

Volatility is an important component to any analytical approach. Here's how to build a volatility measure into a standard price oscillator so its extreme values move with the market's momentum.

Price bands that go with the flow

BY DAVID SEPIASHVILI

Momentum indicators measure the velocity at which a security's price is changing. They track momentum in the price and in this way reveal the relative enthusiasm of buyers and sellers involved in the trading process. The most popular technical analysis momentum indicators are price rate-of-change (ROC), the stochastics oscillator, and the relative strength index (RSI).

Each indicator has its own specific interpretation, but they share some basic interpretation features: they can be used by looking for extremes, positive and negative divergences from the price action, and crosses above and below a zero or center line.

The ROC displays the difference between the current price and the price n periods ago. It is a centered oscillator that fluctuates above and below zero. As other centered oscillators, it is best used to identify the underlying strength and direction of momentum behind a price movement. The greater change in the price, the greater the change in ROC. As prices increase, the ROC rises — as

prices fall the ROC falls. The lower the ROC, the more oversold the security is and the higher the ROC, the more overbought the security is.

Unfortunately, in practice there are no simple and fast rules to determine overbought and oversold levels here. One common practice is to establish extreme levels based on observation of past periods. The levels for ROC, as well as its period, are optimized depending on the security's overall conditions and the previous actions of the ROC itself. The most obvious disadvantage of the method is that it is based entirely upon historical precedence and requires tuning from time to time. Besides, indicating price overbought and oversold levels on the average makes it difficult to gauge extreme peaks and bottoms, which are specific for highly volatile securities.

The conventional banded oscillators (stochastics and RSI) measure the strength of a security and indicate its overbought and oversold conditions in a more efficient way. They are "universal" in that the upper and lower boundaries don't require preliminary matching to

the prices. But they have an important shortcoming in that they measure only relative strength of a security without reflecting its actual rate of change.

To address the limitations of these popular momentum indicators, the price ROC with self-adjusting overbought and oversold extremes — we'll dub it the Sepiashvili Banded ROC (SB-ROC) — has been developed. The distinctive feature of the indicator is it combines all main functions of momentum oscillators into one indicator, integrating advantages and avoiding their main disadvantages. The indicator provides a new way of identifying overbought and oversold levels for price ROC. It considers price rate against volatility so as to compare its highest highs and lowest lows to current levels of volatility used here as overbought and oversold benchmarks.

MEASURING VOLATILITY

An important component of the SB-ROC, volatility, can be calculated in various ways. Here are the three ways to calculate volatility that are the most applicable to this indicator:

1. The most popular method of calculating volatility is standard deviation (SD). It's a pretty straightforward calculation and is available in any basic statistics text or even bare bones spreadsheet software, so we won't repeat it here. In the SB-ROC indicator, two standard deviations, without regarding to time, can be used.

2. Linear deviation is a good alternative to SD. To determine volatility, first calculate linear deviation as the absolute value of the difference between price and n -point period simple moving average of price, then smooth it over n -point period and multiply by correction coefficient c . Here's the formula:

$$\text{Volatility} = c * \text{SMA}(n) \text{ of } [\text{ABS of (Price - SMA(Price, } n))]$$

Where:

$c = 2.2$

SMA = Simple moving average

Linear deviation is the best estimator, but it is not always the most efficient.

3. The simplest and easiest way to calculate volatility is to take the difference between the highest high and lowest low of prices over n periods. To adjust it to the same scale of that of the indicator, multiply the result by correction coefficient k :

$$\text{Volatility} = k * [\text{MAX(Price, } n) - \text{MIN(Price, } n)]$$

Where:

$k = 0.8-0.9$

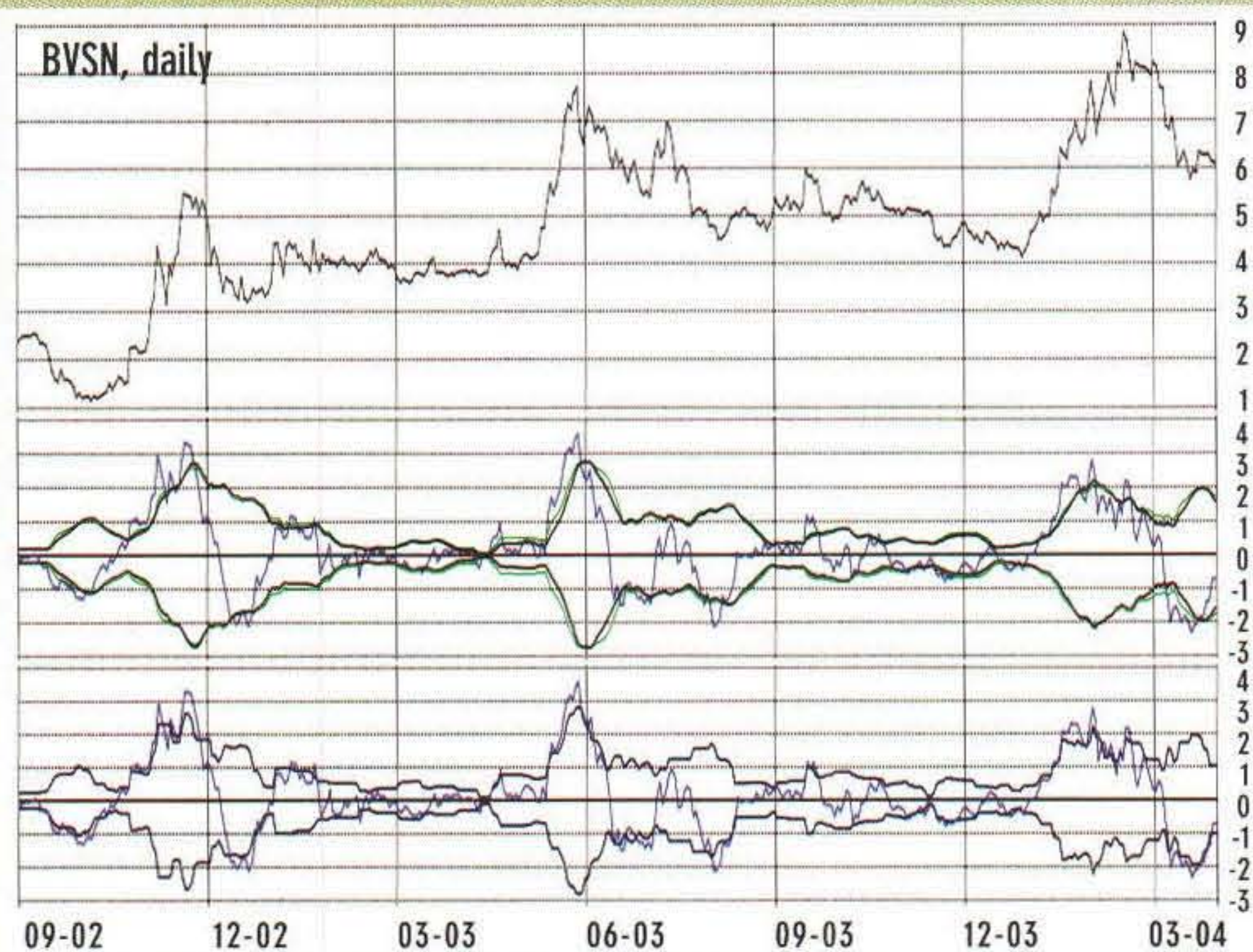
TRADING WITH SB-ROC

SB-ROC is a two-component indicator based on the interplay of two different momentum indicators of the same period — price ROC and volatility. Like other banded oscillators, it is a threshold-crossing indicator and has pre-signal extremities useful for forecasting buy and sell signals. Unlike preset constant thresholds in popular banded oscillators such as RSI and stochastics, the SB-ROC uses moving bands adjusted by a measurement of current volatility.

Volatility designates extreme levels that the price ROC can reach or exceed.

