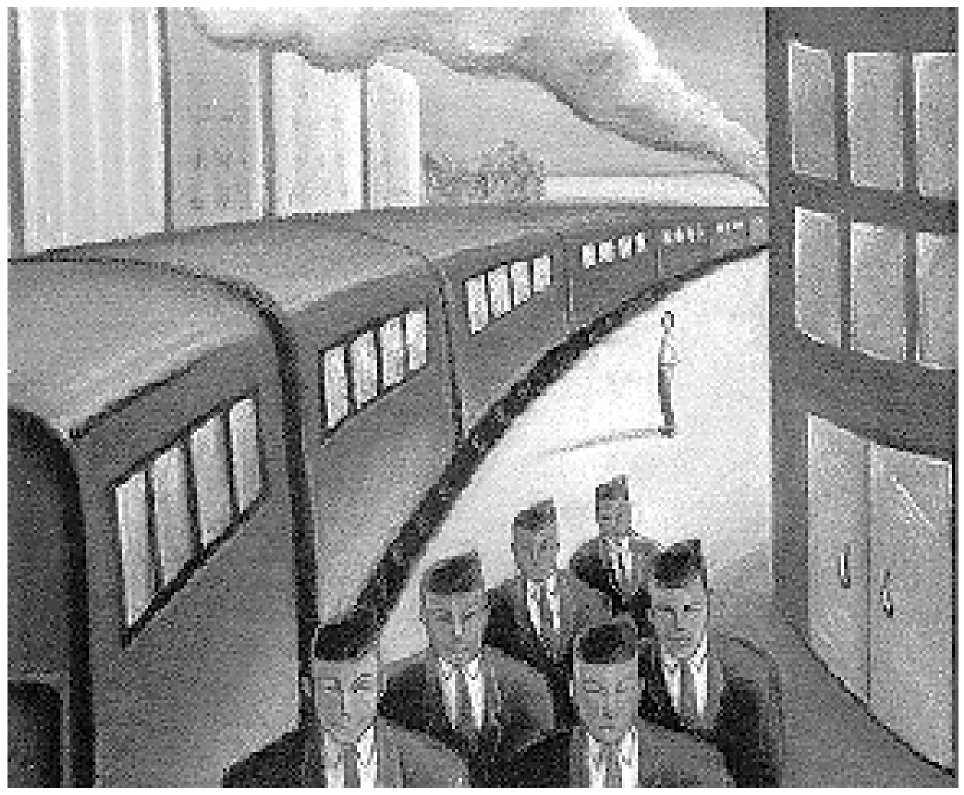
—*Editor*

	A	B	C	D	E	F	G	H
1	Date	DJIA	Tick					
2	6/28/93	3530.2	436					
3	6/29/93	3518.85	191					
4	6/30/93	3516.08	252					
5	7/1/93	3510.54	371					
6	7/2/93	3483.97	0					
7	7/6/93	3449.93	–158					
8	7/7/93	3475.67	–4					
9	7/8/93	3514.42	406	10 Day				
10	7/9/93	3521.06	207	Average				
11	7/12/93	3524.38	188	188				
12	7/13/93	3515.44	231	195				
13	7/14/93	3542.55	244	203	Rating	On Balance		
14	7/15/93	3550.93	240	209		Line		
15	7/16/93	3528.29	622	284	1	1		
16	7/19/93	3535.28	67	244	–1	0		
17	7/20/93	3544.78	46	207	–1	–1		
18	7/21/93	3555.4	116	190	–1	–2	5 Day	5 Day
19	7/22/93	3525.22	–9	153	–1	–3	Momentum	Average
20	7/23/93	3546.74	300	179	1	–2	–3	
21	7/26/93	3567.7	337	207	1	–1	–1	
22	7/27/93	3565.46	233	211	1	0	1	
23	7/28/93	3553.45	–81	157	–1	–1	1	
24	7/29/93	3567.42	270	177	1	0	3	0.20
25	7/30/93	3539.47	485	233	1	1	3	1.13
26	8/2/93	3560.99	469	275	1	2	3	1.75
27	8/3/93	3561.27	212	263	–1	1	1	1.50
28	8/4/93	3552.05	78	229	–1	0	1	1.34
29	8/5/93	3548.97	118	208	–1	–1	–1	0.56
30	8/6/93	3561.54	238	213	1	0	–1	0.04

SIDEBAR FIGURE 1: TICK LINE MOMENTUM OSCILLATOR SPREADSHEET. *Although the oscillator is simple enough to be calculated by hand, the spreadsheet here indicates how the indicator may be calculated using computer software.*

Price/Oscillator Divergences

by W. Lawson McWhorter



Have Dow theory divergences always fascinated you? Well, you're in luck. Here's a primer from first-time STOCKS & COMMODITIES contributor W. Lawson McWhorter on observing divergence between indicators and prices to generate trading signals.

