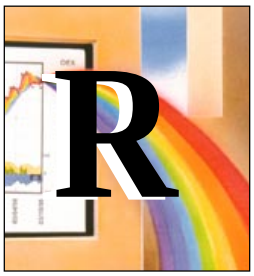
Stocks & Commodities V15:7 (289-297): Rainbow Charts by Mel Widner, Ph.D.

Rainbow Charts

Here's a way that traders can use color for a visual cue about changes in trends.



Repeated smoothing of data gives a spectrum of trends that, when plotted in color, have the appearance of a rainbow. Observe them all, pick your time frame, and act accordingly. The rainbow oscillator, a trend-following oscillator, is derived from a consensus of the trends.

Is there a pot of gold at the end of the rainbow? A fanciful and rhetorical question, but one that may in the final analysis have some truth. One approach to finding gold is momentum tracking and trend-following. Trend-following is a common, if not *the* most common, timing method used by traders and investors. In a perfect world, with smooth, continuous data, it would be easy to determine the direction of the price movement, open a position, hold it until the conditions change and then close the position. The underlying premise is that prices have momentum and inertia and will continue in the same direction until something occurs fundamentally to change that.

In the real world, however, data is volatile, discontinuous and not necessarily predictable. Prices may not follow the same path as they did previously. Markets are responsive and can efficiently discount any predictability that develops. Nonetheless, the trend-following approach has very real merit; identify the trend, follow along and get out when conditions change.

To accomplish this successfully, however, is not a simple matter for many reasons.

First of all, what do I mean by the *trend*? For our purposes, it is, simply, "The tendency of a set of statistical data as related to time." Trendlines, connecting highs or lows, are perhaps the most useful means to determine tendency and require only a chart, a sharp and discerning eye, a ruler, and a pencil. Another statistical method is a least-squares† fit of a straight line to data. The slope shows the trend direction and strength. Other methods use various types of averages to suppress noise and develop a smoothed function. The slope shows the tendency or trend. In a choppy sea of volatility, the trend is the prevailing course or heading of *prior* data over time.

Trend-following can only occur after the trend is identified, after the data has already begun to move. As a consequence, there is a lag. At best, part of the move is missed; at worst, prices reverse by the time the trend is finally apparent. Will the trend continue and for how long, or is it overdone and ready to reverse? These are questions that are not easy to answer. An approach that is flexible and adaptable yet carefully analyzed and back-tested must be found. The key to success is early, reliable identification.

THE WHEAT FROM THE CHAFF

Identification requires separating meaningful signals from noise. Was the latest change a meaningless blip or the start of a trend? The answer often depends on a trader's frame of reference. For the longer-term trader, the trend may be the average tendency over a year or more, while over the shorter term, the period may be a few days, a few hours or even minutes. The choice of time frame depends upon the trading style and time horizon of the trader as well as the characteristics of the issue. For the longer-term trader, the day-to-day variations are noise, while for the shorter-term trader, the day-to-day variations are signals.

To produce a signal and eliminate noise, some form of averaging or consolidation is needed to filter a time

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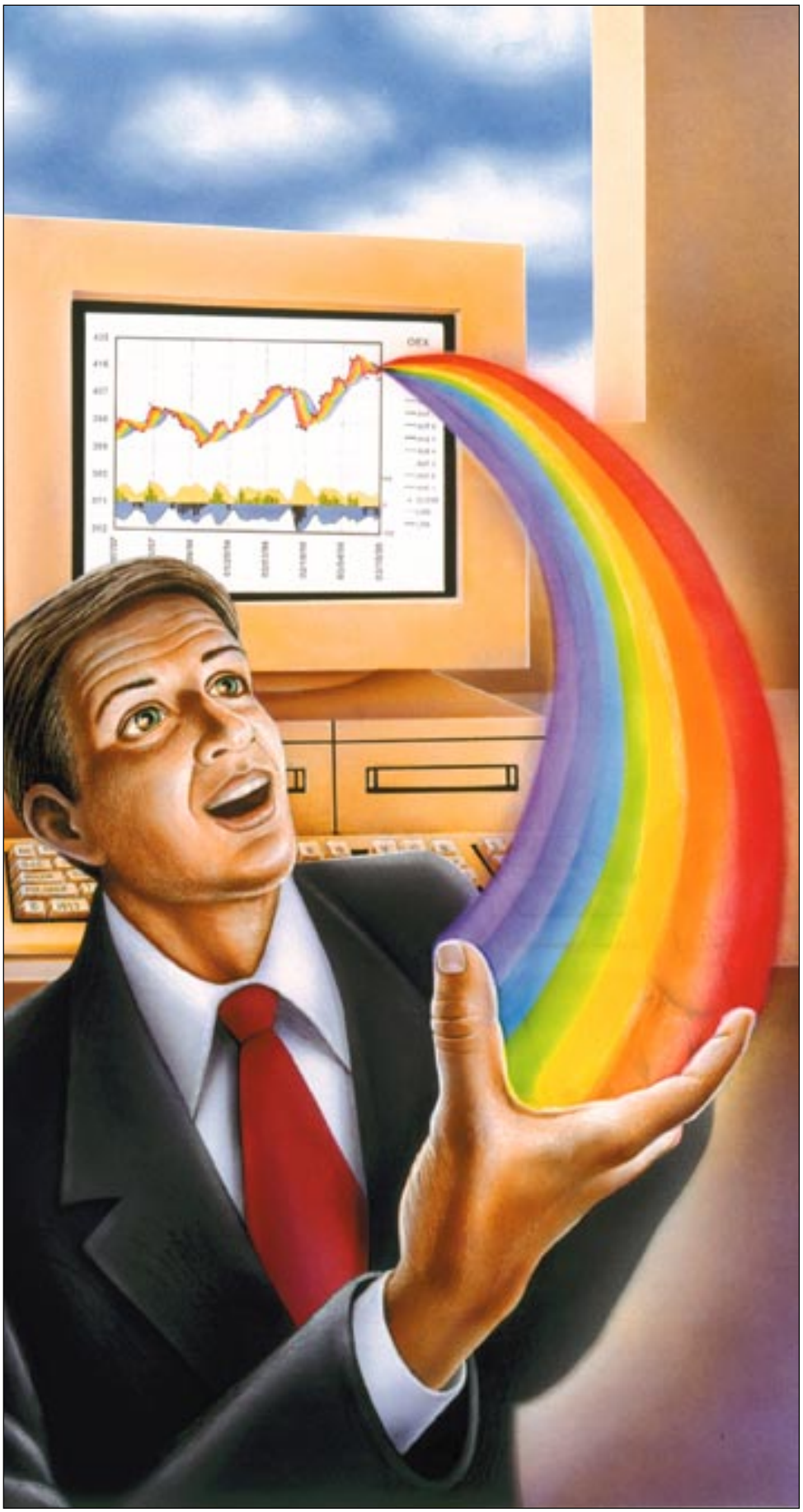

