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Chart School

# Accumulation/Distribution Line

## Introduction - Volume and the Flow of Money

There are many indicators available to measure volume and the flow of money for a particular stock, index or security. One of the most popular volume indicators over the years has been the Accumulation/Distribution Line. The basic premise behind volume indicators, including the Accumulation/Distribution Line, is that volume precedes price. Volume reflects the amount of shares traded in a particular stock and is a direct reflection of the money flowing into and out of a stock. Many times before a stock advances, there will be period of increased volume just prior to the move. Most volume or money flow indicators are designed to identify early increases in positive or negative volume flow to gain an edge before the price moves. (Note: the terms "money flow" and "volume flow" are essentially interchangeable.)

## Methodology

(Click here to see a live example of the Acc/Dist Line)

The Accumulation/Distribution Line was developed by Marc Chaikin to assess the cumulative flow of money into and out of a security. In order to fully appreciate the methodology behind the Accumulation/Distribution Line, it may be helpful to examine one of the earliest volume indicators and see how it compares.

In 1963, Joe Granville developed On Balance Volume (OBV), which was one of the earliest and most popular indicators to measure positive and negative volume flow. OBV is a relatively simple indicator that adds the corresponding period's volume when the close is up and subtracts it when the close is down. A cumulative total of the positive and negative volume flow (additions and subtractions) forms the OBV line. This line can then be compared with the price chart of the underlying security to look for divergences or confirmation.

In developing the Accumulation/Distribution Line, Chaikin took a different approach. OBV uses the change in closing price from one period to the next to value the volume as positive or negative. Even if a stock opened on the low and closed on the high, the period's OBV value would be negative as long as the close was lower than the previous period's close. Chaikin choose to ignore the change from one period to the next and instead focused on the price action for a given period (day, week, month). He derived a formula to calculate a value based on the location of the close, relative to the range for the period. We will call this value the "Close Location Value" or CLV. The CLV ranges from plus one to minus one with the center point at zero. There are basically five combinations:

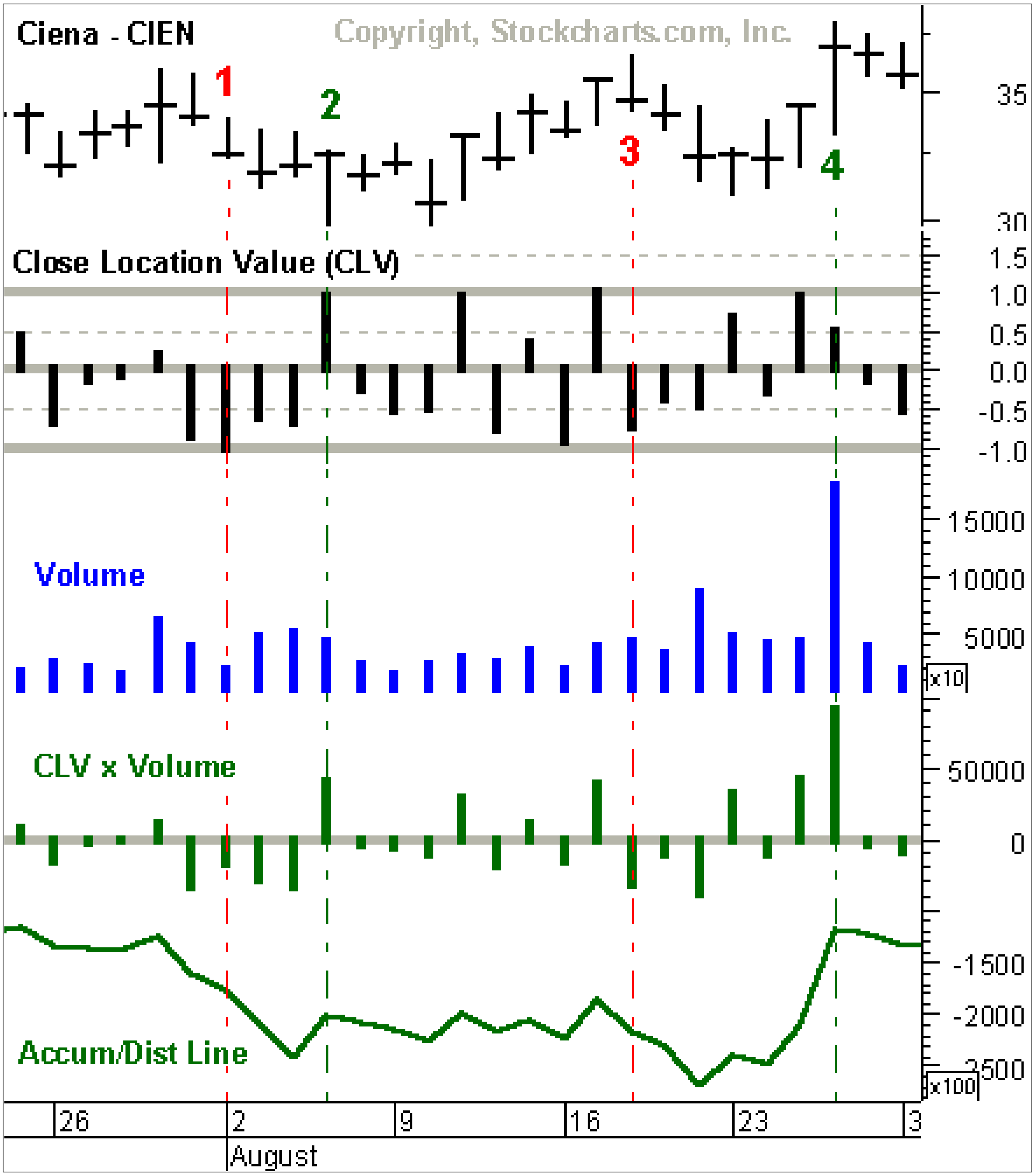
$$\left(\frac{((C-L)-(H-C))}{(H-L)}\right)=CLV$$

1. If the stock closes on the high, the absolute top of the range, then the value would be plus one.
2. If the stock closes above the midpoint of the high-low range, but below the high, then the value would be between zero and one.
3. If the stock closes exactly halfway between the high and the low, then the value would be zero.

4. If the stock closes below the midpoint of the high-low range, but above the low, then the value would be negative.
5. If the stock closes on the low, the absolute bottom of the range, then the value would be minus one.

The CLV is then multiplied by the corresponding period's volume and the cumulative total forms the Accumulation/Distribution Line.

Ciena




The daily chart of CIEN gives a breakdown of the Accumulation/Distribution Line and shows how different closing levels affect the value. The top section shows the price chart for CIEN. The closing level relative to the high-low range is clearly visible. The second section with a black histogram is the Closing Location Value (CLV). The CLV is multiplied by volume and the result appears in the green histogram. Finally, at the bottom, is the Accumulation/Distribution Line.

1. The close is on the low and the CLV = -1. Volume, however, was relatively light and the Accumulation/Distribution Value for that period is only moderately negative.
2. The close is very near the high and the CLV = +.9273. Volume is relatively high and the resulting

Accumulation/Distribution Value is high.

3. The close is near the low and the CLV = -.75. Volume is moderately high and the resulting Accumulation/Distribution Value is moderately high as well.
4. The close is about half way between the mid-point of the high-low range and the high, and the CLV = +.51. Volume is very heavy and the Accumulation/Distribution Value is also very high.

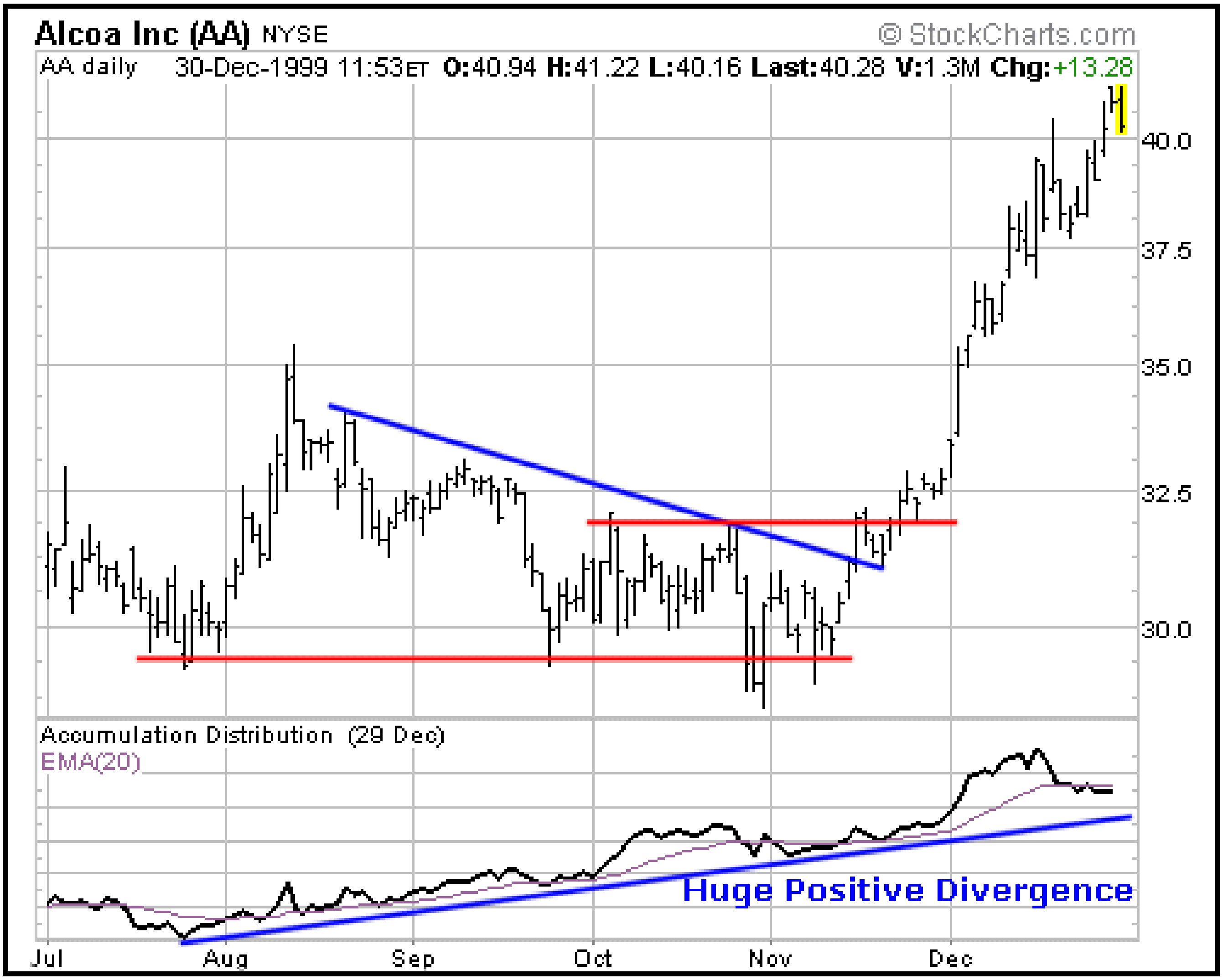
## Accumulation/Distribution Line Signals

The signals for the Accumulation/Distribution Line are fairly straightforward and center around the concepts of divergence and confirmation.

## Bullish Signals

A bullish signal is given when the Accumulation/Distribution Line forms a positive divergence. Be wary of weak positive divergences that fail to make higher reaction highs or those that are relatively young. The main issue is to identify the general trend of the Accumulation/Distribution Line. A two-week positive divergence may be a bit suspect. However, a multi-month positive divergence deserves serious attention.

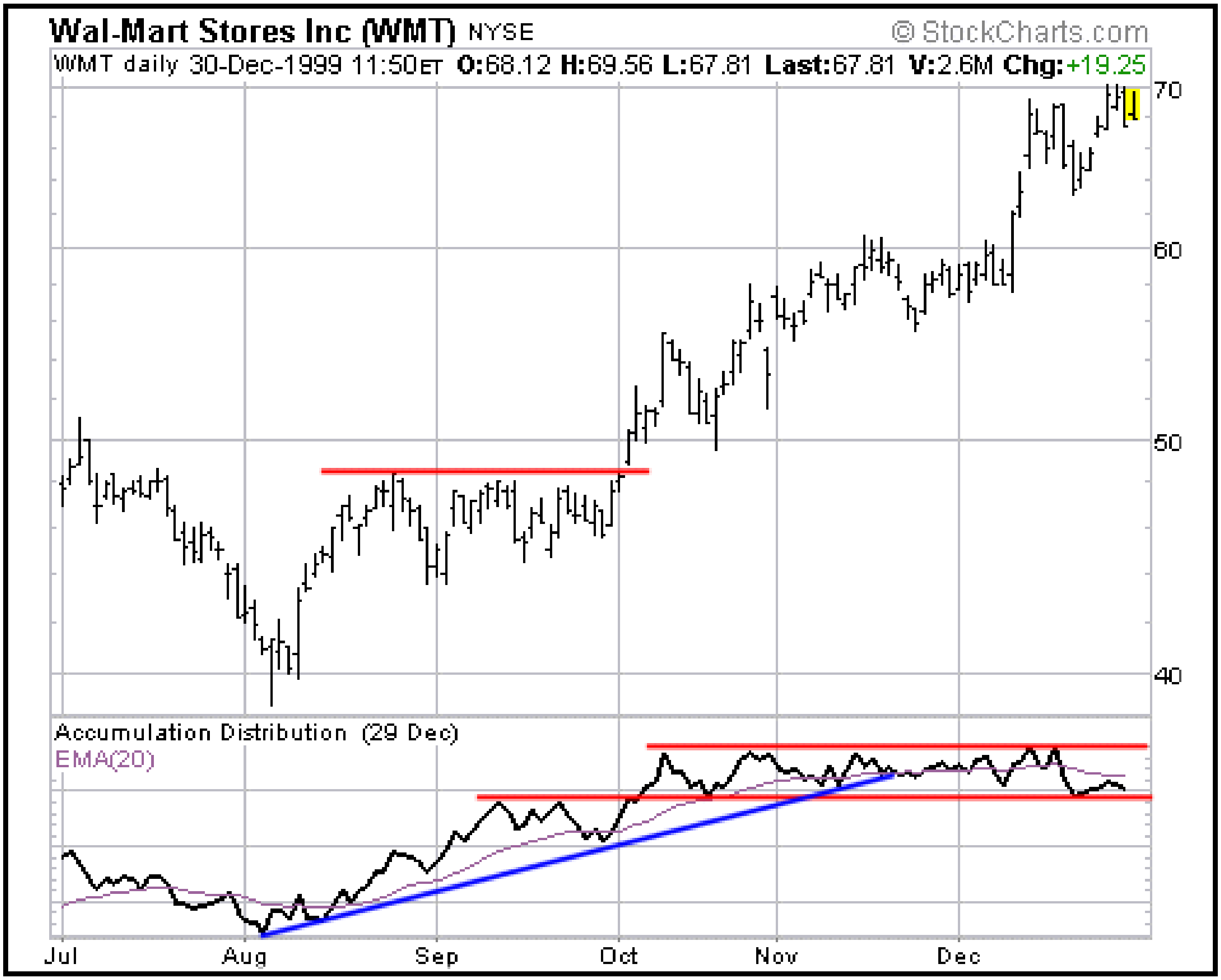
Alcoa




On the chart for AA, the Accumulation/Distribution Line formed a huge positive divergence that was over 4 months in the making. Even though the stock fell from above 35 to below 30, the Accumulation/Distribution Line continued on a relentless march north. If one did not know better, it would seem that the two plots did not belong together. However, the stock finally caught up with the Accumulation/Distribution Line when it broke resistance in November.

Another means of using the Accumulation/Distribution Line is to confirm the strength or sustainability behind an advance. In a healthy advance, the Accumulation/Distribution Line should keep up or at the very least move in an uptrend. If the stock is moving up at a rapid clip, but the Accumulation/Distribution Line has trouble making higher highs or trades sideways, it should serve as an indication that buying pressure is relatively weak.

Walmart



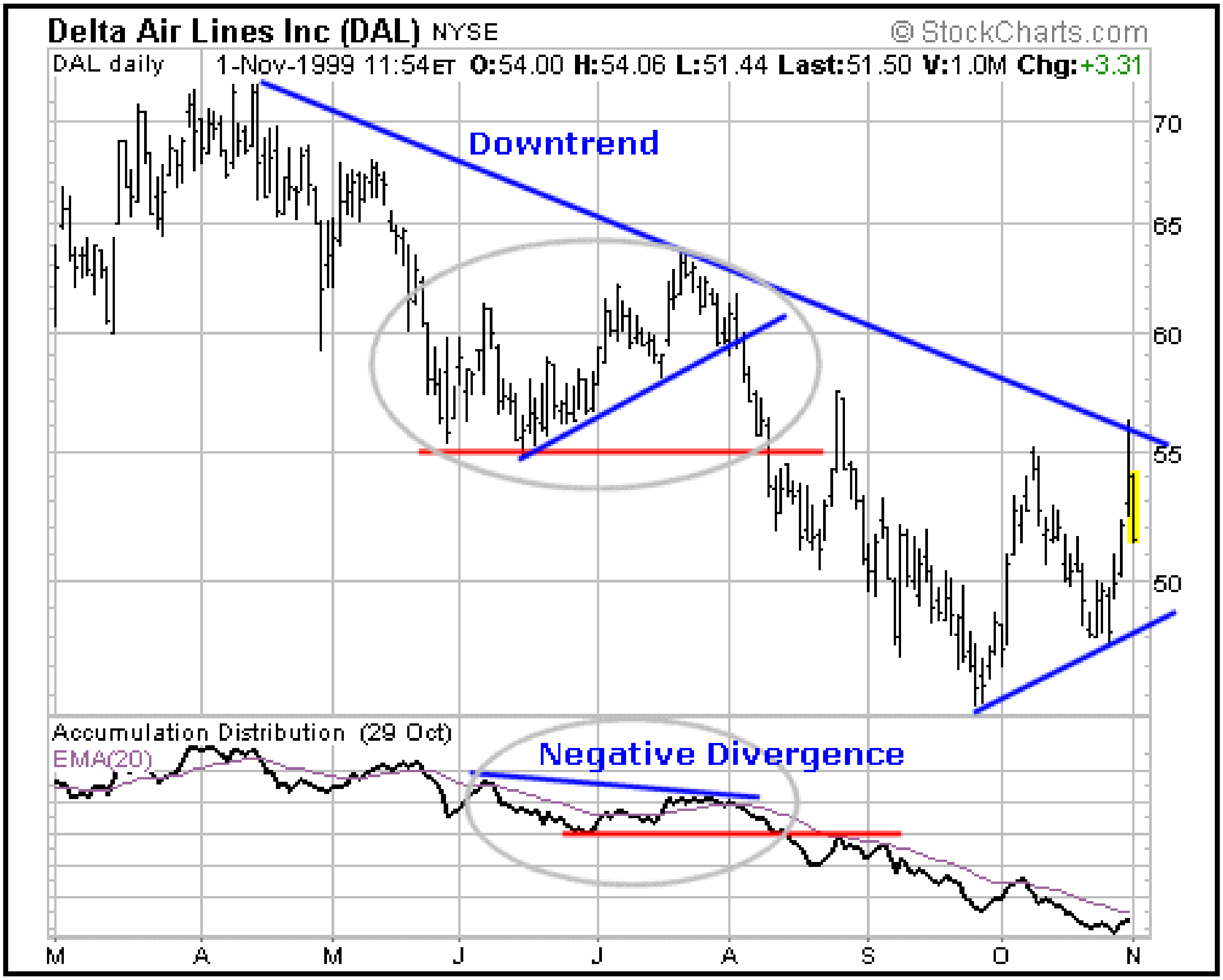

WMT began a sharp advance in August that was accompanied by an equally strong move in the Accumulation/Distribution Line. In fact, the Accumulation/Distribution Line was stronger than the stock in early September. After a bit of a consolidation, both again started higher and recorded new reaction highs in early October. Volume flows were behind this advance from the very beginning and continued throughout. The stock ended up advancing from 40 to 60 in about 3 months. Interestingly, as of this writing (December 1999) the Accumulation/Distribution Line has started to move sideways and is indicating that buying pressure is beginning to wane.

## Bearish Signals

The same principles that apply to positive divergences apply to negative divergences. The key issue is to identify the main trend in the Accumulation/Distribution Line and compare it to the underlying security. Young negative divergences, or those that are relatively flat, should be looked upon with a healthy dose of skepticism.

The WMT chart shows a relatively flat negative divergence that is just over a month old. This negative divergence has yet to make a lower low and should probably be given a little more time to mature. The relative weakness in the Accumulation/Distribution Line should serve as a sign that buying pressure is diminishing while the stock remains at lofty levels.

Delta Airlines




The DAL chart shows a negative divergence that developed within the confines of a clear downtrend. The stock had clearly broken down and the Accumulation/Distribution Line was declining in line with the stock. A deteriorating Accumulation/Distribution Line confirmed weakness in the stock. During the June-July rally, the stock recorded a new reaction high, but the Accumulation/Distribution Line failed, thus setting up the negative divergence.

## Conclusions

The Accumulation/Distribution Line is good means to measure the volume force behind a move.

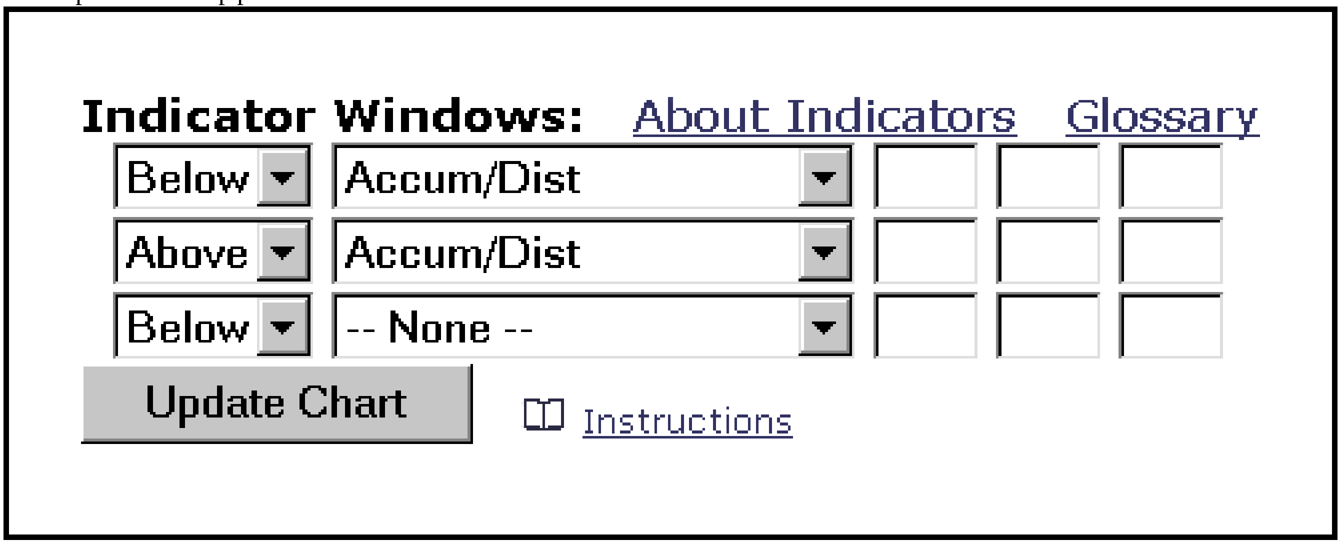
1. As a volume indicator, the Accumulation/Distribution Line will help to determine if the volume in a security is increasing on the advances or declines.
2. The Accumulation/Distribution Line can be used to gauge the general flow of money. An uptrend indicates that buying pressure is prevailing and a downtrend indicates that selling pressure is prevailing.
3. The Accumulation/Distribution Line can be used to spot divergences, both positive and negative
4. The Accumulation/Distribution Line can be used to confirm the strength and sustainability behind a move.

There are some drawbacks to the Accumulation/Distribution Line, though.

1. The indicator does not take gaps into consideration. A stock that gaps up and closes midway between the high and the low will not receive any credit for the advance off of the gap. A series of gaps could go largely undetected.
2. Because the Accumulation/Distribution Line is clearly tied to price movement, specifically the close, it will sometimes move in step with the underlying security and yield few divergences.
3. It sometimes difficult to detect subtle changes in volume flows. The rate of change in a downtrend

could be slowing, but it may be impossible to detect until the Accumulation/Distribution Line turns up. This drawback has been addressed in the form of the Chaikin Oscillator or Chaikin Money Flow, which are next in the education series.

SharpCharts application




The Accumulation/Distribution Line can be set as an indicator above or below a security's price plot. Because it is a cumulative indicator based on each individual period (day, week or month), there are no settings to adjust in the boxes to the right. By default, a 20-period EMA is included with the indicator. Generally, the indicator is strengthening while above the 20-period EMA and weakening while below.

*The next article in this education series examines the method and the madness behind the Chaikin Money Flow Oscillator*.

Written by Arthur Hill

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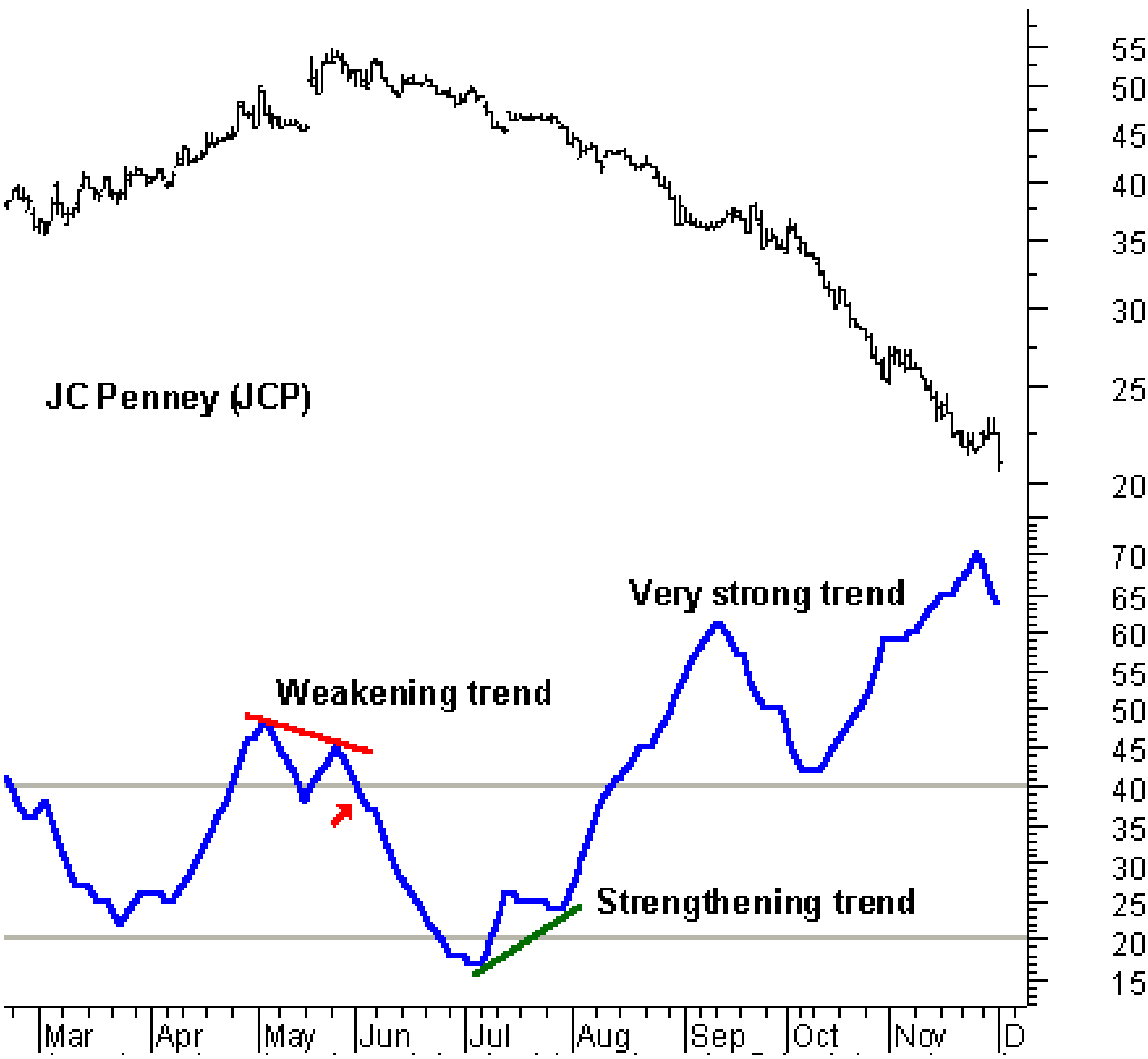
# Average Directional Index (ADX)

J. Welles Wilder Jr. developed the Average Directional Index (ADX) in order to evaluate the strength of the current trend, be it up or down. It's important to detemine whether the market is trending or trading (moving sideways), because certain indicators give more useful results depending on the market doing one or the other.

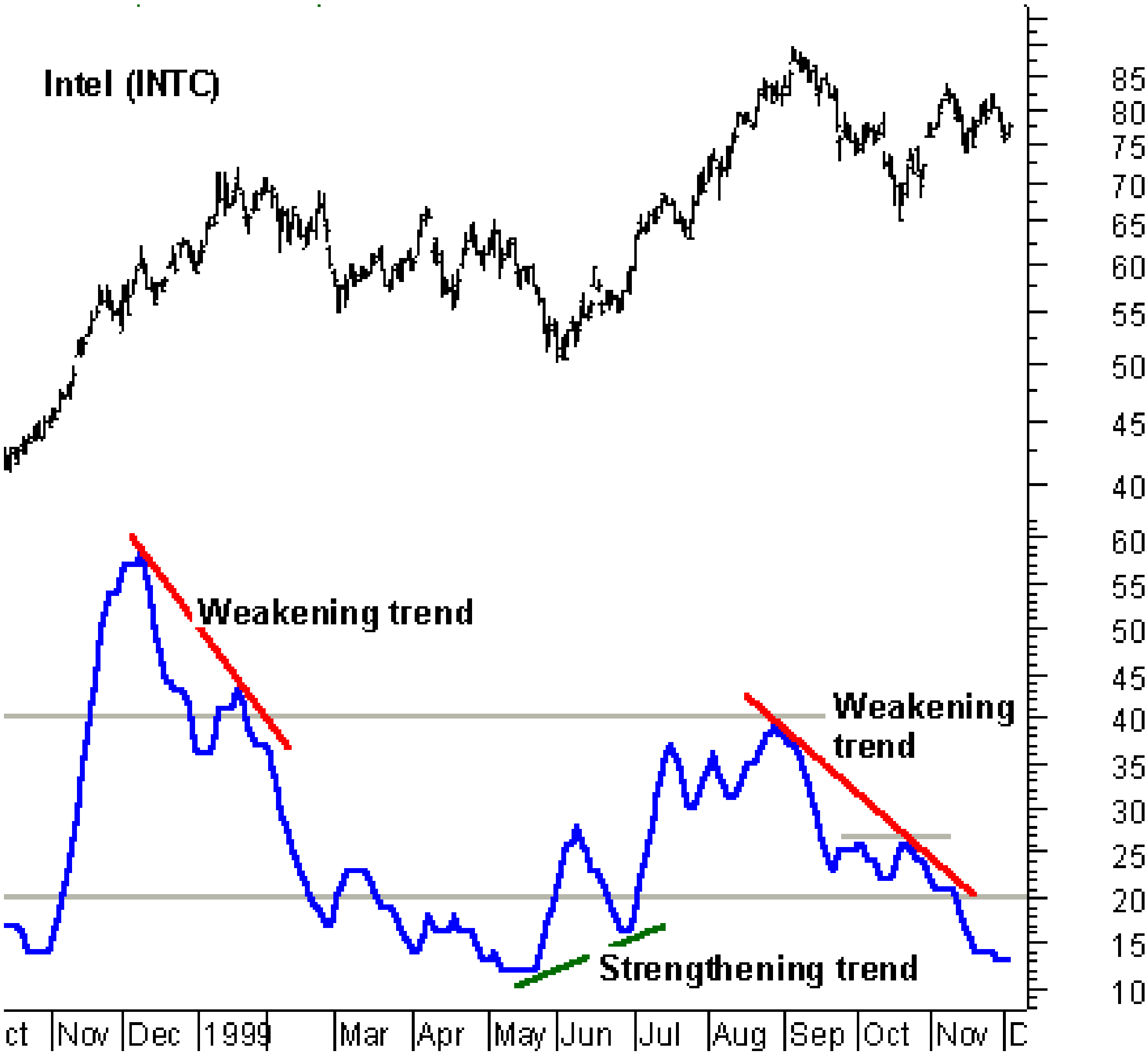
ADX is an oscillator that fluctuates between 0 and 100. Even though the scale is from 0 to 100, readings above 60 are relatively rare. Low readings, below 20, indicate a weak trend and high readings, above 40, indicate a strong trend. The indicator does not grade the trend as bullish or bearish, but merely assesses the strength of the current trend. A reading above 40 can indicate a strong downtrend as well as a strong uptrend.

ADX can also be used to identify potential changes in a market from trending to non-trending. When ADX begins to strengthen from below 20 and/or moves above 20, it is a sign that the trading range is ending and a trend could be developing.



(Click here to see a live example of ADX)

When ADX begins to weaken from above 40 and/or moves below 40, it is a sign that the current trend is losing strength and a trading range could develop.




ADX is derived from two other indicators, also developed by Wilder, called the Positive Directional Indicator (sometimes written +DI) and the Negative Directional Indicator (-DI).

More on ADX can be found in Wilder's book, New Concepts In Technical Trading Systems, written in 1978. Wilder's indicators remain some of the best and most popular indicators today.

