NEW TECHNIQUES

Detecting And Determining Trends

Trend-Quality Indicator

Having trouble detecting trends, or estimating their duration when you do spot one? This indicator comes to the rescue.

by David Sepiashvili

Trend detection and estimation is one of the most important objectives of technical analysis. One common filtering technique that attempts to eliminate stock market noise and extract important trends is smoothing with the help of moving averages. When using moving averages (MAs) to detect a trend in a security's price, the main difficulty is determining the appropriate averaging period.

To determine the appropriate period can be challenging because different periods have advantages and disadvantages. A shorter averaging period, for instance, may give higher profits but involve high risk, owing to numerous random fluctuations that affect the trend. A longer moving average helps avoid many false reversals by lagging behind the security's current prices, but as a rule, less risk means less profit.

The trend-quality indicator (or Q-indicator) is a trend detection and estimation tool that is based on a two-step filtering technique. It measures cumulative price changes over term-oriented semicycles and relates them to "noise." The approach reveals congestion and trending periods of the price movement and focuses on the most important trends, evaluating their strength in the process. The indicator is presented in a centered oscillator and banded oscillator format.

MOVING AVERAGES AND YOU

Even if you have tuned your moving average (MA) length, a new problem crops up: An optimized system gives good results on historical data but is vulnerable to significant market changes. This can mean disappointing results on new (future) data.

There are two steps to approaching this problem:

1. Create a moving average that filters a limited number of term-oriented averaging period alternatives (to avoid overoptimization). Determine in any commonly accepted way the moving average reversal points, and let your MA correspond to upward and downward semicycles of the price movement.
2. Improve the accuracy of this MA with a procedure that attempts to recognize, in a timely way, promising and nonpromising price trends within the extracted semicycles as well as estimate their strength.

If step 1 (moving average filtering) is a conventional, well-mastered technique, step 2 has been a stumbling block for many trading systems.

Remember there is no free lunch in the stock market. The recognition of promising trading opportunities can be achieved only with some concessions. A reliable reversal signal cannot be identified before the trend develops, but if you want to

catch the major part of the trend, you cannot wait too long. As in any decision-making procedure, you must consider the tradeoff between sensitivity and reliability. If your indicator is too sensitive, you will be bandied by false signals, and if it has coarse tuning, you could miss critical points. Striking a compromise between sensitivity and reliability requires some objective criteria, which can be found only through the assessment of the price trend performance.

THE CPC INDICATOR

To estimate the price dynamics, you can use the cumulative price change (CPC) indicator, which measures the amount that the price has changed from a fixed starting point within a given semicycle. The starting points can be determined using, for example, the moving average crossover rule. The CPC indicator is calculated as a cumulative sum of differences between the current and previous prices over the period from the fixed starting point t_0:

$$CPC(t) = \sum_{\tau = t_0}^{t} P(\tau) - P(\tau - 1)$$

The trend within the given semicycle can be found by calculating the moving average of the cumulative price change:

$$Trend = MA(CPC, m, t \geq t_0)$$

Segmenting the price time series and constructing trends within the extracted semicycles offers the smallest average gap between actual and averaged datapoints. This results in a better fit of the real price dynamics. The cumulative price change indicator and trend indicator can both be used either as standalone indicators or as components of other technical analysis tools.

ESTIMATING TREND PERFORMANCE

A basic criterion for estimating trend performance is the amount the trend changes over up or down semicycles. If there is little or no visible progress in the trend, it may be considered as nonefficient.

Further, significant changes in trend may be considered as promising trading opportunities, but the term "significant" is relative and subject to interpretation. The trend-quality indicator (Q-indicator) is an attempt to estimate trend in relation to noise. It answers the long-standing question of whether a trend change qualifies as significant and promising, or insignificant and better ignored. In terms of noise, trend estimation not only determines whether the trend is reliable, but also allows you to measure its strength gradually. Thus, regardless of their prices, trends of various securities can easily be compared to each other or against any index.

The Q-indicator can be calculated by dividing trend by noise:

$$QIndicator = \frac{Trend}{Noise} \cdot c$$

where *c* is an appropriate correction factor. This ratio seems to be closely related to the signal-to-noise ratio in signal processing. The technical analysis problem of detecting a trend in a security's price movement in the presence of random fluctuations differs somewhat from the signal processing problem of regenerating a designated input signal buried in stochastic noise. In spite of this difference, applying such a ratio to measure trend performance relative to the background noise seems to be rewarding.