MARK MOLNAR

period shorter than the trading period. In addition, a reference to a frame longer than the trading period gives the prevailing direction. Robert Krausz described this in his article on multiple time frames, and there are many dimensions to this concept. In summary, some form of trigger or trading signal is needed as well as a longer-term reference to normalize the process.

Applying averages is frequently used to accomplish trend identification. Moving averages, specifically, simple moving averages and exponential moving averages (EMA), are two common averaging methods. These averages combine some number of data points to filter and provide a reference. If the current data is above the average, then the direction is becoming more positive than it was during the averaging period. The trend isn't necessarily positive, but it *is* moving up. When the current price is below the average, then the price direction is becoming more negative. Crossings may signal change, although not all of these are sustained.

Multiple averages give filtered and cleaner signals than single averages and avoid price whipsaws†; one popular example is the moving averge convergence/divergence (MACD). The MACD compares two EMAs and determines if these are converging or diverging from one another. Other methods use multiple averages combined into a single oscillator, such as Martin Pring's KST. And finally, the TRIX indicator considers three averages: An EMA of the close, an EMA of the first EMA, and an EMA of the second EMA. The common features are selective filtering of noise and early reliable identification.

But why stop at two or three averages? How about four, six or even 10 averages? Suppose that rough data could slowly be smoothed by applying a relatively weak averaging many times over to get a stronger effect. Imagine data being morphed into a smooth curve. Imagine being able to observe the morphing process and the interrelationships of the consecutive smoothing passes. This can in fact be done.

Repeating the smoothing process, over and over, and keeping the results from each pass gives a spectrum of trends with multiple time frames. The multiple time scales, observed collectively with color coding, have the appearance of a rainbow. A quick glance

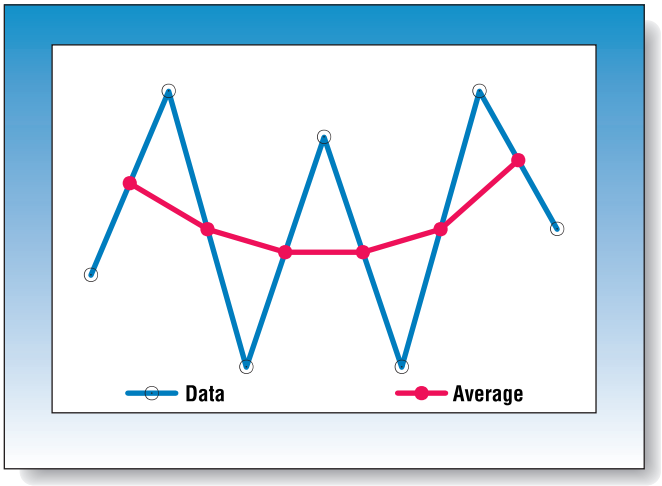

FIGURE 1: TWO-POINT SMOOTHING. The smoothed values are located at the midpoint of a line connecting each pair of data points.

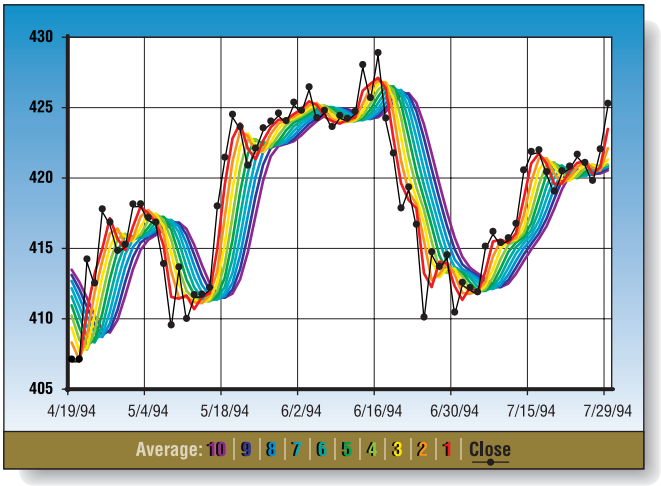

FIGURE 2: RAINBOW CHART. Recursive smoothing is successively applied to OEX data and each smoothed curve plotted.

at a graphic using this technique can indicate whether the price action is trending or volatile, the prevailing direction, and whether prices are expanding or contracting. Early warnings of change as well as confirmation can be based on a graduated measure rather than sharp thresholds. A consensus of the spectrum of trends gives a useful trend-following indicator as well.

RECURSIVE SMOOTHING

Smoothing doesn't get much simpler than averaging two data points. For a time series of data, an average of each pair of points is about the most smoothing you can get with the least complexity. The smoother curve is a reference for the original time series and, to some degree, is a better representation of the prevailing conditions than the original data. But why stop there?

Average the average values again, two by two, and obtain an even smoother curve. Repeat this process over and over, averaging the previous average. Applying the same formula repeatedly is a recursive process, and the formula a recursion relation. The smoothing approach here is called *recursive smoothing*. Each smoother curve is a reference and filter for the less smooth curve. This process can be carried on *ad infinitum*, although generally there is a practical limitation or diminishing return.