Written by Arthur Hill

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# Average True Range (ATR)

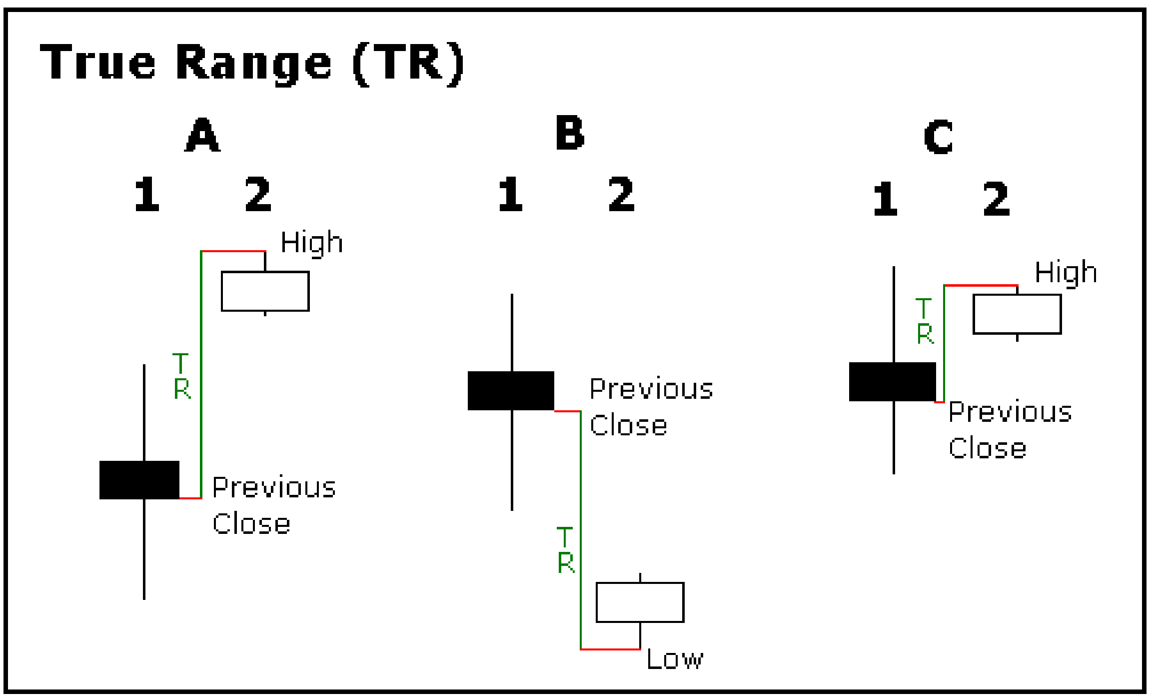
Developed by J. Welles Wilder and introduced in his book, New Concepts in Technical Trading Systems (1978), the Average True Range (ATR) indicator measures a security's volatility. As such, the indicator does not provide an indication of price direction or duration, simply the degree of price movement or volatility.

As with most of his indicators, Wilder designed ATR with commodities and daily prices in mind. In 1978, commodities were frequently more volatile than stocks. However, recent Nasdaq price action may belie that notion. In addition, commodities were (and still are) often subject to gaps and limit moves. A limit move occurs when a commodity opens up or down its maximum allowed move and does not trade again until the next session. The resulting bar or candlestick would simply be a small dash. In order to accurately reflect the volatility associated with commodities, Wilder sought to account for gaps, limit moves and small high/low ranges in his calculations. A volatility formula based on only the high/low range would fail to capture the actual volatility created by the gap or limit move.

Wilder defined the true range (TR) as the greatest of the following:

- The current high less the current low.
- The absolute value of: current high less the previous close.
- The absolute value of: current low less the previous close.

If the current high/low range is large, chances are it will be used as the TR. If the current high/low range is small, it is likely that one of the other two methods would be used to calculate the TR. The last two possibilities usually arise when the previous close is greater than the current high (signaling a potential gap down and/or limit move) or the previous close is lower than the current low (signaling a potential gap up and/or limit move). To ensure positive numbers, absolute values were applied to differences.




The example above shows three potential situations when the TR would not be based on the current high/low range. Notice that all three examples have small high/low ranges and two examples show a significant gap.

A. A small high/low range formed after a gap up. The TR was found by calculating the absolute value of the difference between the current high and the previous close.
B. A small high/low range formed after a gap down. The TR was found by calculating the absolute value of the difference between the current low and the previous close.
C. Even though the current close is within the previous high/low range, the current high/low range is quite small. In fact, it is smaller than the absolute value of the difference between the current high and the previous close, which is used

to value the TR.

Typically, the Average True Range (ATR) is based on 14 periods and can be calculated on an intraday, daily, weekly or monthly basis. For this example, the ATR will be based on daily data. Because there must be a beginning, the first TR value in a series is simply the high minus the low and the first 14-day ATR is found by averaging the daily ATR values for the last 14 days. After that, Wilder sought to smooth the data set, by incorporating the previous period's ATR value. The second and subsequent 14-day ATR value would be calculated with the following steps:

1. Multiply the previous 14-day ATR by 13.
2. Add the most recent day's TR value.
3. Divide by 14.

| Date | | Open | High | Low | Close | H - L | Absolute (H - PrevC) | Absolute (L - PrevC) | Daily TR | | 14-Day ATR | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23/10/00 | 1 | 59.4375 | 61.0000 | 59.0312 | 59.3750 | | | | 1.9688 | * | | |
| 24/10/00 | 2 | 59.6875 | 61.0000 | 58.3750 | 58.9062 | 2.6250 | 1.6250 | 1.0000 | 2.6250 | | | |
| 25/10/00 | 3 | 58.2500 | 58.8438 | 53.6250 | 54.3125 | 5.2188 | 0.0624 | 5.2812 | 5.2812 | | | |
| 26/10/00 | 4 | 54.9375 | 55.1250 | 47.4375 | 51.0000 | 7.6875 | 0.8125 | 6.8750 | 7.6875 | | | |
| 27/10/00 | 5 | 52.6953 | 54.0625 | 50.5000 | 51.5938 | 3.5625 | 3.0625 | 0.5000 | 3.5625 | | | |
| 30/10/00 | 6 | 51.0312 | 53.9688 | 49.7812 | 52.0000 | 4.1876 | 2.3750 | 1.8126 | 4.1876 | | | |
| 31/10/00 | 7 | 52.5312 | 56.0000 | 52.5000 | 55.4375 | 3.5000 | 4.0000 | 0.5000 | 4.0000 | | | |
| 01/11/00 | 8 | 54.2500 | 55.2188 | 52.6250 | 52.9375 | 2.5938 | 0.2187 | 2.8125 | 2.8125 | | | |
| 02/11/00 | 9 | 53.9062 | 55.0312 | 53.2500 | 54.5312 | 1.7812 | 2.0937 | 0.3125 | 2.0937 | | | |
| 03/11/00 | 10 | 54.3750 | 57.4922 | 53.7500 | 56.5312 | 3.7422 | 2.9610 | 0.7812 | 3.7422 | | | |
| 06/11/00 | 11 | 56.7500 | 57.0938 | 55.2500 | 55.3438 | 1.8438 | 0.5626 | 1.2812 | 1.8438 | | | |
| 07/11/00 | 12 | 54.8438 | 56.8125 | 54.3438 | 55.7188 | 2.4687 | 1.4687 | 1.0000 | 2.4687 | | | |
| 08/11/00 | 13 | 55.5000 | 55.5625 | 50.0000 | 50.1562 | 5.5625 | 0.1563 | 5.7188 | 5.7188 | | | |
| 09/11/00 | 14 | 48.9453 | 50.0625 | 46.8438 | 48.8125 | 3.2187 | 0.0937 | 3.3124 | 3.3124 | | 3.6646 | ** |
| 10/11/00 | 15 | 46.9062 | 47.6875 | 44.4688 | 44.5938 | 3.2187 | 1.1250 | 4.3437 | 4.3437 | | 3.7131 | |
| 13/11/00 | 16 | 42.5312 | 44.9062 | 40.6250 | 42.6562 | 4.2812 | 0.3124 | 3.9688 | 4.2812 | | 3.7537 | |
| 14/11/00 | 17 | 44.3125 | 47.3750 | 44.1641 | 47.0000 | 3.2109 | 4.7188 | 1.5079 | 4.7188 | | 3.8226 | |
| 15/11/00 | 18 | 47.3750 | 47.6250 | 45.1250 | 46.9688 | 2.5000 | 0.6250 | 1.8750 | 2.5000 | | 3.7282 | |
| 16/11/00 | 19 | 45.9062 | 48.0156 | 43.2500 | 43.6250 | 4.7656 | 1.0468 | 3.7188 | 4.7656 | | 3.8023 | |
| 17/11/00 | 20 | 44.3125 | 45.0391 | 42.6875 | 44.6562 | 2.3516 | 1.4141 | 0.9375 | 2.3516 | | 3.6986 | |
| 20/11/00 | 21 | 43.5938 | 43.7500 | 40.7500 | 40.8125 | 3.0000 | 0.9062 | 3.9062 | 3.9062 | | 3.7135 | |
| 21/11/00 | 22 | 41.3750 | 43.2500 | 39.9688 | 42.5625 | 3.2812 | 2.4375 | 0.8437 | 3.2812 | | 3.6826 | |
| 22/11/00 | 23 | 41.7500 | 43.0000 | 40.0000 | 40.0000 | 3.0000 | 0.4375 | 2.5625 | 3.0000 | | 3.6338 | |
| 24/11/00 | 24 | 41.5938 | 42.5000 | 40.7500 | 42.4375 | 1.7500 | 2.5000 | 0.7500 | 2.5000 | | 3.5529 | |
| 27/11/00 | 25 | 44.1797 | 44.8750 | 43.3750 | 44.0938 | 1.5000 | 2.4375 | 0.9375 | 2.4375 | | 3.4732 | |
| 28/11/00 | 26 | 44.2500 | 44.3125 | 40.0625 | 40.6250 | 4.2500 | 0.2187 | 4.0313 | 4.2500 | | 3.5287 | |
| 29/11/00 | 27 | 40.8125 | 41.2188 | 37.6250 | 39.8750 | 3.5938 | 0.5938 | 3.0000 | 3.5938 | | 3.5333 | |
| 30/11/00 | 28 | 38.1562 | 39.3750 | 36.5000 | 38.0312 | 2.8750 | 0.5000 | 3.3750 | 3.3750 | | 3.5220 | |
| 01/12/00 | 29 | 39.0000 | 40.9375 | 37.5625 | 38.4688 | 3.3750 | 2.9063 | 0.4687 | 3.3750 | | 3.5115 | |
| 04/12/00 | 30 | 38.5312 | 40.5938 | 36.9375 | 39.4375 | 3.6563 | 2.1250 | 1.5313 | 3.6563 | | 3.5219 | |
| 05/12/00 | 31 | 41.9688 | 46.0000 | 40.8438 | 45.8750 | 5.1562 | 6.5625 | 1.4063 | 6.5625 | | 3.7390 | |
| 06/12/00 | 32 | 46.6875 | 48.1250 | 42.5625 | 44.2500 | 5.5625 | 2.2500 | 3.3125 | 5.5625 | | 3.8693 | |
| 07/12/00 | 33 | 43.7500 | 45.0000 | 42.5000 | 42.8125 | 2.5000 | 0.7500 | 1.7500 | 2.5000 | | 3.7715 | |

*First TR value = (high - low)    ** First ATR value = Simple average of first 14 TR values

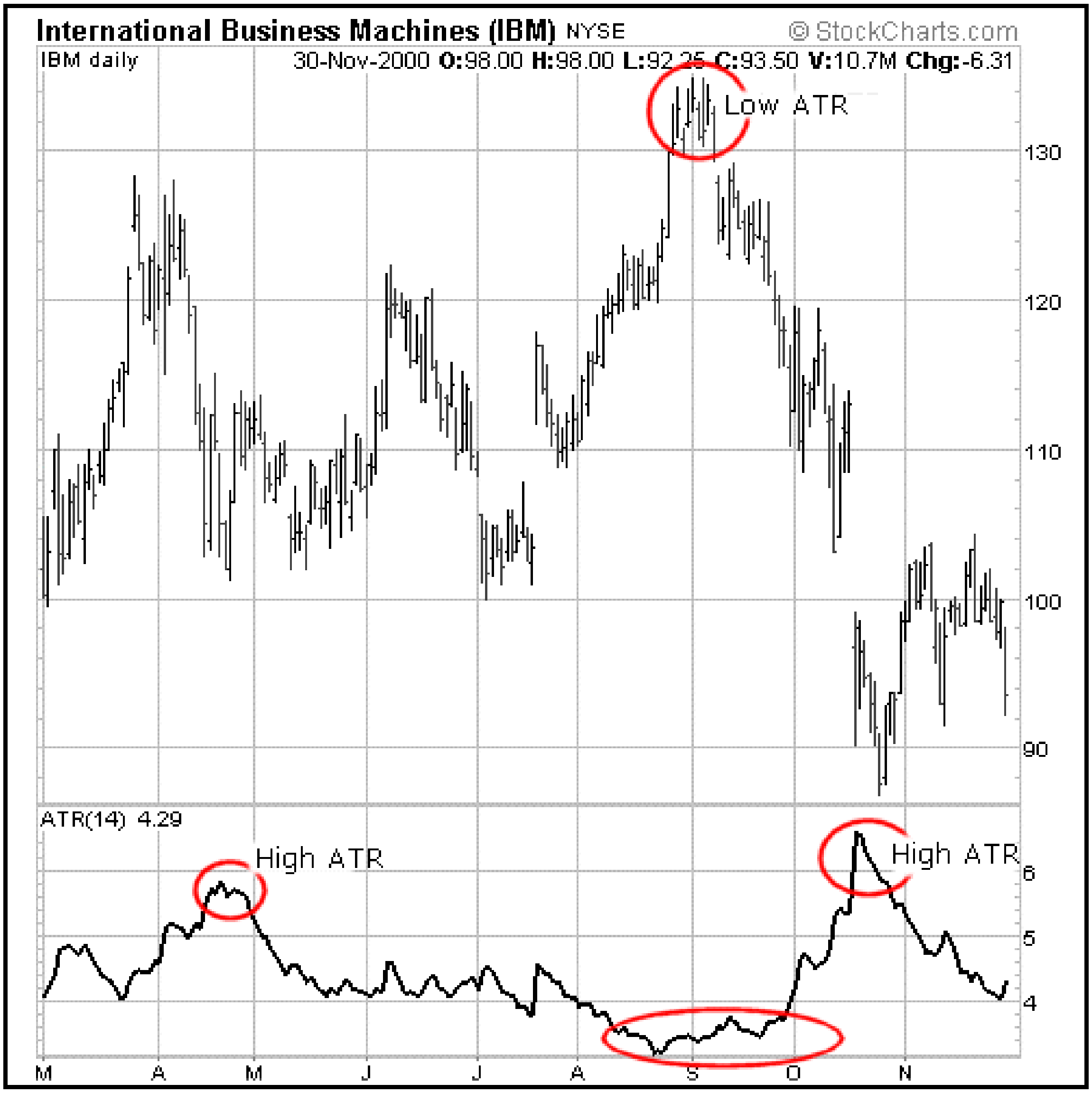
In the Excel spread sheet example above, the first TR value (1.9688) equals the high minus the low. The first 14-day ATR value (3.6646) was calculated by finding the average of first 14 TR values. The second ATR value started the smoothing process by using the previous value.


The chart above corresponds with the Excel spreadsheet calculations for Sun Microsystems from 23-Oct 2000 to 7-Dec 2000.

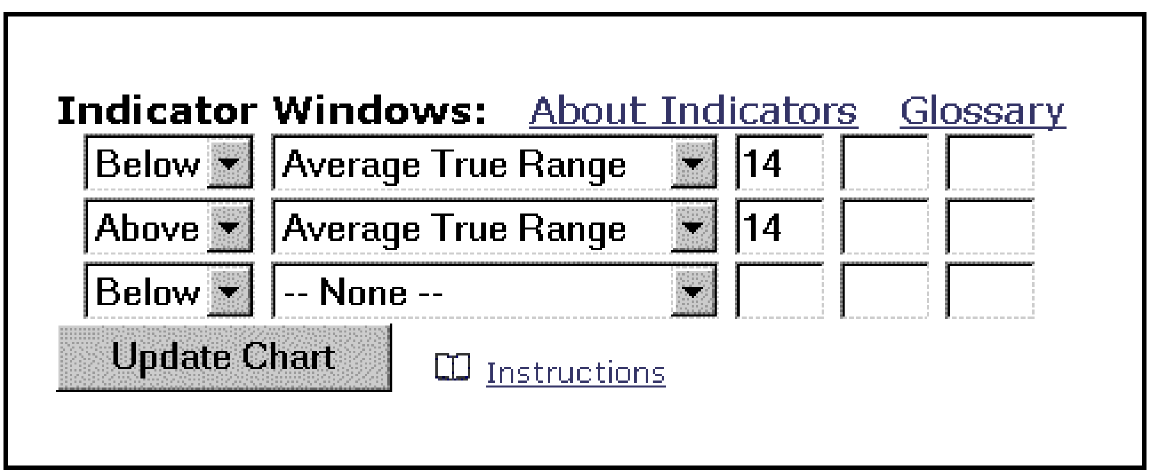
- Day 15: (( 3.6646 x 13 ) + 4.3437 ) / 14 = 3.7131
- Day 16: (( 3.7131 x 13 ) + 4.2812 ) / 14 = 3.7536

For those trying this at home, here are a few cautionary notes on calculations.

- There is always a beginning and the first calculations may not conform exactly with the formula. The first TR value is simply the high minus the low and the first ATR is a simple average of the first 14 TR values.
- Second, many indicators involve a smoothing process. In this example, the previous period's ATR is used to form the current ATR.
- This example only contains a small portion of total available price data. The size of the data set will affect the final outcome. Although the difference is not likely to be huge, a data set of 33 days will produce a different ATR value than a data set of 500 days.
- If you wish to replicate this formula, first try and duplicate the example provided using the same open/high/low/close data. Once your formulas produce answers that match the example, you can then plug in your desired open/high/low/close data.
- Due to rounding issues and decimal places, an exact match may not be possible. Also, discrepancies in the open/high/low/close data can produce different indicator values.




Example: The IBM chart provides an example of the 14-day ATR in action. Extreme levels (both high and low) can mark turning points or the beginning of a move. As a volatility-based indicator like Bollinger Bands, the ATR cannot predict direction or duration, simply activity levels. Low levels indicate quiet trading (small ranges) and high levels indicate violent trading (large ranges). A prolonged period of low ATR readings might indicate consolidation and the beginning of a continuation move or reversal. High ATR readings usually result from a sharp advance or decline and are unlikely to be sustained for extended periods.




SharpChart Application: Using SharpCharts, the ATR can be set as an indicator above or below a security's price plot. The only variable necessary is the number of periods and the first box to the right can be used to make adjustments. The default setting is 14 periods and the indicator can be used on intraday, daily, weekly or monthly charts. The scale is set in absolute (not percentage) price increments based on price changes in the selected security. The lower the price is, the smaller the scale on the ATR.

Special note: Because the ATR shows volatility as an absolute level (versus percentage), low price stocks will have lower ATR levels than high price stocks. For example, a $10 security would have a much lower ATR reading than a $200 stock. Because of this, ATR readings can be difficult to compare across a range of securities. Even for a single security, large price movements, such as a decline from 70 to 20, can make long-term ATR comparisons problematical.

Written by Arthur Hill

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# Bollinger Bands

## Overview

Developed by John Bollinger, Bollinger Bands are an indicator that allows users to compare volatility and relative price levels over a period time. The indicator consists of three bands designed to encompass the majority of a security's price action.

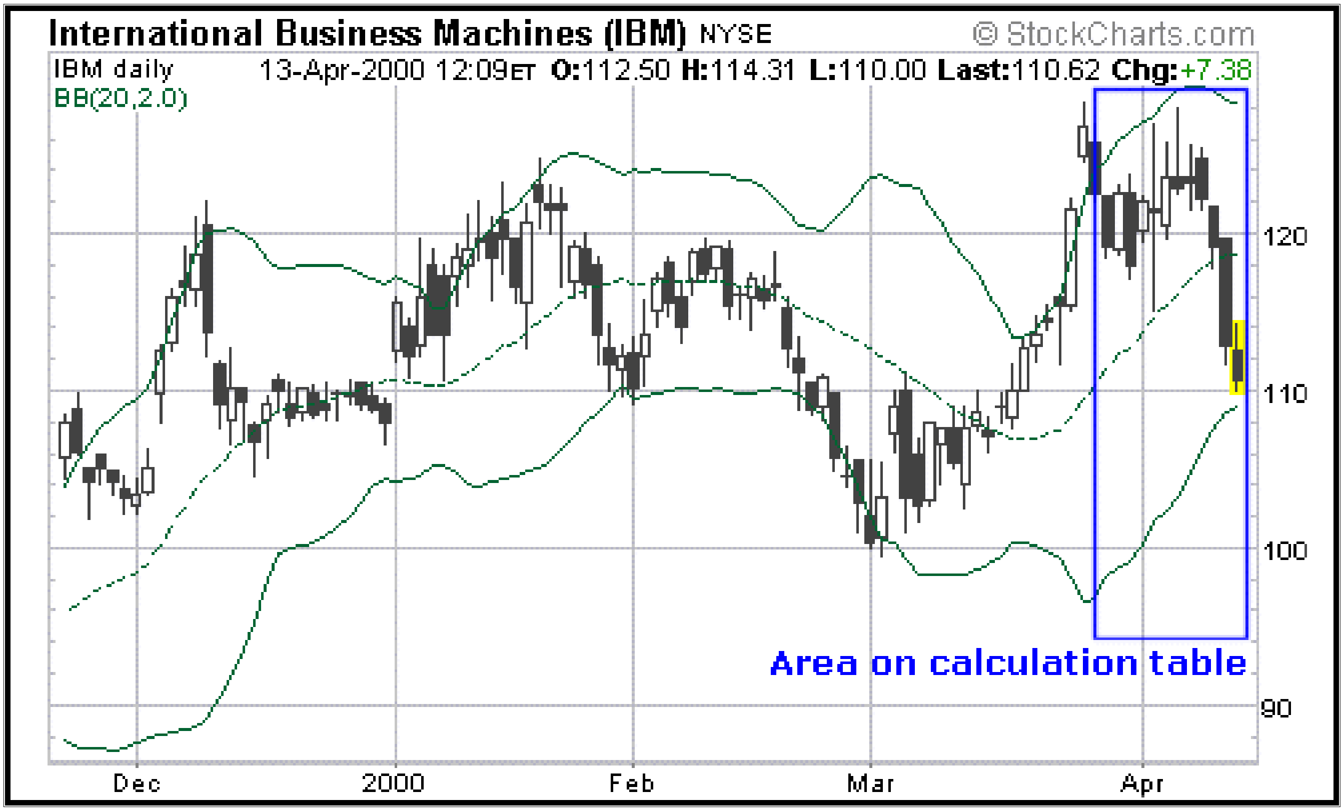
1. A simple moving average in the middle
2. An upper band (SMA plus 2 standard deviations)
3. A lower band (SMA minus 2 standard deviations)

Standard deviation is a statistical term that provides a good indication of volatility. Using the standard deviation ensures that the bands will react quickly to price movements and reflect periods of high and low volatility. Sharp price increases (or decreases), and hence volatility, will lead to a widening of the bands.

## Formula

| | Close | 20-day SMA | StdDev | 2 x StdDev | Upper Band | Middle Band | Lower Band |
|---|---|---|---|---|---|---|---|
| 1 | 103.13 | | | | | | |
| 2 | 109.00 | | | | | | |
| 3 | 103.06 | | | | | | |
| 4 | 102.75 | | | | | | |
| 5 | 108.00 | | | | | | |
| 6 | 107.56 | | | | | | |
| 7 | 105.25 | | | | | | |
| 8 | 107.69 | | | | | | |
| 9 | 108.63 | | | | | | |
| 10 | 107.00 | | | | | | |
| 11 | 109.00 | | | | | | |
| 12 | 110.00 | | | | | | |
| 13 | 112.75 | | | | | | |
| 14 | 113.50 | | | | | | |
| 15 | 114.25 | | | | | | |
| 16 | 115.25 | | | | | | |
| 17 | 121.50 | | | | | | |
| 18 | 126.88 | | | | | | |
| 19 | 122.50 | | | | | | |
| 20 | 119.00 | 111.33 | 6.64 | 13.29 | 124.62 | 111.33 | 98.05 |
| 21 | 122.50 | 112.30 | 6.79 | 13.57 | 125.88 | 112.30 | 98.73 |
| 22 | 118.00 | 112.75 | 6.85 | 13.70 | 126.46 | 112.75 | 99.05 |
| 23 | 122.00 | 113.70 | 6.75 | 13.51 | 127.21 | 113.70 | 100.19 |
| 24 | 121.19 | 114.62 | 6.45 | 12.90 | 127.52 | 114.62 | 101.73 |
| 25 | 123.63 | 115.40 | 6.54 | 13.09 | 128.49 | 115.40 | 102.31 |
| 26 | 122.75 | 116.16 | 6.47 | 12.94 | 129.11 | 116.16 | 103.22 |
| 27 | 123.13 | 117.06 | 6.13 | 12.26 | 129.31 | 117.06 | 104.80 |
| 28 | 122.13 | 117.78 | 5.82 | 11.65 | 129.43 | 117.78 | 106.13 |
| 29 | 119.00 | 118.30 | 5.44 | 10.87 | 129.17 | 118.30 | 107.43 |
| 30 | 112.69 | 118.58 | 4.97 | 9.93 | 128.51 | 118.58 | 108.65 |
| 31 | 110.63 | 118.66 | 4.82 | 9.64 | 128.30 | 118.66 | 109.03 |

IBM




(Click here to see a live example of Bollinger Bands)

The centerline is the 20-day simple moving average. The upper band is the 20-day simple moving average plus 2 standard deviations. The lower band is the 20-day simple moving average less 2 standard deviations.

## Settings

Closing prices are most often used to compute Bollinger Bands. Other variations, including typical and weighted prices, can also be used.

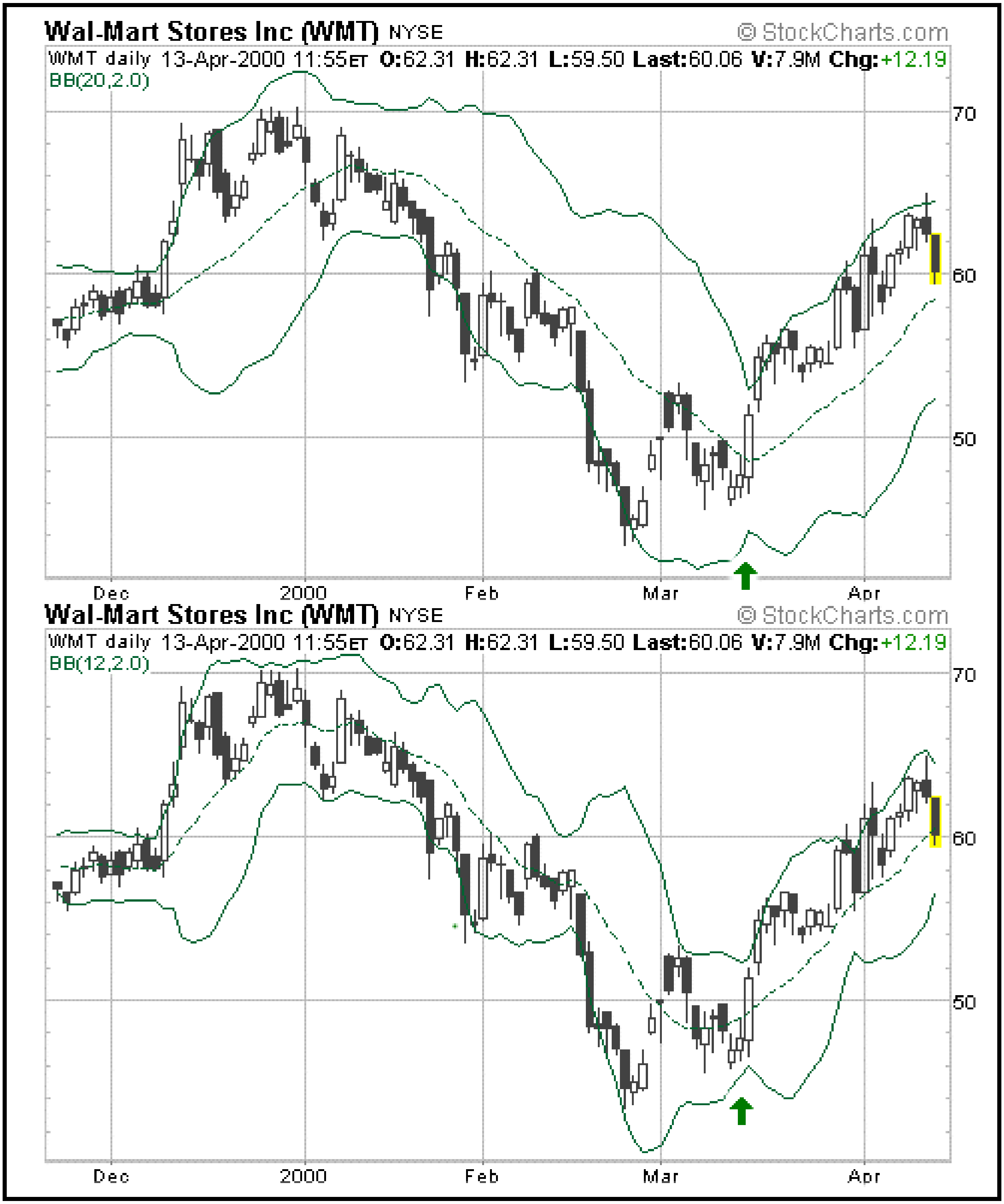
- Typical Price = (high + low + close)/3
- Weighted Price = (high + low + close + close)/4

Bollinger recommends using a 20-day simple moving average for the center band and 2 standard deviations for the outer bands. The length of the moving average and number of deviations can be adjusted to better suit individual preferences and specific characteristics of a security.

Trial and error is one method to determine an appropriate moving average length. A simple visual assessment can be used to determine the appropriate number of periods. Bollinger Bands should encompass the majority of price action, but not all. After sharp moves, penetration of the bands is normal. If prices appear to penetrate the outer bands too often, then a longer moving average may be required. If prices rarely touch the outer bands, then a shorter moving average may be required.

A more exact method to determine moving average length is by matching it with a reaction low after a bottom. For a bottom to form and a downtrend to reverse, a security needs to form a low that is higher than the previous low. Properly set Bollinger Bands should hold support established by the second (higher) low. If the second low penetrates the lower band, then the moving average is too short. If the second low remains above the lower band, then the moving average is too long. The same logic can be applied to peaks and reaction rallies. The upper band should mark resistance for the first reaction rally after a peak.

Walmart




For WMT, a 20-period simple moving average proved to be a bit too long for the Bollinger Bands. Notice the wide gap between the lower band and the higher low in March. Through trial and error, a 12-period simple moving average appears to offer a better fit.

For general timeframes, Bollinger recommends a 10-day moving average for the short term, a 20-day moving average for the intermediate term and 50-day moving average for the long term.

## Use

In addition to identifying relative price levels and volatility, Bollinger Bands can be combined with price action and other indicators to generate signals and foreshadow significant moves.

Double bottom buy: A double bottom buy signal is given when prices penetrate the lower band and remain above the lower band after a subsequent low forms. Either low can be higher or lower than the other. The important thing is that the second low remains above the lower band. The bullish setup is confirmed when the price moves above the middle band, or simple moving average.

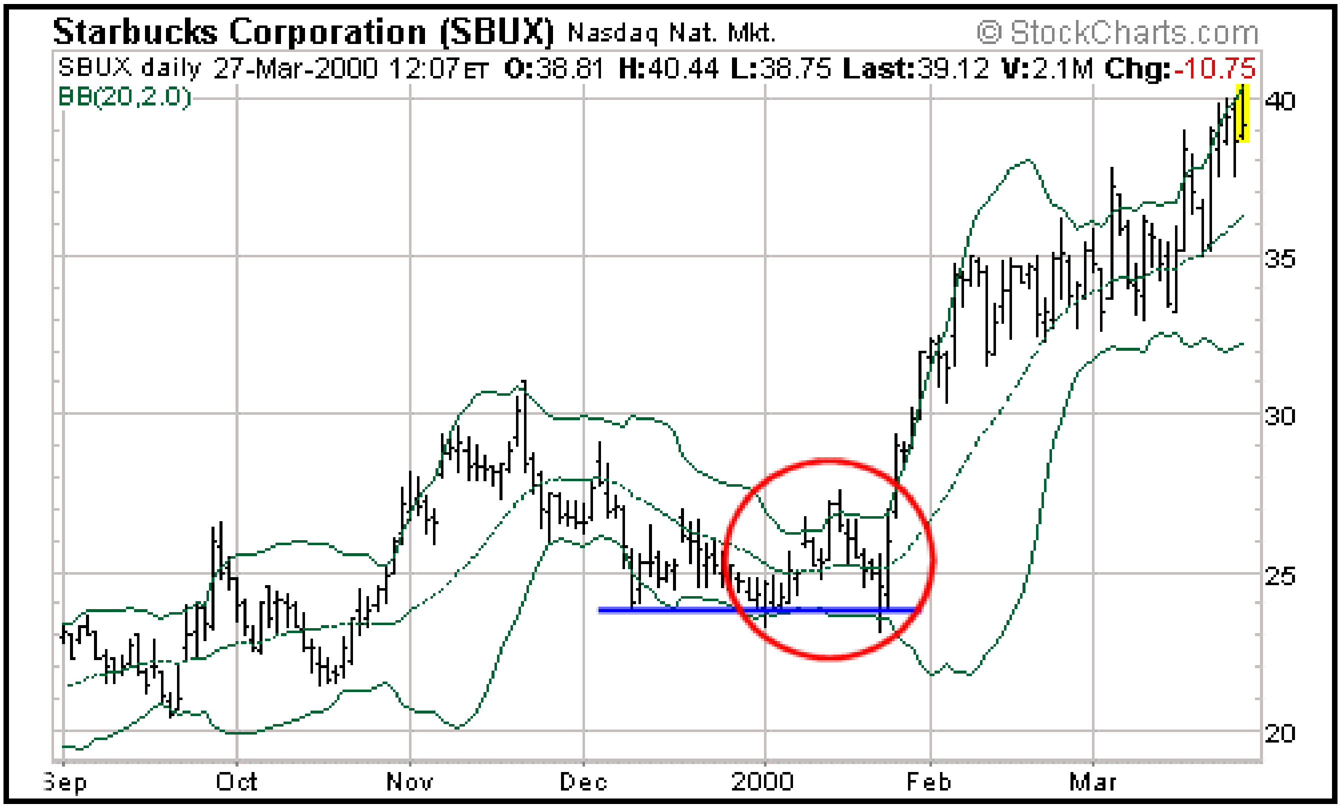
AT&T


T provides an example of a double bottom buy signal. The stock penetrated the lower band in late September (red arrow) and then held above on the subsequent test in October. The October breakout above the middle band (green circle) provided the bullish confirmation.

Double top sell: A sell signal is given when prices peak above the upper band and a subsequent peak fails to break above the upper band. The bearish setup is confirmed when prices decline below the middle band.

Sharp price changes can occur after the bands have tightened and volatility is low. In this instance, Bollinger Bands do not give any hint as to the future direction of prices. Direction must be determined using other indicators and aspects of technical analysis. Many securities go through periods of high volatility followed by periods of low volatility. Using Bollinger Bands, these periods can be easily identified with a visual assessment. Tight bands indicate low volatility and wide bands indicate high volatility. Volatility can be important for options players because options prices will be cheaper when volatility is low.

Starbucks




SBUX provides an example of the bands tightening before a big move. In November, the bands were relatively wide and began to tighten over the next 2 months. By early January, the bands were the tightest in over 4 months (red circle). A little over a week later, the stock exploded for a 10+ point gain in less than 2 weeks.

## Conclusions

Even though Bollinger Bands can help generate buy and sell signals, they are not designed to determine the future direction of a security. The bands were designed to augment other analysis techniques and indicators. By themselves, Bollinger Bands serve two primary functions:

- To identify periods of high and low volatility
- To identify periods when prices are at extreme, and possibly unsustainable, levels.

