Measuring market choppiness with chaos

Making profitable use of chaos theory in the markets has been an enticing but elusive goal for many traders. E.W. Dreiss has developed the Choppiness Index using chaos principles to measure market trendiness.

By Gibbons Burke

The science of chaos has piqued the imaginations of traders looking for an edge in the markets. Since Benoit Mandelbrot, a pioneer in chaos theory, did some of his early analysis of the cotton markets, traders have tried to find an application in the markets, but few have succeeded.

E.W. "Bill" Dreiss, a commodity trading advisor based in Australia, has used concepts from chaos theory to construct a simple measure of the "choppiness" or directionality of the market, that is, whether prices are trending or are in a period of trendless consolidation.

Several indicators already exist that perform a similar function. Welles Wilder's Directional Movement Indicator (ADX) is one of the oldest and most widely known. More recent new indicators of this type are the Random Walk Index, created by Michael Poulos of Trader's Insight and Adam White's Vertical Horizontal Filter.

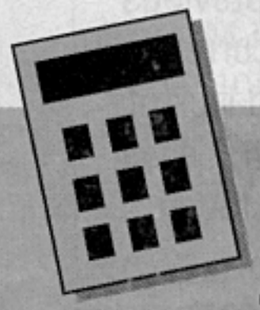
With the "Choppiness Index" (CI) Dreiss measures something akin to the "fractal dimension" of the market. Conventional Euclidean geometry describes geometric figures in terms of dimensions. Two points in space define a line, and a line has one dimension — length. Three points not on the same line define a plane which has two dimensions — length and width. Four points not on the same plane define a space which has three dimensions — length, width and depth.

New paradigm

Chaos theory says the real world is not so neatly Euclidean. While standard geometry has proven useful for measuring and quantifying the world around us, it falls short in critical areas and leads to paradoxes. Chaos theory provides a new "paradigm" for viewing the world that may be more useful. It says, among other things, that objects don't necessarily have an integral dimension, i.e. whole numbers like one, two, three or four. Rather, real world objects are more likely to have fractional or fractal dimension which may be 1.37 or 2.89.

Market prices provide a good example of fractal dimension. When prices are plotted over time on a chart, the resulting figure is by no means a one-dimensional straight line. Nor is the figure fully two-dimensional because it does not cover an area as such. However, the market exhibits times when its movement is more linear (when trends appear), and other times when its movement is more plane-filling (choppy consolidating periods). The dimension of the market price through time falls on a fractional number somewhere between one and two dimensions.

Dreiss employed this concept when he created the CI to measure the trending characteristic of the market. Higher index readings indicate the market is more choppy with fewer identifiable trends (which correspond to a fractal dimension closer to two); lower numbers indicate market prices are moving in a more linear or trendy way (and have fractal dimensions closer to one). The index can be used as a measure of market risk or volatility in a way



How to calculate CI

One advantage of the Choppiness Index over other "trendiness" indicators is its simplicity and ease of calculation. Here are the steps needed to calculate a 14-day CI. It may help to refer to the software calculations included for the exact formulas.

One Calculate the true range for each day. True range is different from a daily range (high minus the low) because it includes yesterday's close to account for days when the market moves strongly from one day to the next, creating a gap or a hole between yesterday's prices and today's prices. (Wilder introduced this concept in the seminal *New Concepts in Technical Trading Systems* where the ADX indicator also is described.) A day's true high is the greater of today's high or yesterday's close; the true low is the lower of today's low or yesterday's close. The true range for a given day is then the difference between the true high and true low.

Two For each day, sum up the last 14 (or other time frame) days' true ranges to get the total amount of "ink" for that period.

Three Find the highest true high (top of the box) and the lowest true low (bottom of the box) in the 14-day period and take the difference between them to get the height of the 14-day box.

Four Divide the sum of the true ranges (from step 2) by the 14-day range (from step 3) and take the logarithm (base 10) of the result. Divide this number by the logarithm of 14 and multiply the result by 100 to get the Choppiness Index.

For users who cannot calculate the log function, Dreiss suggests it can be dropped from the calcula-