A graphical display of the two-point averaging and smoothing is shown in Figure 1. For a data series with typical variability, the two-point average is simply the midpoint between each of the data points. This process can be accomplished graphically, by hand, if desired. Connecting these averaged points with a line produces a smoother curve than the original data. In practice, the averaged values are not assigned to the midpoint of each period but to the later time to the right for each period. This results in the average lagging the data by half the period for a two-point average.

The lag of moving averages behind data is well known and is half the averaging period. Averaging can be applied again to the previously averaged points to obtain an even smoother curve, and so on. Multiple averages reach further back in time and reflect the longer-term trend. The lag increases and is compounded for averages on averages as well. The data is smoothed and sharp changes and spikes are dispersed and spread.

The formulas for the smoothing are shown below. Start with a time series of closing data (C_I), with I = 1 to N, and N the number of data points. The first average, AVE1 for data point I, is the simple average of the close at that time and the close at the previous time. The second average, AVE2, is applied to the first average AVE1 and so on. In general, the number of averaging passes can be as large as desired but is cut off here at a value of 10.

$$AVE1_I = 0.5 * (C_I + C_{I-1})$$
for I = 2 to N

$$AVE2_I = 0.5 * (AVE1_I + AVE1_{I-1})$$
for I = 3 to N

$$AVE3_I = 0.5 * (AVE2_I + AVE2_{I-1})$$
for I = 4 to N ...

$$AVE10_I = 0.5 * (AVE9_I + AVE9_{I-1})$$
for I =11 to N

The same recursion formula is applied over and over and is easy to implement in a spreadsheet (see sidebar, "Creating a rainbow chart").

It is possible to substitute and solve for the higher-order averages in terms of the close directly and get exactly the same answer. This leads to more complex formulas and because of

this, it is not used for evaluations. For example, it can be shown that:

$$AVE2_I = (C_I + 2 * C_{I-1} + C_{I-2})/4$$
for $I = 3$ to N

$$AVE3_I = (C_I + 3 * C_{I-1} + 3 * C_{I-2} + C_{I-3})/8$$
for $I = 4$ to N

$$AVE4_I = (C_I + 4 * C_{I-1} + 6 * C_{I-2} + 4 * C_{I-3} + C_{I-4})/16$$
for $I = 5$ to N

and so on. While not as practical for evaluation as the simple recursion formula, these equivalent formulas give insight into the multiple averaging process and the weightings applied to the closing data. Note that the endpoints have relatively low weights and the central points have higher weights, thereby reducing sensitivity to abrupt changes in new data or to dropoff of old data at the back of the interval. The higher averages also reach back further, adding one period for each averaging pass. The lag time corresponds to the highest weight at the interval center and increases one half period per averaging pass.

Identification requires separating meaningful signals from noise. Was the latest change a blip or the start of a trend? The answer often depends on a trader's frame of reference.

Because of the progressive smoothing and increasing lag, all of the smoothed data series can be displayed together without some of the series covering or hiding the other series. The current data is put on top and the progressively smoothed series reside at sequentially lower layers. Each of these is a little smoother and shifted from the one earlier and directly underneath. If these were plotted with a single color, it would be difficult to distinguish between them, but by adding color, they are separated in an easily identifiable manner.

The color plots are contiguous and appear as a continuous spectral color change. Figure 2 shows an example of this. Here, daily OEX closing data and the progressive averages are plotted. When the trend is up, the current data is at the top (red) and the most smoothed curve is at the bottom (violet). When the trend is down, the order is reversed. When the data crosses the rainbow and continues on up or down, the averages follow and cross in sequence. Moves away from the rainbow are seen as expansion and lead to greater rainbow width, while moves into the rainbow are a contraction or potential reverse. If the change is not large, then an attempted crossing may fail. The depth of the penetration into the rainbow can measure the strength of the move.

After all the averaging is completed, there are multiple series of smoothed data, each progressively smoother than its predecessor. Attributes of these smoothed data series reflect trend direction, strength and character. These features are consolidated into a trend-following indicator, the rainbow oscillator (RO), and accompanying bands that measure bandwidth.

RAINBOW OSCILLATOR

Bandwidth is determined directly from the averages and is the normalized range of the averages at a particular time. The range of averages (RANGEA) is as follows. All the averages are those for the current date I (subscript has been omitted).

```
RANGEA =
MAX(AVE1, AVE2, …, AVE10) - MIN(AVE1, AVE2, …, AVE10)
```

RANGEA is normalized by the range in closing prices (RANGEC) over the period for the data that is reflected in the averages; 10 averages look back 10 data points.

$$RANGEC = MAX\ (C_J) - MIN\ (C_J)\ FOR\ J = I\ TO\ I\text{-}10$$

The rainbow bandwidth (RB), expressed as a percentage, is

$$RB = 100 * RANGEA / RANGEC$$

Since the averages are derived from the data, RANGEA <= RANGEC and the values of RB are from zero to 100%.

A narrow width means prices have converged over time and a wide width means prices have diverged over the lookback period. A narrowing width corresponds to a contracting market and an expanding width corresponds to an expanding market. The contracting situation generally means the move has occurred and is slowing, or there is a pause or step. The expanding case means the move is under way and momentum is growing. The early signs of expansion are a trigger for action. Periods with widening bandwidth, following a minimum, are most significant for defining direction.

Another frequently seen feature occurs when, occasionally before a large move, the bandwidth becomes very narrow and all the averages converge to essentially a single value. This *harmonic convergence* pattern has been reported before for multiple averages. It is also similar to the presence of very narrow Bollinger bands before a move or to the development of congestion. It's doubtful there is any astrological significance to this. More likely than not, the market is just waiting.

The position of the current close (C) is now compared with the average of the averages. This establishes a relative ranking of the current close with the bands and defines the rainbow oscillator (RO). This is shown below for the current date (subscript omitted):

```
AVEA = AVERAGE(AVE1, AVE2, …, AVE10)

RO = 100 * (C - AVEA) / RANGEC
```

RO ranges between -100% and +100%. Combining bandwidth with ranking amplifies changes that occur when the market is

expanding and attenuates those when the market is contracting or coasting.