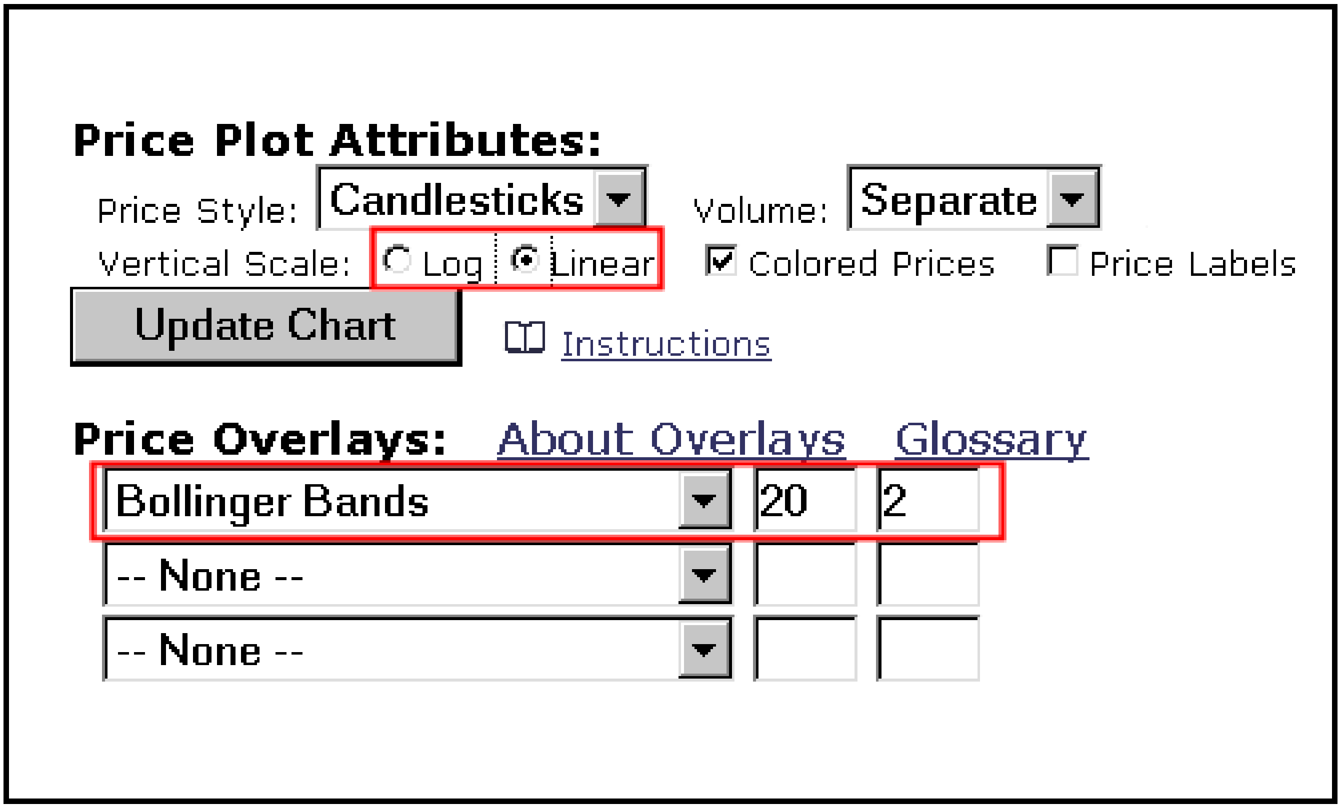
As stated above, securities can fluctuate between periods of high volatility and low volatility. Being able to identify a period of low volatility can serve as an alert to monitor the price action of a security. Other aspects of technical analysis, such as momentum, moving averages and retracements, can then be employed to help determine the direction of the potential breakout.

Remember that buy and sell signals are not given when prices reach the upper or lower bands. Such levels merely indicate that prices are high or low on a relative basis. A security can become overbought or oversold for an extended period of time. Knowing whether or not prices are high or low on a relative basis can enhance our interpretation of other indicators and assist with timing issues in trading.

## SharpChart Application

As a SharpChart indicator, Bollinger Bands can be found in the price overlays section. The first box sets the number of days for the simple moving average, which is the middle band. The second box sets the number of standard deviations above and below the simple moving average to set the upper and lower bands. The default setting is a 20-day simple moving average with the upper and lower bands set 2 standard deviations above and below. Both settings can be changed and users are encouraged to experiment.

Starbucks




Sometimes when using the log scale, the lower band will exceed the price scale and become cut off. To alleviate this, change the scale setting from "log" to "linear."

Written by Arthur Hill

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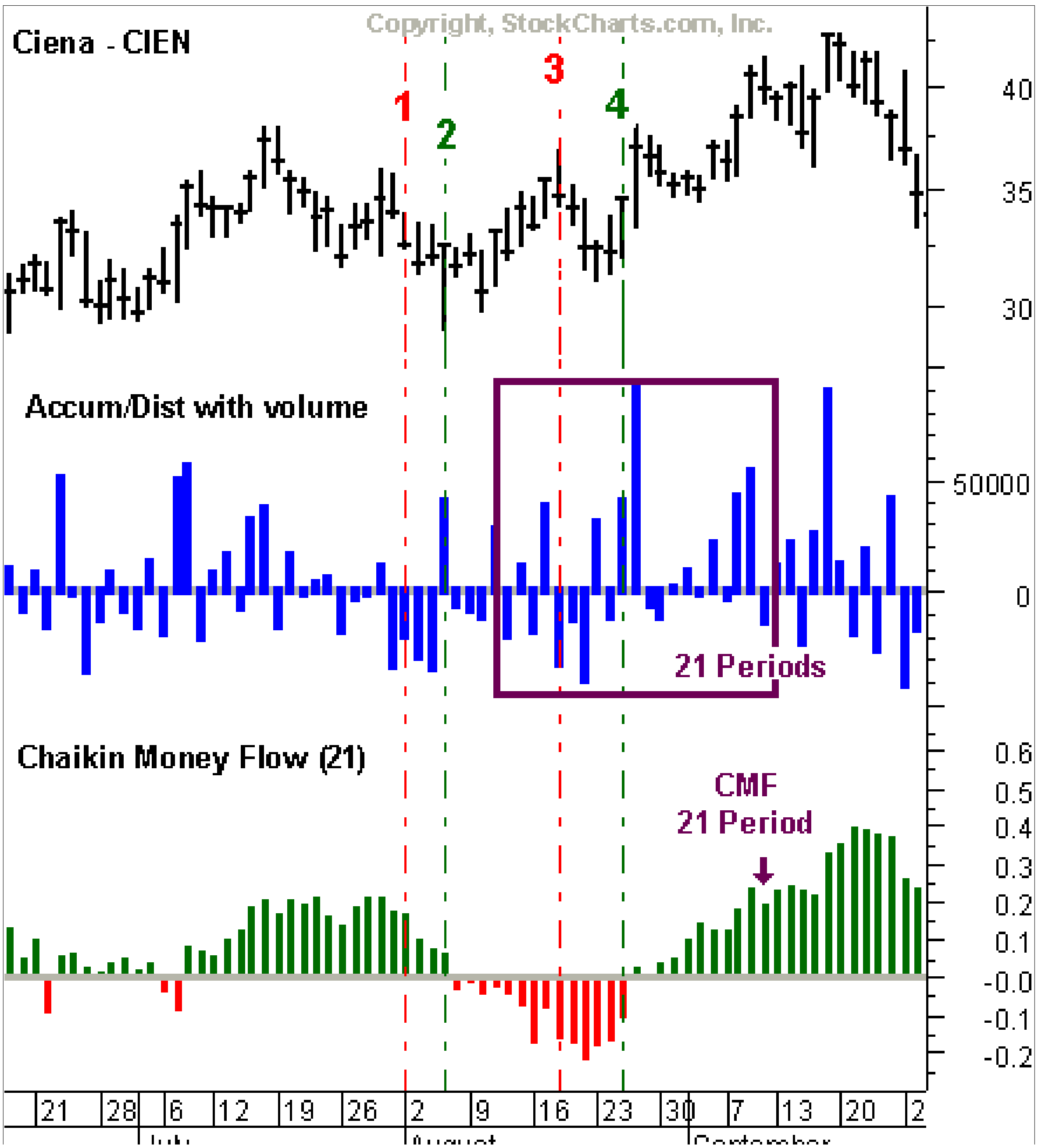
Chart School

# Chaikin Money Flow Part 1

## Introduction

Developed by Marc Chaikin, the Chaikin Money Flow oscillator is calculated from the daily readings of the Accumulation/Distribution Line. The basic premise behind the Accumulation Distribution Line is that the degree of buying or selling pressure can be determined by the location of the close relative to the high and low for the corresponding period (Closing Location Value). There is buying pressure when a stock closes in the upper half of a period's range and there is selling pressure when a stock closes in the lower half of the period's trading range. The Closing Location Value multiplied by volume forms the Accumulation/Distribution Value for each period. (See our Chart School article for a detailed analysis of the Accumulation/Distribution Line.)

Ciena




(Click here to see a live example of CMF)

## Methodology

The CIEN chart details the breakdown of the daily Accumulation/Distribution Values and how they relate to Chaikin Money Flow. The formula for Chaikin Money Flow is the cumulative total of the Accumulation/Distribution Values for 21 periods divided by the cumulative total of volume for 21 periods.

On the CIEN chart, the purple box encloses 21 days of Accumulation/Distribution Values. The total of these 21 days divided by the total for the 21 days of volume forms the value of Chaikin Money Flow at the end of that day (purple arrow). To calculate the next day, the Accumulation/Distribution Value from the first day is removed and the value for the next day is entered into the equation.

The number of periods can be changed to best suit a particular security and timeframe. The 21-day Chaikin Money Flow is a good representation of the buying and selling pressure for the past month. A month is long enough to filter out the random noise. By using a longer timeframe, the indicator will be less volatile and be less prone to whipsaws. For weekly and monthly charts, a shorter timeframe is usually suitable.

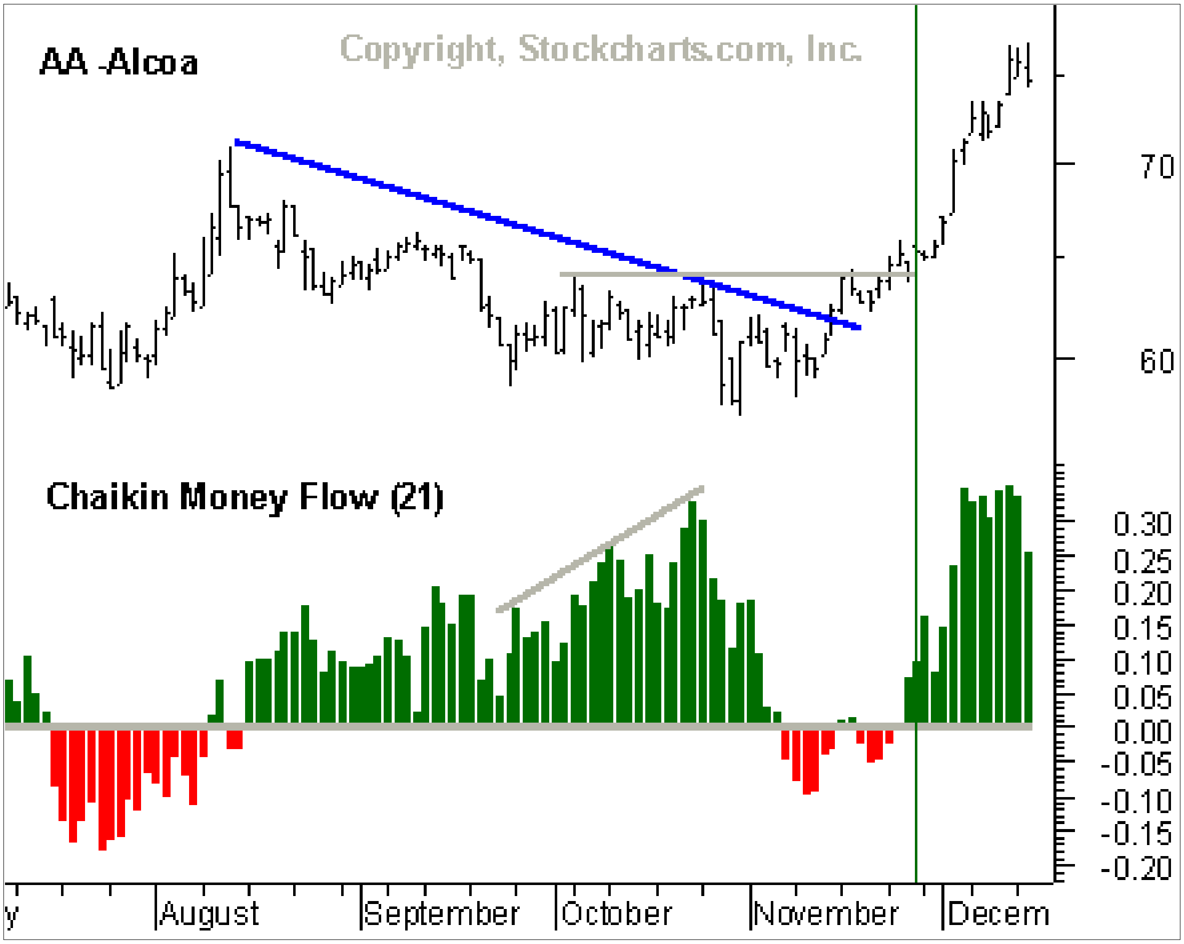
Generally speaking, Chaikin Money Flow is considered bullish when it is positive and bearish when it is negative. The next item to assess is the length of time Chaikin Money Flow has remained positive or negative. Even though divergences are not an intricate part of the strategy behind Chaikin Money Flow, the absolute level and general direction of the oscillator can be important.

## Accumulation Indications

The Chaikin Money Flow oscillator generates bullish signals by indicating that a security is under accumulation. There are three items that determine if a security is under accumulation and the strength of the accumulation.

1. The first and most obvious signal to look for: is Chaikin Money Flow greater than zero? It is an indication of buying pressure and accumulation when the indicator is positive
2. The second item: determine how long the oscillator has been able to remain above zero. The longer the oscillator remains above zero, the more evidence there is that the security is under sustained accumulation. Extended periods of accumulation or buying pressure are bullish and indicate that sentiment towards the security remains positive.
3. The third indication: the actual level of the oscillator. Not only should the oscillator remain above zero, but it should also be able to increase and attain a certain level. The more positive the reading is, the more evidence of buying pressure and accumulation. There is such a thing as weak buying! This is usually a judgment call, based on prior levels for the oscillator.

Alcoa




On the chart for AA, Chaikin Money Flow actually strengthened while the stock continued to decline. For most of October, the stock traded flat while Chaikin Money Flow remained positive and continued to strengthen. The accumulation levels, as evidenced by Chaikin Money Flow, were very strong in October. The stock fell at the end of October and Chaikin Money Flow declined in November. When the stock fell, distribution levels never surpassed -.10, indicating that selling pressure was not that intense. In late November, the stock managed a comeback and broke resistance at 64. Chaikin Money Flow formed a higher low and returned to positive territory to confirm the breakout. Selling pressure dried up quickly and Chaikin Money Flow was able to bounce back in strong fashion. The evidence is clearly bullish, but to capitalize a trader would have had to act fast.

AOL


The chart for AOL is a bit different. The stock formed a double bottom in August and September while Chaikin Money Flow formed a rather large positive divergence. This divergence was not a signal, but would have served as an alert that the selling pressure was decreasing. Divergences can be difficult to act on and should be used in conjunction with other aspects of technical analysis. By the time the stock broke resistance at 52, Chaikin Money Flow has moved from a mildly bearish levels just above -.10 to moderately bullish levels just above +.13. The interesting point about AOL is the period from 28-Sept to 22-Oct (gray lines). During this period, the stock traded sideways, but Chaikin Money Flow continued to strengthen as buying pressure intensified. The oscillator moved from +.1208 on 28-Sept to +.2377 on 22-Oct. Buying pressure has nearly doubled. This was a clearly bullish indication and the stock soon obliged with an advance from the low fifties to over 90.

*In Part 2, we examine how Chaikin Money Flow measures distribution or selling pressure and offer some strategies for using the oscillator with other indicators.*

Written by Arthur Hill

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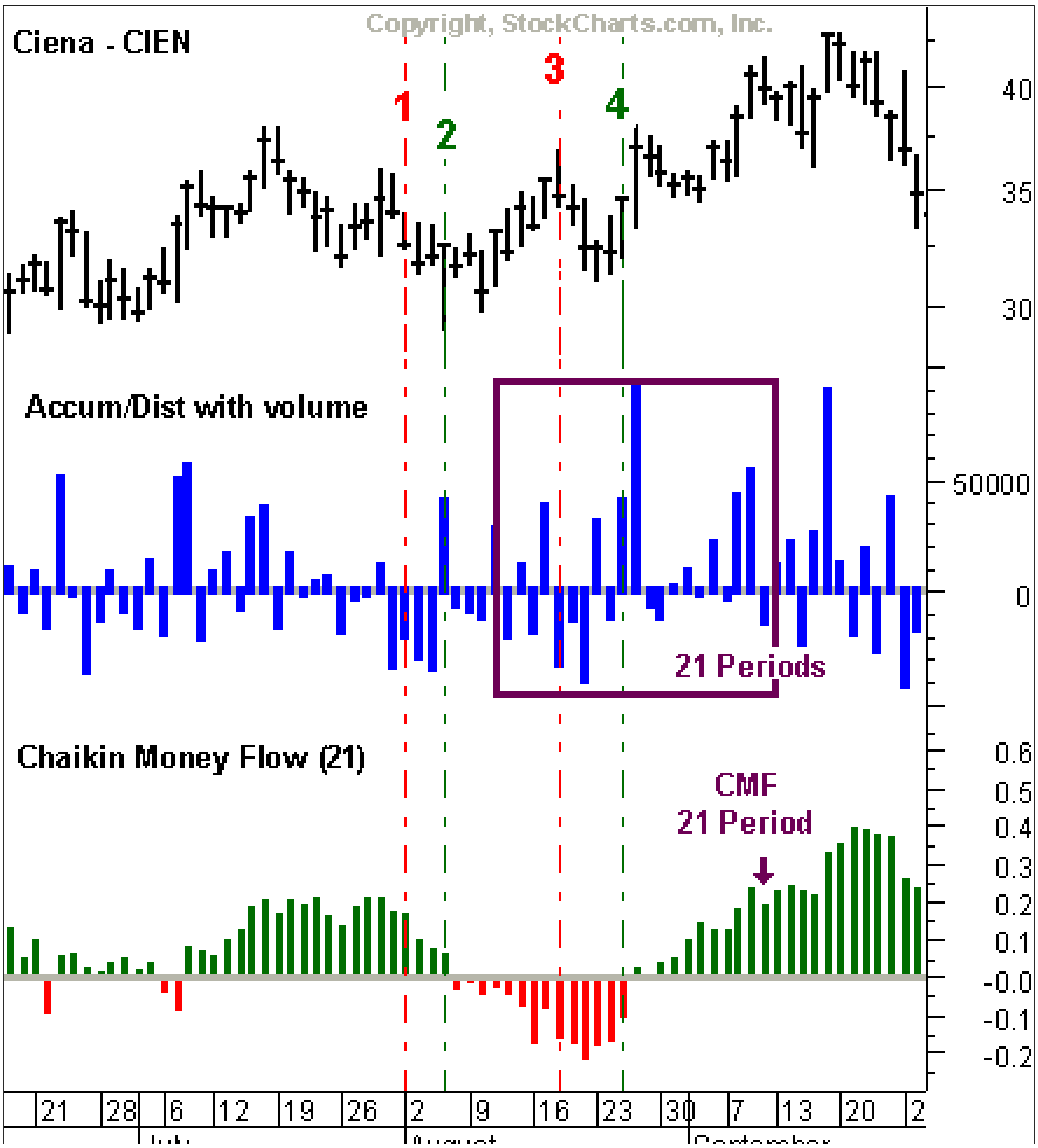


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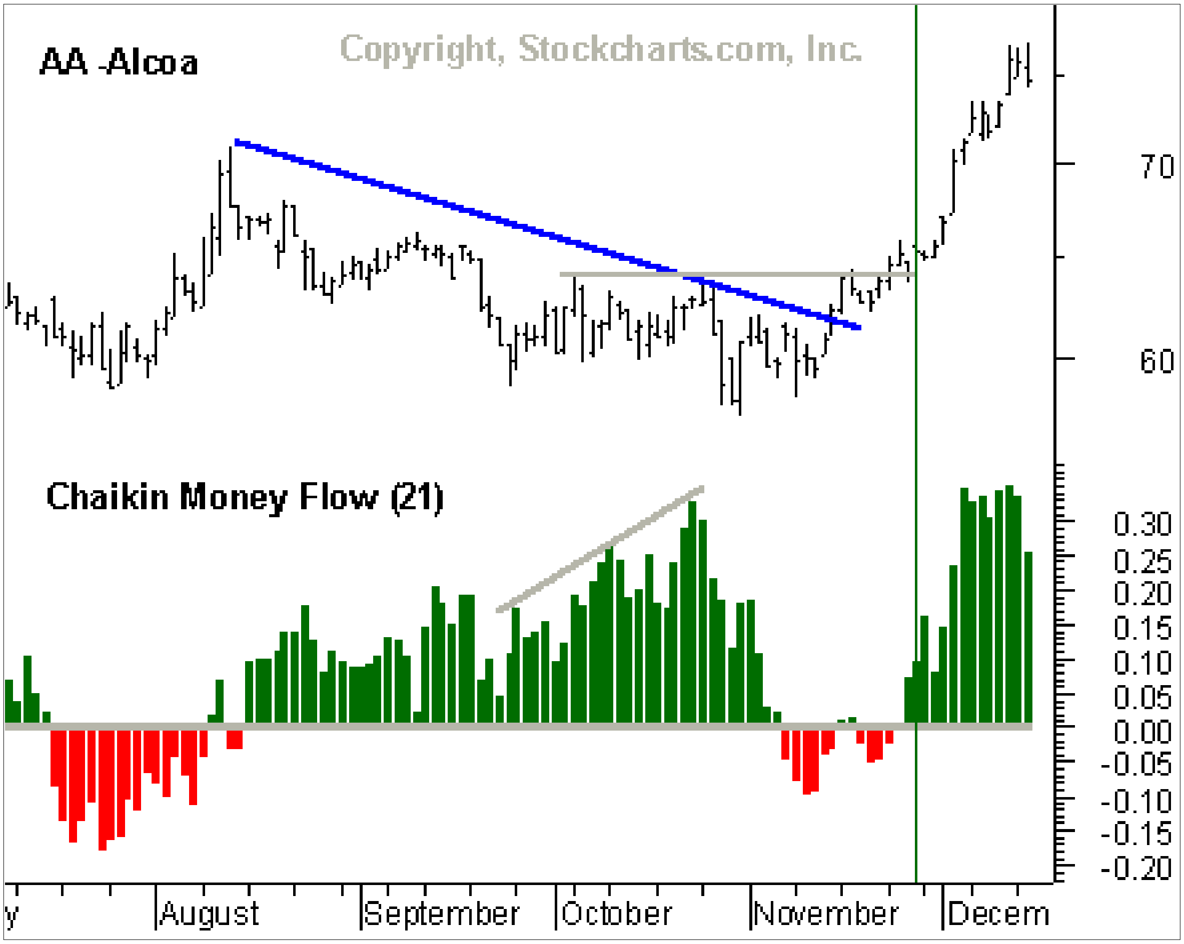


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Written by Arthur Hill

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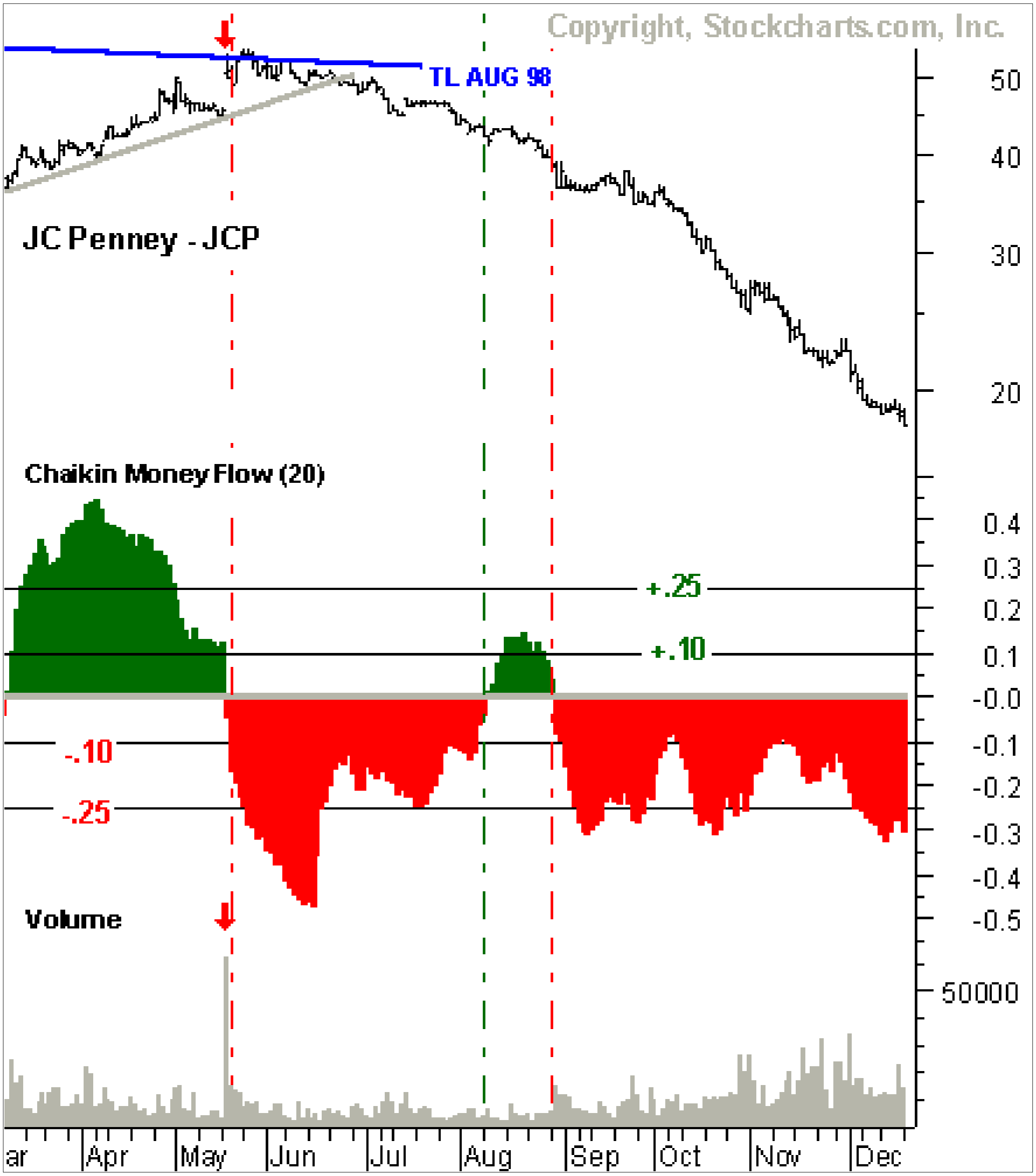
# Chaikin Money Flow Part 2

## Distribution Indications

The Chaikin Money Flow oscillator generates bearish signals by indicating that a security is experiencing selling pressure, or is perhaps under distribution. As with the bullish signals, there are three items used to determine whether or not a security is experiencing selling pressure and the degree of selling pressure.

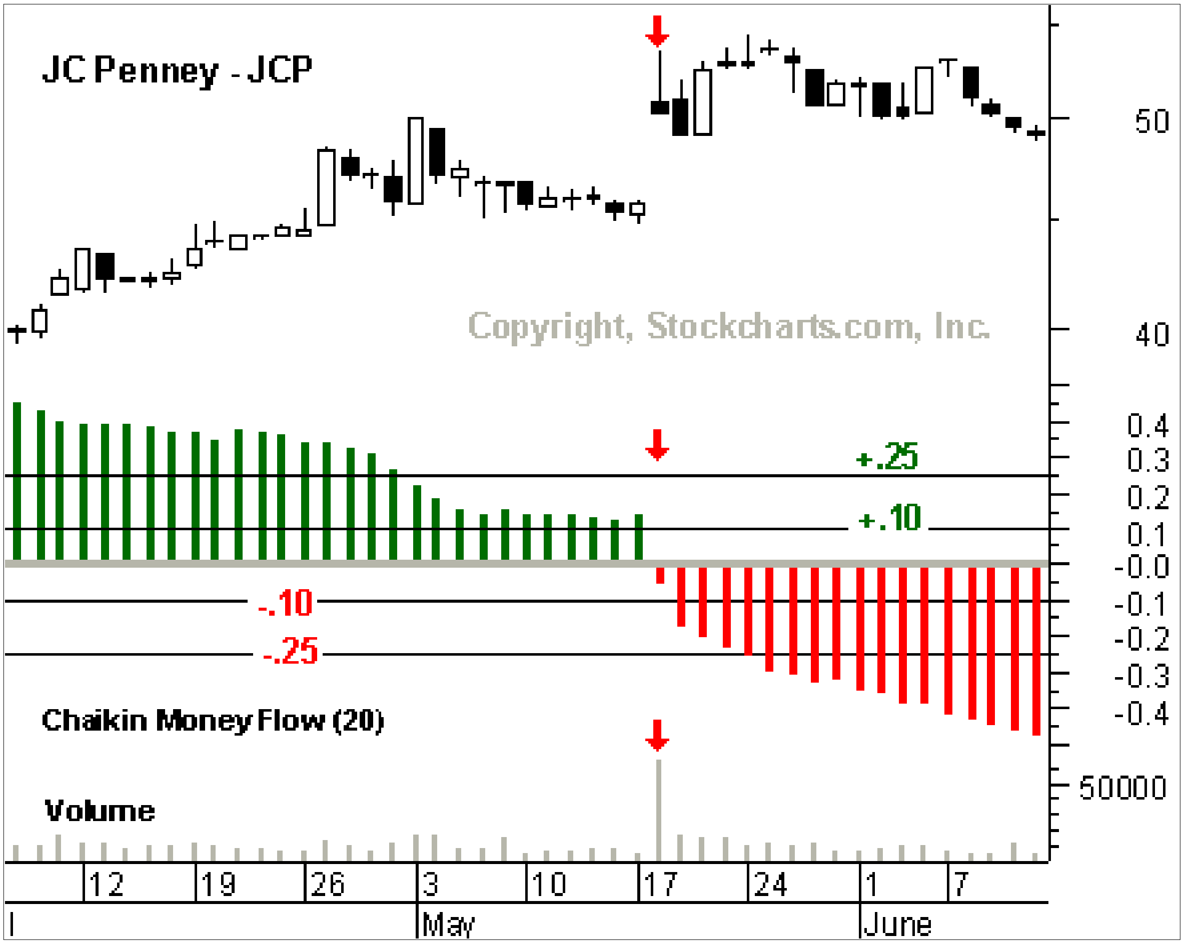
1. The first and most obvious bearish signal is when Chaikin Money Flow is less than zero. A negative reading indicates that the security in question is under selling pressure or experiencing distribution.
2. The second potentially bearish signal is the length of time that Chaikin Money Flow has remained negative. The longer the oscillator remains negative, the greater the evidence of sustained selling pressure or distribution. Extended periods below zero indicate that sentiment towards the underlying security is bearish and there is likely to be downward pressure on the price as well. The length of time can be determined by measuring the percentage of time that the indicator remains below zero. If Chaikin Money Flow is negative to 3 out of 4 weeks, then it would be experiencing selling pressure 75% of the time.
3. The third potentially bearish signal is the degree of selling pressure or distribution. This can be determined by the oscillator's absolute level. Readings on either side of the zero line or within 10 percent of both sides (plus or minus .10) are usually not considered strong enough to warrant a bullish or bearish signal. Once the indicator moves below -.10, the degree selling pressure begins to warrant a bearish signal. (A move above .10 would be significant enough to warrant a bullish signal). Any further movement would increase the degree of selling pressure and the bearish or bullish inclination. Marc Chaikin considers a reading below 25 percent (.25) to be indicative of strong selling pressure. Conversely, a reading above .25 is considered to be indicative of strong buying pressure. These levels are general guidelines and establishing important levels will depend on the characteristics of the individual security and past readings for Chaikin Money Flow.

J C Penny




J. C. Penny (JCP) is an example of a stock that experienced distribution for many weeks before the price actually fell. Once the price began to fall, the indicator remained in negative territory for an extended period of time. From March to May, Chaikin Money Flow had been positive (green). On 18-May, the stock gapped up on the open, but the indicator abruptly fell and turned negative (red arrows). The stock advanced intraday on the 18th, but fell by the close to end the day near the lows. Based on the previous close, the stock advanced. However, from the perspective of Chaikin Money Flow, the stock closed near the low for the day on heavy volume, which is regarded as selling pressure.

J C Penny



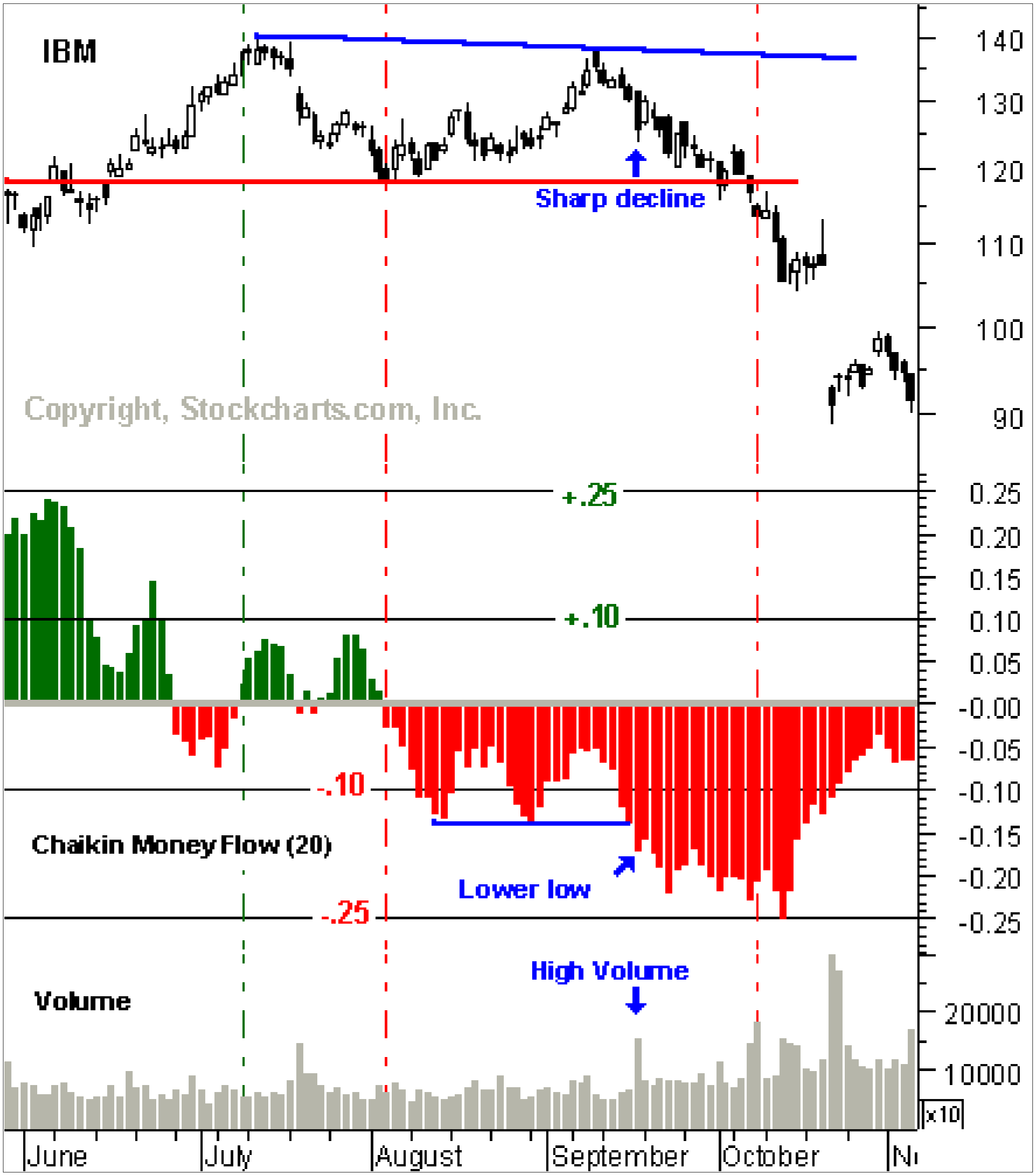

To prove that this abrupt change was not a fluke, the indicator declined further over the next several weeks and remained negative for almost 3 months, indicating that selling pressure was strong in the stock. Not only did the selling pressure remain for an extended period, but also the degree of selling pressure increased. Chaikin Money Flow reached a low of -.468 (negative 46.8 percent) while the stock was near its highs around 50. The stock began to confirm the selling pressure and worked its way down in June and July.