Divergence, or the nonconfirmation of price movement by a related market, security or technical indicator, has long been a useful part of the technician's repertoire. The importance of divergence was first recognized by Charles Dow and his successor, William Hamilton, in what has become known as the Dow theory. One of the central premises of this method is that any move in the Dow Jones Industrial Average (DJIA) must be confirmed by the Dow Jones Transportation Average (DJIA). If the industrials are making new highs while the transports are unable to break old ones, the strength of the primary trend is called into question.

Figure 1 demonstrates a typical Dow theory divergence; in it, as the industrials set new records, the transports failed to better highs set in April. While the Dow theory is certainly not without its detractors, the concept of divergence forms the foundation of many different technical studies and has become a pillar of technical analysis.

While not referred to as such, divergence plays a vital role in the proper analysis of classic chart patterns. Chart analysis generally calls for volume to confirm price movement; the absence of proper volume is essentially a form of divergence. As Edwards and Magee state in *Technical Analysis of Stock Trends:*

> [Volume] is always to be watched as a vital part of the total picture. The chart of trading activity makes a pattern just as does the chart of price ranges. The two go together and each must conform to the requirements of the case.

Open interest is used in a similar manner by futures traders. Ideally, a strong trend should be mirrored by rising open interest as more and more traders commit to the move. Divergences in price and open interest indicate that a strong upward trend is losing steam or is fueled primarily by short-covering and is therefore technically weak.

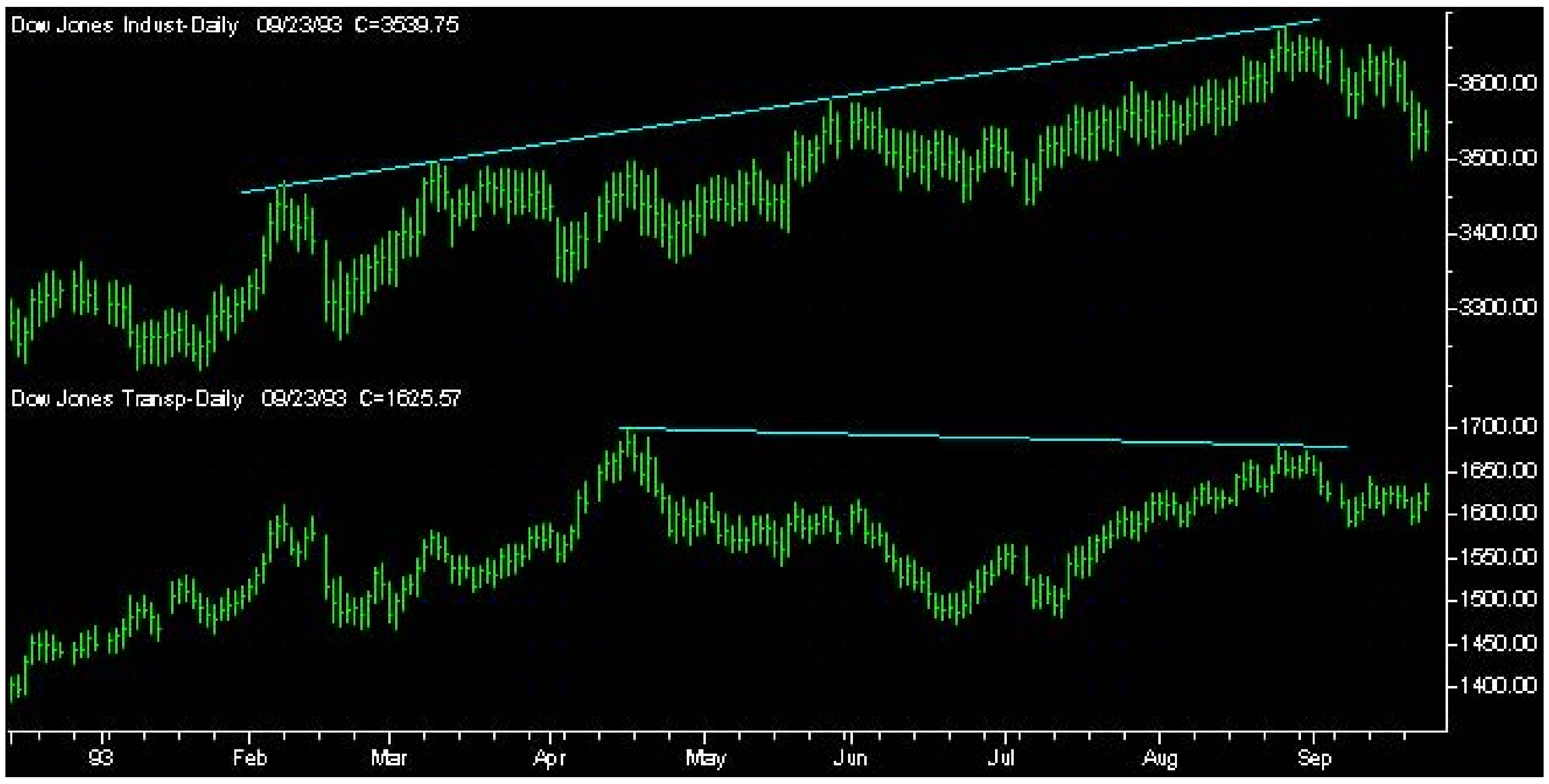


FIGURE 1: DOW THEORY DIVERGENCE. In Dow theory, a move in the Dow Jones Industrial Average must be confirmed by the Dow Jones Transportation Average. If the industrials are making new highs while the transports are not, the strength of the primary trend is called into question. As the industrials set new records, the transports failed to better highs set in April.