The denominator of the Q-indicator — noise — can be defined as the average deviation of the cumulative price change from the trend. To determine linear noise, first calculate the absolute value of the difference between CPC and trend, and then smooth it over the *n*-point period:

$$Noise_1 = MA(|CPC - Trend|, n)$$

The root mean square noise, similar to the conventional standard deviation, can be derived by summing the squares of the difference between CPC and trend over each of the preceding *n*-point periods, dividing the sum by *n*, and calculating the square root of the result. Since MA is defined as a summation over *n*-point periods divided by *n*, we can write:

$$Noise_2 = \sqrt{MA\left[(CPC - Trend)^2, n\right]}$$

Unlike the standard deviation, where *n*=*m*, here an allowance is made for averaging periods: *n*>*m*.

The Q-indicator is intended to measure trend activity. Some benchmarks can be used to determine the strength of a trend. In the range of Q-indicator values from -1 to +1, the trend is buried beneath noise. It is preferable to stay out of this zone. The greater the Q, the less the risk of trading with a trend, and the more reliable the trading opportunity. The range from +1 to +2, or from -1 to -2, may be treated as zone of weak trending. However, if the trend exceeds this level (absolute value of Q>2), it can be qualified as promising.

Readings in the range from +2 to +5, or from -2 to -5, can indicate moderate trending, and readings above Q=+5 or below Q=-5 indicate strong trending. Strong upward trending often leads to the security's overvaluing, and strong downward trending often results in the security's undervaluing. Readings exceeding strong trending benchmarks can indicate overbought or oversold conditions and signal that price action should be monitored closely.

In Figure 1, the short-term Q-indicator of Citrix Systems helps to both identify the trending phase of the price movement and estimate the strength of the trend. It keeps you from responding to every little zigzag in the congestion periods, yet points to the developing trends.

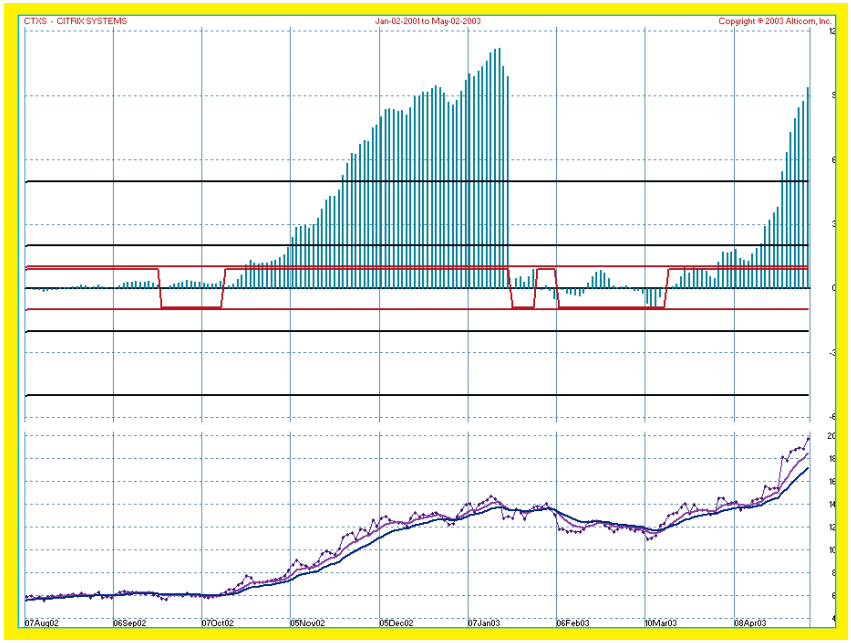

FIGURE 1: THE Q-INDICATOR. Here you see how the Q-indicator evaluates the relative strength of the trends within the semicycles, which were extracted by the seven-day and 15-day period exponential moving averages crossover rule. For convenience, the reversal indicator is built in.