There were a few weeks in August when the indicator turned positive. This might have been seen as bullish, but it lasted a mere 3 weeks and Chaikin Money Flow only managed to get as high as +.1270. Furthermore, the price action of the stock never confirmed this strength and it is likely that other price and momentum indicators were bearish as well. The positive readings did not last long and by early September, Chaikin Money Flow was trading below -.25 and the stock was trading around 36. This was a solid signal that selling pressure in the stock remained heavy and there would likely be downward pressure on the price before long. The stock subsequently declined below 20 and Chaikin Money Flow has not been positive since late August.

All three indications of selling pressure were prevalent in JCP:

1. Chaikin Money Flow turned negative before the stock declined.
2. The indicator remained negative for 6 out of 7 months (85% of the time).
3. Almost all of the negative readings were below -.10 and many times the indicator dipped below -.25.

IBM




IBM provides an excellent example of a reaction rally that had failure written all over it. When the stock peaked in July, Chaikin Money Flow was already well off of its highs. The indicator was still positive and mildly bullish, but could not surpass +.10 to even partially confirm the high. The indicator formed a double top in July with both peaks well below +.10. After the decline in late July, the stock began to find support and rallied in August, but Chaikin Money Flow would have none of it. The indicator broke below -.10 twice and remained negative for almost the entire month. When the stock reached its September reaction high, Chaikin Money Flow was still negative.

After the September high in the stock, things began to fall apart. On 17-Sept, the stock declined with heavy volume and Chaikin Money Flow recorded a new reaction low. Each of these items is marked with a blue arrow on the chart. By this time, selling pressure had been evident for over a month. Chaikin Money Flow had been negative the whole time and had progressively weakened. The sharp decline in the stock on the heaviest volume in over 4 months indicated something was not right. The final straw came when support at 118.5 was broken and Chaikin Money Flow was trading below -.20.

## Chaikin Money Flow and other Indicators

It is best to choose indicators that complement each other. In a recent interview with Technical Analysis of Stocks and Commodities magazine, Marc Chaikin advises against using indicators that have common characteristics. It would be redundant to analyze both Momentum and MACD. These are both momentum oscillators that are based on the closing price and reflect the rate of change. Their signals will not be exactly the same, but it would be a waste of valuable time to analyze both. Chaikin singles out the Stochastic Oscillator, CCI and RSI as similar indicators. All three are banded momentum oscillators that are good for detecting overbought and oversold conditions. Buy and sell signals are also generated in much the same fashion. All three are excellent indicators, but it would be a waste of time to follow all three when one will be sufficient.

Chaikin Money Flow can be used to identify the tradable trend. If Chaikin Money Flow has been above zero for most of the past three months, then prudence would dictate that the tradable trend is up. The oscillator is indicating that buying pressure prevails. It would not be sensible to attempt a short sale if the tradable trend is up. By identifying the tradable trend, traders can ignore bearish signals and only pay attention to signals that concur. If Chaikin Money Flow indicates that buying pressure prevails, then positive divergences, bullish moving average crossovers, bullish centerline crossovers and bullish oversold crossovers would be potential buy signals. (A bullish oversold crossover occurs when an indicator advances above the oversold line. This would be a move from below 30 to above 30 for RSI). All bearish signals would be ignored, at least as long as Chaikin Money Flow indicated that buying pressure reigned.

One possible combination of indicators would be the following:

- Chaikin Money Flow - A non-trend-following volume indicator to identify buying and selling pressure.
- RSI - A momentum indicator used to identify potential overbought and oversold levels.
- Moving averages - A trend-following indicator to identify the underlying trend in the stock.
- Price relative - A comparative indicator to identify the strength of the stock relative to a major index.

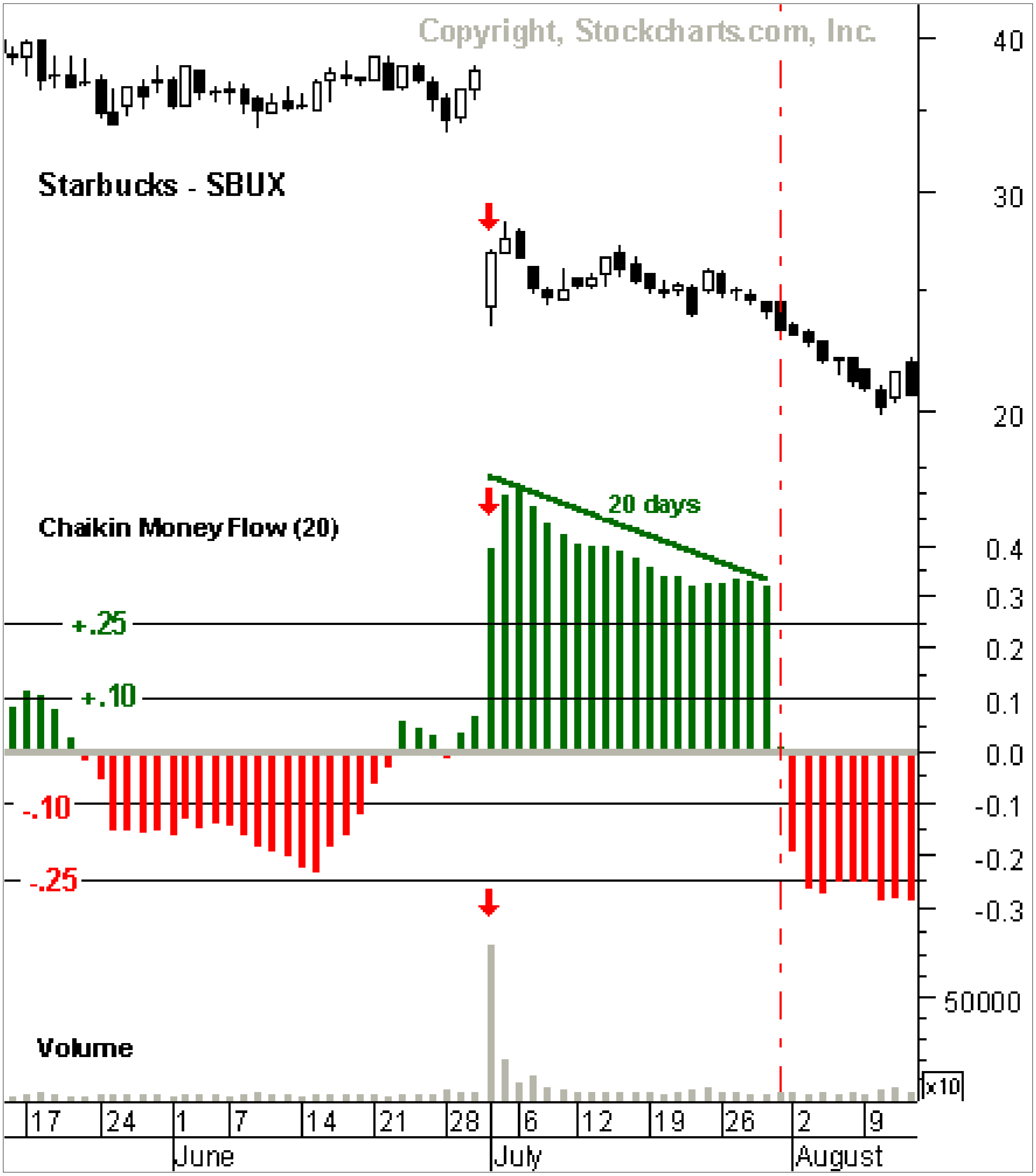
These four indicators have little in common and complement each other very well.

## Conclusion

Chaikin Money Flow is an indicator that is best used in conjunction with other aspects of technical analysis. This is usually the case with indicators, but probably even more so in this case. The oscillator is unlike a momentum oscillator and is not influenced by the price change from day to day. Instead, the indicator focuses on the location of the close relative to the range for the period (daily or weekly). This is the strength of Chaikin Money Flow, but can also be its weakness.

Because Chaikin Money Flow does not reflect the change in price from day to day or week to week, large opening gaps are sometimes not reflected in the indicator. Sometimes the indicator moves in the opposite direction of the gap and creates a misleading picture.

Starbucks




Starbucks (SBUX) formed a large down gap on 1-July with extremely heavy volume. Even though the stock opened more than 10 points lower, it managed to close on the high for the day. Strong closes indicate accumulation and the heavy volume amplified this message to cause a large jump in the indicator. The strength was a bit misleading and the indicator slowly declined over the next 20 days. On the 21st day, the data from 1-July was removed and the current day's data added. This caused an immediate drop in the indicator. Chaikin Money Flow was well below zero the next day and more accurately reflected the selling pressure taking place in the stock.

Even though Chaikin Money Flow can be used on an intraday, daily or weekly basis, it was designed with daily data in mind. One day is an unambiguous time period with measurable volume and a specific open, high, low and close. This definability may lessen in the future, with the proliferation of after-hours trading, but determining the location of the close relative to the high and low is still fairly straightforward. When dealing with weekly or monthly data, the beginning and end are less precise. This imprecision can affect the location of the close relative to the high and low for the period. Weekly is obviously more definable than monthly, but less definable than daily. This is something to consider when analyzing Chaikin Money Flow with periods other than daily.

Chaikin advocated a 21-day time frame for Chaikin Money Flow. If Chaikin Money Flow is to be used on a weekly chart, a shorter time frame will probably work better. A 21-day period represents about one month of trading and will allow for some smoothing. A shorter timeframe may prove too choppy, but a longer time frame may lag too much. Each security will have its own optimum time frame.

Keep in mind that the short-term trend is not as important as the absolute level. As long as the indicator remains above zero, it is considered bullish. It is also important to gauge the length of time that the indicator remains positive. If the indicator is positive for 7 out of 9 weeks, then buying pressure is the order of the day. The two negative weeks are a blip on the radar, and should not be taken out of context.

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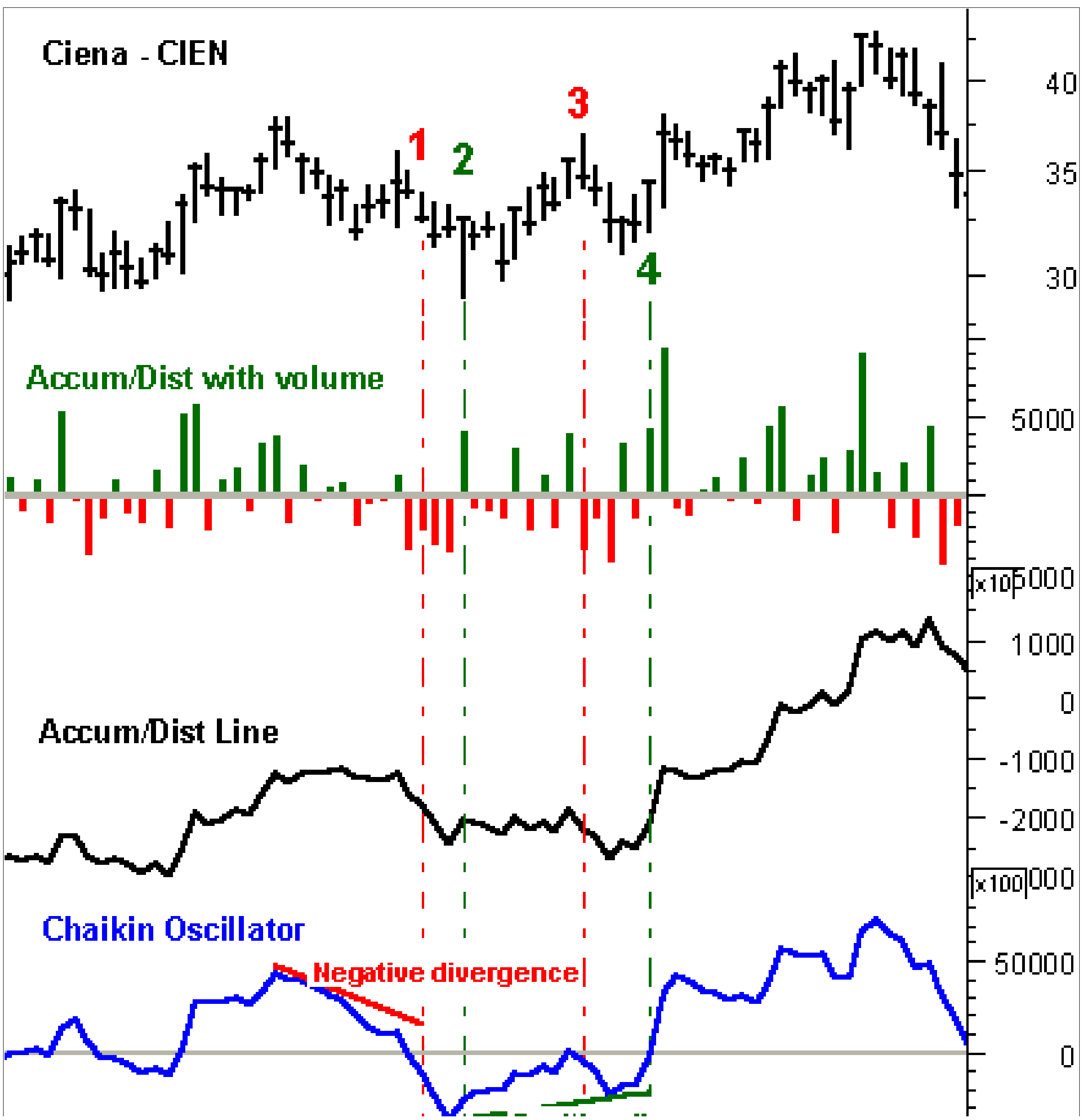
# Chaikin Oscillator

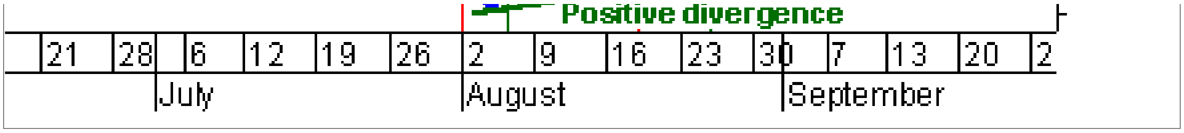
## Introduction

The Accumulation/Distribution Line was covered in a previous article; here we will examine an indicator that stems from the concept behind the Accumulation/Distribution Line: the Chaikin Oscillator or Chaikin A/D Oscillator as it is sometimes called, named after its creator, Marc Chaikin. Before reading this article, you may want to become familiar with the concepts behind the Accumulation/Distribution Line.

The basic premise of the Accumulation/Distribution Line is that the degree of buying or selling pressure can be determined by the location of the close, relative to the high and low for the corresponding period. There is buying pressure when a stock closes in the upper half of a period's range and there is selling pressure when a stock closes in the lower half of the period's trading range.

Ciena






The CIEN chart shows the relationship among each period's Accumulation/Distribution Value, Accumulation/Distribution Line, and Chaikin Oscillator. The same four points noted in the Accumulation/Distribution Line article have been noted in this example for reference as well.

## Methodology

The Chaikin Oscillator is simply the Moving Average Convergence Divergence indicator (MACD) applied to the Accumulation/Distribution Line. The formula is the difference between the 3-day exponential moving average and the 10-day exponential moving average of the Accumulation/Distribution Line. Just as the MACD-Histogram is an indicator to predict moving average crossovers in MACD, the Chaikin Oscillator is an indicator to predict changes in the Accumulation/Distribution Line.

Many of the same signals that apply to MACD are also applicable to the Chaikin Oscillator. Keep in mind though, that these signals relate to the Accumulation/Distribution Line, not directly to the stock itself. Readers may want to refer to our MACD series for more detailed information on various signals such as positive divergences, negative divergences and centerline crossovers.

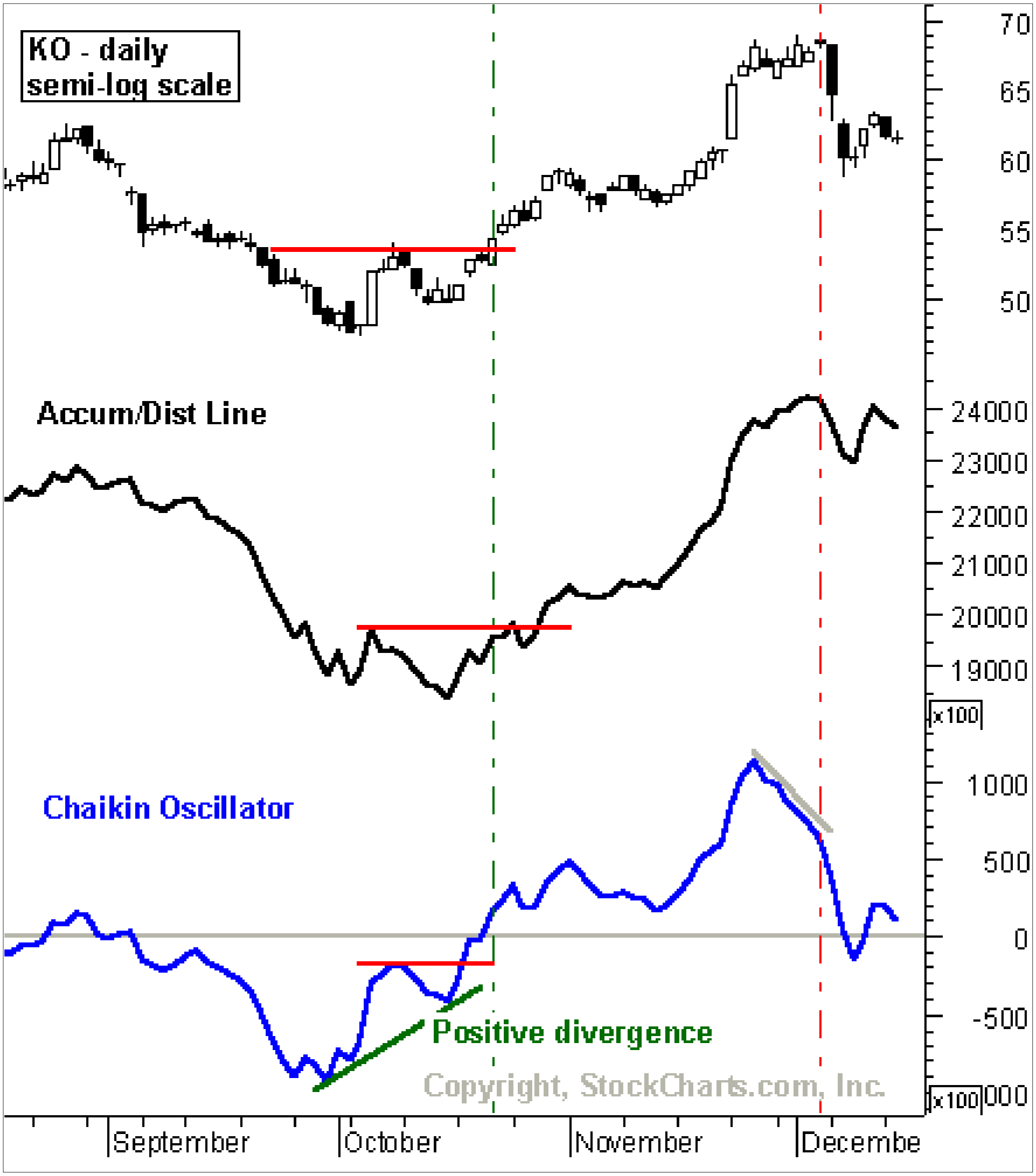
Just as MACD injects momentum characteristics into moving averages, the Chaikin Oscillator gives momentum characteristics to the Accumulation/Distribution Line, which can be a bit of a laggard sometimes. By adding momentum features, the Chaikin Oscillator will lead the Accumulation/Distribution Line. The CIEN chart confirms that movements in the Accumulation/Distribution Line are usually preceded by corresponding divergences in the Chaikin Oscillator.

1. The July negative divergence in the Chaikin Oscillator foreshadowed the impending weakness in the Accumulation/Distribution Line. This was a slant type divergence that is characterized by its lack of distinctive peaks to form the divergence. The Chaikin Oscillator peaked about a week before the Accumulation/Distribution Line and formed a bearish centerline crossover 2 weeks later. When the oscillator is negative, it implies that momentum for the Accumulation/Distribution Line is negative or bearish, which would ultimately be a negative reflection on the stock.
2. The August positive divergence in the Chaikin Oscillator foreshadowed a sharp advance in the Accumulation/Distribution Line. This divergence was longer and could have been referred to as a trough divergence. In a trough divergence there are two noticeable troughs, one higher than the other, that form the divergence. The bullish, or positive, momentum was confirmed when the Chaikin Oscillator formed a bullish moving average crossover in late August.

## Bullish Signals

There are two bullish signals that can be generated from the Chaikin Oscillator: positive divergences and centerline crossovers. Because the Chaikin Oscillator is an indicator of an indicator, it is prudent to look for confirmation of a positive divergence, by a bullish moving average crossover for example, before counting this as a bullish signal. The chart for KO is an excellent example of a positive divergence that has been confirmed by a centerline crossover.

Coca Cola Co.

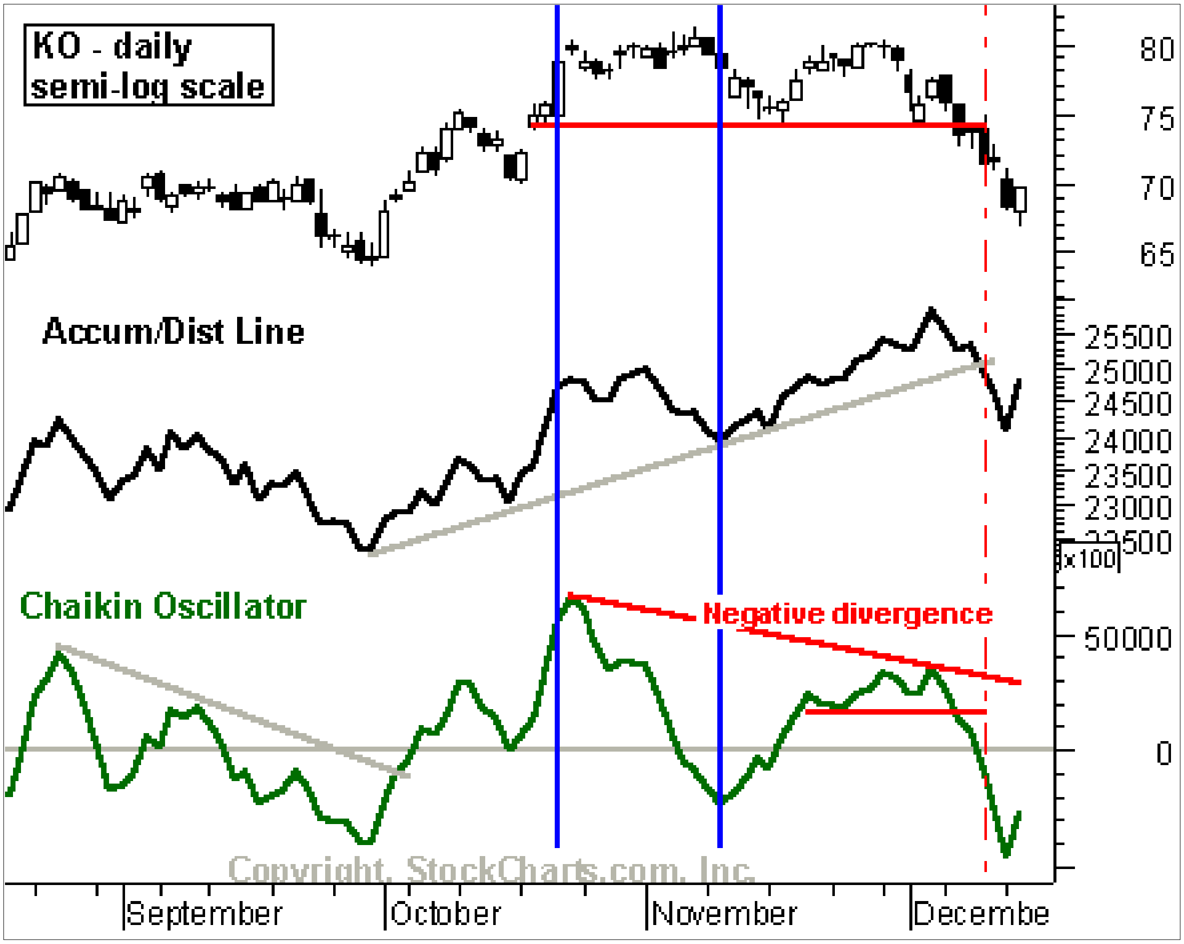



1. The positive divergence is sharp and pronounced. When using an indicator of an indicator, it is preferable to take only strong signals. Note the steepness of the positive divergence.
2. The bullish centerline crossover occurred in the Chaikin Oscillator before the Accumulation/Distribution Line broke to a new reaction high.
3. At the point of the centerline crossover (green dotted line), the stock also broke resistance and the bullish signal was further validated.

## Bearish Signals

In direct contrast to the bullish signals, there are two bearish signals that can be generated from the Chaikin Oscillator: a negative divergence and a bearish centerline crossover. Allow a negative divergence to be confirmed by a bearish centerline crossover, before a bullish signal is rendered. The chart for MRK shows a recent bearish signal that coincided with a support break in the stock.

Coca Cola Co.




1. The negative divergence is not as sharp and pronounced at the positive divergence in KO, but it is detectable none the less. Divergences that cover long time spans are sometimes difficult to time for a trade.
2. It is easy to see the effects of price action on the Chaikin Oscillator and the Accumulation/Distribution Line in this example. The blue lines mark a period when the stock traded basically flat for 13 days. However, many of the closes for this period were below the midway point and some were near the intraday lows. Note the action of the Chaikin Oscillator and Accumulation/Distribution Line during this period; both declined markedly.
3. The bearish centerline crossover to confirm the divergence occurred just recently and coincided with a break of support in the stock and a trendline break in the Accumulation/Distribution Line.

## Conclusion

The Chaikin Oscillator is good for adding momentum to the Accumulation/Distribution Line, but can sometimes add a little too much momentum and be difficult to interpret. The moving averages are both relatively short and will therefore be more sensitive to changes in the Accumulation/Distribution Line. Sensitivity is important, but one must also be able to interpret the indicator. Those with the software and resources may try different moving averages to further smooth the fluctuations. This indicator should definitely be used in conjunction with other aspects of technical analysis.

*Chaikin Money Flow is one answer to the volatility that has been created from the Chaikin Oscillator.*

Written by Arthur Hill

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# MACD Part 1

## The Combination Oscillator

Developed by Gerald Appel, Moving Average Convergence Divergence (MACD) is one of the simplest and most reliable indicators available. MACD uses moving averages, which are lagging indicators, to include some trend-following characteristics. These lagging indicators are turned into a momentum oscillator by subtracting the faster moving average from the slower moving average. The resulting plot forms a line that oscillates above and below zero, without any upper or lower limits. MACD is a centered oscillator and the guidelines for using centered oscillators apply.

## MACD Formula

The most popular formula for the "standard" MACD is the difference between a security's 26-day and 12-day exponential moving averages. This is the formula that is used in many popular technical analysis programs, including SharpCharts, and quoted in most technical analysis books on the subject. Appel and others have since tinkered with these original settings to come up with a MACD that is better suited for faster or slower securities. Using shorter moving averages will produce a quicker, more responsive indicator, while using longer moving averages will produce a slower indicator, less prone to whipsaws. For our purposes in this article, the traditional 12/26 MACD will be used for explanations. Later in the indicator series, we will address the use of different moving averages in calculating MACD.

Of the two moving averages that make up MACD, the 12-day EMA is the faster and the 26-day EMA is the slower. Closing prices are used to form the moving averages. Usually, a 9-day EMA of MACD is plotted as a along side to act as a trigger line. A bullish crossover occurs when MACD moves above its 9-day EMA and a bearish crossover occurs when MACD moves below its 9-day EMA. The Merrill Lynch chart below shows the 12-day EMA (thin green line) with the 26-day EMA (thin blue line) overlaid the price plot. MACD appears in the box below as the thick black line and its 9-day EMA is the thin blue line. The histogram represents the difference between MACD and its 9-day EMA. The histogram is positive when MACD is above its 9-day EMA and negative when MACD is below its 9-day EMA.

Merrill Lynch


## What does MACD do?

MACD measures the difference between two moving averages. A positive MACD indicates that the 12-day EMA is trading above the 26-day EMA. A negative MACD indicates that the 12-day EMA is trading below the 26-day EMA. If MACD is positive and rising, then the gap between the 12-day EMA and the 26-day EMA is widening. This indicates that the rate-of-change of the faster moving average is higher than the rate-of-change for the slower moving average. Positive momentum is increasing and this would be considered bullish. If MACD is negative and declining further, then the negative gap between the faster moving average (green) and the slower moving average (blue) is expanding. Downward momentum is accelerating and this would be considered bearish. MACD centerline crossovers occur when the faster moving average crosses the slower moving average.

Merrill Lynch


(Click here to see a live example of MACD)

This Merrill Lynch chart shows MACD as a solid black line and its 9-day EMA as the thin blue line. Even though moving averages are lagging indicators, notice that MACD moves faster than the moving averages. In this example with Merrill Lynch, MACD also provided a few good trading signals as well.

1. In March and April, MACD turned down ahead of both moving averages and formed a negative divergence ahead of the price peak.
2. In May and June, MACD began to strengthen and make higher lows while both moving averages continued to make lower lows.
3. And finally, MACD formed a positive divergence in October while both moving averages recorded new lows.

## MACD Bullish Signals

MACD generates bullish signals from three main sources:

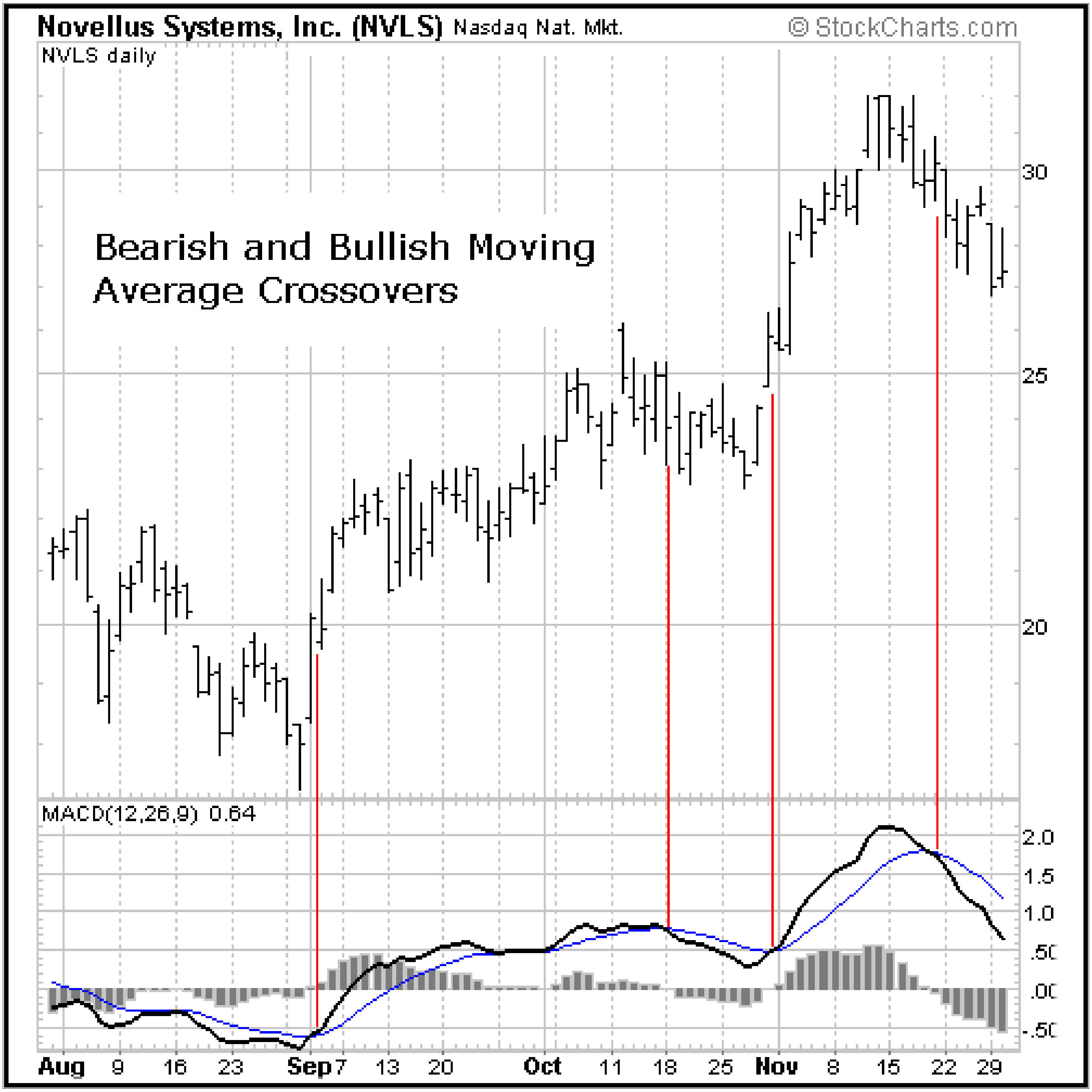
1. Positive divergence
2. Bullish moving average crossover

3. Bullish centerline crossover

Positive Divergence
Novellus


A positive divergence occurs when MACD begins to advance and the security is still in a downtrend and makes a lower reaction low. MACD can either form as a series of higher lows or a second low that is higher than the previous low. Positive divergences are probably the least common of the three signals, but are usually the most reliable and lead to the biggest moves.