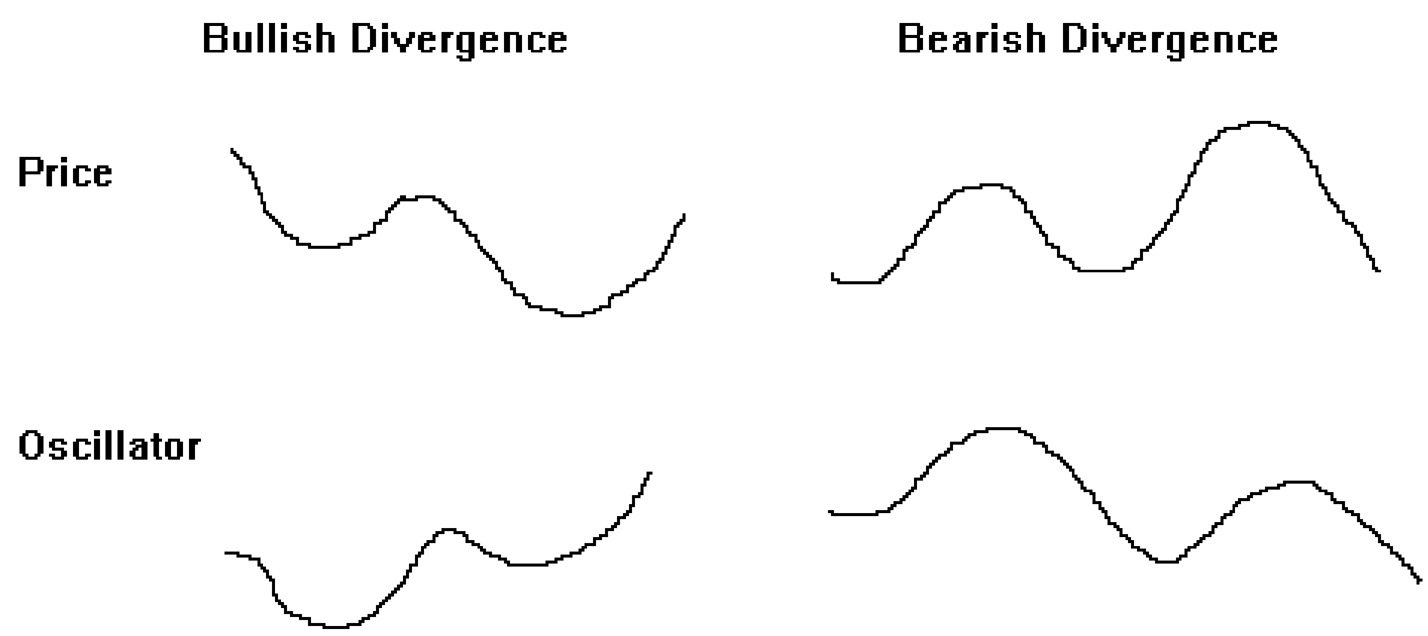


FIGURE 2: IDEALIZED DIVERGENCE PATTERNS. Ideally, a bullish divergence is marked by price making a new low while the oscillator concurrently makes a higher low. A bearish divergence occurs when prices make a higher high but the confirming indicator makes a lower high.

FIGURE 3: RSI AND OPEN INTEREST DIVERGENCES IN OCTOBER SUGAR. The relative strength index (RSI) can be used as a confirming indicator. For a valid signal to occur, the RSI should be in overbought or oversold territory as the divergence begins to take shape.

Divergences act as a technician's early warning system, allowing valuable insight into the internal strength of a price move. Unfortunately, divergences are also quite subjective and often noticed only in hindsight. Nonetheless, they are an important concept deserving of closer scrutiny. When properly employed, divergences can signal trades with both high success rates and risk/reward ratios. Perhaps the most powerful of all divergences occurs when oscillators fail to confirm price movements. While clean signals occur infrequently, the wait for them usually pays off well, making such opportunities advantageous especially for novice traders.

> **A bullish divergence is marked by price making a new low while the oscillator concurrently makes a higher low. This pattern reflects internal strength not yet reflected in the market price. A bearish divergence occurs when prices make a higher high but the confirming indicator makes a lower high.**

A bullish divergence is marked by price making a new low while the oscillator concurrently makes a higher low. This pattern reflects internal strength not yet reflected in the market price. A bearish divergence occurs when prices make a higher high but the confirming indicator makes a lower high. Figure 2 illustrates the idealized cycle. Once you become accustomed to these patterns, they should act as signposts warning you of an important turn ahead.