Plotting both RO and the bandwidth together on the same chart show both direction and contraction/expansion. The approach here is to plot the RB as the upper rainbow band (URB) and -RB as the lower rainbow band (LRB).

$$URB = RB$$

$$LRB = -RB$$

These bands are not bands in the usual sense; they are applied to the oscillator instead of the prices. The RO is always in between: below the URB and above the LRB.

Figure 3 puts it all together: the rainbow chart and oscillator, and upper and lower rainbow bands. This example of recent daily OEX data has a modest overall rise with minor cycles and occasional smaller steps. Steps and reversals are usually accompanied by a local minimum in the bandwidth. By tracking the RO and the URB and LRB, it is easy to determine the direction and activity. The RO is set here to track moves of several days or more. Shorter, abrupt moves lead to quick changes to large bandwidth and often signal an overdone condition or that the move is essentially over. More interpretation will follow.

EXAMPLES WITH DAILY DATA

OEX daily data is a good basis for examining the rainbow charting method. A gallery of examples for different conditions is presented.

Figure 4 shows one of the best examples of a steady uptrend that occurred during spring 1995. A continuous rise can be seen with periodic steps of 10 trading days or so. The bandwidth identifies each step with a minimum and the RO picks up the direction. The averages experience a weak harmonic convergence at each step that is usually followed by a catch-up move that is larger than normal. With the exception of a few days, the RO remains positive and fluctuates with varying degrees of positive strength. It is always difficult to distinguish between a step and a reversal until the follow-on expansion (bandwidth increasing following a minimum) is under way. At the end of the chart, the character of the trend seems to be changing, as can be seen by several sloshing cycles with above-average bandwidth and directional changes.

During the buildup for the Gulf War, the markets declined for an extended period, as can be seen in Figure 5. The downward steps are well correlated with the minimums in the bandwidth, as the trend direction from the RO remained negative. At each minimum, the RO tests the zero level but falls back as the expansion resumes. As the OEX nears bottom, the rebound is seen a little higher each time. Sign of the RO is a good indicator for moves the duration of which is comparable to or longer than the smoothing period.

Another situation can be seen in Figure 6. In this case, there is a significant uptrend in late January and early February 1996. This move is embedded in a background of oscillations of 20 points or so of relatively short duration of about six to nine days. The RO tracks the major move quite well but has trouble following the oscillations. The higher averages are out of phase with the lower averages, and the bandwidth remains relatively large. Today's direction of the RO is not necessarily a good prediction for tomorrow's move for short oscillations; a more responsive signal is needed. Signaling off the changes in the RO rather than the sign of the RO is one possibility.

No analysis evaluation is complete without testing its behavior for the period of the crash of 1987. The rainbow chart captures this event reasonably well, as can be seen in Figure 7. A significant decline had been under way since late August, well in advance of the precipitous historic drop in October. There was a minor recovery in late September that showed signs of weakness with small values of RO and a narrowing bandwidth before it failed. The downturn on October 5 gave the signal to exit, and the direction remained negative well past the crash.

DIFFERENT TIMES

While daily data can be useful for most situations, it is also worthwhile to look at longer and shorter periods for perspective and opportunity. Monthly closing data captures years of data on a single chart (Figure 8) and shows prevailing conditions. The obvious interpretation for this data is that the long-term trend is significantly positive, with two noteworthy exceptions for the 1987 crash and the 1990 Gulf War. The OEX also tends to fall much faster than it rises. For this multiyear time frame and using monthly data, it is not possible to realize any significant benefit for identifying and following downward moves with this method. Nonetheless, it does give the obvious perspective of the long-term trend when performing analysis over shorter time frames.

Another view of monthly data up to the present can be seen in Figure 9. This chart is almost featureless, except for the consistent positive slope and one significant change in slope. While there are several steps and contractions, there are essentially no meaningful downward signals for the entire period of almost seven years!

Stepping back to a shorter, weekly period, the situation appears to improve. It is easier to follow some of the significant moves. For example, the sustained decline and recovery for the Gulf War period are identified sufficiently early to take action. Generally, the direction at the start of the expansion, following the minimum in the bandwidth, is a good bet for the subsequent direction. In this case, however, there are several examples of a brief flurry of activity in the opposite direction prior to the major move. These are seen both at the beginning of the major

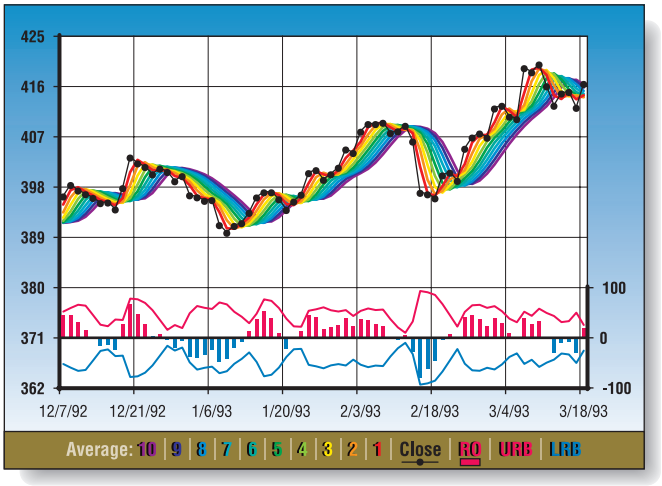

FIGURE 3: RAINBOW OSCILLATOR AND BANDS. The rainbow oscillator measures trend direction and strength. The upper and lower rainbow bands identify expansion or contraction.

