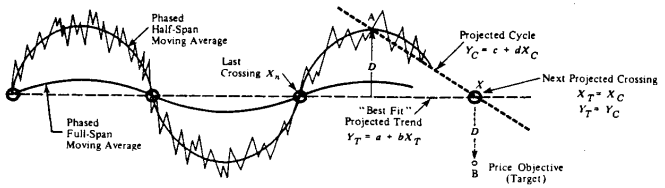
FIGURE 8-15 Finding the target price.



5. Record the highest (or lowest) values of the price since the last crossing, X_n.
6. Calculate the projection of the half-span by creating a straight line from the highest (or lowest) half-span value since the last crossing (A) to the last calculated half-span value. This equation will be $Y_C = c + dX_C$.
7. Find the point at which the projected trendline crosses the projected cyclic line by setting the equations equal to one another and solving for X and Y. At the point of crossing $(X_T, Y_T) = (X_C, Y_C)$, giving two equations in two unknowns, which is easily solvable (X is time in days; Y is price).
8. If the half-span is moving down, the maximum price reached by the commodity since the last crossing is subtracted from the Y coordinate of the projected crossing. This distance D is subtracted again from the Y coordinate to determine the price objective. If the half-span is moving up, the price objective uses the minimum price and reflects the distance above the projected crossing. It should be noted that this calculation of distance is simplified because the trend is established by a straight line; for nonlinear fits, the measurement of D will be more complicated.
9. Recalculate the moving averages, the half-span projection (6), the projected crossing (7), and price objective (8) each day until the actual crossing occurs. At that time D is fixed.
10. Follow the trading rules:
    a. Enter a new long position when the half-span moving average turns up; cover any existing short positions regardless of the price objective.
    b. Enter a new short position when the half-span moving average turns down; close out any long positions.
    c. Close out both long and short positions if the price objective is reached. An allowable error factor is considered as 10% of the height of the full cycle (lowest to highest point).

This approach to cycles should be studied carefully as an example of a complex problem solved using elementary mathematics. There are many techniques for determining trends and a number of seasonally oriented systems, but a cyclic approach is rare. Whereas Hurst's explanation is more complete and more sophisticated, the interpretation presented in this section should be considered only a reasonable approximation.

9

Charting

Nowhere can a picture be more valuable than in price forecasting. Elaborate theories and complex formulas may ultimately be successful, but the loss of perspective is rarely corrected without a simple chart. We should remember the investor who, anxious after a long technical presentation by a research analyst, could only blurt out, "But is it going up or down?" Even the most sophisticated market strategies must capture the obvious trends or countertrends. Before any trading method is used, the past buy and sell signals should be plotted on a chart. Those signals should appear at logical points; otherwise, the basis of the strategy or the testing method should be questioned.

Through the mid-1980s technical analysis was considered chart interpretation. In the equities industry that perception is still strong. Most traders begin as chartists, and many return to it or use it along with their other methods. William L. Jiler, a great trader and founder of Commodity Research Bureau, wrote:

> One of the most significant and intriguing concepts derived from intensive chart studies by this writer is that of characterization, or habit. Generally speaking, charts of the same commodity tend to have similar pattern sequences which may be different from those of another commodity. In other words, charts of one particular commodity may appear to have an identity or a character peculiar to that commodity. For example, cotton charts display many round tops and bottoms, and even a series of these constructions, which are seldom observed in soybeans and wheat. The examination of soybean charts over the years reveals that triangles are especially favored. Head and shoulders formations abound throughout the wheat charts. All commodities seem to favor certain behavior patterns.[1]

In addition to Jiler's observation, the cattle market is recognized as also having the unusual occurrence of "V" bottoms. Both the silver and pork belly markets have tendencies to look very similar, with long periods of sideways movement and short-lived, violent *price shocks*, where prices leap rather than trend to a new level. The financial markets have equally unique personalities. The S&P traditionally makes new highs, then immediately falls back; it has fast, short-lived drops and slower, steady gains. Currencies show intermediate trends bounded by noticeable major stopping levels, while long-term interest rates have long-term direction.

Charting remains a most popular and practical form for evaluating commodity price movement, and numerous works have been written on methods of interpretation. This chapter will summarize some of the accepted approaches to charting, and then consider advanced concepts of both standard charting methods and systems designed to take advantage of behavioral patterns found in charts. Some conclusions will be drawn as to what is most likely to work and why.