THE INDICATOR OF CHOICE

Stochastics, the relative strength index (RSI) or even the moving average convergence/divergence (MACD) can be used as the confirming technical indicator. The choice is governed simply by the trader's comfort level and familiarity with the indicator's particular nuances. For a valid signal to occur, the oscillator should be in overbought or oversold territory as the divergence begins to take shape. By screening potential trades in this way, you can avoid many marginal patterns and unnecessary losses.

MACD is not an oscillator in the traditional sense, and proper interpretation of MACD divergences is more difficult because there are no definitive overbought/oversold levels. Stochastics and RSI, on the other hand, are forced to oscillate between zero and 100. I prefer to use the stochastics oscillator because of the extra information imparted to the technician. Using a standard 14-day slow stochastic, I look for divergences using the %D line. Waiting for the faster %K line to cross gives the signal to initiate the trade. Figures 3 and 4 show RSI and MACD-histogram divergences, respectively. In addition, we will explore a few specific trades using stochastic divergences.

In Figure 5, Merck displays a clear divergence in December. Another timely sell signal was given after the short-lived rally in May. Besides demonstrating the usefulness of this technique, this chart is an excellent example in two other respects as well. Note the bullish divergence in February. While this signal eventually resulted in an anemic five-point rally from February 22 to March 11, the major downtrend quickly overwhelmed this short-term move, especially as prices hit resistance at 41. While divergences of this nature seldom completely fail, the individual must always remain aware of the dominant trend, especially when it is of the magnitude as the one that afflicted drug stocks.

The second bearish divergence (Figure 6) illustrates another common phenomenon associated with these

FIGURE 4: MACD-HISTOGRAM DIVERGENCES IN DECEMBER SILVER. Interpretation of MACD divergences can be difficult because no definitive overbought/oversold levels are given.

