TRIX: Triple Exponential Smoothing Oscillator

by Jack K. Hutson

Relating the use of Fourier spectrum analysis to stock or commodity data filter selection has been the subject of a number of articles in *Technical Analysis*. In particular, Warren uses Fourier, in "Optimizing TRIX: Further Analysis of Triple Exponential Smoothing" (September 1983 *Technical Analysis*), to select TRIX's filter coefficients. The problem with any exponential moving average type filter is to properly choose "alpha", the filtering constant. Warren's article was important because he was able to mathematically manipulate our TRIX algorithm to obtain its transfer function. The transfer function is an important tool in the design of filters and may be used to precisely relate cycle frequency and filter coefficients, such as "alpha" in TRIX.

TRIX is obtained by triple exponentially smoothing the logarithm of daily market closes, then taking a one day difference (momentum). In TRIX the "alpha" used for each pass through (three times) the exponential filter process is the same, thus simplifying optimization. Warren used a frequency spectrum generated by Fourier analysis of daily market closes to choose a cutoff frequency. This is an excellent example of using a frequency spectrum of past data to estimate the significance of price moves. We should be able to pinpoint where the power in a spectrum drops off and therefore where shorter cycles are not useful for trading daily price swings. This point is called the high frequency cutoff frequency. Warren explained how to convert cutoff frequency to TRIX "alpha" by the use of a chart in the above-mentioned article. The following change to my original TRIX (July 1983 *Technical Analysis*) BASIC computer subroutine eliminates the need of a chart. All that is required is the cutoff frequency in cycles per year. TRIX will then filter out all cycles that are less than the cutoff frequency.

Figure 1 shows an example of 52 weeks of pork belly closing and its associated Fourier power spectrum in figure 2. A cutoff frequency for pork bellies could also be selected by trial-and-error or simply inspecting of figure 1, but Fourier analysis is easier. The use of Fourier analysis to produce spectrum plots, for cutoff frequency selection, is best with at least 64 points of past data (daily closes), but the more data, the more consequential. Figure 2 shows that a good starting place for a cutoff frequency selection is at about line 14, which is analogous to a 36.6 day cycle (cycle length = N/P = 512/14 = 36.6 days per cycle). Figure 2 also shows a small cycle centered at 27 days (512/19) that will be filtered out, in this example, as insignificant. The cutoff frequency is calculated as follows:

 Copyright (c) Technical Analysis Inc.

$$\text{Cutoff Frequency} = \text{C.F.} = \frac{130\,P}{NM}$$

where:

P = Number of cursor positions over (e.g. 14)

N = Number of Fourier coefficients (e.g. 512)

M = Averaging interval (e.g. 3 days) this is an option added to the Fourier routine: REF: Nov/Dec 1983 *Technical Analysis)*

Example:

$$\text{C.F.} = \frac{130\,P}{NM} = \frac{130 \times 14}{512 \times 1} = 3.55$$

(Note that the averaging interval (M) used in the example was one day for no averaging.)

Figure 3 shows our TRIX oscillator using a cutoff frequency of 3.55. TRIX has filtered out yearly cycles of less than 3.55 per year and displays daily closing price movement direction. Assuming we have chosen the correct cutoff frequency, TRIX clearly shows market direction as well as important turning points.

If you are trading against the direction that TRIX is moving you are trading against the trend. Just like any other filter that smooths random noise out of market price movement, TRIX has a time lag. The advantage of an exponential filter over a simple linear weighted moving average is that its lag is relatively short. The cutoff frequency normal range for daily data usually falls between 1.00 (filters 130 day or shorter cycles) to 10.0 (filters 13 day or shorter cycles). Figure 4 is a TRIX plot overlay using Pork Bellies daily highs, and then lows, with a cutoff frequency of 10.0. TRIX reacts very fast and displays occasional leading divergence from daily price highs and lows. This is because TRIX may also be thought of as a smoothed out one day momentum.

Figure 1

Copyright (c) Technical Analysis Inc.

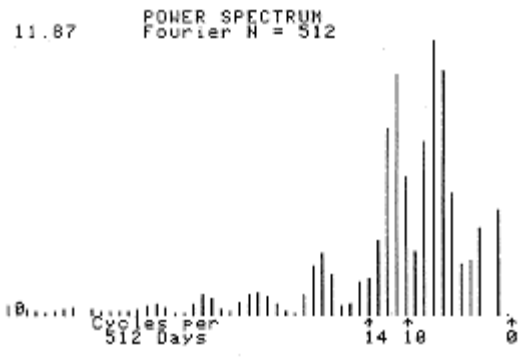

Figure 2

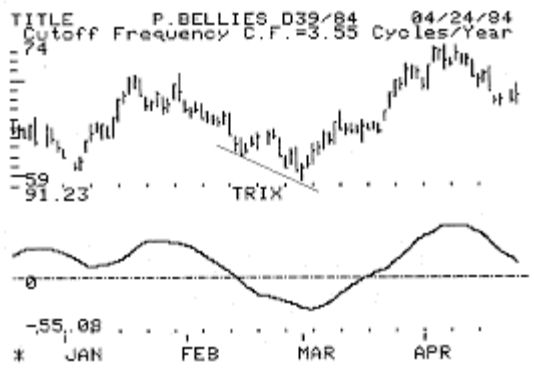

Figure 3

Copyright (c) Technical Analysis Inc.

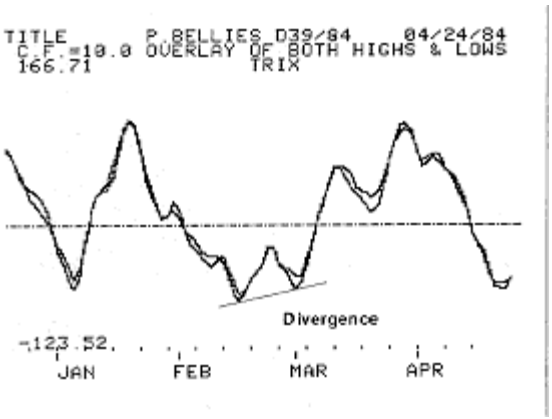

Figure 4

 Copyright (c) Technical Analysis Inc.