Bullish Moving Average Crossover
Novellus




A bullish moving average crossover occurs when MACD moves above its 9-day EMA or trigger line. Bullish moving average crossovers are probably the most common signals and as such are the least reliable. If not used in conjunction with other technical analysis tools, these crossovers can lead to whipsaws and many false signals. Moving average crossovers are sometimes used to confirm a positive divergence. The second low or higher low of a positive divergence can be considered valid when it is followed by a bullish moving average crossover.

Sometimes it is prudent to apply a price filter to the moving average crossover in order to ensure that it will hold. An example of a price filter would be to buy if MACD breaks above the 9-day EMA and remains above for three days. The buy signal would then commence at the end of the third day.

Bullish Centerline Crossover
Apple


A bullish centerline crossover occurs when MACD moves above the zero line and into positive territory. This is a clear indication that momentum has changed from negative to positive, or from bearish to bullish. After a positive divergence and bullish moving average crossover, the centerline crossover can act as a confirmation signal. Of the three signals, moving average crossover are probably the second most common signals.

Using a Combination of Signals
Halliburton


Even though some traders may use only one of the above signals to form a buy or a sell signal, using a combination can generate more robust signals. In the Halliburton example, all three bullish signals were present and the stock still advanced another 20%. The stock formed a lower low at the end of February, but MACD formed a higher low, thus creating a potential positive divergence. MACD then formed a bullish crossover by moving above its 9-day EMA. And finally, MACD traded above zero to form a bullish centerline crossover. At the time of the bullish centerline crossover, the stock was trading at 32 1/4 and went above 40 immediately after that. In August, the stock traded above 50.

*In [Part 2](), we look at MACD bearish signals.*

Written by Arthur Hill

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# MACD Part 2

## Bearish Signals

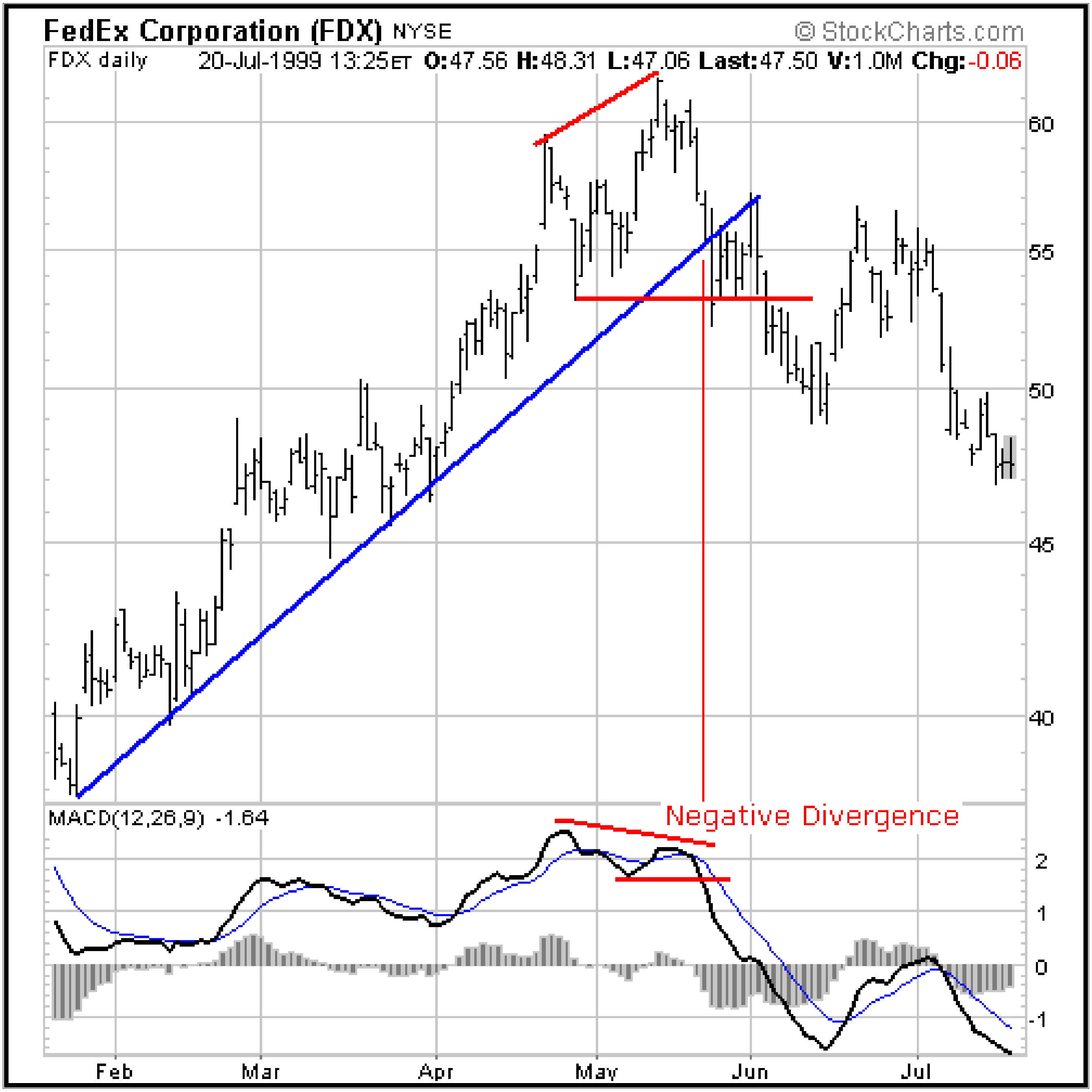
MACD generates bearish signals from three main sources. These signals are mirror reflections of the bullish signals.

1. Negative divergence
2. Bearish moving average crossover
3. Bearish centerline crossover

### Negative Divergence

A negative divergence forms when the security advances or moves sideways and MACD declines. The negative divergence in MACD can take the form of either a lower high or a straight decline. Negative divergences are probably the least common of the three signals, but are usually the most reliable and can warn of an impending peak.

Federal Express




The FDX chart shows a negative divergence when MACD formed a lower high in May and the stock formed a higher high at the same time. This was a rather blatant negative divergence and signaled that momentum was slowing. A few days later, the stock broke the uptrend line and MACD formed a lower low.

There are two possible means of confirming a negative divergence. First, the indicator can form a lower low. This is traditional peak-and-trough analysis applied to an indicator. With the lower high and subsequent lower low, the up trend for MACD has changed from bullish to bearish. Second, a bearish moving average crossover, which is explained below, can act to confirm a negative divergence. As long as MACD is trading above its 9-day EMA or trigger line, it has not turned down and the lower high is difficult to confirm. When MACD breaks below its 9-day EMA, it signals that the short-term trend for the indicator is weakening, and a possible interim peak has formed.

Bearish moving average crossover

The most common signal for MACD is the moving average crossover. A bearish moving average crossover occurs when MACD declines below its 9-day EMA. Not only are these signals the most common, but they also produce the most false signals. As such, moving average crossovers should be confirmed with other signals to avoid whipsaws and false readings.

Merck


Sometimes a stock can be in a strong uptrend and MACD will remain above its trigger line for a sustained period of time. In this case, it is unlikely that a negative divergence will develop. A different signal is needed to identify a potential change in momentum. This was the case with MRK in February and March. The stock advanced in a strong up trend and MACD remained above its 9-day EMA for 7 weeks. When a bearish moving average crossover occurred, it signaled that upside momentum was slowing. This slowing momentum should have served as an alert to monitor the technical situation for further clues of weakness. Weakness was soon confirmed when the stock broke its uptrend line and MACD continued its decline and moved below zero.

Bearish centerline crossover
A bearish centerline crossover occurs when MACD moves below zero and into negative territory. This is a clear indication that momentum has changed from positive to negative, or from bullish to bearish. The centerline crossover can act as an independent signal, or confirm a prior signal such as a moving average crossover or negative divergence. Once MACD crosses into negative territory, momentum, at least for the short term, has turned bearish.

Unisys


The significance of the centerline crossover will depend on the previous movements of MACD as well. If MACD is positive for many weeks, begins to trend down and then crosses into negative territory, it would be considered bearish. However, if MACD has been negative for a few months, breaks above zero and then back below, it may be seen as more of a correction. In order to judge the significance of a centerline crossover, traditional technical analysis can be applied to see if there has been a change in trend, higher high or lower low.

The UIS chart depicts a bearish centerline crossover that preceded a 25% drop in the stock. Although there was little time to act once this signal appeared, there were other warnings signs just prior to the dramatic drop.

1. After the drop to trendline support , a bearish moving average crossover formed.
2. When the stock rebounded from the drop, MACD did not even break above the trigger line, indicating weak upside momentum.
3. The peak of the reaction rally was marked by a shooting star candlestick (blue arrow) and a gap down on increased volume (red arrows).
4. After the gap down, the trendline extending up from Apr-98 was broken.

In addition to the signal mentioned above, the bearish centerline crossover occurred after MACD had been above zero for almost two months. Since 20-Sept, MACD had been weakening and momentum was slowing. The break below zero acted as the final straw of a long weakening process.

## Combining Signals

As with bullish MACD signals, bearish signals can be combined to create more robust signals. In most cases, stocks fall faster than they rise. This was definitely the case with UIS and only two bearish MACD signals were present. Using momentum indicators like MACD, technical analysis can sometimes provide clues to impending weakness. While it may be impossible to predict the length and duration of the decline, being able to spot weakness can enable traders to take a more defensive position.


After issuing a profit warning in late Feb-00, CPQ dropped from above 40 to below 25 in a few months. Without inside information, predicting the profit warning would be pretty much impossible. However, it would seem that smart money began distributing the stock before the actual warnings. Looking at the technical picture, we can spot evidence of this distribution and a serious loss of momentum.

1. In January, a negative divergence formed in MACD.

2. Chaikin Money Flow turned negative on January 21.
3. Also in January, a bearish moving average crossover occurred in MACD (black arrow).
4. The trendline extending up from October was broken on 4-Feb.
5. A bearish centerline crossover occurred in MACD on 10-Feb (green arrow).
6. On 16, 17 and 18-Feb, support at 41 1/2 was violated (red arrow).

A full 10 days passed in which MACD was below zero and continued to decline (thin red lines). The day before the gap down, MACD was at levels not seen since October. For those waiting for a recovery in the stock, the continued decline of momentum suggested that selling pressure was increasing, and not about to decrease. Hindsight is 20/20, but with careful study of past situations, we can learn how to better read the present and prepare for the future.

*In Part 3, we look at some of the benefits and drawbacks of MACD.*

Written by Arthur Hill

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# MACD Part 3

## MACD Benefits

One of the primary benefits of MACD is that it incorporates aspects of both momentum and trend in one indicator. As a trend-following indicator, it will not be wrong for very long. The use of moving averages ensures that the indicator will eventually follow the movements of the underlying security. By using exponential moving averages, as opposed to simple moving averages, some of the lag has been taken out.

As a momentum indicator, MACD has the ability to foreshadow moves in the underlying security. MACD divergences can be key factors in predicting a trend change. A negative divergence signals that bullish momentum is waning and there could be a potential change in trend from bullish to bearish. This can serve as an alert for traders to take some profits in long positions, or for aggressive traders to consider initiating a short position.

MACD can be applied to daily, weekly or monthly charts. MACD represents the convergence and divergence of two moving averages. The standard setting for MACD is the difference between the 12 and 26-period EMA. However, any combination of moving averages can be used. The set of moving averages used in MACD can be tailored for each individual security. For weekly charts, a faster set of moving averages may be appropriate. For volatile stocks, slower moving averages may be needed to help smooth the data. No matter what the characteristics of the underlying security, each individual can set MACD to suit his or her own trading style, objectives and risk tolerance.

## MACD Drawbacks

One of the beneficial aspects of MACD may also be a drawback. Moving averages, be they simple, exponential or weighted, are lagging indicators. Even though MACD represents the difference between two moving averages, there can still be some lag in the indicator itself. This is more likely to be the case with weekly charts than daily charts. One solution to this problem is the use of the MACD-Histogram.

MACD is not particularly good for identifying overbought and oversold levels. Even though it is possible to identify levels that historically represent overbought and oversold levels, MACD does not have any upper or lower limits to bind its movement. MACD can continue to overextend beyond historical extremes.

MACD calculates the absolute difference between two moving averages and not the percentage difference. MACD is calculated by subtracting one moving average from the other. As a security increases in price, the difference (both positive and negative) between the two moving averages is destined to grow. This makes its difficult to compare MACD levels over a long period of time, especially for stocks that have grown exponentially.

Amazon


The AMZN chart demonstrates the difficult in comparing MACD levels over a long period of time. Before 1999, AMZN's MACD is barely recognizable and appears to trade close to the zero line. MACD was indeed quite volatile at the time, but this volatility has been dwarfed since the stock rose from below 20 to almost 100.

An alternative is to use the Price Oscillator, which find the percentage difference between two moving averages:

(12 day EMA - 26 day EMA) / (12 day EMA)

(20 - 18) / 20 = .10 or +10%

The resulting percentage difference can be compared over a longer period of time. On the AMZN chart, we can see that the Price Oscillator provides a better means for a long-term comparison. For the short term, MACD and the Price Oscillator are basically the same. The shape of the lines, the divergences, moving average crossovers and centerline crossovers for MACD and the Price Oscillator are virtually identical.

## MACD Conclusion

Since Gerald Appel developed MACD, there have been hundreds of new indicators introduced to technical analysis. While many indicators have come and gone, MACD is an oscillator that has stood the test of time. The concept behind its use is straightforward and its construction simple, yet it remains one of the most reliable indicators around. The effectiveness of MACD will vary for different securities and markets. The lengths of the moving averages can be adapted for a better fit to a particular security or market. As with all indicators , MACD is not infallible and should be used in conjunction with other technical analysis tools.

*In Part 4, we examine the benefits and drawbacks of MACD-Histogram.*

Written by Arthur Hill

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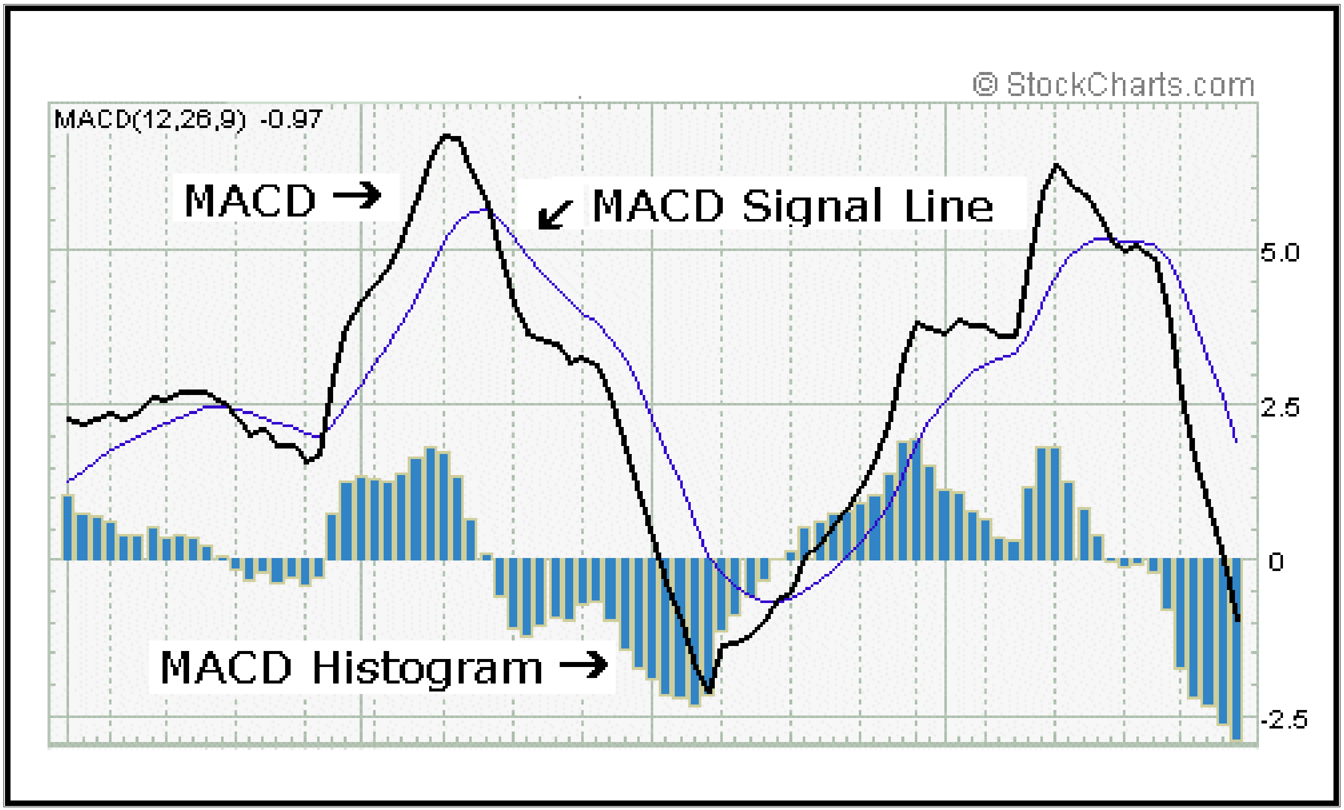
# MACD Part 4

## MACD-Histogram

In 1986, Thomas Aspray developed the MACD-Histogram. Some of his findings were presented in a series of articles for Technical Analysis of Stocks and Commodities. Aspray noted that MACD would sometimes lag important moves in a security, especially when applied to weekly charts. He first experimented by changing the moving averages and found that shorter moving averages did indeed speed up the signals. However, he was looking for a means to anticipate MACD crossovers. One of the answers he came up with was the MACD-Histogram.

MACD



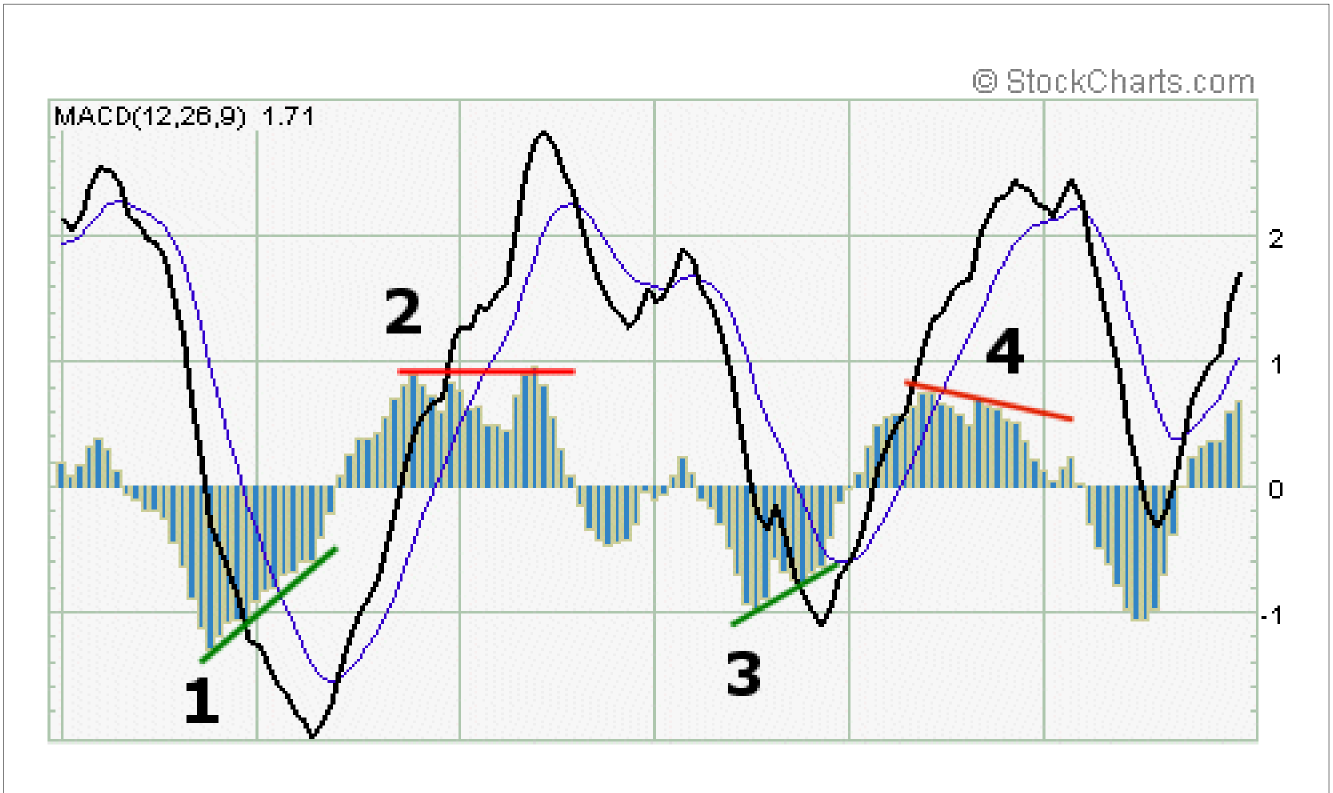

## Definition and Construction

The MACD-Histogram represents the difference between MACD and the 9-day EMA of MACD, which can also be referred to as the signal or trigger line. The plot of this difference is presented as a histogram, making centerline crossovers and divergences are easily identifiable. A centerline crossover for the MACD-Histogram is the same as a moving average crossover for MACD. If you will recall, a moving average crossover occurs when MACD moves above or below the signal line.

If the value of MACD is larger than the value of its 9-day EMA, then the value on the MACD-Histogram will be positive. Conversely, if the value of MACD is less than its 9-day EMA, then the value on the MACD-Histogram will be negative.

Further increases or decreases in the gap between MACD and its 9-day EMA will be reflected in the MACD-Histogram. Sharp increases in the MACD-Histogram indicate that MACD is rising faster than its 9-day EMA and bullish momentum is strengthening. Sharp declines in the MACD-Histogram indicate that MACD is falling faster than its 9-day EMA and bearish momentum is increasing.

MACD




On the chart above, we can see that MACD-Histogram movements are relatively independent of the actual MACD. Sometimes MACD is rising while the MACD-Histogram is falling. At other times, MACD is falling while MACD-Histogram is rising. MACD-Histogram does not reflect the absolute value of MACD, but rather the value of MACD relative to its 9-day EMA. Usually, but not always, a move in MACD is preceded by a corresponding divergence in MACD-Histogram.

1. The first point shows a sharp positive divergence in MACD-Histogram that preceded a bullish moving average crossover.
2. On the second point, MACD continued to new highs, but MACD-Histogram formed two equal highs. Although not a textbook positive divergence, the equal high failed to confirm the strength seen in MACD.
3. A positive divergence formed when MACD-Histogram formed a higher low and MACD continued lower.
4. A negative divergence formed when MACD-Histogram formed a lower high and MACD continued higher.

## Usage

Thomas Aspray designed the MACD-Histogram as a tool to anticipate a moving average crossover in MACD. Divergences between MACD and the MACD-Histogram are the main tool used to anticipate moving average crossovers. A positive divergence in the MACD-Histogram indicates that MACD is strengthening and could be on the verge of a bullish moving average crossover. A negative divergence in the MACD-Histogram indicates that MACD is weakening and can act to foreshadow a bearish moving average crossover in MACD.

In his book, Technical Analysis of the Financial Markets, John Murphy asserts that the MACD-Histogram is best used to identify periods when the gap between MACD and its 9-day EMA is either widening or shrinking. Broadly speaking, a widening gap indicates strengthening momentum and a shrinking gap indicates weakening momentum. Usually a change in the MACD-Histogram will precede any changes in MACD.

## Signals

The main signal generated by the MACD-Histogram is a divergence followed by a moving average crossover. A bullish signal is generated when a positive divergence forms and there is a bullish centerline crossover. A bearish signal is generated when there is a negative divergence and a bearish centerline crossover. Keep in mind that a centerline crossover for the MACD-Histogram represents a moving average crossover for MACD.

Divergences can take many forms and varying degrees. Generally speaking, two types of divergences have been identified: the slant divergence and the peak-trough divergence.

Unisys


A slant divergence forms when there is a continuous and relatively smooth move in one direction (up or down) to form the divergence. Slant divergences generally cover a shorter timeframe than divergences formed with two peaks or two troughs. A slant divergence can contain some small bumps (peaks or troughs) along the way. The world of technical analysis is not perfect and there are exceptions to most rules and hybrids for many signals.

General Electric


A peak-trough divergence occurs when at least two peaks or two troughs develop in one direction to form the divergence. A series of two or more rising troughs (higher lows) can form a positive divergence and a series of two or more declining peaks (lower highs) can form a negative divergence. Peak-trough divergences usually cover a longer timeframe than slant divergences. On a daily chart, a peak-trough divergence can cover a timeframe as short as two weeks or as long as several months.

Usually, the longer and sharper the divergence is, the better any ensuing signal will be. Short and shallow divergences can lead to false signals and whipsaws. In addition, it would appear that peak-trough divergences are a bit more reliable than slant divergences. Peak-trough divergences tend to be sharper and cover a longer time frame than slant divergences.

## MACD-Histogram Benefits

The main benefit of the MACD-Histogram is its ability to anticipate MACD signals. Divergences usually appear in the MACD-Histogram before MACD moving average crossovers. Armed with this knowledge, traders and investors can better prepare for potential trend changes.

MACD-Histogram can be applied to daily, weekly or monthly charts. (Note: This may require some tinkering with the number of periods used to form the original MACD; shorter or faster moving averages may be required for weekly and monthly charts.) Using weekly charts, the broad underlying trend of a stock can be determined. Once the broad trend has been determined, daily charts can be used to time entry and exit strategies.

In Technical Analysis of the Financial Markets, John Murphy advocates this type of two-tiered approach to investing in order to avoid making trades against the major trend. The weekly MACD-Histogram can be used to generate a long-term signal in order to establish the tradable trend. Then only short-term signals that jibe with the major trend are eligible for use. If the long-term trend were bullish, only positive divergences with bullish centerline crossovers would be considered valid for the MACD-Histogram. If the long-term trend were bearish, only negative divergences with bearish centerline crossovers would be considered valid.

IBM


On the IBM weekly chart, the MACD-Histogram generated four signals. Before each moving average crossover in MACD, a corresponding divergence formed in the MACD-Histogram. To make adjustments for the weekly chart, the moving averages have been shortened to 6 and 12. This MACD is formed by subtracting the 6-week EMA from the 12-week EMA. A 6-week EMA has been used as the trigger. The MACD-Histogram is calculated by taking the difference between MACD (6/12) and the 6-day EMA of MACD (6/12).

1. The first signal was a bearish moving average crossover in Jan-99. From its peak in late Nov-98, the MACD-Histogram formed a negative divergence that preceded the bearish moving average crossover in MACD.
2. The second signal was a bullish moving average crossover in April. From its low in mid-February, the MACD-Histogram formed a positive divergence that preceded the bullish moving average crossover in MACD.
3. The third signal was a bearish moving average crossover in late July. From its May peak, the MACD-Histogram formed a negative divergence that preceded a bearish moving average crossover in MACD.
4. The final signal was a bullish moving average crossover, which was preceded by a slight positive divergence in MACD-Histogram.

The third signal was based on a peak-trough divergence. Two readily identifiable and consecutive lower peaks formed to create the divergence. The peaks and troughs on the previous divergences, although identifiable, do not stand out as much.

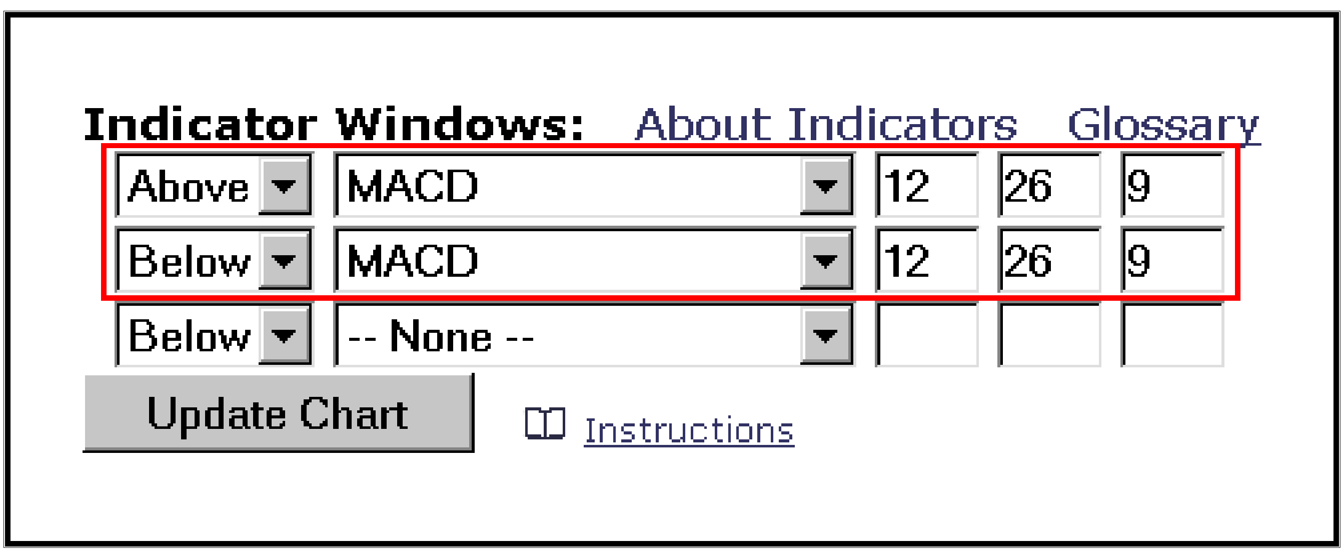
## MACD-Histogram Drawbacks

The MACD-Histogram is an indicator of an indicator or a derivative of a derivative. MACD is the first derivative of the price action of a security and the MACD-Histogram is the second derivative of the price action of a security. As the second derivative, the MACD-Histogram is further removed from the actual price action of the underlying security. The further removed an indicator is from the underlying price action, the greater the chances of false signals. Keep in mind that this is an indicator of an indicator. MACD-Histogram should not be compared directly with the price action of the underlying security.

Because MACD-Histogram was designed to anticipate MACD signals, there may be a temptation to jump the gun. The MACD-Histogram should be used in conjunction with other aspects of technical analysis. This will help to alleviate the temptation for early entry. Another means to guard against early entry is to combine weekly signals with daily signals. There will of course be more daily signals than weekly signals. However, by using only the daily signals that agree with the weekly signals, there will be fewer daily signals to act on. By acting only on those daily signals that are in agreement with the weekly signals, you are also assured of trading with the longer trend and not against it.

Be careful of small and shallow divergences. While these may sometimes lead to good signals, they are also more apt to create false signals. One method to avoid small divergences is to look for larger divergences with two or more readily identifiable peaks or troughs. Compare the peaks and troughs from past action to determine significance. Only peaks and troughs that appear to be significant should warrant attention.

## MACD and SharpCharts




Using SharpCharts, MACD can be set as an indicator above or below a security's price plot. Once the indicator is chosen from the drop down list, the three boxes to the right are used to adjust the settings. The default setting is (12,26,9), which automatically appears. The default would use a 12-day EMA and 26-day EMA to calculate MACD and a 9-day EMA of MACD as the signal/trigger line. MACD appears as the thick solid line and the signal/trigger line as the thinner and smoother line. Typically, MACD crosses above and below its signal line as it fluctuates around the zero line. The histogram is the MACD-Histogram, which measures the difference between MACD and its signal/trigger line. The scale shows the range of values for MACD. Stocks with low prices (eg between 10 and 20) will have a smaller MACD range and stocks with high prices (eg above 100) will have a higher MACD range.

*Want more on indicators? See our overview article.*

Written by Arthur Hill

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# Moving Averages - Part 1

## Introduction

Moving averages are one of the most popular and easy to use tools available to the technical analyst. By using an average of prices, moving averages smooth a data series and make it easier to spot trends. This can be especially helpful in volatile markets.


In the first part of this series on moving averages, we will examine the differences between the two most popular moving averages: the simple moving average and the exponential moving average. In part two, we will look at how moving averages can be used as tools of technical analysis.