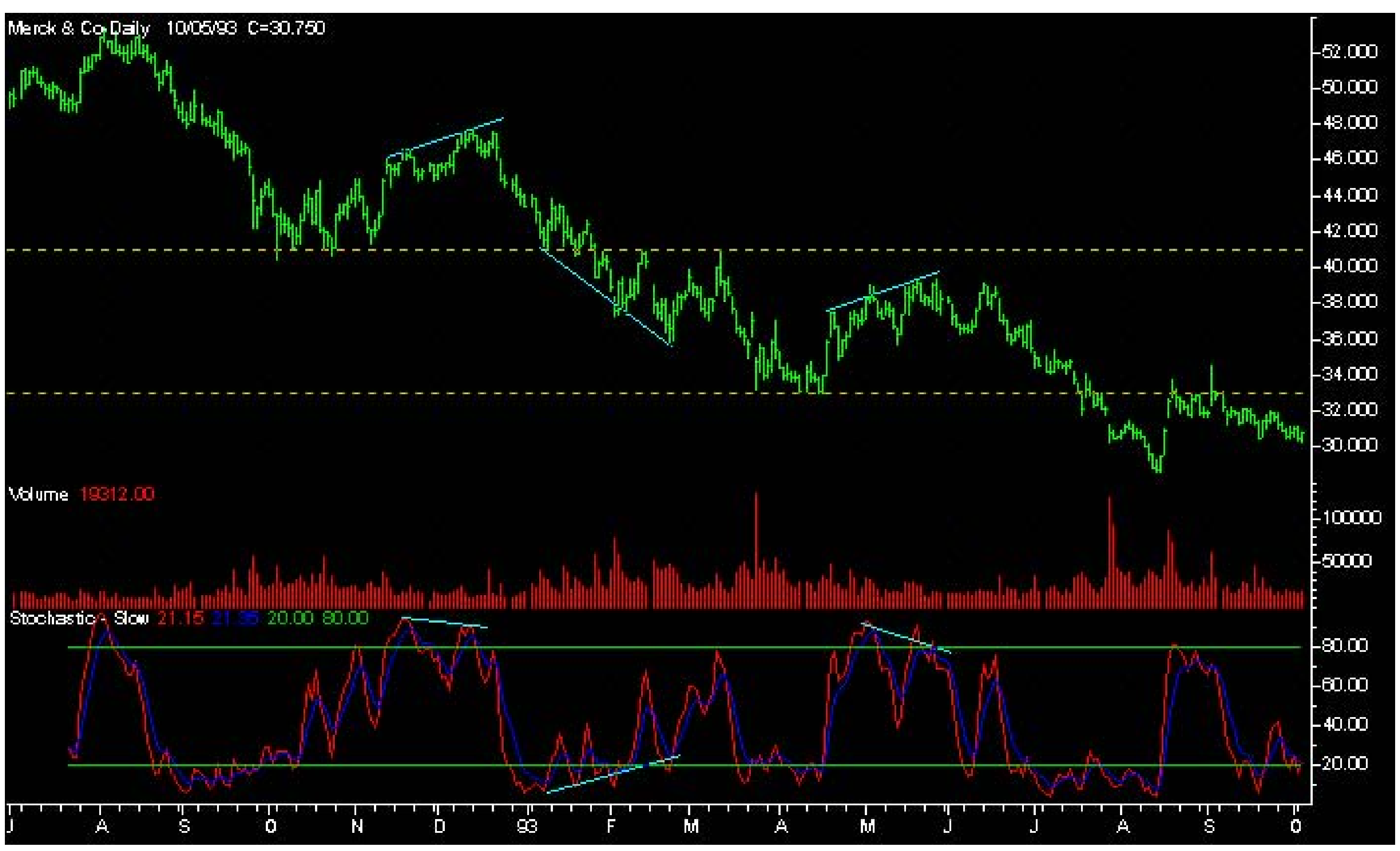


FIGURE 5: MERCK & COMPANY, JULY 1992 THROUGH SEPTEMBER 1993. Merck displays a clear divergence in December. Another timely sell signal was given after the short-lived rally in May.

signals. The divergence was completed on May 27 as the %K crossed below the %D and a short position should have been established the next day on the opening at 38.25. As expected, prices began their descent, reaching 36.25 before reversing direction and rallying as high as 39.125 by June 14. When any position is initiated, the order should not be considered complete until a corresponding stop is entered as well. The stop should be placed a few ticks above the highest high for a bearish divergence, and conversely, a few ticks below the lowest low for a bullish divergence. In this case, we would reference the high of 39.375 established on May 27 and place our stop somewhere in the neighborhood of 39.75. In this manner, we control our risk while allowing the trade plenty of room to work in our favor.

REASONABLE EXPECTATIONS

What can we reasonably expect as a goal for this trade? Since no specific measuring implications are associated with price/oscillator divergences, we must rely on other techniques. The most obvious target is 33, where prices encountered support three separate times in March and April. It would therefore be wise to tighten the stop as we approach this goal. As our trade becomes profitable, prices hesitate before breaking support and eventually gap to a low of 28.625. The gap to the upside, completing an island reversal, should have been a clear indication to close the trade if the profits were still unrealized.

The risk/reward characteristics of this particular trade were quite appealing. A minimum goal of 5 points coupled with a risk of approximately 1.5 points yields a risk/reward ratio of more than 3 to 1. While one may not sell at the exact high or cover at the exact low, the potential did exist for a 10-point move in little over two months.

Dow Chemical recently presented another set of textbook divergence opportunities (Figure 7). The bullish divergence in mid-April was firmly resolved by an explosive 7.5-point rally culminating in a three-week flag formation, the measuring implications of which would lead us to expect a move ultimately to 60.5. A unique confluence of technical events worked in our favor to provide another trade with excellent risk/reward characteristics. Dow Chemical topped out at 62, forming a clean divergence and violating a well-defined trendline in the process. If you missed the boat the first time, you were handed another golden opportunity as prices pulled back to the trendline, encountering resistance at our original target of 60.5.

The December Deutschemark (Figure 8) demonstrates the power of divergence analysis in flagging important tops and bottoms and the difficulty inherent in acting upon such information. Both the April top and July bottom produced multiple divergences rather than the ideal two-part divergences seen in earlier examples. These premature signals are often immediately profitable, attesting to the efficacy of price/oscillator divergences as well as the necessity of stop-loss orders. In both instances, the ultimate turning point was several trading sessions away.

The shallow divergence (Figure 9) completed on July 13 looked quite promising; however, the ensuing rally encountered resistance at 0.5824 as well as a downward sloping trendline. Unable to overcome these hurdles, prices retreated, triggering our stop-loss and creating a much cleaner and more profitable divergence in the process. This next trade should have been placed on August 2 on the opening at 0.5655 with a stop based on 0.5649, the low of the divergence. Moving quickly in our favor, the Dmark decisively broke the trendline, moving 125 ticks from open to close. After overcoming old resistance at 0.5824 and blowing through potential resistance at 0.5980, the move was finally overcome around 0.6230. Overall, this divergence heralded an important bottom in the Dmark as well as the potential for an extremely profitable trade.

FIGURE 6: DETAILED VIEW OF MAY BEARISH DIVERGENCE IN MERCK & COMPANY. A divergence was completed on May 27 as the %K crossed below the %D. A short position should have been established the next day on the opening at 38.25. Prices then began their descent, reaching 36.25 before reversing direction and rallying as high as 39.125 by June 14.