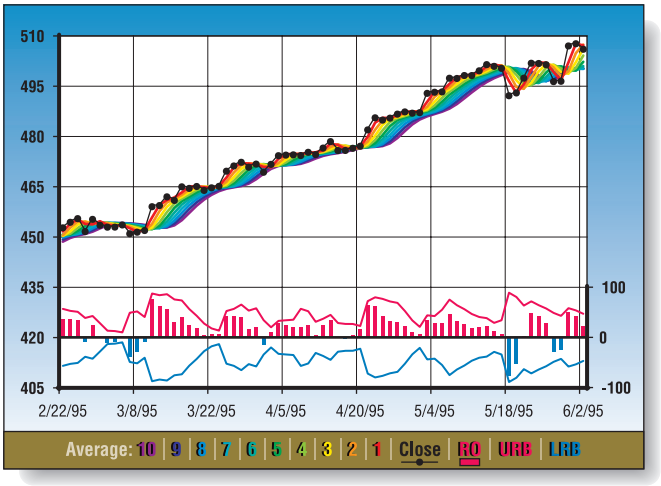

FIGURE 4: STEADY UPTREND. Not surprisingly, the trend signal is consistently up, with occasional steps correlated with bandwidth minima along the way.

decline in mid-August and at the beginning of the recovery in early January (Figure 10). This can also be seen in other data from time to time and is a call for caution.

Let's jump now from the multiyear and yearly scale to the other extreme — one day. A lot can happen in a day, not to mention five minutes, and a good example is Figure 11. This was a significant down day, from the open on and continuing throughout the remainder of the day. Again, the common features are weak oscillations and significant steps that are familiar patterns seen in longer time frames. At the open, there is a start-up period where the averages have not yet equilibrated. It takes about 10 data periods to fully absorb the starting conditions. Caution about interpretation should be exercised near the open during this period. The smoothing curves also continue beyond the close and can be ignored once the market settles. The RO is seen to track the direction reasonably well. The bandwidth minima correlate with the steps and maxima with expansions. Attempts to recover after each step are seen to be weak with little strength.

A different day can be seen in Figure 12. Here, the OEX goes up, pauses for a while, and then comes back down. The RO seems to do reasonably well at predicting trend direction; occasionally, when a sharp move occurs, the bandwidth pops up to a large value. Quite often it's not worth following. In many cases, the move may essentially be completed with little room for further expansion. Examples of this can be seen at about 2:30 and 3:30 p.m. in the chart seen in Figure 12.

BEATING BUY-AND-HOLD

Beating the buy-and-hold approach is a difficult proposition for the market conditions of the past decade. The large cash flow entering the markets and favorable economic conditions have resulted in a long-term, highly positive trend. Pauses, steps and minor downturns are currently viewed as buying

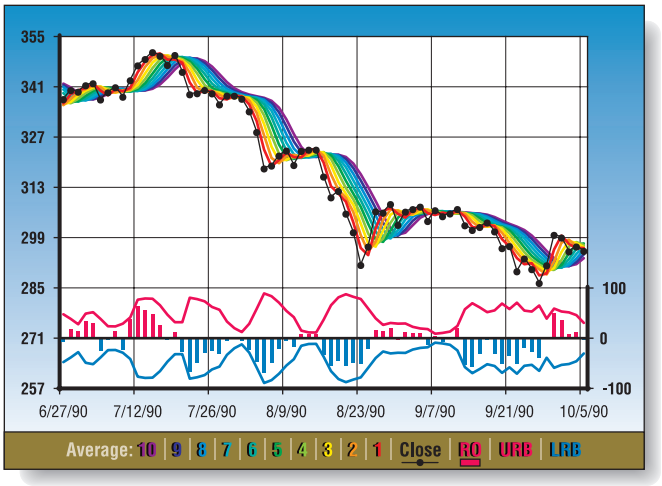

FIGURE 5: DOWNWARD CASCADE. A downward crossing is followed by a downward move made in several distinct steps.

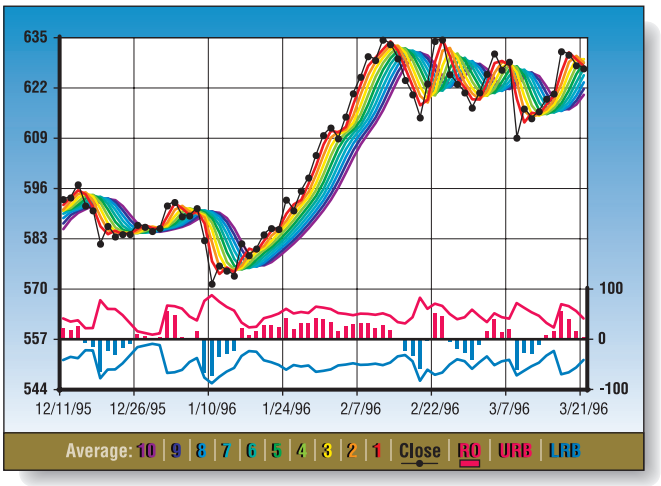

FIGURE 6: STEP UP. A significant upward step is sandwiched between two regions of lesser oscillations. Keying off the RO is good for the longer step, while keying off changes in the slope of the RO works better for rapid oscillations.

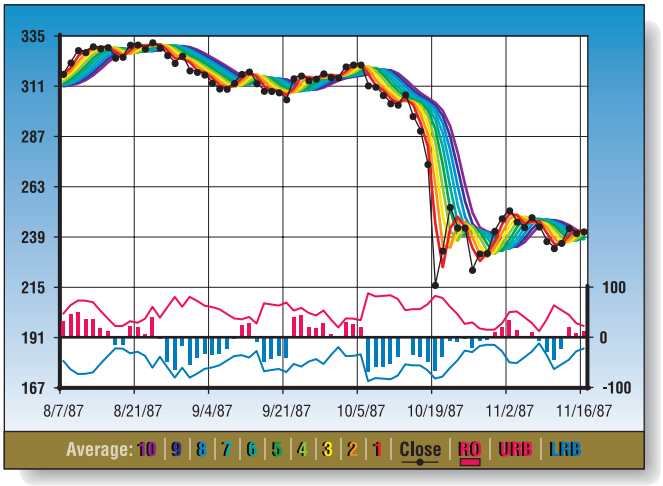

FIGURE 7: GOING DOWN. The 1987 crash and the preceding events are correctly flagged. The RO remains negative for 17 days with large bandwidth.