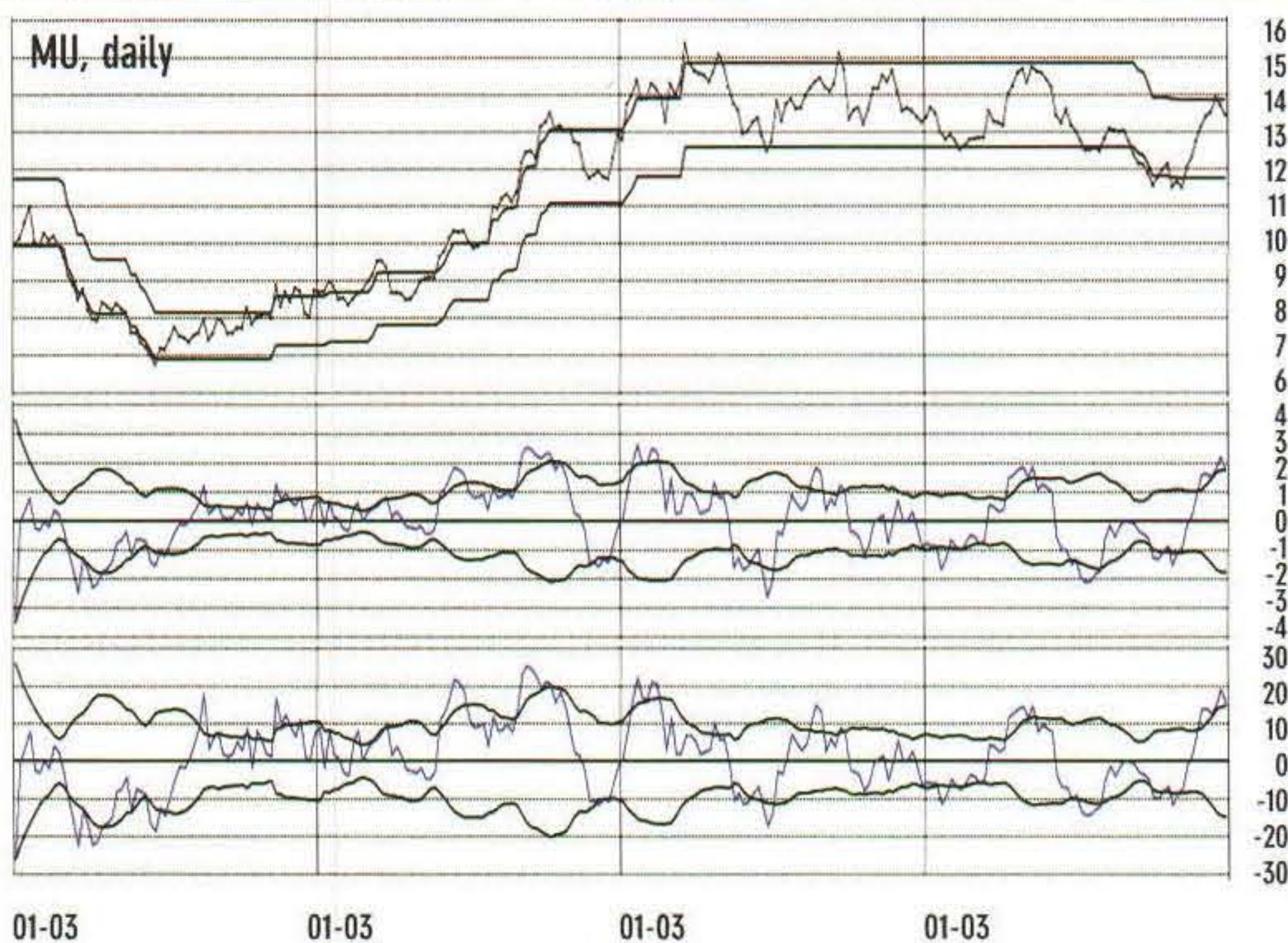
BANDS ON THE RUN

Regardless of which volatility measure you use to calculate the self-adjusting ROC bands, the signals will be similar.



TWO TURNS FOR PROFITS

The SB-ROC is useful in both trending and non-trending market environments.



When the ROC reverses and diverges from the direction of the bands, it can be interpreted as a signal to buy or sell.

The corresponding volatility bands, along with the 15-day period price

ROC, are shown in "Bands on the run" (above) applied to Broadvision Inc. (BVSN). On the first sub-chart, bands based on standard deviation (green lines) and linear deviation (blue lines)

are shown. The second sub chart shows high-low volatility bands (purple). The three methods of measuring volatility are highly correlated, giving almost the same readings for extremities.

Regardless of which volatility measure you use, plotting self-adjusting volatility bands on the security's price ROC, we get an indicator that identifies overbought and oversold conditions, and helps us anticipate trend reversals. Periods of low readings of ROC and volatility typically precede a large move in the security's price and indicate "dead" zones, during which it is best to be out of the market.