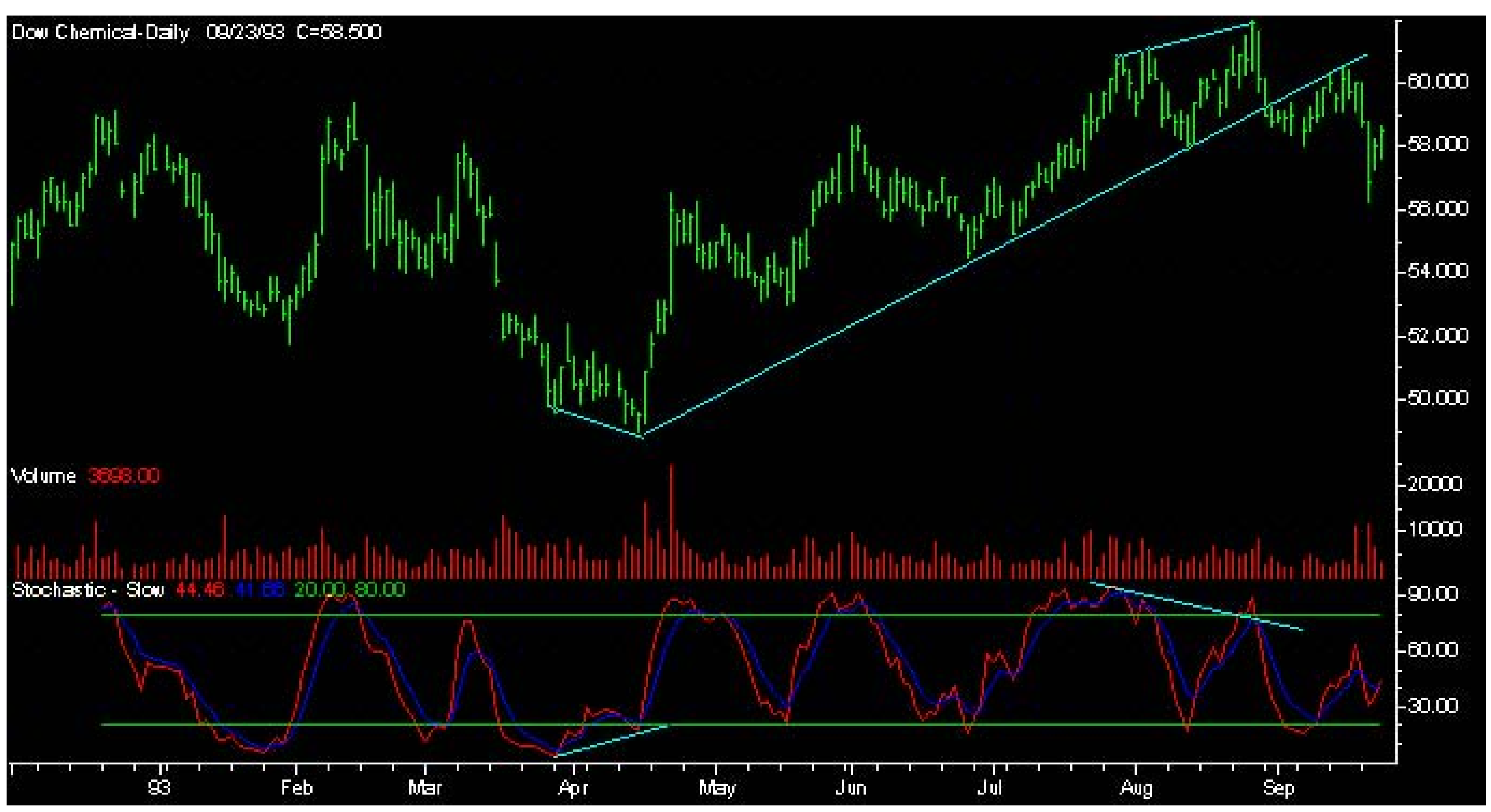


FIGURE 7: DOW CHEMICAL, DECEMBER 1992 THROUGH SEPTEMBER 1993. Here, the bullish divergence in mid-April was resolved by an explosive 7.5-point rally culminating in a three-week flag formation. Dow Chemical topped out at 62, forming a divergence while violating the trendline. Prices then pulled back to the trendline, encountering resistance at 60.5.

FIGURE 8: 1993 DEUTSCHEMARK CONTINUOUS CONTRACT. Both the April top and July bottom in the December Deutschemark produced multiple divergences rather than the ideal two-part divergences seen in earlier examples. In both instances, the ultimate turning point was several trading sessions away.

FIGURE 9: JULY BOTTOM IN DEUTSCHEMARK. The shallow divergence completed on July 13 looked promising, but the ensuing rally encountered resistance at 0.5824 as well as a downward sloping trendline. Prices then retreated, creating a much stronger divergence that heralded a 125-tick intraday move and an important bottom.

For further study

These examples illustrate the power of price/oscillator divergences, which, while difficult to identify, are usually worth the effort. It is also important to be aware of the overall technical picture, including chart patterns and trendlines, as well as likely areas of support and resistance. Combining classical chart analysis, proper risk management techniques and a healthy respect for the dominant trend will do much to minimize losses. Several software packages now have the capability to identify divergences automatically. Unfortunately, with this function the computer often flags ghost divergences and misses glaring opportunities. Consistent pattern recognition is a daunting programming challenge and is deserving of further study and refinement. Although the technique of price/oscillator divergences can hardly be described as ground-breaking, these examples should stimulate ideas to be incorporated in your own trading plans.