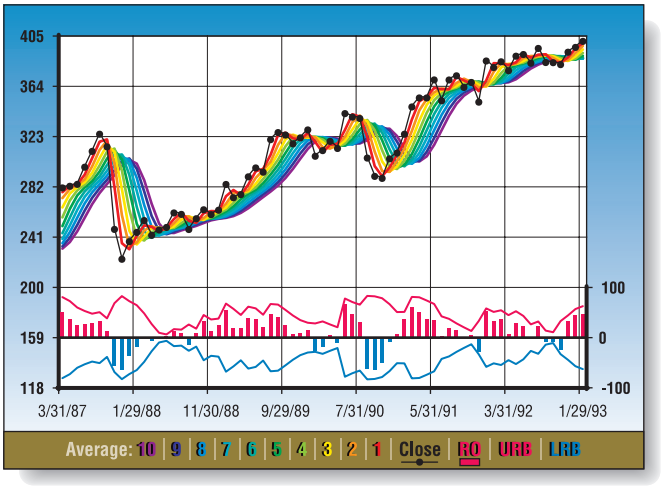

FIGURE 8: OEX MONTHLY CLOSES FROM 1987 TO 1993. Following OEX trends with data at monthly intervals is not fruitful, since once the trend is identified, it is essentially too late to act. Examples are the 1987 crash and the 1990 Gulf War.

opportunities and don't seem to create any significant fear.

So what improvements *are* possible? One strategy is to essentially adopt the buy-and-hold approach, for the most part. Stay long unless you have a *very* good reason not to. Sometimes there are extenuating circumstances, as was the case in 1987. Even in a long-term uptrend there are cycles. Why ride along all the way to the bottom of each one? Get out briefly from time to time when conditions are unfavorable. A trend-following approach that does this was developed and tested using the rainbow oscillator and bands.

What are the conditions for a downward move? Simply put, from a trend-following perspective, they are: downward direction, momentum, strength and the potential for further expansion. When these conditions are all present at the same time, then a better than even chance exists that the move will continue. More precisely, for a downward trend direction, the RO should be negative. Since the move has already started, the RO should also be declining. To avoid noise and to identify momentum as soon as possible, the decline should be confirmed for two days. The bandwidth should not be too large; otherwise, the move may be over. If all these conditions occur together, then go short. These rules are:

$$RO < 0\ ,\ RO < RO_{-1}\ ,\ RO < RO_{-2}\ ,\ \text{and}\ URB < UBRO$$

where RO and URB are for the current date and RO_{-1} and RO_{-2} are for the prior date and second prior date, respectively. UBRO is a constant. Values of UBRO ranging from 30% to 60% are found to give higher gain than buy-and-hold, with 38% being optimum, as determined from the past 11 years of daily OEX data. Gain is not that sensitive to this choice.

A further enhancement is to add a stop. Generally, when

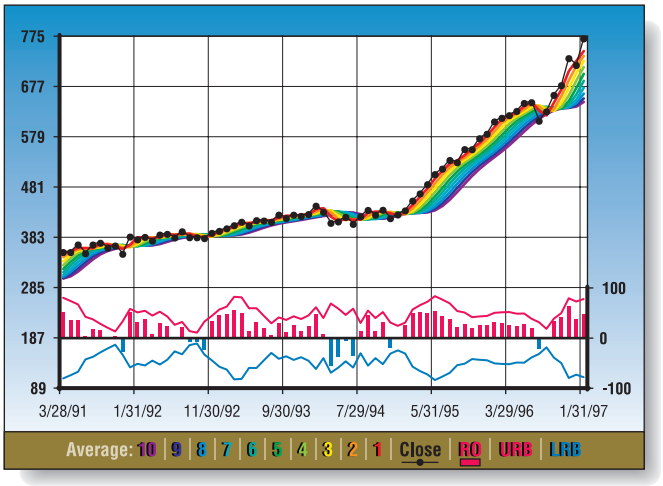

FIGURE 9: OEX MONTHLY CLOSES FROM 1991 TO 1997. The chart shows the unprecedented prevailing upward trend; don't fight it too hard or too often. If your time horizon is long term, and your data update is monthly or more, then it's hard to argue against buy-and-hold for these conditions.

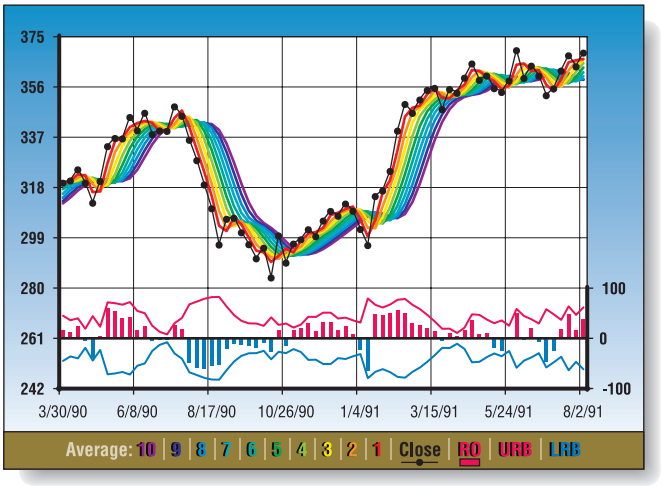

FIGURE 10: OEX WEEKLY DATA FOR THE GULF WAR PERIOD. With data at weekly intervals, it is possible to correctly flag declines lasting a month or more with time to act.

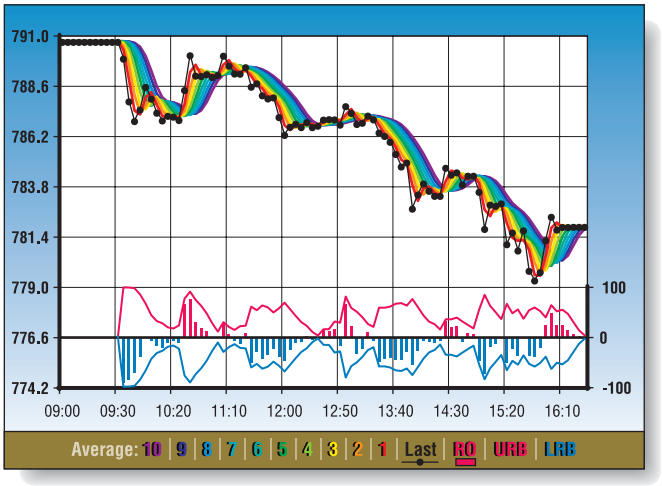

FIGURE 11: OEX DATA AT 5-MINUTE INTERVALS. Rainbow chart analysis is also useful for short periods of one day. A sequence of steps down are identified, resulting in a large decline of 8.83 points.