[1] William L. Jiler, *How Charts Are Used in Commodity Price Forecasting* (Commodity Research Publications, New York, 1977).

$$\text{CCI}_t = \frac{x_t - \bar{x}_t}{.015\text{MD}}$$

where $x_t = (H_t + L_t + C_t)/3$ is the average of the daily high, low, and close

$\bar{x}_t = \sum_{t=t-N+1}^{t} x_i$ is the moving average over the past N days

$\text{MD} = \sum_{t=t-N+1}^{t} |x_i - x|$ is the mean deviation over the past N days

N is the number of days selected (less than ¼ cycle)

Because all terms are divided by N, that value has been omitted. In the CCI calculations, the use of .015MD as a divisor scales the result so that 70% to 80% of the values fall within a +100 to −100 channel. The rules for using the CCI state that a value greater than +100 indicates a cyclic turn upward; a value lower than −100 defines a turn downward. Improvements in timing rest in the selection of N as short as possible but with a mean deviation calculation that is a consistent representation of the noise. The CCI concept of identifying cyclic turns is good because of the substantial latitude in the variance of peaks and valleys, even with regular cycles.

PHASING

One of the most interesting applications of the cyclic element of a time series is presented by J.M. Hurst in *The Profit Magic of Stock Transaction Timing* (Prentice-Hall); it is the *phasing* or synchronization of a moving average to represent cycles. This section will highlight some of the concepts and present a simplified example of the method. It is already known that to isolate the cycle from the other elements, the trending and seasonal factors should be subtracted, reducing the resulting series to its cyclic and chance parts. In many cases, the seasonal and cyclic components are similar, but the trend is unique. Hurst treats the cyclic component as the dominant component of price movement and uses a moving average in a unique way to identify the combined trend-cycle.

The system can be visualized as measuring the oscillation about a straight-line approximation of the trend (centered line), anticipating equal moves above and below. Prices have many long- and short-term trends, depending on the interval of analysis. Because this technique was originally applied to stocks, most of the examples used by Hurst are long-term trends expressed in weeks. For commodities the same technique could be used by applying the nearest futures contract on a continuous basis.

As a simple example of the concept, choose a moving average of medium length for the trending component. The *full-span* moving average may be selected by averaging the distance between the tops on a price chart. The *half-span* moving average is then equal to half the days used in the full-span average.

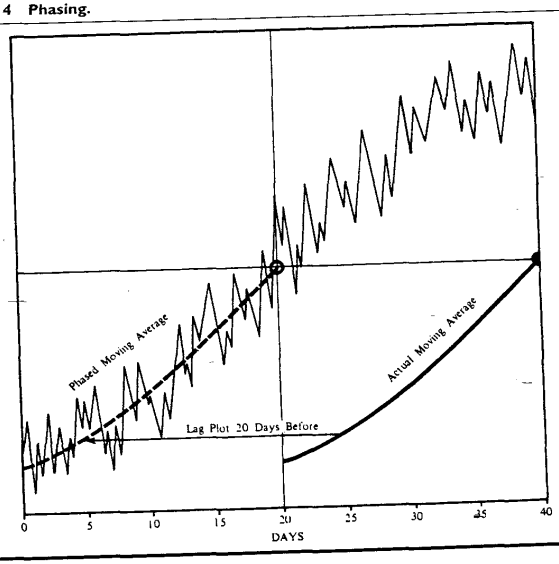
The problem with using moving averages is that they aways lag. A 40-day moving average is always 20 days behind the price movement. The current average is plotted under the most recent price, although it actually represents the price pattern if the plot were lagged by one-half the value of the average. This method applies a process called *phasing*, which aligns the tops and bottoms of the moving average with the corresponding tops and bottoms of the price movement. To phase the full- and half-span moving averages, lag each plot by half the days in the average; this causes the curve to overlay the prices (Figure 8-14). Then project the phased full- and half-span moving averages until they cross. A line or curve connecting two or more of the most recent intersections will be the major trendline. The more points used, the more complicated the regression formula for calculating

the trend; Chapter 3 discusses a variety of linear and nonlinear techniques for finding the *best fit* for these intersections. Once the trendline is calculated, it is projected as the center of the next price cycle.

With the trend identified and projected, the next step is to reflect the cycle about the trend. When the phased half-span average turns down at point A (Figure 8-15), measure the greatest distance D of the actual prices above the projected trendline. The system then anticipates the actual price crossing the trendline at point X and declining an equal distance D below the projected trendline. Once the projected crossing becomes an actual crossing, the distance D can be measured exactly and the price objective firmed. Rules for using this technique can be listed as follows:

1. Calculate the full-span moving average for the selected number of days; lag the plot by half the days. If the full-span moving average uses F days, the value of the average is calculated at $t - F/2$, where t is the current day. Call this phased point PH_t.
2. The half-span moving average is calculated for H days and plotted at $t - H/2 + PH_t$.
3. Record the points where the two phased averages PH_t and PF_t cross and call these points $X_n, X_{n-1}, \ldots$.
4. Find the trend by performing a linear regression on the crossing points X_n, $X_{n-1}, \ldots$. If a straight line, then $Y_T = a + bX_T$.

FIGURE 8-14 Phasing.



The sine wave changes phase at the rate of 9 degrees per day, completing one full cycle every 40 days.

A fast method for observing the possible results is to use weekly rather than daily data. This will be a close approximation for low-frequency waves but will be less representative for the high frequencies. Averaging the data points can yield results very similar to the daily analysis.