References

Edwards, Robert D., and John Magee [1991]. *Technical Analysis of Stock Trends*, enhanced edition, John Magee Inc.

LeBeau, Charles, and David Lucas [1992]. *Computer Analysis of the Futures Markets*, Business One-Irwin.

Rhea, Robert [1962]. *The Dow Theory*, Rhea, Greiner & Co.

Sheimo, Michael D. [1989]. *Dow Theory Redux,* Probus Publishing Co.

TRADERS' TIPS

Do you have a custom formula, solution or user tip for your software that you would like to share? Have you ever pondered a trading question that you'd like to share with other readers? Have you ever contemplated a question for a while and come up with a solution that you'd like to share with others? Or are you still stuck without a solution? Send your formulas, solutions, tips and questions to Traders' Tips, STOCKS & COMMODITIES, 4757 California Ave. SW, Seattle, WA 98116-4499.

■METASTOCK

The interview this month, with Marc Chaikin, discussed one of his indicators, called the Chaikin money flow. To create Chaikin's money flow indicator in MetaStock, simply enter and plot the following custom formula:

```
sum((((CLOSE-LOW)-(HIGH-CLOSE))/(HIGH-LOW))*VOLUME,21)/sum(VOLUME,21)
```

Figure 1 shows the 21-day Chaikin money flow plotted below the price chart of COMPAQ (CPQ). Note how each of the turns in the price of COMPAQ was forewarned by the indicator turning direction before the price.

—Allan McNichol, EQUIS International

■ TRADESTATION

In the article "Smoothing data with faster moving averages" by Patrick Mulloy in this issue, the filter DEMA1 is introduced. Here is the custom formula for DEMA1 in TradeStation:

```
inputs: price(close), length(30); vars:
X1(0), X2(0), Dema1(0) ;
X1 = Xaverage(price, length) ;
X2 = Xaverage(Xaverage(price, length), length) ; Dema1 = X1 * 2 - X2 ;
plot1(Dema1, "DEMA1") ;
```

Also discussed is the Chaikin money flow indicator. Here is the custom formula for the Chaikin money flow using a 30-day lookback period:

```
inputs: length(30) ;
vars: AccDist(0), MF(0) ;
if high - low <> 0 and volume <> 0 then AccDist = ((close - low) -
(high - close)) / (high - low) * volume ;
MF = summation(AccDist, length) / summation(volume, length) * 100 ;
plot1(MF, "MoneyFlow");
```

Figure 2 shows the 30-period DEMA1 and a 30-period Chaikin money flow plotted below the Standard & Poor's 500 during 1992. The 30-period DEMA1 smoothes out the volatile daily swings of the market while still maintaining the direction of the trend.

—Rico Font, Omega Research Inc.