## Simple Moving Average (SMA)

(Click here to see a live example of a Simple Moving Average)

A simple moving average is formed by finding the average price of a security over a set number of periods. Most often, the closing price is used to compute the moving average. For example: a 5-day moving average would be calculated by adding the closing prices for the last 5 days and dividing the total by 5.

$$10 + 11 + 12 + 13 + 14 = 60$$

$$60 \div 5 = 12$$

A moving average *moves* because as the newest period is added, the oldest period is dropped. If the next closing price in the average is 15, then this new period would be added and the oldest day, which is 10, would be dropped. The new 5-day moving average would be calculated as follows:

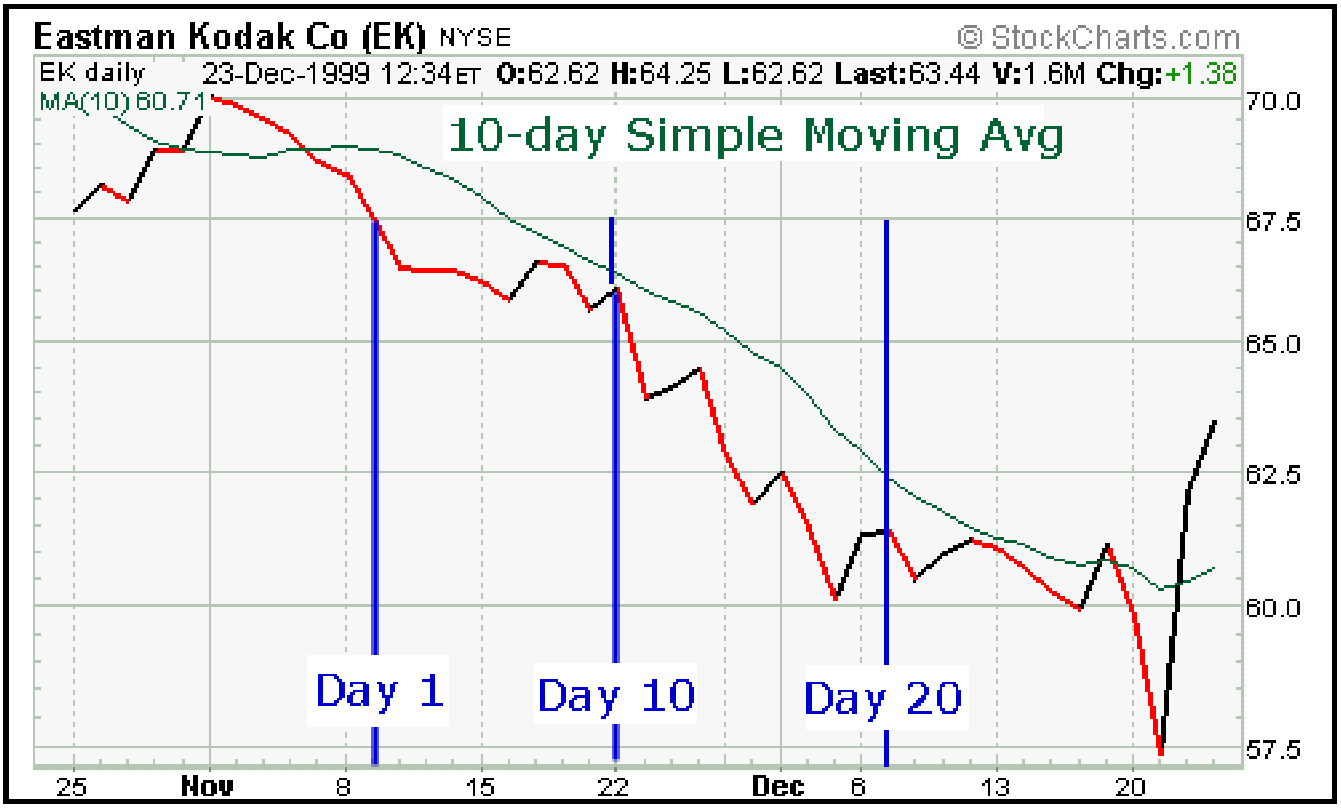
$$11 + 12 + 13 + 14 + 15 = 65$$

$$65 \div 5 = 13$$

Over the last 2 days, the moving average moved from 12 to 13. As new days are added, the old days will be subtracted and the moving average will continue to move over time.

| Day | Daily Close | 10-day SMA |
|---|---|---|
| 1 | 67.50 | |
| 2 | 66.50 | |
| 3 | 66.44 | |
| 4 | 66.44 | |
| 5 | 66.25 | |
| 6 | 65.88 | |
| 7 | 66.63 | |
| 8 | 66.56 | |
| 9 | 65.63 | |
| 10 | 66.06 | 66.39 |
| 11 | 63.94 | 66.03 |
| 12 | 64.13 | 65.79 |
| 13 | 64.50 | 65.60 |
| 14 | 62.81 | 65.24 |
| 15 | 61.88 | 64.80 |
| 16 | 62.50 | 64.46 |
| 17 | 61.44 | 63.94 |
| 18 | 60.13 | 63.30 |
| 19 | 61.31 | 62.87 |
| 20 | 61.38 | 62.40 |

In the example above, using closing prices from Eastman Kodak (EK), day 10 is the first day possible to calculate a 10-day moving average. As the calculation continues, the newest day is added and the oldest day is subtracted. The 10-day moving average for day 11 is calculated by adding the prices of day 2 through day 11 and dividing by 10. The averaging process then moves on to the next day where the 10-day moving average for day 12 is calculated by adding the prices of day 3 through day 12 and dividing by 10.




The chart above is a plot that contains the data sequence in the table. The moving average begins on day 10 and continues.

This simple illustration highlights the fact that moving averages are lagging indicators and will always be behind the price. The price of EK is trending down, but the moving average, which is based on the previous 10 days of data, remains above the price. If the price were rising, the moving average most likely be below. Because moving averages are lagging indicators, they fit in the category of trend following. When prices are trending, moving averages work well. However, when prices are not trending, moving averages do not work.

## Exponential Moving Average (EMA)

(Click here to see a live example of an Exponential Moving Average)

In order to reduce the lag in simple moving averages, technicians sometimes use exponential moving averages, or exponentially weighted moving averages. Exponential moving averages reduce the lag by applying more weight to recent prices relative to older prices. The weighting applied to the most recent price depends on the length of the moving average. The shorter the exponential moving average is, the more weight that will be applied to the most recent price. For example: a 10-period exponential moving average weighs the most recent price 18.18% and a 20-period exponential moving average weighs the most recent price 9.52%. The method for calculating the exponential moving average is fairly complicated. The important thing to remember is that the exponential moving average puts more weight on recent prices. As such, it will react quicker to recent price changes than a simple moving average. For those who wish to see an example formula for an exponential moving average, one is provided below. Others may prefer to skip this section and move on the comparison of the moving averages.

### Exponential Moving Average Calculation

The formula for an exponential moving average is:

$$X = (K \times (C - P)) + P$$

X = Current EMA
C = Current Price
P = Previous period's EMA*
K = Smoothing constant
(*A SMA is used for first period's calculation)

The smoothing constant applies the appropriate weighting to the most recent price relative to the previous exponential moving average. The formula for the smoothing constant is:

K = 2/(1+N)
N = Number of periods for EMA

For a 10-period EMA, the smoothing constant would be .1818.

$$\frac{2}{(\text{Time periods} + 1)} = \frac{2}{(10 + 1)} = \underset{(18.18\%)}{.1818}$$

The EMA formula works by weighting the difference between the current period's price and the previous period's EMA and adding the result to the previous period's EMA. There are two possible outcomes: the weighted difference is either positive or negative.

1. If the current price (C) is higher than the previous period's EMA (P), the difference will be positive (C - P). The positive difference is weighted by multiplying it by the constant ((C - P) x K) and the answer is added to the previous period's EMA, resulting in a new EMA that is higher ((C - P) x K) + P.
2. If the current price is lower than the previous period's EMA, the difference will be negative (C - P). The negative difference is weighted by multiplying it by the constant ((C - P) x K) and the final result is added to the previous period's EMA, resulting in a new EMA that is lower ((C - P) x K) + P.

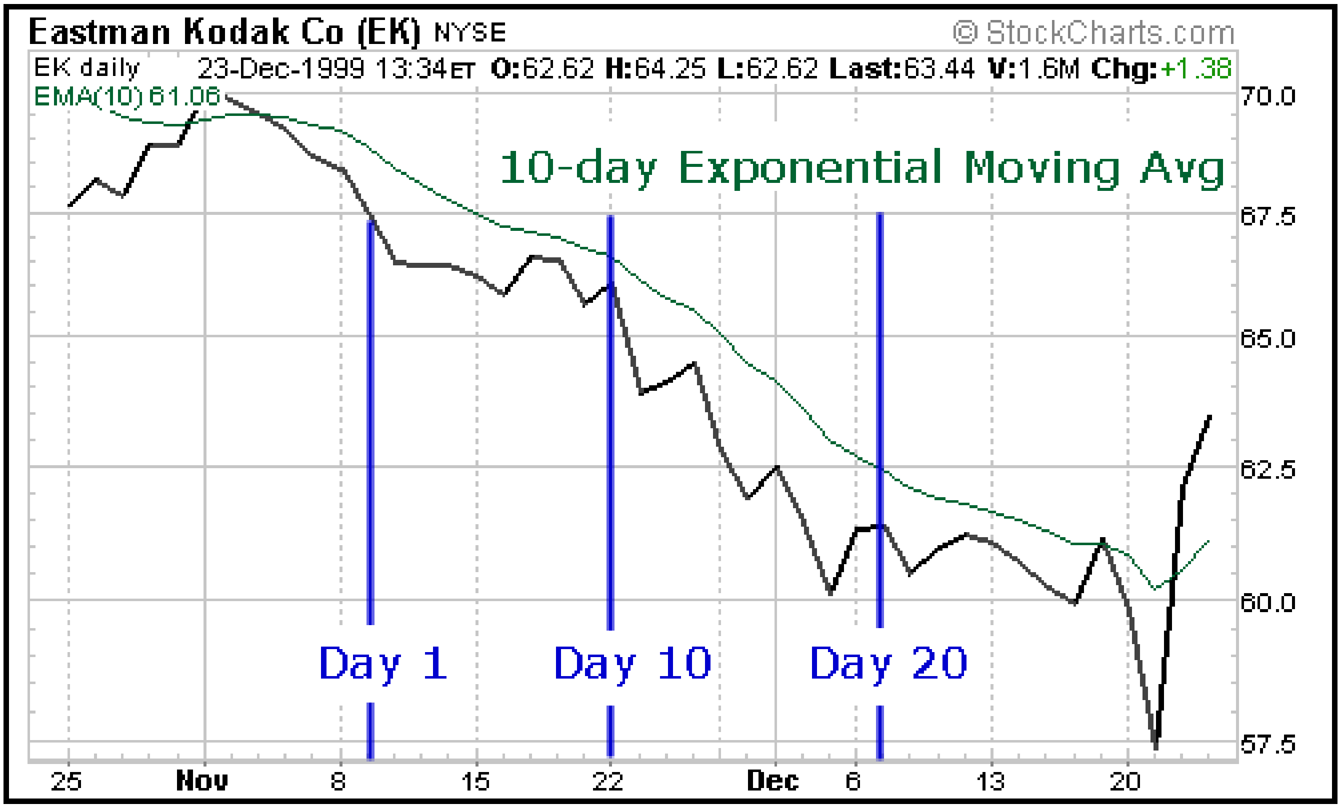
Below is a table with the results of an exponential moving average calculation for Eastman Kodak. For the first period's exponential moving average, the simple moving average was used as the previous period's exponential moving average (yellow highlight for the 10th period). From period 11 onwards, the previous period's EMA was used. The calculation in period 11 breaks down as follows:

1. (C - P)= (73.81 - 74.28) = -.47
2. (C - P) x K= -.47 x .1818 = -.08
3. ((C - P) x K) + P= -.08 + 74.28 = 74.20

The current price was 71.81, which was lower than the previous period's EMA. In order to pull it closer to the EMA, .08 of a point was shaved off of the previous period's EMA and the new EMA was 74.20.

| Period | Current Price (C) | Previous Period's EMA* (P) | 10-day EMA (X) | EMA Periods (N) | Smoothing constant (K) |
|---|---|---|---|---|---|
| 1 | 76.69 | | | | |
| 2 | 76.13 | | | | |
| 3 | 75.50 | | | | |
| 4 | 74.94 | | | | |
| 5 | 74.81 | | | | |
| 6 | 75.19 | | | | |
| 7 | 73.81 | | | | |
| 8 | 73.38 | | | | |
| 9 | 73.06 | | | | |
| 10 | 72.75 | 74.63* | 74.28 | 10 | 0.18182 |
| 11 | 73.81 | 74.28 | 74.20 | 10 | 0.18182 |
| 12 | 75.63 | 74.20 | 74.46 | 10 | 0.18182 |
| 13 | 75.25 | 74.46 | 74.60 | 10 | 0.18182 |
| 14 | 76.94 | 74.60 | 75.03 | 10 | 0.18182 |
| 15 | 76.38 | 75.03 | 75.27 | 10 | 0.18182 |
| 16 | 76.31 | 75.27 | 75.46 | 10 | 0.18182 |
| 17 | 75.44 | 75.46 | 75.46 | 10 | 0.18182 |
| 18 | 74.75 | 75.46 | 75.33 | 10 | 0.18182 |
| 19 | 74.69 | 75.33 | 75.21 | 10 | 0.18182 |
| 20 | 72.44 | 75.21 | 74.71 | 10 | 0.18182 |

*The 10-period simple moving average is used for the first calculation only. After that the previous period's EMA is used.



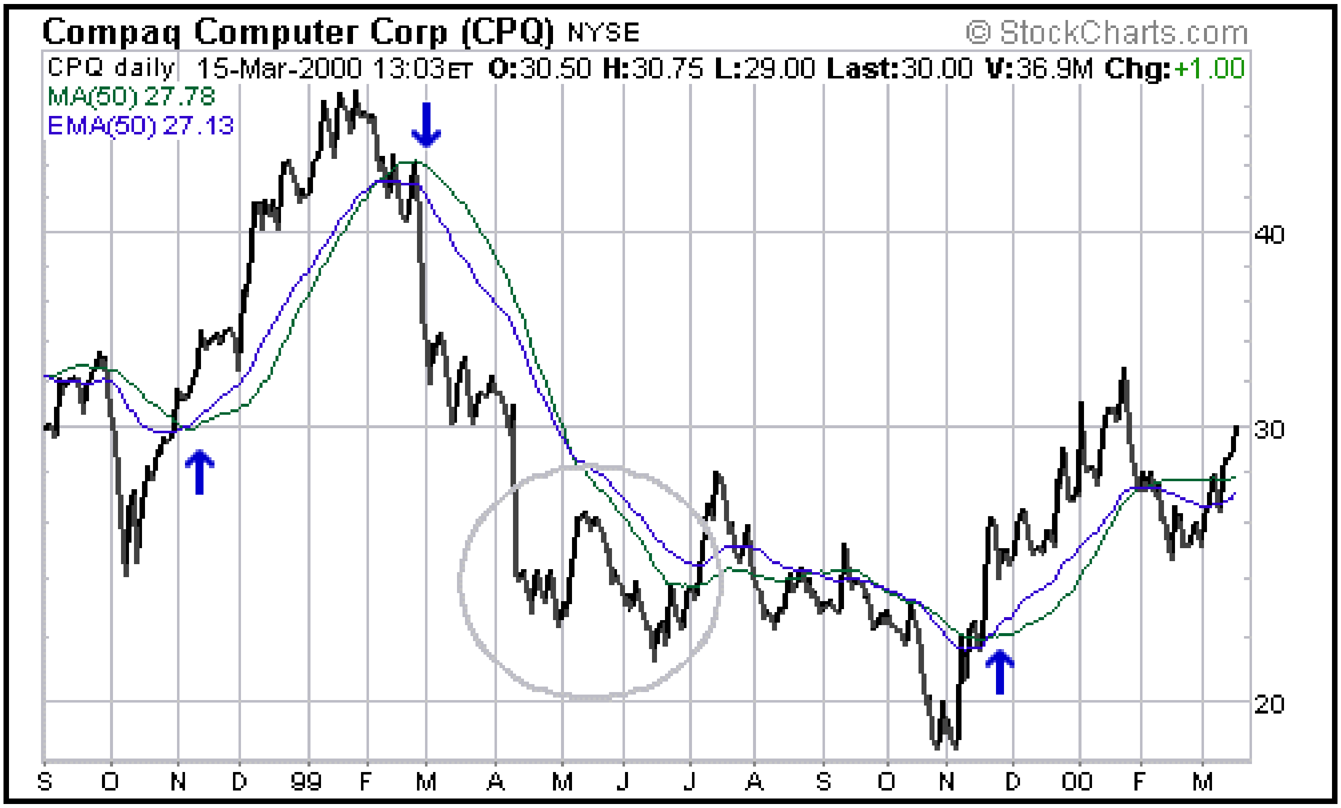

## Simple Versus Exponential

From afar, it would appear that the difference between an exponential moving average and a simple moving average is minimal. For this example, which uses only 20 trading days, the difference is minimal, but a difference nonetheless. The exponential moving average is consistently closer to the actual price. On average, the EMA is 3/8 of a point closer to the actual price than the SMA.

| Period | EMA Absolute Difference | SMA Absolute Difference |
|---|---|---|
| 10 | 1.53 | 1.88 |
| 11 | 0.39 | 0.53 |
| 12 | 1.17 | 1.34 |
| 13 | 0.65 | 0.99 |
| 14 | 1.91 | 2.47 |
| 15 | 1.10 | 1.76 |
| 16 | 0.85 | 1.58 |
| 17 | 0.02 | 0.54 |
| 18 | 0.58 | 0.28 |
| 19 | 0.52 | 0.51 |
| 20 | 2.27 | 2.72 |
| Average Difference | 1.00 | 1.33 |


From day 10 to day 20, the EMA was closer to the price than the SMA 9 out of 10 times. The only time the SMA was closer was in period number 18 (yellow highlight), and this did not last long. The average absolute difference between the exponential moving average and the current price was 1 and the simple moving average had an average absolute difference of 1.33. This means that on average, the exponential moving average was 1 point above or below the current price and the simple moving average was 1.33 points above or below the current price.

When EK stopped falling and started to trade flat, the SMA kept on declining. During this period, the SMA was closer to the actual price than the EMA. The EMA began to level out with the actual price and remain further away. This was because the actual price started to level out. Because of its lag, the SMA continued to decline and even touched the actual price on 13-Dec.




A comparison of a 50-day EMA and a 50-day SMA for Compaq also shows that the EMA picks up on the trend quicker than the SMA. The blue arrows mark points when the stock started a strong trend. By giving more weight to recent prices, the EMA reacted quicker than the SMA and remained closer to the actual price. The gray circle shows when the trend began to slow and a trading range developed. When the change from trend to trading began, the SMA was closer to the price. As the trading range continued into the latter part of 1999, both moving averages converged. In later 1999, CPQ started to trend up and the EMA was quicker to pick up on the recent price change and remain closer to the price.

## Which is better?

Which moving average you use will depend on your trading and investing style and preferences. The simple moving average obviously has a lag, but the exponential moving average may be prone to quicker breaks. Some traders prefer to use exponential moving averages for shorter time periods to capture changes quicker. Some investors prefer simple moving averages over long time periods to identify long-term trend changes. In addition, much will depend on the individual security in question. A 50-day SMA might work great for identifying support levels in the Nasdaq, but a 100-day EMA may work better for the Dow Transports. Moving average type and length of time will depend greatly on the individual security and how it has reacted in the past.

The initial thought for some is that greater sensitivity and quicker signals are bound to be beneficial. This is not always true and brings up a great dilemma for the technical analyst: the trade off between sensitivity and reliability. The more sensitive an indicator is, the more signals that will be given. These signals may prove timely, but with increased sensitivity comes an increase in false signals. The less sensitive an indicator is, the fewer signals that will be given. However, less sensitivity leads to fewer and more reliable signals. Sometimes these signals can be late as well.

For moving averages, the same dilemma applies. Shorter moving averages will be more sensitive and generate more signals. The EMA, which is generally more sensitive than the SMA, will also be likely to generate more signals. However, there will also be an increase in the number of false signals and whipsaws. Longer moving averages will move slower and generate fewer signals. These signals will likely prove more reliable, but they also may come late. Each investor or trader should experiment with different moving average lengths and types to examine the trade-off between sensitivity and signal reliability.

*In Part 2, we examine how to use moving averages to identify support and resistance levels, recognize trends and develop a trading system.*

Written by Arthur Hill

Part 1 | Part 2

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# Moving Averages - Part 2

## Moving Averages

### Trend-Following Indicator

Moving averages smooth out a data series and make it easier to identify the direction of the trend. Because past price data is used to form moving averages, they are considered lagging, or trend following, indicators. Moving averages will not predict a change in trend, but rather follow behind the current trend. Therefore, they are best suited for trend identification and trend following purposes, not for prediction.

### When to Use

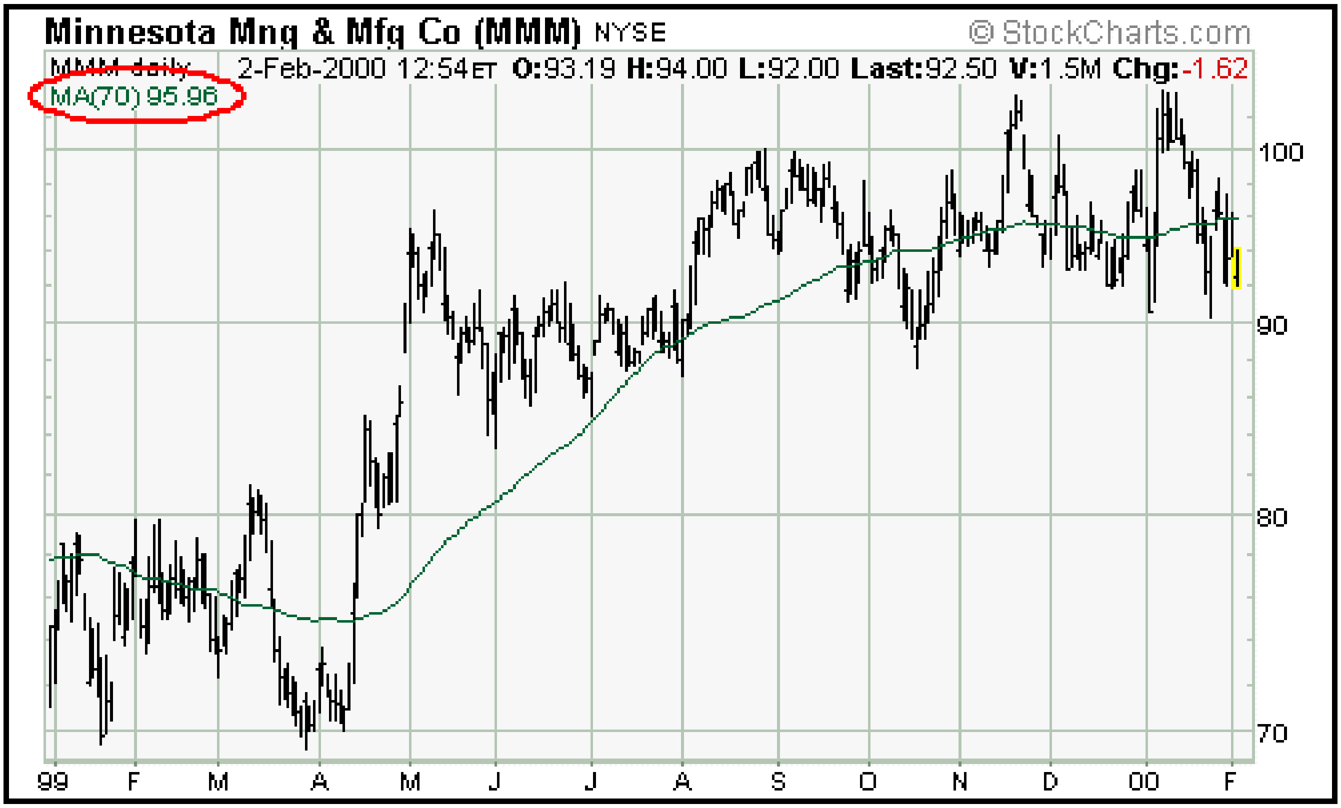
Because moving averages follow the trend, they work best when a security is trending and are ineffective when a security moves in a trading range. With this in mind, investors and traders should first identify securities that display some trending characteristics before attempting to analyze with moving averages. This process does not have to be a scientific examination. Usually, a simple visual assessment of the price chart can determine if a security exhibits characteristics of trend.

In its simplest form, a security's price can be doing only one of three things: trending up, trending down or trading in a range. An uptrend is established when a security forms a series of higher highs and higher lows. A downtrend is established when a security forms a series of lower lows and lower highs. A trading range is established if a security cannot establish an uptrend or downtrend. If a security is in a trading range, an uptrend is started when the upper boundary of the range is broken and a downtrend begins when the lower boundary is broken.

Ford


In the Ford example, it is evident that a stock can go through both trending and trading phases. The red circles indicate trading range phases that are interspersed among trending periods. It is sometimes difficult to determine when a trend will stop and a trading range will begin or when a trading range will stop and a trend will begin. The basic rules for trends and trading ranges laid out above can be applied to Ford. Notice the trading range periods, the breakouts (both up and down) and the trending periods. The moving average worked well in times of trend, but faired poorly in times of trading. Also note how the moving average lags behind the trend: it is always under the price during an uptrend and above the price during a downtrend. A 50-day simple moving average was used for this example. However, the number of periods is optional and much will depend on the characteristics of the security as well as an individual's trading and investing style.

3M




If price movements are choppy and erratic over an extended period of time, then a moving average is probably not the best choice for analysis. The chart for MMM shows a security that moved from 70 to 90 in a few weeks in late April. Prior to this advance, the price gyrated above and below its moving average. After the advance, the stock continued its erratic behavior without developing much of a trend. Trying to analyze this security based on a moving average is likely to be a lesson in futility.

AOL


A quick look at the chart for AOL shows a different picture than for MMM. Over the same time period, AOL has shown the ability to trend. There are 3 distinct trends or price movements that extend for a number of months. Once the stock moves above or below the 70-day SMA, it usually continues in that direction for a little while longer. MMM, on the other hand, broke above and below its 70-day SMA numerous times and would have been prone to numerous whipsaws. A longer moving average would probably work better for MMM, but it is clear that there are fewer characteristics of trend than in AOL.

### Moving Average Settings

Once a security has been deemed to have enough characteristics of trend, the next task will be to select the number of moving average periods and type of moving average. The number of periods used in a moving average will vary according to the security's volatility, trendiness and personal preferences. The more volatility there is, the more smoothing that will be required and hence the longer the moving average. Stocks that do not exhibit strong characteristics of trend may also require longer moving averages. There is no one set length, but some of the more popular lengths include 21, 50, 89, 150 and 200 days as well as 10, 30 and 40 weeks. Short-term traders may look for evidence of 2-3 week trends with a 21-day moving average, while longer-term investors may look for evidence of 3-4 month trends with a 40-week moving average. Trial and error is usually the best means for finding the best length. Examine how the moving average fits with the price data. If there are too many breaks, lengthen the moving average to decrease its sensitivity. If the moving average is slow to react, shorten the moving average to increase its sensitivity. In addition, you may want to try using both simple and exponential moving averages. Exponential moving averages are usually best for short-term situations that require a responsive moving average. Simple moving averages work well for longer-term situations that do not require a lot of sensitivity.

## Uses for Moving Averages

There are many uses for moving averages, but three basic uses stand out:

- Trend identification/confirmation
- Support and Resistance level identification/confirmation
- Trading Systems

### Trend Identification/Confirmation

There are three ways to identify the direction of the trend with moving averages: direction, location and crossovers.

The first trend identification technique uses the direction of the moving average to determine the trend. If the moving average is rising, the trend is considered up. If the moving average is declining, the trend is considered down. The direction of a moving average can be determined simply by looking at a plot of the moving average or by applying an indicator to the moving average. In either case, we would not want to act on every subtle change, but rather look at general directional movement and changes.

Disney


In the case of Disney, a 100-day exponential moving average (EMA) has been used to determine the trend. We do not want to act on every little change in the moving average, but rather significant upturns and downturns. This is not a scientific study, but a number of significant turning points can be spotted just based on visual observation (red circles). A few good signals were rendered, but also a few whipsaws and late signals. Much of the performance would depend on your entry and exit points. The length of the moving average influences the number of signals and their timeliness. Moving averages are lagging indicators. Therefore, the longer the moving average is, the further behind the price movement it will be. For quicker signals, a 50-day EMA could have been used.

The second technique for trend identification is price location. The location of the price relative to the moving average can be used to determine the basic trend. If the price is above the moving average, the trend is considered up. If the price is below the moving average, the trend is considered down.

Enron


This example is pretty straightforward. The long-term for ENE is determined by the location of the stock relative to its 100-day SMA. When ENE is above its 100-day SMA, the trend is considered bullish. When the stock is below the 100-day SMA, the trend is considered bearish. Buy and sell signals are generated by crosses above and below the moving average. There was a brief sell signal generated in Aug-98 and a false buy signal in Nov-99. Both of these signals occurred when Enron's trend began to weaken. For the most part though, this simple method would have kept an investor in throughout most of the bull move.

The third technique for trend identification is based on the location of the shorter moving average relative to the longer moving average. If the shorter moving average is above the longer moving average, the trend is considered up. If the shorter moving average is below the longer moving average, the trend is considered down.

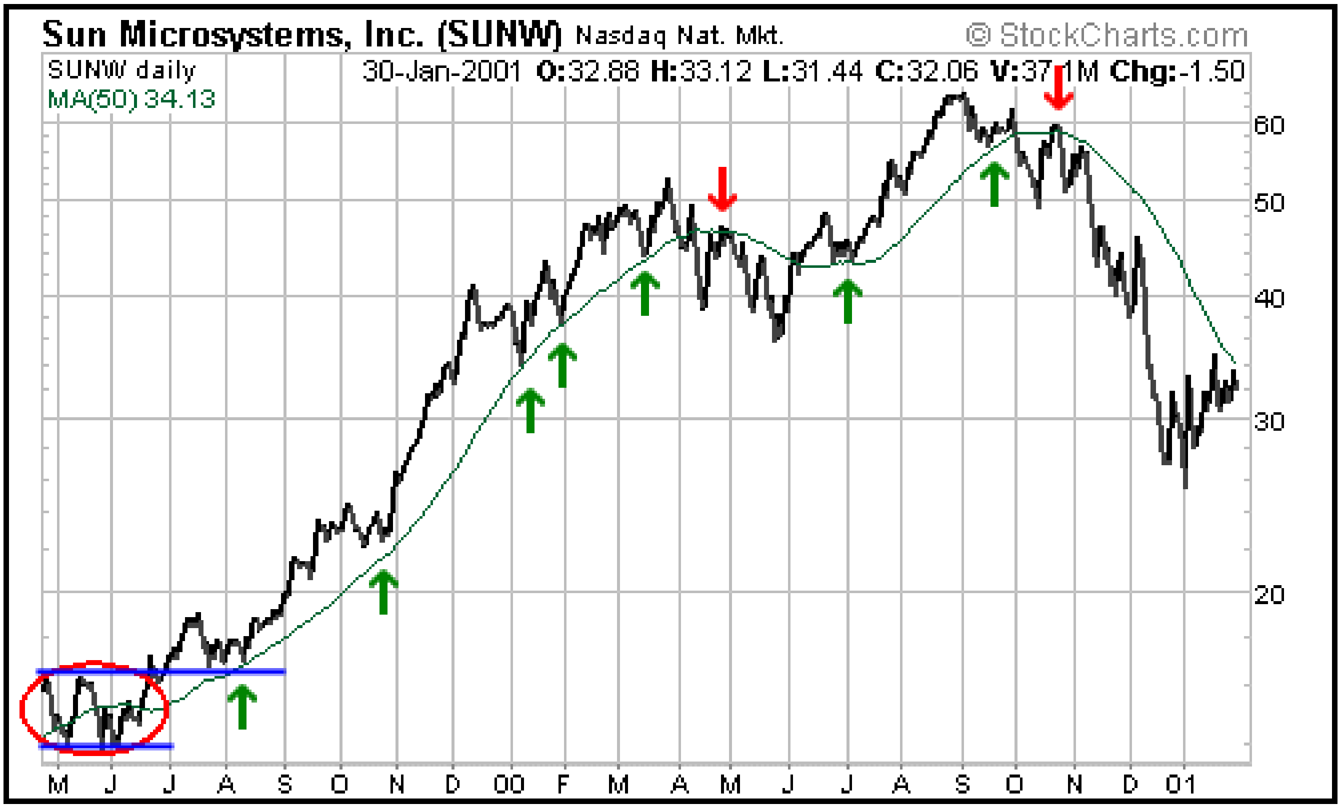
Xircom


For Xircom, a 30/100 moving average crossover was used to determine the trend. When the 30-day moving average moves above the 100-day moving average, the trend is considered bullish. When the 30-day moving average declines below the 100-day moving average, the trend is considered bearish. A plot of the 30/100 differential is plotted below the price chart by using the Percentage Price Oscillator (PPO) set to (30,100,1). When the differential is positive the trend is considered up -- when it is negative the trend is considered down. As with all trend-following systems, the signals work well when the stock develops a strong trend, but are ineffective when the stock is in a trading range. Also notice that the signals tend to be late and after the move has begun. Again, trend following indicators are best for identification and following, not predicting.

Support and Resistance Levels

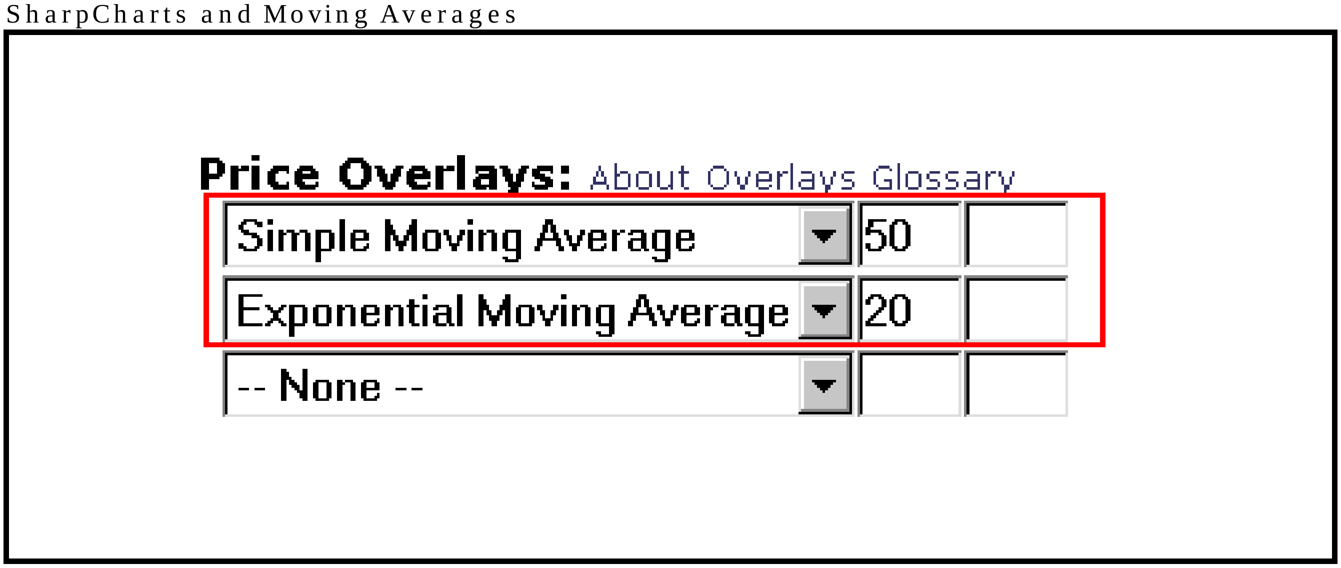
Another use of moving averages is to identify support and resistance levels. This is usually accomplished with one moving average and is based on historical precedent. As with trend identification, support and resistance level identification through moving averages works best in trending markets.

Sun Microsystems




After breaking out of a trading range, Sun Microsystems successfully tested moving average support in late July and early August. Also notice that the June resistance breakout near 18 turned into support. Therefore, the moving average acted as a confirmation of resistance-turned-support. After this first test, the 50-day moving average went on to 4 more successful support tests over the next several months. A break of support from the 50-day moving average would serve as a warning that the stock may move into a trading range or may be about to change the direction of the trend. Such a break occurred in Apr-00 and the 50-day SMA turned into resistance later that month. When the stock broke above the 50-day SMA in early Jun-00, it returned to a support level until the Oct-00 break. In Oct-00, the 50-day SMA became a resistance level and that held for many months.

SharpCharts and Moving Averages




Moving averages are available as a price overlay feature on SharpCharts. From the price overlay option, you can choose either a simple moving average or an exponential moving average. The first box to the right is used to set the number of time periods. If charting on daily periods, then 50 would be for a 50-day moving average. If charting on weekly periods, then 50 would be for a 50-week moving average. The moving averages are based on closing prices and multiple moving averages can be overlaid the price plot.

## Conclusions

Moving averages can be effective tools to identify and confirm trend, identify support and resistance levels, and develop trading systems. However, traders and investors should learn to identify securities that are suitable for analysis with moving averages and how this analysis should be applied. Usually, an assessment can be made with a visual examination of the price chart, but sometimes it will require a more detailed approach. The ADX, Average Directional Index, is one tool that can help identify securities that are trending and those that are not.