Though SB-ROC is useful in non-trending market environments when extreme readings, positive and negative divergences and crosses of the zero line provide useful information, it's also a useful tool during trending phases for both momentum and volatility readings. "Two Turns for Profits" (page 35) shows both types of environments for Micron Technology Inc. (MU).

In the chart, the first sub-chart shows the 10-day SB-ROCs using an absolute

calculation and the second sub-chart shows the indicator using a percentage (relative) calculation. You can see how harmonically the volatility bands contract and the price rate magnitude decreases during downtrends and how the bands expand and the price rate magnitude increases during the uptrend. You also can see how distinctly the indicator performs in the prolonged trading range, lasting for a six-month period from July through January. The SB-ROC fluctuates in a range of its own, adequately reflecting price movement in the horizontal channel formed by support and resistance.

We also can gain advantage from opportunities offered by a three-component picture. "Combo approach" (below) shows how additional indicators can be applied with the SB-ROC. The first sub-chart shows the 50-day SB-ROC with linear deviation (blue) and standard deviation (green) bands. The black line shows the 50-day price oscillator. By simultaneously representing price movement and its rate-of-change, each of which has a specific and distinct fea-

ture, we can turn the difference into competitive advantage, getting two sets of readings. We can look for preliminary warnings from the oscillator as well as signals from the SB-ROC.

These two indicators are further complemented by displaying information directly on the price charts. However, the construction of most momentum indicators does not allow them to be easily transferred to the same scale as market prices. To plot the SB-ROC on the price chart, we need another solution in the form of multi-component bands.

SCALING FOR PRICE

The price band version of the SB-ROC adds a moving average and moving average bands to the inputs for the momentum oscillator.

An essential component of the indicator is the Sepiashvili Velocity Curve (SVC). The SVC presents the velocity of price change on the price chart itself. The following formula lets us transfer the price ROC to the price chart:

$$\text{ROC in price chart format} = \text{SMA}(\text{Price}, n) + \text{ROC}(\text{Price}, n)$$

To eliminate high-frequency fluctuations, it is preferable to smooth the price ROC when it is displayed on the price chart, as such:

$$\text{SVC} = \text{SMA}(m) \text{ of } [\text{SMA}(\text{Price}, n) + \text{ROC}(\text{Price}, n)]$$