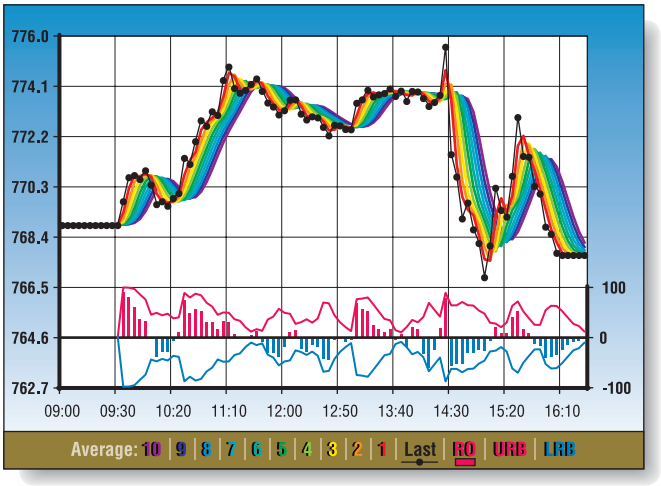

FIGURE 12: CAN DIRECTION BE PREDICTED? Direction is seen early in each expansion cycle (bandwidth increasing) and is often a sign of things to come for the next several intervals.

there is an extreme move, it is followed by a quick recovery, although not always. If the move goes too far, then it can continue to free fall, as was the case in 1987. To avoid such conditions, a stop is added to reverse direction if the market plunges beyond a certain percentage over a short period. The formula compares the percentage change in closing prices of the current close (C) and the close seven days prior (C_{-7}):

$$200* (C - C_{-7})/(C + C_{-7}) < -7\%$$

The value of -7% is optimum here and values from -7% to -12% give superior results.

The position is long *unless* either the combined set of rules are satisfied or the conditions of the stop are satisfied. For those conditions, the position is short.

A good example of the method can be seen in Figure 13. During this period of 70 days, there were five short days and 65 long days. Buy and hold resulted in a gain of 55.69 points, while

CREATING A RAINBOW CHART

Start with closing data in columns A and B (sidebar Figure 1). Seed the starting row (row 3) with the first data point, then load the recursive formula in the next row and fill down.

{Cell C3} = B3

Then fill right through {cell L3}.

{Cell C4} = .5 * (B3 + B4)

Then fill right through {cell L4}.

Select {cells C4:L4} and fill down through last row.

The bandwidth and oscillators are defined starting in row 13 for the smoothing formulas to be independent of the starting conditions.

{Cell M13} =
100*(MAX(B13:L13)-MIN(B13:L13))/
(MAX(B3:B13 - MIN(B3:B13))

{Cell N13} = -M13

{Cell O13} =
100*(B13-AVERAGE(C13:L13))/
(MAX(B3:B13 - MIN(B3:B13))

Select {cells M13:O13} and fill down through last row.

Insert a chart and plot starting in row 13 and beyond. Plot the close and 10 averages on the primary axis and the bandwidth and oscillator on the secondary axis.

The colors of the lines can be adjusted by selecting "Tools - Options - Color." Select the first box in "Chart Lines." Select "Modify," then set "Hue, Saturation and Luminosity" to get the desired color. Save and move to the next color box in sequence.

The close and the smoothed series should be placed in proper order by selecting "Format - Line Group 1 - Series Order." AVE 10 should be at the top, with AVE 1 next to the bottom with the close at the very bottom. Other choices are marker = none, line style = continuous, and line weight = thick. —*M.W.*

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	DATE	CLOSE	AVE1	AVE2	AVE3	AVE4	AVE5	AVE6	AVE7	AVE8	AVE9	AVE10	URB	LRB	RO
2															
3	11/25/96	731.96	731.96	731.96	731.96	731.96	731.96	731.96	731.96	731.96	731.96	731.96			
4	11/26/96	731.35	731.66	731.81	731.88	731.92	731.94	731.95	731.96	731.96	731.96	731.96			
5	11/27/96	731.51	731.43	731.54	731.68	731.78	731.85	731.90	731.92	731.94	731.95	731.95			
6	11/29/96	733.39	732.45	731.94	731.74	731.71	731.74	731.80	731.85	731.88	731.91	731.93			
7	12/02/96	734.55	733.97	733.21	732.58	732.16	731.93	731.84	731.82	731.83	731.86	731.89			
8	12/03/96	726.63	730.59	732.28	732.75	732.66	732.41	732.17	732.00	731.91	731.87	731.87			
9	12/04/96	724.96	725.80	728.19	730.24	731.49	732.08	732.24	732.21	732.11	732.01	731.94			
10	12/05/96	723.11	724.04	724.92	726.55	728.40	729.94	731.01	731.63	731.92	732.01	732.01			
11	12/06/96	717.33	720.22	722.13	723.52	725.04	726.72	728.33	729.67	730.65	731.28	731.65			
12	12/09/96	726.59	721.96	721.09	721.61	722.57	723.80	725.26	726.79	728.23	729.44	730.36			
13	12/10/96	723.31	724.95	723.46	722.27	721.94	722.25	723.03	724.14	725.47	726.85	728.14	36.03	-36.03	-5.46
14	12/11/96	717.04	720.18	722.56	723.01	722.64	722.29	722.27	722.65	723.40	724.43	725.64	49.12	-49.12	-33.51
15	12/12/96	706.43	711.74	715.96	719.26	721.13	721.89	722.09	722.18	722.41	722.91	723.67	61.30	-61.30	-49.41
16	12/13/96	705.84	706.14	708.94	712.45	715.85	718.49	720.19	721.14	721.66	722.04	722.47	57.93	-57.93	-38.65
17	12/16/96	698.55	702.20	704.17	706.55	709.50	712.67	715.58	717.89	719.51	720.59	721.31	63.23	-63.23	-40.13
18	12/17/96	704.28	701.42	701.81	702.99	704.77	707.13	709.90	712.74	715.32	717.41	719.00	62.63	-62.63	-17.69
19	12/18/96	710.15	707.22	704.32	703.06	703.02	703.90	705.51	707.71	710.23	712.77	715.09	43.05	-43.05	10.23
20	12/19/96	724.47	717.31	712.26	708.29	705.67	704.35	704.12	704.82	706.26	708.24	710.51	72.57	-72.57	58.08
21	12/20/96	728.87	726.67	721.99	717.13	712.71	709.19	706.77	705.45	705.13	705.70	706.97	78.29	-78.29	56.40
22	12/23/96	726.14	727.51	727.09	724.54	720.83	716.77	712.98	709.88	707.66	706.40	706.05	70.77	-70.77	33.54
23	12/24/96	730.70	728.42	727.96	727.53	726.03	723.43	720.10	716.54	713.21	710.43	708.42	69.32	-69.32	32.64
24	12/26/96	735.60	733.15	730.79	729.37	728.45	727.24	725.34	722.72	719.63	716.42	713.43	59.85	-59.85	29.55