The advantages of using moving averages need to be weighed against the disadvantages. Moving averages are trend following, or lagging, indicators that will always be a step behind. This is not necessarily a bad thing though. After all, the trend is your friend and it is best to trade in the direction of the trend. Moving averages will help ensure that a trader is in line with the current trend. However, markets, stocks and securities spend a great deal of time in trading ranges, which render moving averages ineffective. Once in a trend, moving averages will keep you in, but also give late signals. Don't expect to get out at the top and in at the bottom using moving averages. As with most tools of technical analysis, moving averages should not be used on their own, but in conjunction with other tools that complement them. Using moving averages to confirm other indicators and analysis can greatly enhance technical analysis.

Written by Arthur Hill

Part 1 | Part 2

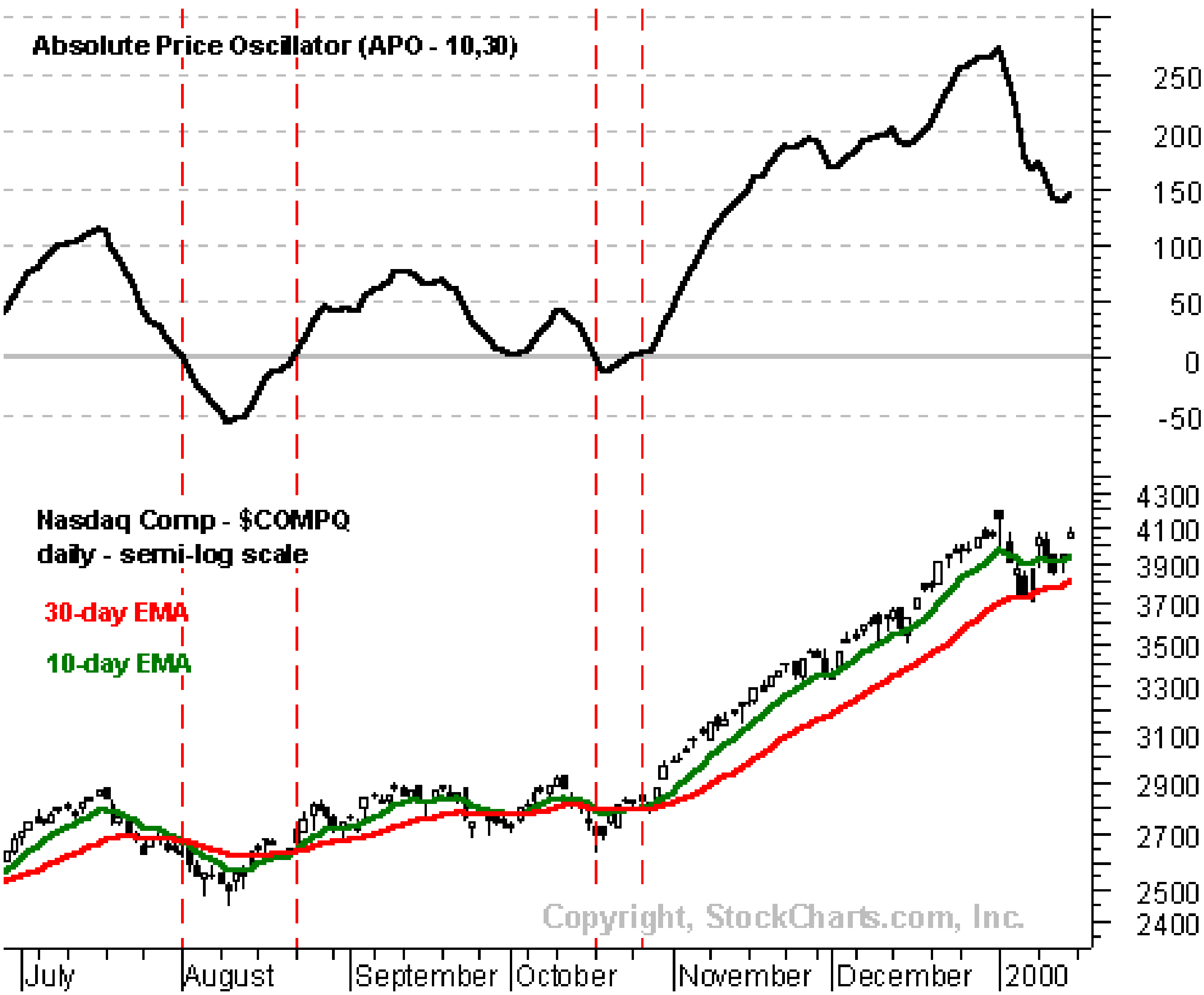
# Price Oscillator

## Introduction

The Price Oscillator is an indicator based on the difference between two moving averages, and is expressed as either a percentage or in absolute terms. According to user preferences, the moving averages used to calculate the Price Oscillator can be exponential, weighted or simple and the number of time periods can vary. For daily data, longer moving averages might be preferred to filter out some of the randomness associated with daily prices. For weekly data, which will have already filtered out some of the randomness, shorter moving averages may be deemed more appropriate. In addition, a moving average of the ensuing plot can be overlaid to act as a trigger line, much like is done with MACD. In our charts and commentary, we will use the abbreviation PPO to refer to the Percentage Price Oscillator and APO to refer to the Absolute Price Oscillator.

## Absolute Price Oscillator (APO)

The Absolute Price Oscillator is calculated by subtracting the longer moving average from the shorter moving average. For example:



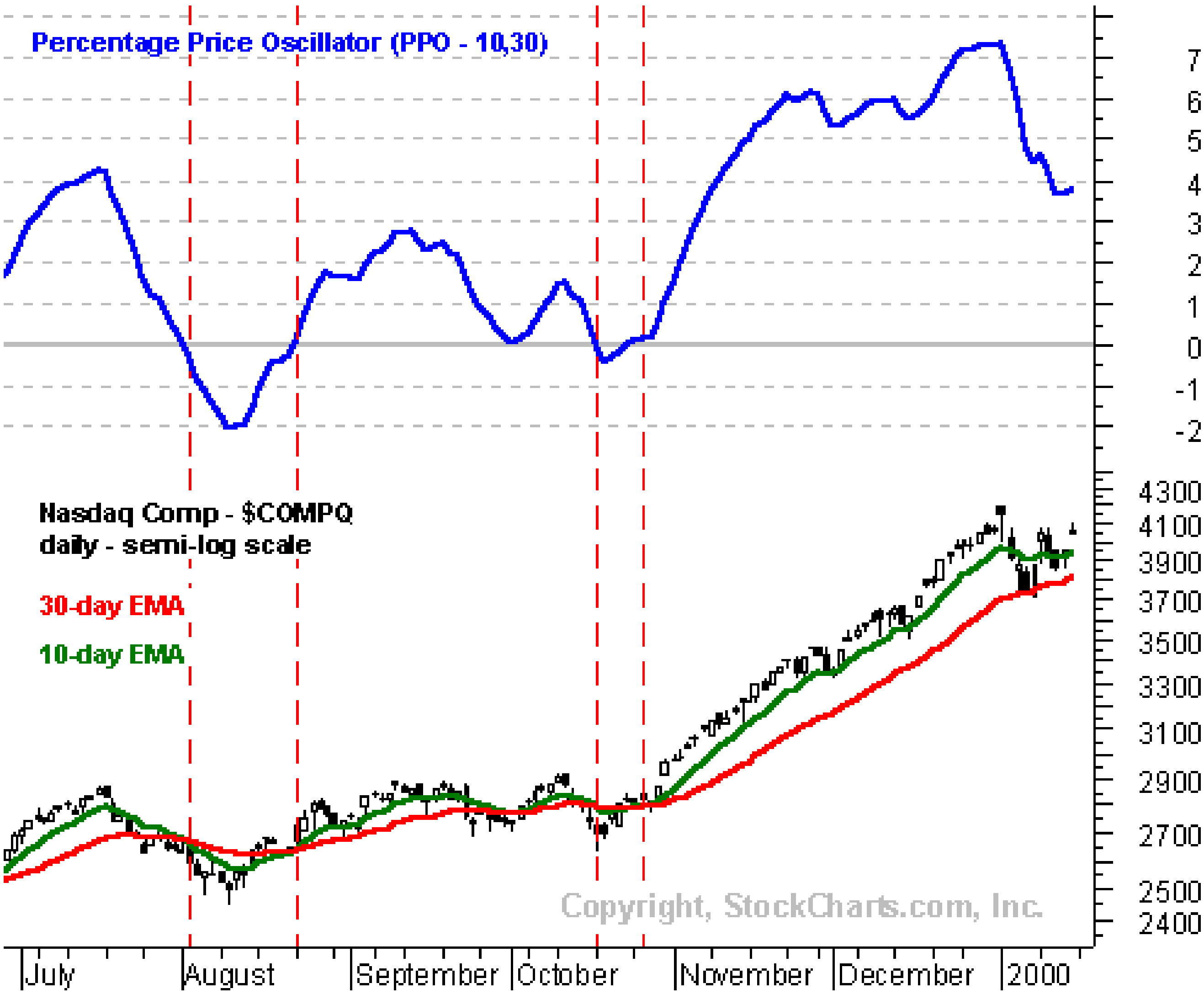
10-period exponential moving average (EMA) minus 30-period EMA

The resulting plot forms an oscillator that fluctuates above and below zero according to the differences in the moving averages. If the shorter moving average is above the longer moving average, then the indicator will be positive. If the shorter moving average is below the longer moving average, then the indicator will be negative.

Note: MACD is also calculated by finding the absolute difference. Theoretically, MACD can be calculated with any two user-defined moving averages. However, it is typically calculated by subtracting the 26-day exponential moving average from the 12-day exponential moving average.

## Percentage Price Oscillator (PPO)

The Percentage Price Oscillator is found by subtracting the longer moving average from the shorter moving average and then dividing the result by the shorter moving average. For example:



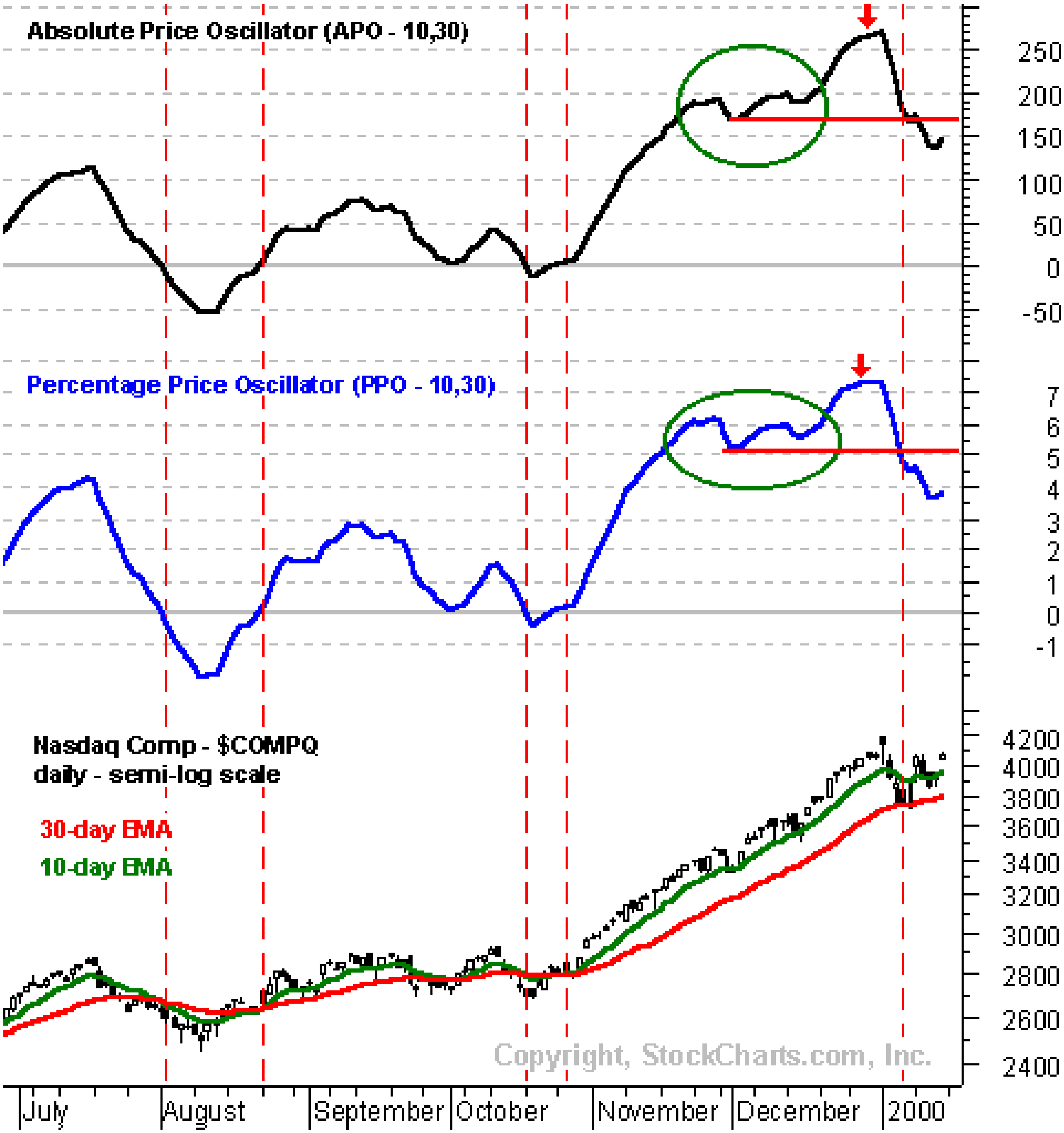

(Click here to see a live example of PPO)

{(10-period EMA minus 30-period EMA) divided by the 10-period EMA}

This formula displays the difference between the two moving averages as a percentage of the shorter moving average.

## Absolute versus Percentage

The Percentage Price Oscillator (PPO) and the Absolute Price Oscillator (APO) generate many of the same signals and have basically the same shape. All centerline crossovers, which represent the shorter moving average crossing above or below the longer moving average, occur at the same time. However, because the shape of the lines are not exactly identical, there will likely be discrepancies. This analysis of the Nasdaq Composite illustrates some of the differences that may crop up.

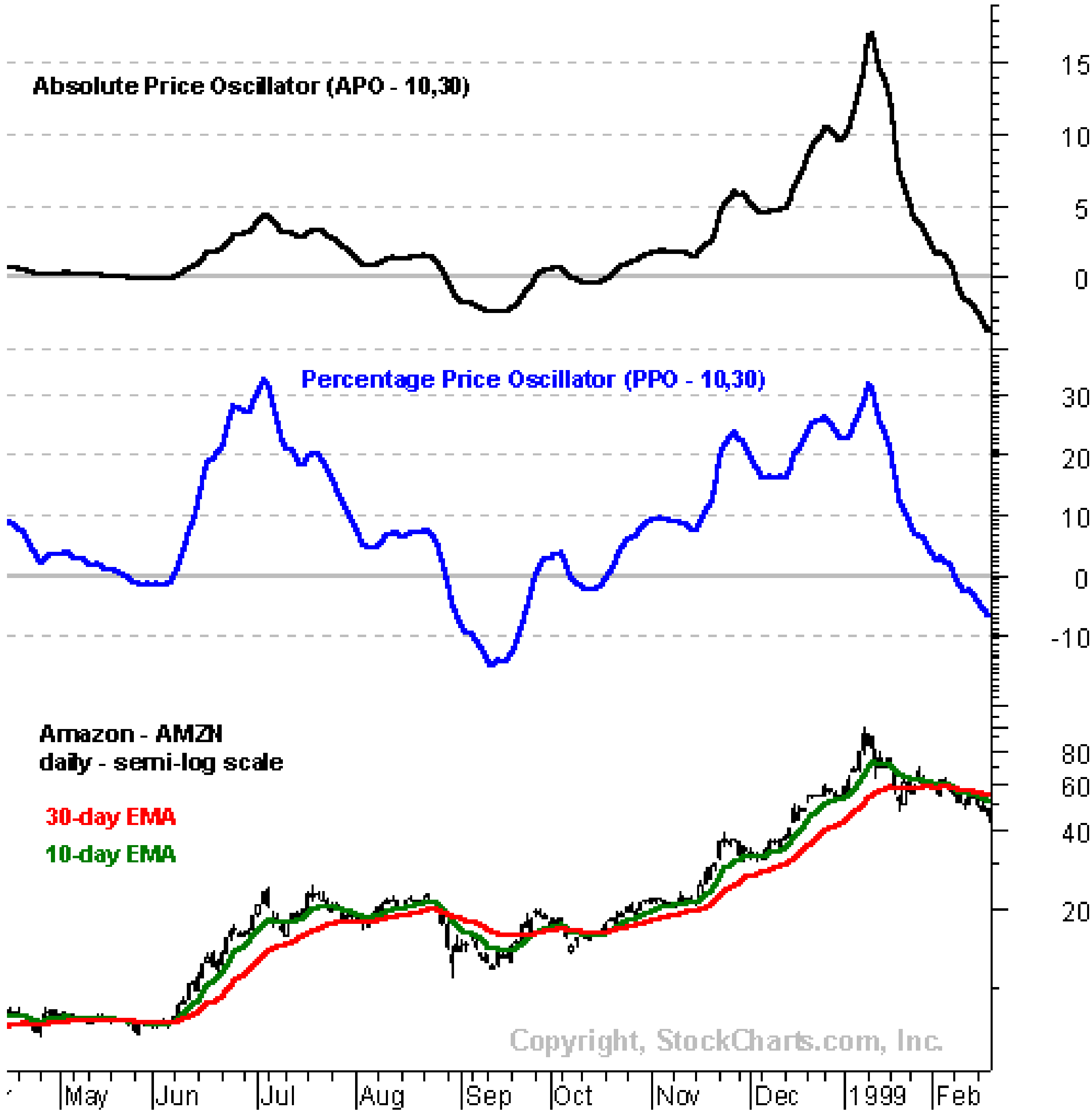



1. The green circle shows that the PPO formed a lower high in December while the APO formed a higher high.
2. Later in December, the APO continued higher and the PPO began to flatten out. (red arrows)
3. In early January, the PPO recorded a lower low, which was a day earlier than the APO.

There are two main reasons for using the PPO versus the APO.

1. With the Percentage Price Oscillator, it is possible to compare Price Oscillator levels from one security to the next. A PPO reading of +5% means that the shorter moving average is 5% higher than the longer moving average. This percentage reading is comparable against another security, regardless of the price of a security. The Percentage Price Oscillator (PPO) for SLB only reached 3% for its highs while that of the Nasdaq Composite rose above 7%.


2. The Percentage Price Oscillator is a better representation of the two moving averages relative to each other. The difference between the two moving averages is shown in relation to the shorter moving average. This allows for comparisons across time periods, regardless of the price of the stock. With the Absolute Price Oscillator, the higher the price of the stock, the greater the extremes of the oscillator. With the Percentage Price Oscillator, a comparison of Amazon over time is possible regardless of whether the stock is at 10 or 100.

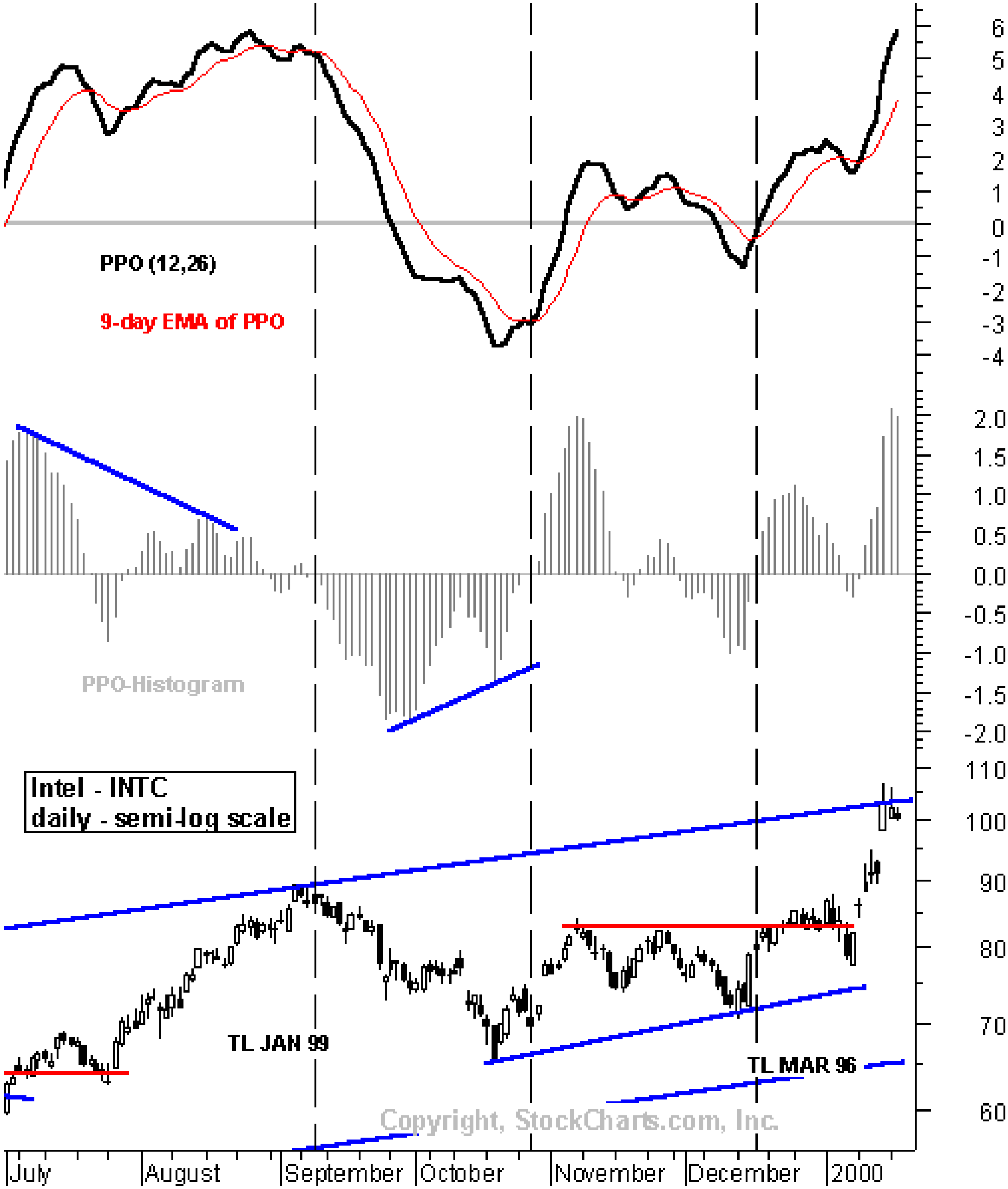



## PPO-Histogram

The daily Percentage Price Oscillator, using 12 and 26-day EMAs, is very similar to the standard MACD, which also uses the 12 and 26-day EMAs. The Percentage Price Oscillator measures the difference between the two moving averages as a percentage of the shorter moving average.

Because the Price Oscillator and MACD are so similar, the concept of the MACD-Histogram has been applied to the PPO. The PPO-Histogram shows the difference between the PPO and the 9-day EMA of the PPO. The plot is presented as a histogram so that centerline crossovers and divergences are easily identifiable. The same principles that apply to the MACD-Histogram are also applicable to the PPO-Histogram. The Absolute Price Oscillator (APO) is exactly the same as the MACD.

A centerline crossover for the PPO-Histogram is the same as a moving average crossover for the PPO. If the value of the PPO is larger than the value of its 9-day EMA, then the value on the PPO-Histogram will be positive. Conversely, if the value of the PPO is less than its 9-day EMA, then the value of the PPO-Histogram will be negative.




Further increases or decreases in the gap between the PPO and its 9-day EMA will be reflected in the PPO-Histogram. Sharp increases in the PPO-Histogram indicate that the PPO is rising faster than its 9-day EMA -- bullish momentum is strengthening. Sharp declines in the PPO-Histogram indicate that the PPO is falling faster than its moving average -- bearish momentum is increasing.

For the weekly charts on StockCharts.com's StockWatch, the Percentage Price Oscillator (PPO) uses the 6 and 12-week EMAs with a 10-week EMA of the PPO as a trigger line. A PPO-Histogram has also been formulated for these charts and is shown as a histogram. Please see our Chart School article on the MACD-Histogram for more detailed description of how to use the MACD-Histogram. These guidelines are also valid for the PPO-Histogram.

For more on the interpretation of this oscillator and its signals, see our articles about oscillators and MACD.

Written by Arthur Hill

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# Price Relative

The Price Relative compares the performance of one security against that of another. It is often used to compare the performance of a particular stock to a market index, usually the S&P 500. Because the goal of many portfolio managers is to outperform the S&P 500, they are usually interested in the strongest stocks. The price relative offers a straightforward and accurate portrayal of a stock's performance relative to the market.

The price relative is calculated by dividing the security's price by the value of the S&P 500. If WMT were trading at 60 and the S&P 500 were 1400, then the price relative would be 60/1400, which equals .0428. Should WMT advance to 70 and the S&P 500 to 1450, the price relative would be .0482 (70/1450). The advance from .0428 to .0482 shows the WMT is stronger than the S&P 500. This number is then plotted along the Y-axis to form a line chart. The price relative can be calculated on a daily, weekly or monthly basis; closing prices are normally used.

Traditional technical analysis techniques can be used to analyze the plot of the price relative. Support, resistance, trendlines, moving averages and pattern analysis can all be applied. Some analysts even apply indicators to the price relative in an attempt to identify changes.

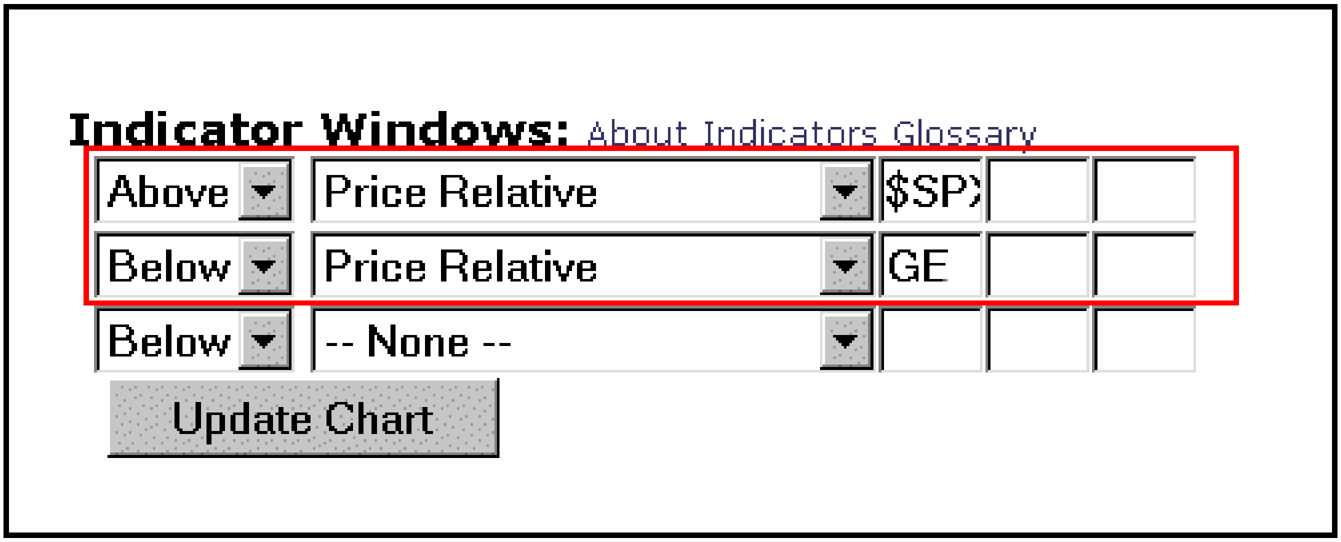

(Click here to see a live example of Price Relative)

In the WMT chart, we can see that the price relative peaked on 16-Dec (red line), about two weeks earlier than the stock. A series of lower highs ensued, and short-term support was broken in mid-January. A few days later, the price relative broke its trendline extending up from early August (blue line). The support and trendline breaks in the stock occurred later than those in the price relative. A sharp decline in the stock was foreshadowed by weakness in the price relative.


In the 1998 chart for SUNW, the price relative recorded a higher low in August and a new reaction high in September (black arrow). This created a positive divergence and signaled that SUNW was much stronger than the overall market. When the October-1998 rally kicked in, SUNW was one of the top performers over the next 17 months.

Rotation among sectors and stocks plays a big part in today's market. By applying the price relative to industry groups and stocks, traders and investors can identify pockets of relative strength and relative weakness. As with most indicators and analysis techniques, the price relative is just one tool and should be used in conjunction with other aspects of technical analysis.

Sharp Charts and the Price Relative




The price relative for SharpCharts can displayed above or below the price plot of the underlying security. The first box to the right can be used to change the symbol -- any security can be entered here. For example, if the underlying security was the Amex Oil Index ($XOI) and you wanted to plot a price relative against West Texas Intermediate Crude ($WTIC), then $WTIC would be entered into the box. An advancing price relative would indicate that $XOI was outperforming $WTIC and a declining price relative would show underperformance relative to $WTIC.

Written by Arthur Hill

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Chart School

# Percentage Volume Oscillator (PVO)

The Percentage Volume Oscillator (PVO) is the percentage difference between two moving averages of volume. The indicator is calculated with the following formula:

> Volume Oscillator (%) - PVO = ((Vol 12-day EMA - Vol 26-day EMA)/Vol 12-day EMA) x 100

The 12-day exponential moving average (EMA) and 26-exponential moving average were used as examples. Typically, these can be changed to suit longer or shorter time periods. Because of its formula, the PVO has a maximum value of +100, but no minimum value. For example: if the 12-day EMA equals 2000 and the 26-day EMA equals 8000, then the PVO would equal -300 (((2000 - 8000)/2000) x 100) = -300. The absolute value is not as important as the direction or the crosses above and below the zero line.

Uses

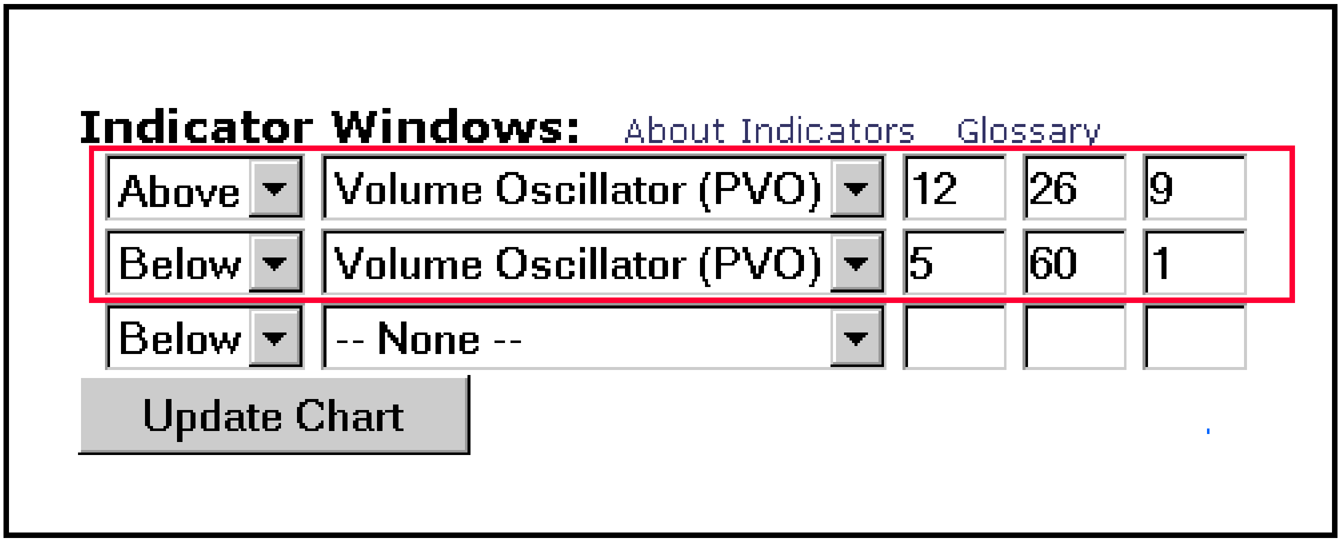
The PVO can be used to identify periods of expanding or contracting volume in three different ways:

- Centerline Crossovers: like the PPO, the PVO oscillates above and below the zero line. When PVO is positive, the shorter EMA of volume is greater than the longer EMA of volume. When PVO is negative, the shorter EMA of volume is less than the longer EMA of volume. A PVO above zero indicates that volume levels are generally above average and relatively heavy. When the PVO is below zero, volume levels are generally below average and light.
- Directional Movement: General directional movement of the PVO can offer a quick visual assessment of volume patterns. A rising PVO signals that volume levels are increasing and a falling PVO signals that volume levels are decreasing.
- Moving average crossovers: The last variable in the PVO forms the signal line. For example: PVO(12,26,9) would include a 9-day EMA of PVO as well as a histogram representing the difference between the PVO and its 9-day EMA. When PVO moves above its signal line, volume levels are generally increasing. When PVO moves below its signal line, volume levels are generally decreasing.

Movements in the PVO are completely separate from price movements. As such, movements in PVO can correlated with price movements to assess the degree of buying or selling pressure. Advances combined with strength in the PVO would be considered strong. Should the PVO decline while a security's price fell, it would indicate decreasing volume on the decline.


In the example above, FILE is shown with two PVO settings: PVO (12,26,9) in the top window and PVO (5,60,1) in the bottom window. When the final variable is set at 1, as with PVO(5,60,1) there is no signal line or histogram. During August and September, the stock traded between 15 and 21, and the PVO remained mostly below zero. There was a small bounce above zero with the late August advance, but the stock remained confined to its trading range. When the stock began to advance off of its low in October, the PVO moved into positive territory with a sharp rise (green line). The advance was confirmed with expanding volume and the stock broke resistance. The breakout with expanding volume signaled exceptionally strong buying pressure.

The Percentage Volume Oscillator (PVO) and SharpCharts




On SharpCharts, the PVO has three variable boxes and appears in the same format as the Percentage Price Oscillator (PPO). The default setting is (12,26,9): the first variable is for the short exponential moving average (EMA) of volume, the second is for the long exponential moving average of volume and the third is for the signal line. The signal line is the EMA of the indicator itself (the PVO) and can also be made longer or shorter. The histogram (solid area above and below zero) represents the difference between the PVO and its signal line. For those who do not wish to have a trigger line or histogram, the third variable (the signal line) can be set equal to 1.


In the example above, the PVO is set in the top window at the default setting (12,26,9) and in the bottom window at (5,60,1). Even though the line shapes for both PVO settings are almost identical, the scales on the right reflect different ranges and crossover points.

- PVO (12,26,9) surpassed +20 in late October, while PVO (5,60,1) surpassed +50.
- In early October (red line #1), PVO (5,60,1) crossed below zero, but PVO (12,26,9) remained above.
- At the beginning of December (red line #2), PVO (5,60,1) moved above zero before PVO (12,26,9) did.