Where:
 $m = n/4$

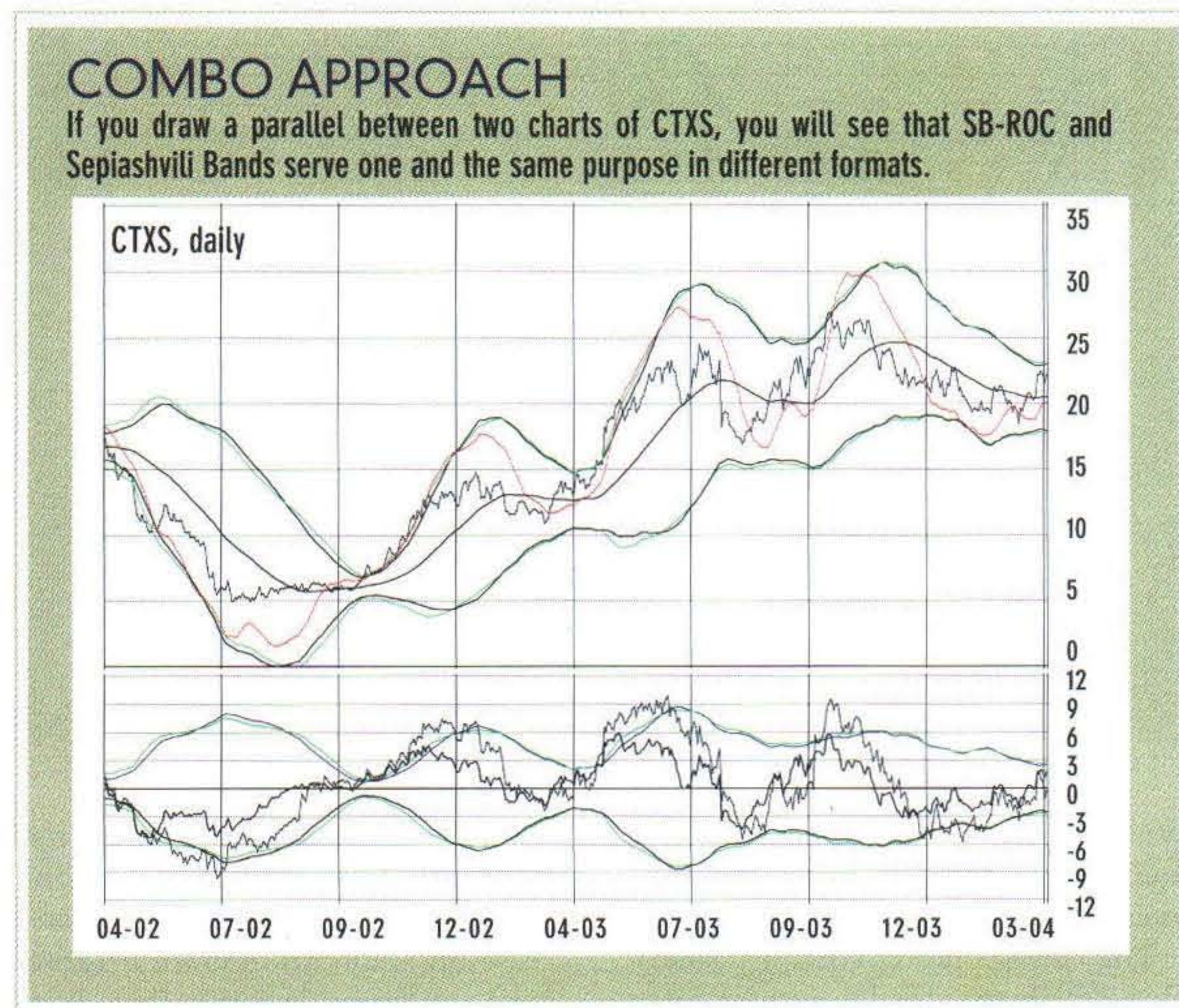
Volatility bands are another essential component of the indicator, based on the moving average and volatility plotted around this average. They identify highs and lows in relation to price:

$$\text{Volatility Upper Band} = \text{SMA}(\text{Price}, n) + \text{Volatility}$$

$$\text{Volatility Lower Band} = \text{SMA}(\text{Price}, n) - \text{Volatility}$$

Volatility can be defined in any of the three methods listed.

Taking an approach of explicit and simultaneous representation of four dif-



fering variables — price, moving average of price, price velocity and volatility on the same price chart — we get an indicator that gives a multi-component representation of the security.

In "Combo approach" the price chart reflects the 50-day moving average bands based on linear deviation (blue) and standard deviation (green), and the 50-day SVC (red).

It's clear that the two indicator sets serve same purpose. The difference is not functional, but representational. A distinctive feature between the two indicators is only that instead of ROC we have a smoothed velocity curve based on ROC in the price chart format.

CLEAR SIGNALS

Price bands often are criticized for not providing more straightforward buy and sell signals. When price is losing

momentum it can deviate from the bands in advance, much before its peaks and troughs. The problem arises from the nature of the components: the speed of the price is slowing down to a crawl, especially in intermediate and long terms, while the price is still rising while the bands reflecting velocity also are speeding up at that time. That is why when prices hit the upper or lower boundaries of a given set of bands it is not necessarily an indication of an imminent reversal in a trend. It just means prices have reached the upper limits of established parameters. Thus, traders must use other indicators in conjunction with these price bands to determine the reversal points of the trend.

In the bands described here, the shortcoming is compensated by implementing a complementary component, the SVC. The SVC reduces the gap and

improves the effectiveness of the indicator by adding to the interplay between price and bands — interplay between price, velocity of price and bands.

The price bands, as well as SB-ROC, don't require a variable correction factor and offer constant measures of volatility across time frames. In the case of SD, they use a set number of two standard deviations, and not x number of standard deviations that the analyst can adjust for usefulness. In addition, linear deviation bands, which are simpler in constructing, are just as effective in this application. **FM**

David Sepiashvili is a doctorate candidate in signal processing at Carnegie Mellon University in Pittsburgh. Financial time series analysis is one of the applications of his scientific efforts. He is president of Alticom Inc., which has developed a number of solutions for stock market technical analysis (www.alticom.com). Reach him at das@alticom.com.



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