THE B-INDICATOR

The Q-indicator is a centered oscillator that fluctuates around a zero line with no upper or lower limits. Another indicator that estimates trends in terms of noise is the trend-noise balance indicator (B-indicator). This indicator can be calculated by dividing the absolute value of trend by noise added to absolute value of trend, and scaling the result appropriately. The formula for the B-indicator is:

$$\text{BIndicator} = \frac{|\text{Trend}|}{|\text{Trend}| + \text{Noise}} \cdot 100$$

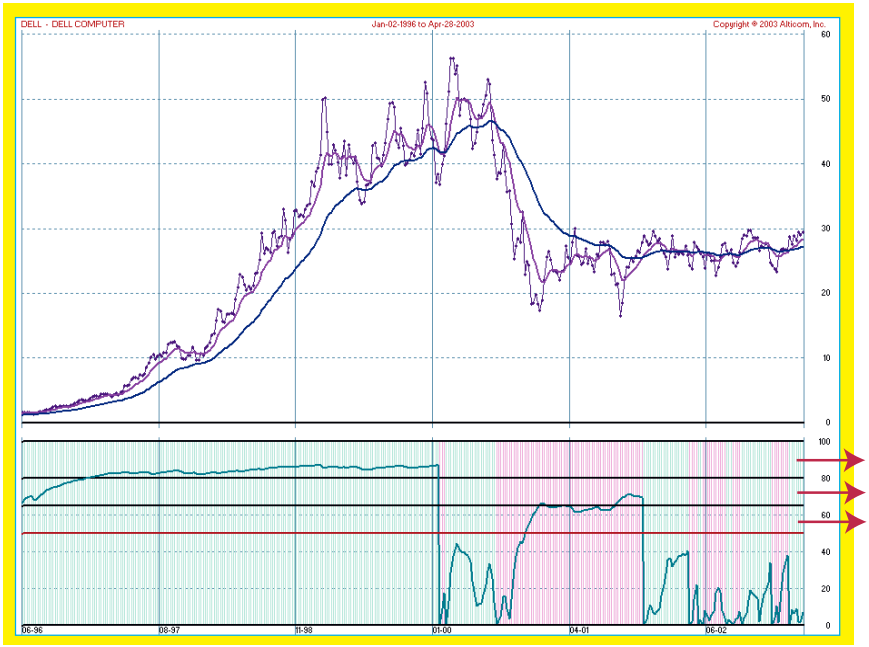

FIGURE 2: THE B-INDICATOR. Here you see that the B-indicator identifies not only up and down trending periods, but also congestion phases, which are better avoided (they tend to be unprofitable).

The B-indicator is a banded oscillator that fluctuates between zero and 100. The Q-indicator and the B-indicator both estimate the strength of a trend, but the B-indicator better identifies overbought and oversold conditions. Another distinctive feature is that the B-indicator doesn't show the direction of price movement, but only the existence of the trend and its strength. It requires additional tools for reversal manifestations.

The indicator's interpretation is simple. The central line suggests that the trend and noise are in equilibrium (trend is equal to noise). Readings in the 50–65 range indicate weak trending; those in the 65–80 range indicate moderate trending; and ranges above 80 indicate strong trending. The 65 level can be thought of as the demarcation line of trending and ranging markets and can help determine which type of technical analysis indicator (lagging or leading) is better suited to current market conditions.

Readings exceeding strong trending levels can indicate overbought or oversold conditions. Figure 2 illustrates how the long-term B-indicator of Dell Computer performs to reveal trending and congestion phases of the price movement. The built-in reversal diagram shows up and down semicycles, extracted by 10-week and 40-week exponential moving average crossovers.

Other possible modifications exist of the trend-noise balance indicator, but they are beyond the scope of this article. The moving average crossover system may be used to extract up and down semicycles of price movement for the first stage of filtering. The two indicators discussed, Q-indicator and B-indicator, may then be used to recognize trends and their strengths.

David Sepiashvili is a doctoral candidate in signal processing (Carnegie Mellon University, Pittsburgh, PA). One of the applications of his scientific efforts is financial time series analysis. He is president of Alticom Inc., which has developed a number of solutions for stock market technical analysis (www.alticom.com).

See our Traders' Tips section for program code implementing David Sepiashvili's technique.

†See Traders' Glossary for definition

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