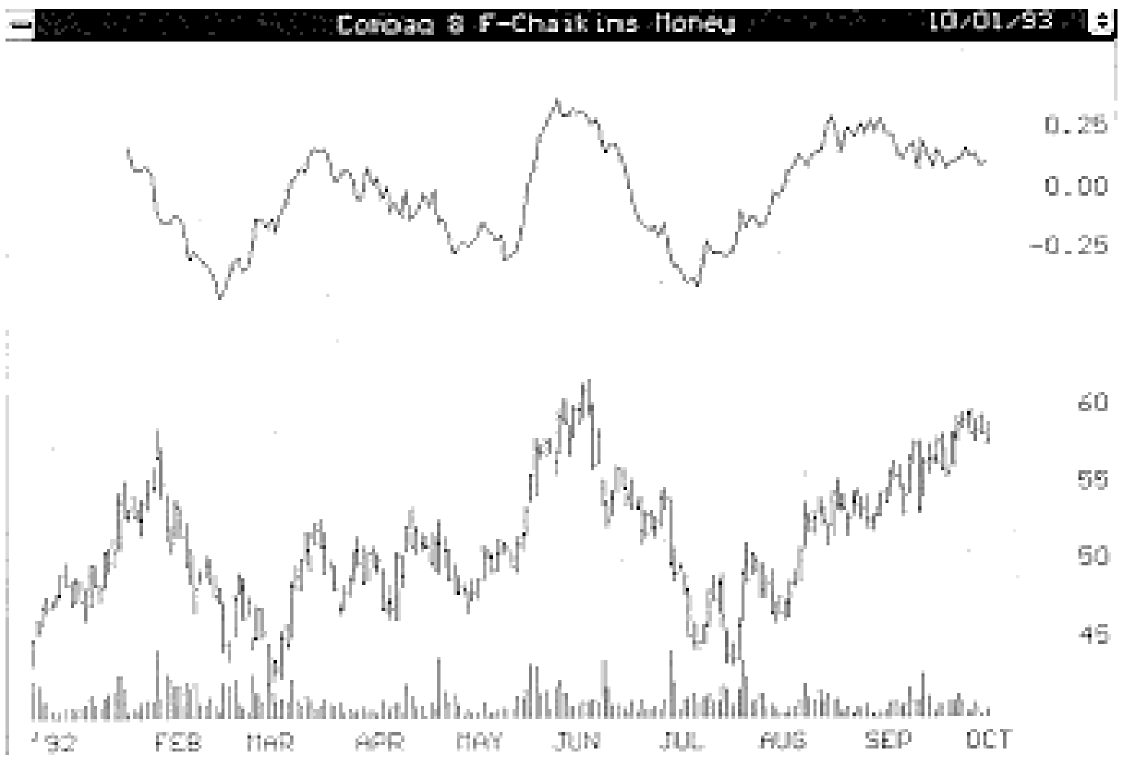


FIGURE 1: COMPAQ. *The 21-day Chaikin money flow is an oscillator that can forewarn of changes in the direction of price by divergence. In addition, persistent positive readings by the indicator are bullish, while persistent negative readings are a bearish indication.*

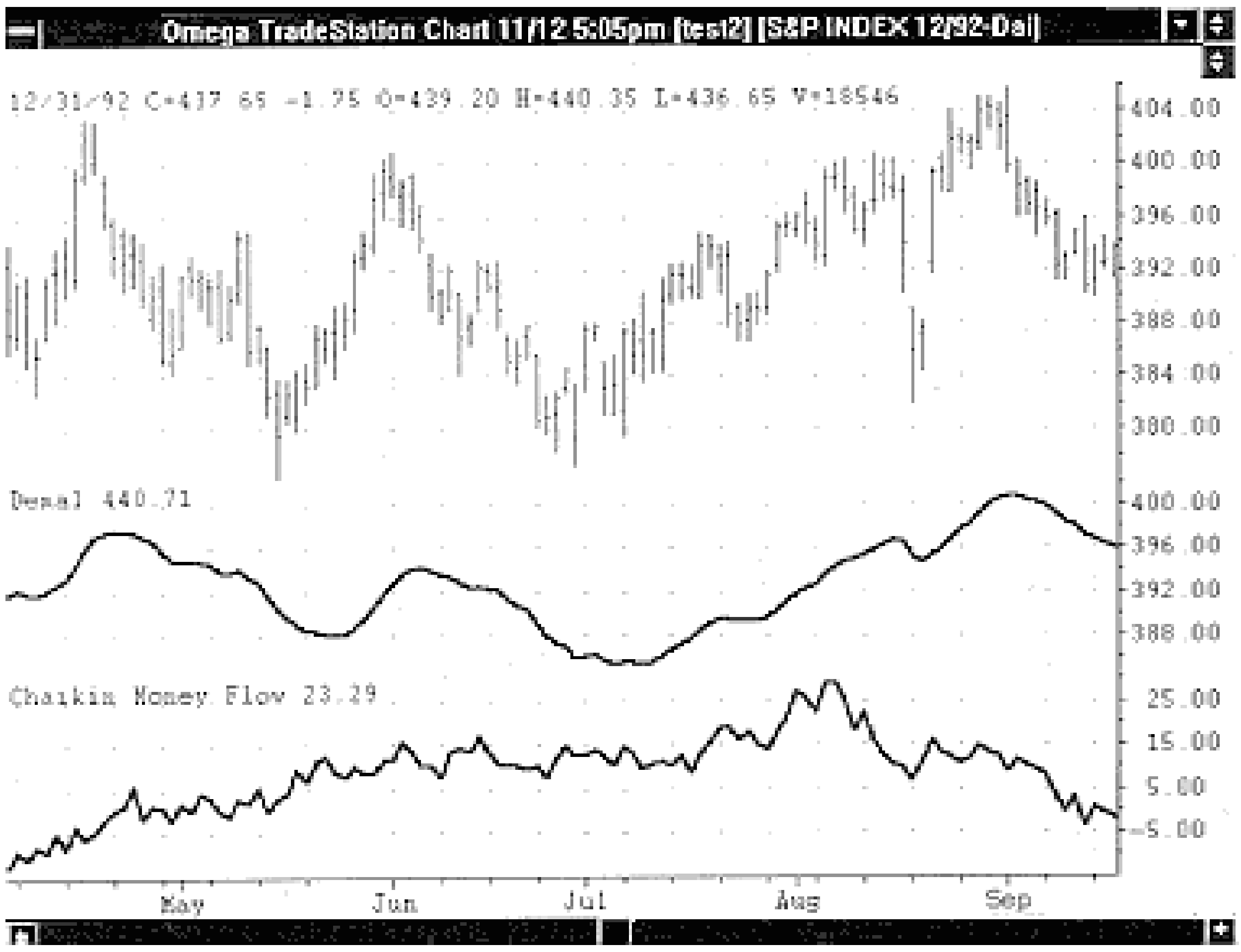


FIGURE 2: S&P 500. *The DEMA1 filter can smooth price fluctuation to aid in trend identification. The trend of the indicator can represent the trend of the market. If DEMA1 is in an uptrend and the Chaikin money flow is in positive territory, then higher prices are likely.*