SIDEBAR FIG1 FIG1_DAT FIG2 FIG2_DAT FIG3 FIG3_DAT FIG4

SIDEBAR FIGURE 1: CREATING A RAINBOW, EXCEL. Here's how to create a rainbow chart.

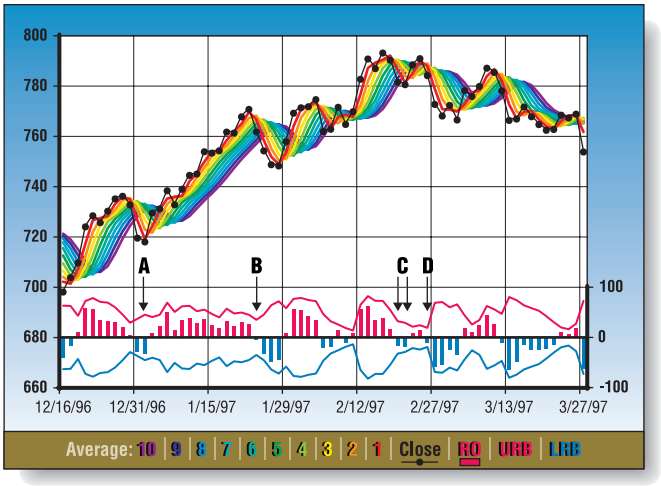

FIGURE 13: METHOD APPLIED TO RECENT DATA. Since the prevailing trend is positive, stay long unless the RO is declining and negative, but not too negative (otherwise the move may be over). Short signals occur infrequently about 10% of the time.

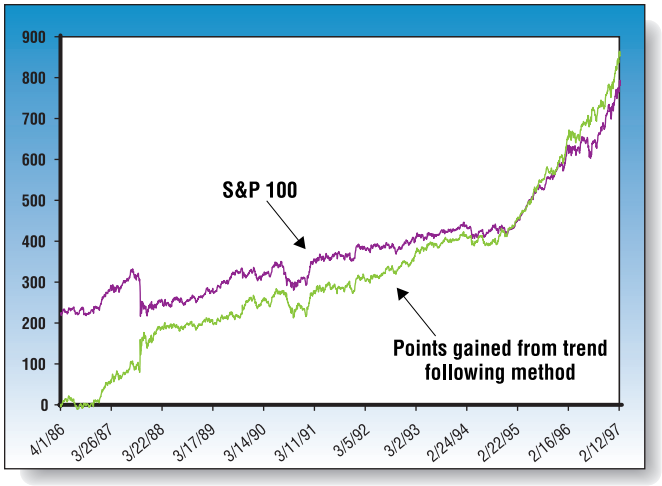

FIGURE 14: COMPARISON OF BUY-AND-HOLD WITH TREND-FOLLOWING. Based on about 11 years of daily OEX data, it is possible to realize larger point gains than experienced by the OEX. The point gain for buy-and-hold was 557.28 points and for the trend-following method, 852.72 points.

the trend-following method resulted in a gain of 82.87 points. The first signal (A) resulted in a weak gain of 1.52 points, the second signal (B) a larger gain of 7.53 points, the third signal (C) a loss of (6.89) points over two days, and the fourth signal (D) a gain of 11.43 points. Upon looking at the chart, it would be tempting to adjust the rules for the most recent downward move where there was no signal; however, over longer times on average this has not proved to be correct.

Now apply the same rules to a much longer period. Figure 14 shows daily closing data for the OEX for about the past 11 years. The stop and the RO both contributed to the performance during the 1987 period. The benefit for the remainder of the time is seen as a steady improvement over the S&P 100 index. Overall, there were 2,756 trading days examined with 2,488 long days and 268 short days. Generally, the short signals occur as a single day or sometimes two days together. These occurrences are infrequent, about 10% of the time, averaging about two or three per month.

Does this represent curve-fitting? Perhaps to some extent. The particular choice of 38% for the bandwidth and -7% for the stop may. However, if you want to use these criteria, you must pick *something*. Because of the lack of sensitivity of the gain to these values and because over time the benefit is steady for a large number of positions, I must conclude that there is at least some validity to the method. There probably are also refinements that could improve the performance of the method. Adaptations that emphasize the direction of the RO during trending periods and emphasize change of the RO during trading range periods should help.

CONCLUDING REMARKS

Simultaneous viewing of multiple averages of data provides a graphical means as well as a quantitative means of trend-following. Seeing the averages and their interrelationships as well as bandwidth add additional dimensions to chart analysis. Many investment approaches are possible, ranging from mutual fund switching to option strategies. Observe all the trends from noise, to signal, to reference. Pick your time frame and trade. Remember, it's true — the trend *is* your friend!

Mel Widner holds a doctorate in engineering and is the developer of projection bands and the price mobility analysis method.

RELATED READING

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†See Traders' Glossary for definition

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