MAXIMUM ENTROPY

Maximum Entropy Spectral Analysis (MESA) is a technique that filters noise (*entropy*) from a time series and exposes the useful cycles;[11] it provides a very practical alternative to Fourier analysis that makes it possible to find cycles using a very small amount of data. The use of Fourier transforms requires at least 256 data points and a minimum of 16 consistent cycles of 16 bars. That would eliminate the possibility of uncovering cycles for the short-term trader.

John Ehlers describes the existence of short-term cycles as a natural phenomenon.[12] It is part of the process that causes rivers to meander back and forth as water seeks to flow in a straight line, or a drunkard who walks through an alley bumping against the walls but moving steadily forward. From these patterns, useful cycles can be found about 20% of the time.

Using the Phase Angle

In an ideal situation, in which the market cycle can be shown as a pure sine wave, the phase angle constantly increases throughout the cycle, beginning at 0 and ending at 360°. The phase angle then drops to 0 when the new cycle begins and increases again at a constant rate until it ends at 360°. This repeated pattern forms a *sawtooth* chart, as shown in Figure 8-13. Although the cycle goes from peak to value, the phase angle moves constantly in one direction.

In the practical analysis of short-term cycles, Ehlers compresses tick data into bars of equal numbers of ticks, then examines the phase for uniformity. Once found, the uniform phase, which appears as a sawtooth chart, will become erratic as the short-term cycle begins to break down, marking the end of a current market event.

Ehlers's Lateral Shift in Thinking

At first glance, the use of only a small amount of data needed by MESA seems to contradict the basic rules of statistics, which demand that results be based on as much data as possible to be reliable. But Ehlers, who has been the dominant influence in cycles since about 1990, is too knowledgeable to have made a mistake so simple. His book *MESA and Trading Market Cycles*[13] focuses on the use of short-term cycles based on short sample time periods. Instead, he has used this very attribute to apply cycles inside out.

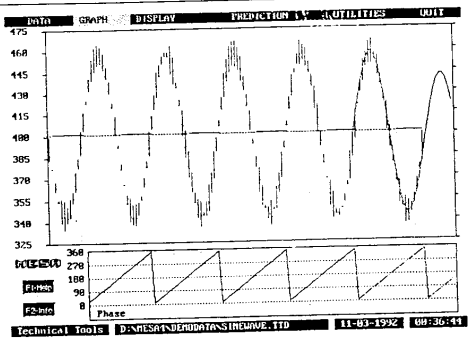
Ehlers's objective is to find very short-term cycles. By definition, these cycles must be the result of human behavior, rather than based on market economics, because fundamentals are not usually relevant to periods of only a few days, and they are not likely to have a regular pattern when they make a rare appearance. If very short-term cycles exist,

[11] Anthony Warren, "An Introduction to Maximum Entropy Method (MEM)," *Technical Analysis of Stocks & Commodities* (February 1984). See the bibliography for other articles on this topic.

[12] John F. Ehlers, "How to Use Maximum Entropy," *Technical Analysis of Stocks & Commodities* (November 1987).

[13] John F. Ehlers, *MESA and Trading Market Cycles* (John Wiley & Sons, New York, 1992).

FIGURE 8-13 The phase angle forms a sawtooth pattern.



Source: John Ehlers, "Cycle Analysis and Intraday Trading," *Technical Analysis of Stocks & Commodities*, 11, no. 4 (February 1993). © 1993 Technical Analysis, Inc. Used with permission.

they will not continue for long periods, and you must recognize them quickly if they are to be useful; therefore, short-term cycles are found by analyzing only a small amount of recent data.

Then how does it help to find a short-term cycle based on a small amount of data, if it is not statistically dependable? In a lateral shift, Ehlers uses the existence of a short-term cycle to tell if prices are in a sideways pattern or trending. If a short-term cycle exists, then the market trend should be weak. Ehlers has no interest in trading the cycle, which is surprising for a cycle expert, but prefers the dependability of the trend. He has, instead, attempted to solve one of the most difficult problems facing the analyst, trying to distinguish between a trending and sideways market. If a short-term cycle exists, then we cannot rely on the trend. Ehlers develops this method throughout his book.

CYCLE CHANNEL INDEX

A trend-following system that operates for a market with a well-defined cyclic pattern should have specific qualities that do not necessarily exist in a generalized smoothing model. To confirm the cyclic turning points, which do not often occur precisely where they are expected, a standard moving average should be used, rather than an exponentially smoothed one. Although exponential smoothing always includes some residual effect of older data, the determination of a cyclic turning point must be limited to data that is nearer to one-fourth of the period, combined with a measure of the relative noise in the series, which may obscure the turn.

These features have been combined by Lambert[14] into a *Commodity Cycle Index* (CCI), which is calculated as follows:

[14] Donald R. Lambert, "Commodity Channel Index Tools for Trading Cyclic Trends," *Commodities* (1980), reprinted in *Technical Analysis of Stocks & Commodities*.