Much of this difference can be attributed to the short EMA of volume in both PVO settings. The 5-day EMA of volume is much more sensitive than the 12-day EMA of volume. Shorter moving averages are more volatile and more likely to have centerline crossovers. Above-average volume periods can also be confirmed by watching for volume bars that exceed the 60-day EMA (green oval in October). Notice that both PVOs shot up in the second half of October as volume spiked above 60m shares.

Written by Arthur Hill

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Chart School

# Relative Strength Index (RSI)

## Overview

Developed by J. Welles Wilder and introduced in his 1978 book, New Concepts in Technical Trading Systems, the Relative Strength Index (RSI) is an extremely useful and popular momentum oscillator. The RSI compares the magnitude of a stock's recent gains to the magnitude of its recent losses and turns that information into a number that ranges from 0 to 100. It takes a single parameter, the number of time periods to use in the calculation. In his book, Wilder recommends using 14 periods.

The RSI's full name is actually rather unfortunate as it is easily confused with other forms of Relative Strength analysis such as John Murphy's "Relative Strength" charts and IBD's "Relative Strength" rankings. Most other kinds of "Relative Strength" stuff involve using more than one stock in the calculation. Like most true indicators, the RSI only needs one stock to be computed. In order to avoid confusion, many people avoid using the RSI's full name and just call it "the RSI."

## Formula

$$\text{RSI} = 100 - \frac{100}{1 + \text{RS}}$$

$$\text{Average Gain} = (\text{Total Gains}/n)$$

$$\text{Average Loss} = (\text{Total Losses}/n)$$

$$\text{First RS} = (\text{Average Gain}/\text{Average Loss})$$

$$\text{Smoothed RS} = \frac{[(\text{previous Average Gain}) \times 13 + \text{Current Gain}]/14}{[(\text{previous Average Loss}) \times 13 + \text{Current Loss}]/14}$$

$$n = \text{number of RSI periods}$$

To simplify the formula, the RSI has been broken down into its basic components which are the Average Gain, the Average Loss, the First RS, and the subsequent Smoothed RS's.

For a 14-period RSI, the Average Gain equals the sum total all gains divided by 14. Even if there are only 5 gains (losses), the total of those 5 gains (losses) is divided by the total number of RSI periods in the calculation (14 in this case). The Average Loss is computed in a similar manner.

Calculation of the First RS value is straightforward: divide the Average Gain by the Average Loss. All subsequent RS calculations use the previous period's Average Gain and Average Loss for smoothing purposes. See the "Smoothed RS" formula above for details. The table below illustrates the formula in action.

| | Close | Chg | Adva | Decl | AvgGain | AvgLoss | RS | RSI |
|---|---|---|---|---|---|---|---|---|
| | 46.1250 | | | | | | | |
| 1 | 47.1250 | 1.0000 | 1.0000 | | | | | |
| 2 | 46.4375 | -0.6875 | | 0.6875 | | | | |
| 3 | 46.9375 | 0.5000 | 0.5000 | | | | | |
| 4 | 44.9375 | -2.0000 | | 2.0000 | | | | |
| 5 | 44.2500 | -0.6875 | | 0.6875 | | | | |
| 6 | 44.6250 | 0.3750 | 0.3750 | | | | | |
| 7 | 45.7500 | 1.1250 | 1.1250 | | | | | |
| 8 | 47.8125 | 2.0625 | 2.0625 | | | | | |
| 9 | 47.5625 | -0.2500 | | 0.2500 | | | | |
| 10 | 47.0000 | -0.5625 | | 0.5625 | | | | |
| 11 | 44.5625 | -2.4375 | | 2.4375 | | | | |
| 12 | 46.3125 | 1.7500 | 1.7500 | | | | | |
| 13 | 47.6875 | 1.3750 | 1.3750 | | | | | |
| 14 | 46.6875 | -1.0000 | | 1.0000 | 0.5848 | 0.5446 | 1.0738 | 51.779 |
| 15 | 45.6875 | -1.0000 | | 1.0000 | 0.5430 | 0.5772 | 0.9409 | 48.477 |
| 16 | 43.0625 | -2.6250 | | 2.6250 | 0.5043 | 0.7234 | 0.6970 | 41.073 |
| 17 | 43.5625 | 0.5000 | 0.5000 | | 0.5040 | 0.6718 | 0.7502 | 42.863 |
| 18 | 44.8750 | 1.3125 | 1.3125 | | 0.5617 | 0.6238 | 0.9005 | 47.382 |
| 19 | 43.6875 | -1.1875 | | 1.1875 | 0.5216 | 0.6640 | 0.7855 | 43.992 |

(Click here for an Excel spreadsheet with this example in it.)

Here's how lines 14 and 15 were calculated:

$$\text{First RS} = \frac{(.5848)}{(.5446)} = 1.0738$$

$$\text{RSI(period 14)} = 100 - \frac{100}{1 + 1.0738} = 51.779$$

$$\text{Smoothed RS} = \frac{(((.5848 \times 13) + 0.00) / 14)}{(((.5446 \times 13) + 1.00) / 14)} = .9409$$

$$\text{RSI(period 14)} = 100 - \frac{100}{1 + .9409} = 48.477$$

Note: *It is important to remember that the Average Gain and Average Loss are* ***not true averages****! Instead of dividing by the number of gaining (losing) periods, total gains (losses) are always divided by the specified number of time periods - 14 in this case.*

When the Average Gain is greater than the Average Loss, the RSI rises because RS will be greater than 1. Conversely, when the average loss is greater than the average gain, the RSI declines because RS will be less than 1. The last part of the formula ensures that the indicator oscillates between 0 and 100.

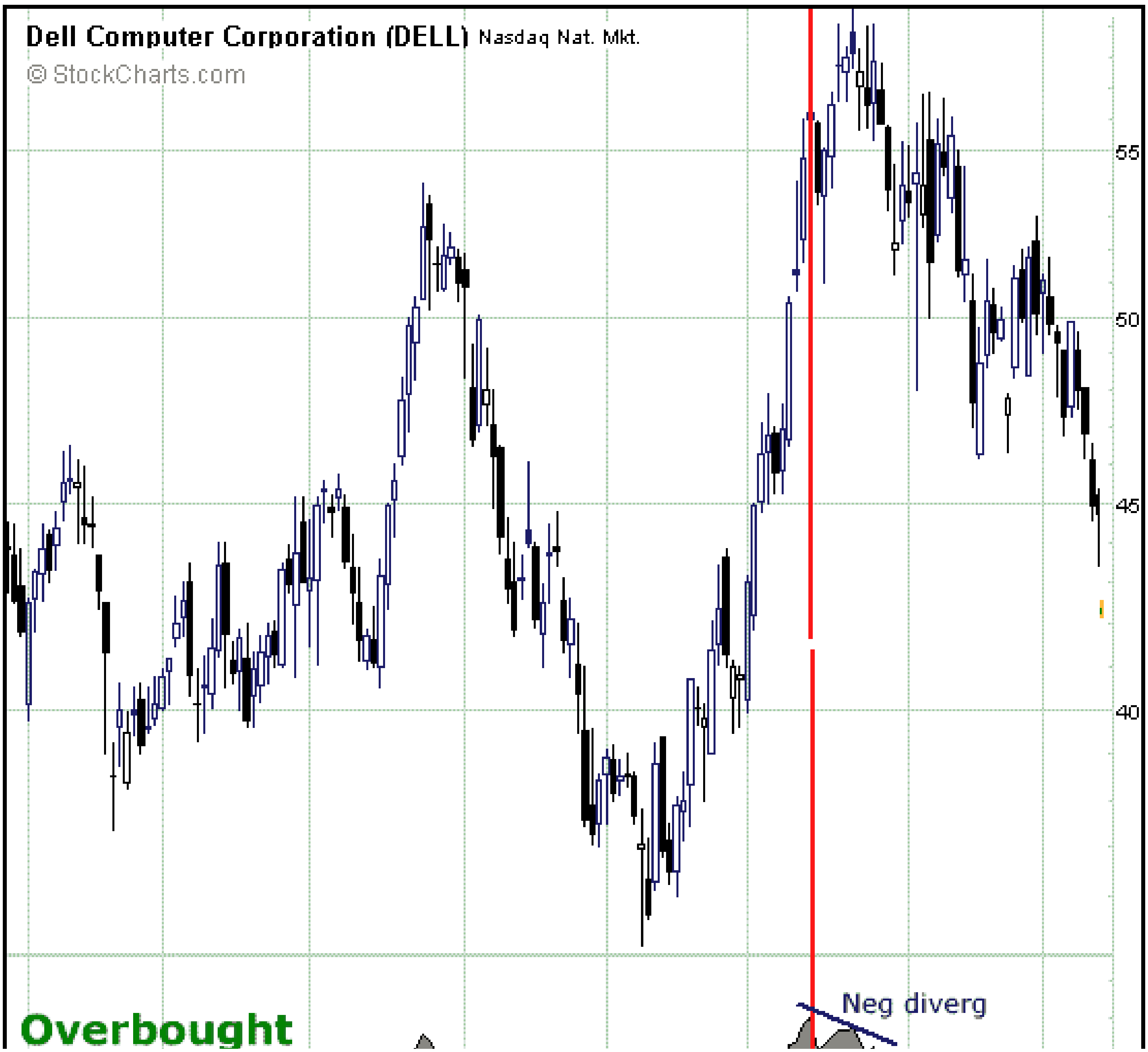
## Use

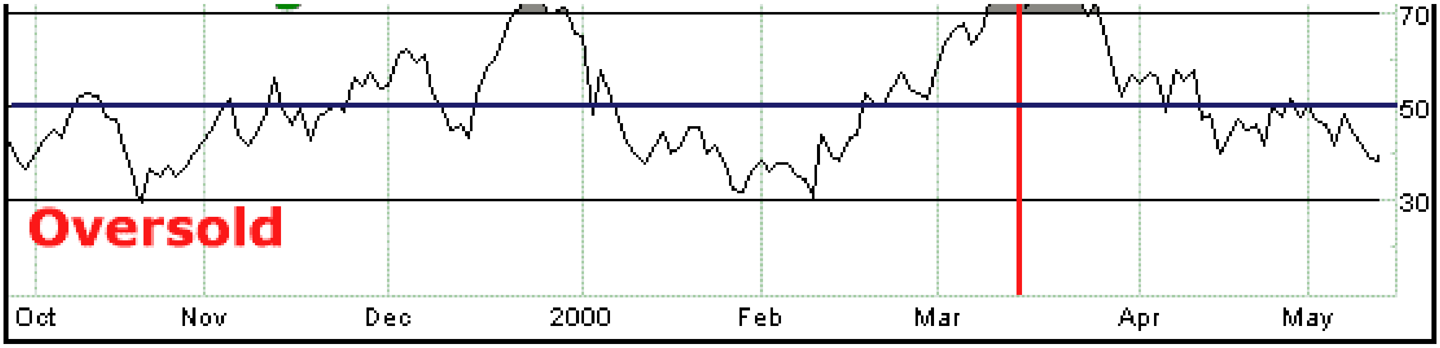
Overbought/Oversold
Wilder recommended using 70 and 30 and overbought and oversold levels respectively. Generally, if the RSI rises above 30 it is considered bullish for the underlying stock. Conversely, if the RSI falls below 70, it is a bearish signal. Some traders identify the long-term trend and then use extreme readings for entry points. If the long-term trend is bullish, then oversold readings could mark potential entry points.

Divergences
Buy and sell signals can also be generated by looking for positive and negative divergences between the RSI and the underlying stock. For example, consider a falling stock whose RSI rises from a low point of (for example) 15 back up to say, 55. Because of how the RSI is constructed, the underlying stock will often reverse its direction soon after such a divergence. As in that example, divergences that occur after an overbought or oversold reading usually provide more reliable signals.

Centerline Crossover
The centerline for RSI is 50. Readings above and below can give the indicator a bullish or bearish tilt. On the whole, a reading above 50 indicates that average gains are higher than average losses and a reading below 50 indicates that losses are winning the battle. Some traders look for a move above 50 to confirm bullish signals or a move below 50 to confirm bearish signals.

## Example

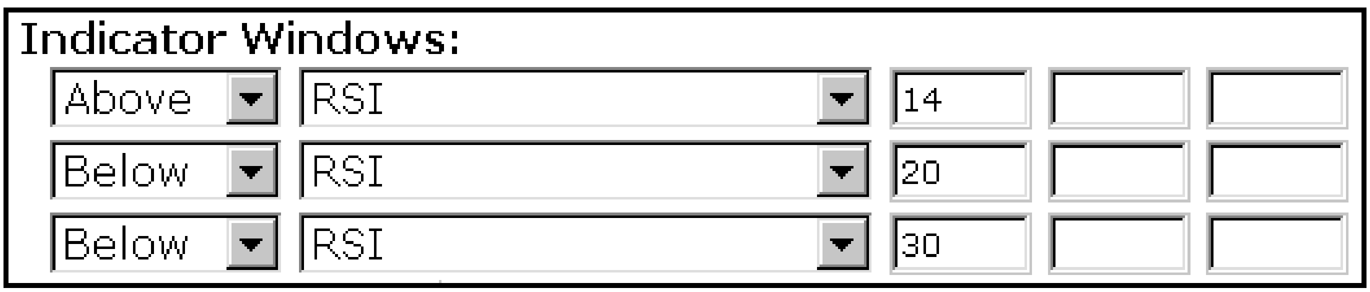





(Click here to see a live example of RSI)

The DELL example shows a number of extreme readings as well as a negative divergence. In Oct-99, RSI reached oversold for a brief moment to mark the low around 38. The next extreme reading (overbought) occurred after a large advance that peaked in Dec-99. RSI reached overbought levels in late Dec-99 and moved below 50 by the second week of Jan-00. The next oversold reading occurred in Feb for another brief moment and marked the low around 35. By the end of Feb-00, RSI moved back above 50 and into overbought territory in March. A negative divergence formed in March and marked the high in the upper fifties.

## RSI and SharpCharts




RSI is available on our SharpCharts charting tool. There is one box to choose the number of periods. In the example box, RSI has been assigned 14, 20 and 30 periods. A swing trader might prefer 14-periods, while an investor may prefer 30-periods. Users are encouraged to test different RSI settings and judge for themselves which ones work best and suit their particular trading/investing style.

For more on oscillators, please see our Chart School article on how to use and interpret oscillators.

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# Standard Deviation (volatility)

Standard deviation is a statistical term that provides a good indication of volatility. It measures how widely values (closing prices for instance) are dispersed from the average. Dispersion is difference between the actual value (closing price) and the average value (mean closing price). The larger the difference between the closing prices and the average price, the higher the standard deviation will be and the higher the volatility. The closer the closing prices are to the average price, the lower the standard deviation and the lower the volatility.

The calculation for the standard deviation is based on the number of periods chosen. 20 days, which represents about a month, is a popular number of periods to use and will be used in the example below.

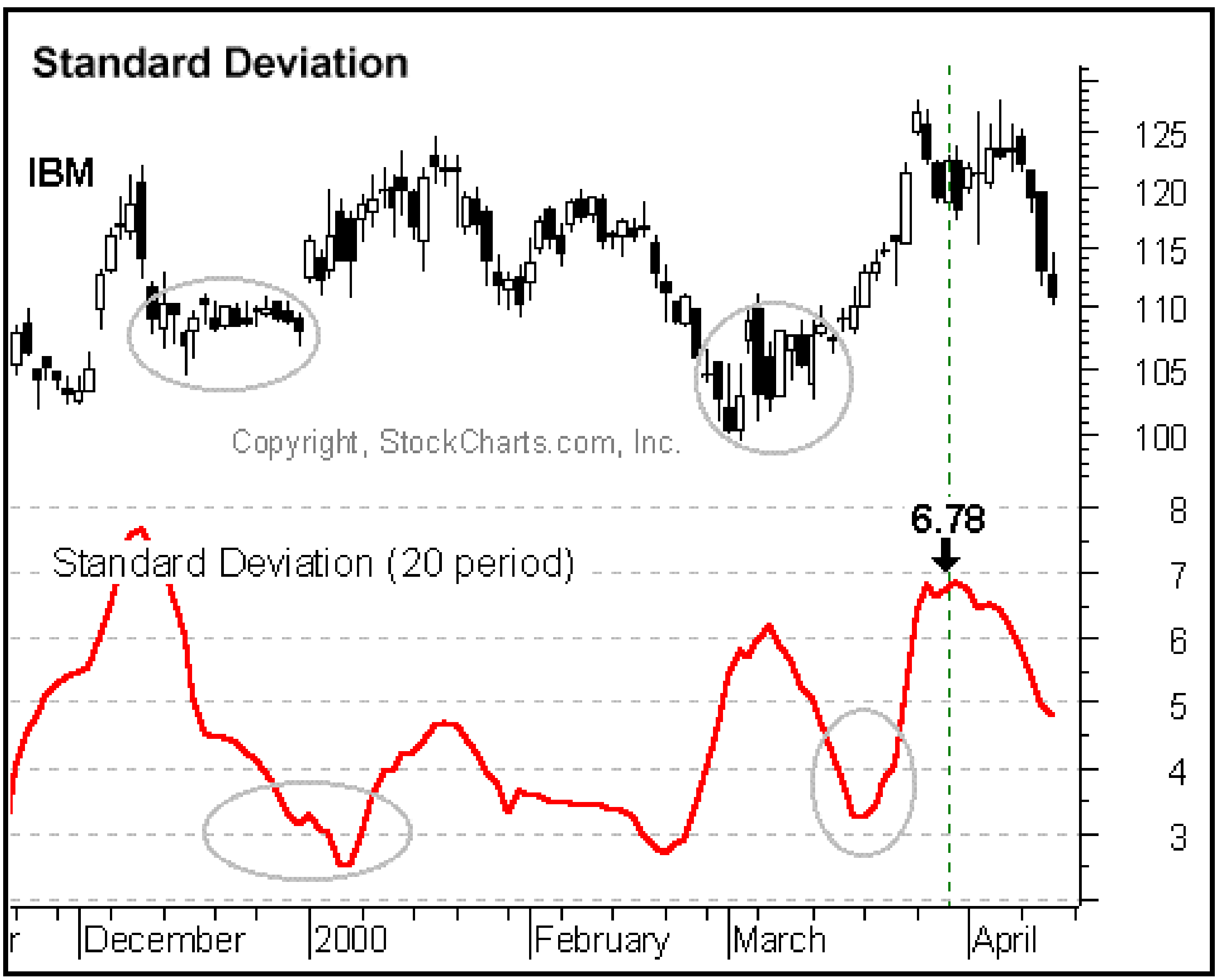
| | Close | 20-day Mean | Deviation | Deviation squared |
|---|---|---|---|---|
| 1 | 109.00 | 112.30 | -3.30 | 10.91 |
| 2 | 103.06 | 112.30 | -9.24 | 85.38 |
| 3 | 102.75 | 112.30 | -9.55 | 91.26 |
| 4 | 108.00 | 112.30 | -4.30 | 18.52 |
| 5 | 107.56 | 112.30 | -4.74 | 22.47 |
| 6 | 105.25 | 112.30 | -7.05 | 49.75 |
| 7 | 107.69 | 112.30 | -4.62 | 21.30 |
| 8 | 108.63 | 112.30 | -3.68 | 13.53 |
| 9 | 107.00 | 112.30 | -5.30 | 28.12 |
| 10 | 109.00 | 112.30 | -3.30 | 10.91 |
| 11 | 110.00 | 112.30 | -2.30 | 5.30 |
| 12 | 112.75 | 112.30 | 0.45 | 0.20 |
| 13 | 113.50 | 112.30 | 1.20 | 1.43 |
| 14 | 114.25 | 112.30 | 1.95 | 3.79 |
| 15 | 115.25 | 112.30 | 2.95 | 8.68 |
| 16 | 121.50 | 112.30 | 9.20 | 84.58 |
| 17 | 126.88 | 112.30 | 14.57 | 212.34 |
| 18 | 122.50 | 112.30 | 10.20 | 103.97 |
| 19 | 119.00 | 112.30 | 6.70 | 44.85 |
| 20 | 122.50 | 112.30 | 10.20 | 103.97 |

| | | | |
|---|---|---|---|
| 2246.06 | 112.30 | | 921.28 |
| | | DevSqr/20 | 46.06 |
| | | StdDev | 6.787 |

The steps for a 20-period standard deviation formula are as follows:

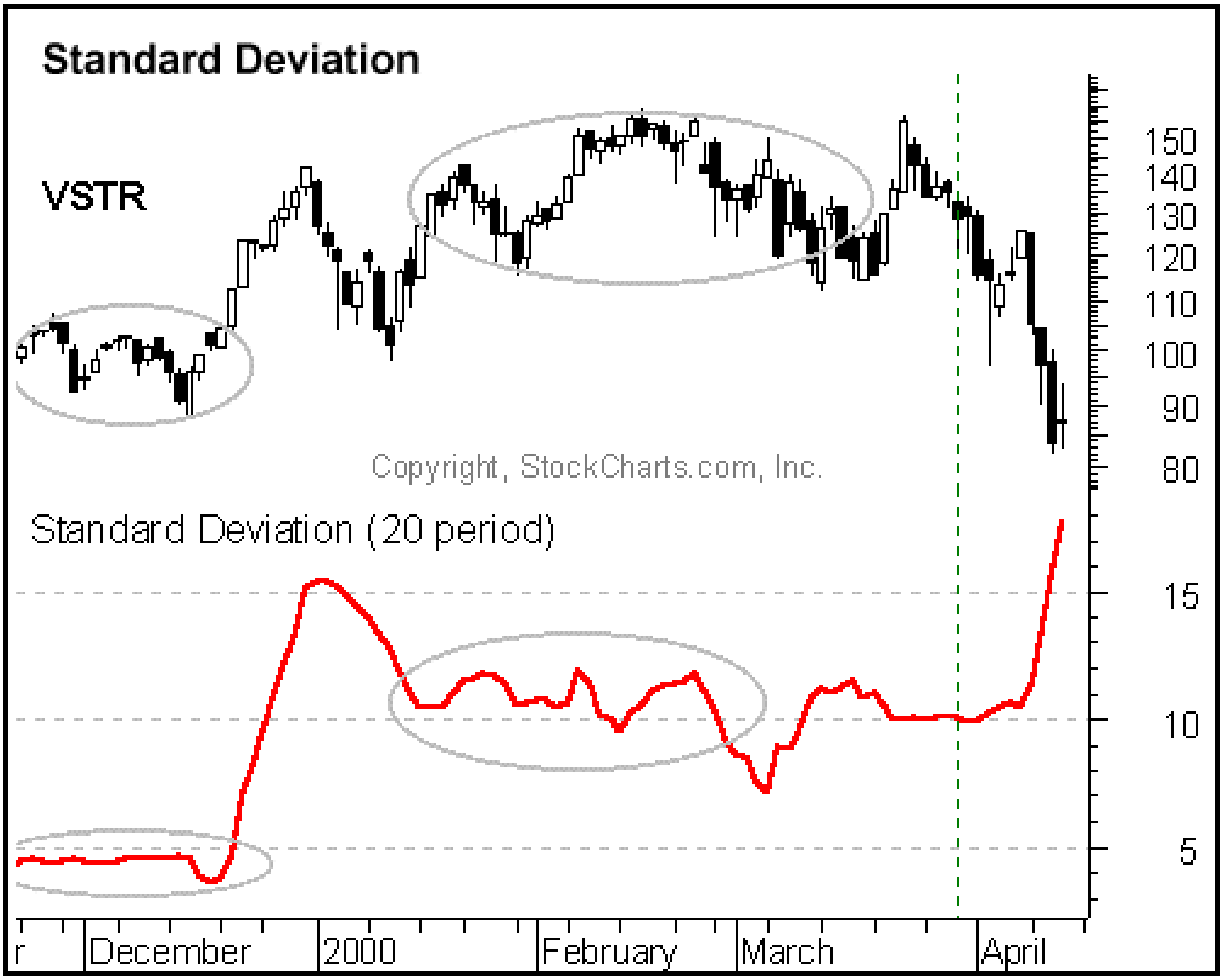
1. Calculate the mean price. Sum the 20 periods and divide by 20. This is also the average price over 20 periods. (2246.06/20 = 112.30)
2. For each period, subtract the mean price from the close. This gives us the deviation for each period (-3.30, -9.24....).
3. Square each period's deviation (10.91, 85.38...).
4. Add together the squared deviations for periods 1 through 20 (921.28).
5. Divide the sum of the squared deviations by 20 (921.28/20 = 46.06).
6. Calculate the square root of the sum of the squared deviations. The square root of 46.06 equals 6.787.

The standard deviation for the 20 periods is 6.787. This example was formed with a price series for IBM. The chart below shows how the standard deviation can change over time.




After extended periods of consolidation, the standard deviation (or volatility) dropped. Notice that in late

December the stock traded in a tight range and volatility dropped. Later in mid-March, the stock also traded in a tight range and volatility dropped. When the stock took off in the second half of March, volatility also rose.




VSTR, which is in the same price range as IBM, has a higher standard deviation. Until late December, the standard deviation was below 5. With the sharp advance in late December, the standard deviation rose from 5 to above 15. Since then it leveled out around 10 and has recently risen above 17. This is quite a volatile stock and its options will have more premium than IBM options. The higher the volatility for a particular stock, the higher the option premiums. The lower the volatility is for a particular stock, the lower the option premiums.

Written by Arthur Hill

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Chart School

# Stochastic Oscillator

## Overview

Developed by George C. Lane in the late 1950s, the Stochastic Oscillator is a momentum indicator that shows the location of the current close relative to the high/low range over a set number of periods. Closing levels that are consistently near the top of the range indicate accumulation (buying pressure) and those near the bottom of the range indicate distribution (selling pressure).

## Formula

| | | | |
|---|---|---|---|
| %K = | 100 x ( | $\frac{\text{Recent Close - Lowest Low (n)}}{\text{Highest High(n) - Lowest Low(n)}}$ | ) |
| %D = | 3-period moving average of %K | | |
| (n)= | Number of periods used in calculation | | |

| Periods | High | Low | Close |
|---|---|---|---|
| 1 | 119.50 | 116.00 | 119.13 |
| 2 | 119.94 | 116.00 | 116.75 |
| 3 | 118.44 | 111.63 | 113.50 |
| 4 | 114.19 | 110.06 | 111.56 |
| 5 | 112.81 | 109.63 | 112.25 |
| 6 | 113.44 | 109.13 | 110.00 |
| 7 | 115.81 | 110.38 | 113.50 |
| 8 | 117.50 | 114.06 | 117.13 |
| 9 | 118.44 | 114.81 | 115.63 |
| 10 | 116.88 | 113.13 | 114.13 |
| 11 | 119.00 | 116.19 | 118.81 |
| 12 | 119.75 | 117.00 | 117.38 |
| 13 | 119.13 | 116.88 | 119.13 |
| 14 | 119.44 | 114.56 | 115.38 |

| | | | | |
|---|---|---|---|---|
| %K = | 100 x ( | $\frac{115.38 - 109.13}{119.94 - 109.13}$ | ) | = 57.81 |

A 14-day %K (14-period Stochastic Oscillator) would use the most recent close, the highest high over the last 14 days and the lowest low over the last 14 days. The number of periods will vary according to the sensitivity and the type of signals desired. As with RSI, 14 is a popular number of periods for calculation.

%K tells us that the close (115.38) was in the 57th percentile of the high/low range, or just above the mid-point. Because %K is a percentage or ratio, it will fluctuate between 0 and 100. A 3-day simple moving average of %K is usually plotted alongside to act as a signal or trigger line, called %D.

## Slow versus Fast versus Full

There are three types of Stochastic Oscillator: Fast, Slow, and Full. The Full Stochastic is discussed later. For now, let's look at Fast versus Slow. As shown above, the Fast Stochastic Oscillator is made up of %K and %D. In order to avoid confusion between the two, I'll use %K (fast) and %D (fast) to refer to those used in the Fast Stochastic Oscillator, and %K (slow) and %D (slow) to refer to those used in the Slow Stochastic Oscillator. The driving force behind both Stochastic Oscillators is %K (fast), which is found using the formula provided above.

(Click here to see a live example of Fast and Slow Stochastics)

In the CSCO example, the Fast Stochastic Oscillator is plotted in the box just below the price plot. The thick black line represents %K (fast) and the thin red line represents %D (fast). Also called the trigger line, %D (fast) is a smoothed version of %K (fast). One method of smoothing data is to apply a moving average. To smooth %K (fast) and create %D (fast), a 3-period simple moving average was applied to %K (fast). Notice how the %K (fast) line pierces the %D (fast) line a number of times during May, June and July. To alleviate some of these false breaks and smooth %K (fast), the Slow Stochastic Oscillator was developed.

The Slow Stochastic Oscillator is plotted in the lower box: the thick black line represents %K (slow) and the thin red line represents %D (slow). To find %K (slow) in the Slow Stochastic Oscillator, a 3-day SMA was applied to %K (fast). This 3-day SMA slowed (or smoothed) the data to form a slower version of %K (fast). A close examination would reveal that %D (Fast), the thin red line in the Fast Stochastic Oscillator, is identical to %K (Slow), the thick black line in the Slow Stochastic Oscillator. To form the trigger line, or %D (slow) in the Slow Stochastic Oscillator, a 3-day SMA was applied to %K (Slow).

The Full Stochastic Oscillator takes three parameters. Just as in the Fast and Slow versions, the first parameter is the number of periods used to create the initial %K line and the last parameter is the number of periods used to create the %D (full) signal line. What's new is the additional parameter, the one in the middle. It is a "smoothing factor" for the initial %K line. The %K (full) line that gets plotted is a n-period SMA of the initial %K line (where n is equal to the middle parameter).

The Full Stochastic Oscillator is more advanced and more flexible than it's Fast and Slow cousins. You can even use it to duplicate the other versions. For example, a (14, 3) Fast Stochastic is equivalent to a (14, 1, 3) Full Stochastic and a (12, 2) Slow Stochastic is equal to a (12, 3, 2) Full Stochastic.

%K and %D Recap

- %K (fast) = %K formula presented above using x periods
- %D (fast) = y-day SMA of %K (fast)
- %K (slow) = 3-day SMA of %K (fast)
- %D (slow) = y-day SMA of %K (slow)
- %K (full) = y-day SMA of %K (fast)
- %D (full) = z-day SMA of %K (full)

where x is the first parameter, y is the second parameter and (in the case of Full stochastics), z is the third parameter. In the case of Fast and Slow Stochastics, x is typically 14 and y is usually set to 3.

## Use

Readings below 20 are considered oversold and readings above 80 are considered overbought. However, Lane did not believe that a reading above 80 was necessarily bearish or a reading below 20 bullish. A security can continue to rise after the Stochastic Oscillator has reached 80 and continue to fall after the Stochastic Oscillator has reached 20. Lane believed that some of the best signals occurred when the oscillator moved from overbought territory back below 80 and from oversold territory back above 20.

Buy and sell signals can also be given when %K crosses above or below %D. However, crossover signals are quite frequent and can result in a lot of whipsaws.

One of the most reliable signals is to wait for a divergence to develop from overbought or oversold levels. Once the oscillator reaches overbought levels, wait for a negative divergence to develop and then a cross below 80. This usually requires a double dip below 80 and the second dip results in the sell signal. For a buy signal, wait for a positive divergence to develop after the indicator moves below 20. This will usually require a trader to disregard the first break above 20. After the positive divergence forms, the second break above 20 confirms the divergence and a buy signal is given.

## Example


In the IBM example above, it is clear that acting solely on overbought and oversold crossovers can generate false signals. Using crossovers of %D (slow) by %K (slow) can result in some good signals, but there are still whipsaws. By looking for divergences and overbought/oversold crossovers together, the 14-day Slow Stochastic Oscillator can produce fewer yet more reliable signals. The Slow Stochastic Oscillator produced 2 solid signals in IBM between Aug-99 and Mar-99. In Nov-99, a buy signal was given when the indicator formed a positive divergence and moved above 20 for the second time. Note that the double top in Nov-Dec (gray circle) was not a negative divergence -- the stock continued higher after this formed. In Jan-00, a sell signal was given when a negative divergence formed and the indicator dipped below 80 for the second time.

## SharpChart Application

In StockCharts.com's SharpCharts tool, the Slow Stochastic Oscillator uses %K (slow) and the Fast Stochastic Oscillator uses %K (fast). There are two options available for both fast or slow. The first box represents the number of periods used to calculate %K for each. The second box represents the number of periods used in the moving average to form %D. The defaults are 14 and 3. For the Slow Stochastic Oscillator, that would imply a 14-period %K (slow) with a 3-day SMA of %K (slow) to form %D (slow). The Full Stochastic uses three parameters: the period for %K (fast), the period for the SMA that smooths %K (fast), and the period of the SMA that forms %D (full). While the tool provides some excellent default values, I encourage you to test different variations to discover what fits with their particular investing style or what works with a particular security.

For more, please see our Chart School article on how to use and interpret oscillators.

Written by Arthur Hill

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# StochRSI

## Overview

Developed by Tushard Chande and Stanley Kroll, StochRSI is an oscillator that measures the level of RSI relative to its range, over a set period of time. The indicator uses RSI as the foundation and applies to it the formula behind Stochastics. The result is an oscillator that fluctuates between 0 and 1.

In their 1994 book, The New Technical Trader, Chande and Kroll explain that RSI sometimes trades between 80 and 20 for extended periods without reaching overbought and oversold levels. Traders looking to enter a stock based on an overbought or oversold reading in RSI might find themselves continuously on the sidelines. To increase the sensitivity and provide a method for identifying overbought and oversold levels in RSI, Chande and Kroll developed StochRSI.

Developed by Welles Wilder, RSI is a momentum oscillator that compares the magnitude of gains to the magnitude of losses over a period of time. Developed by George Lane, Stochastics is a momentum oscillator that compares the closing level to the high/low range over a given period of time.

## Formulas

**RSI:**

| | | |
|---|---|---|
| RSI = | 100 - | $\dfrac{100}{1 + RS}$ |
| | RS = | $\dfrac{\text{(Total Gains/n)}}{\text{(Total Losses/n)}}$ |
| | n = | number of RSI periods |

**Stochastics:**

| | |
|---|---|
| %K = | 100 x ( $\dfrac{\text{Recent Close} - \text{Lowest Low (n)}}{\text{Highest High(n)} - \text{Lowest Low(n)}}$ ) |
| %D = | 3-period moving average of %K |
| (n)= | Number of periods used in calculation |

**StochRSI:**

$$\text{StochRSI} = \frac{\text{RSI (n)} - \text{RSI Lowest Low(n)}}{\text{RSI Highest High(n)} - \text{RSI Lowest Low(n)}}$$

(n)= Number of periods used in calculation

From the formula above, it can be seen that StochRSI is the Stochastics formula applied to RSI; that is, it's an indicator of RSI. StochRSI measures the value of RSI relative to its high/low range over a set number of periods. When RSI records a new low for the period, StochRSI will be at 0. When RSI records a new high for the period, StochRSI will be at 100. A reading of .20 would mean that the current RSI was 20% above the lowest level of the period, or 80% below the highest level. A reading of .80 would mean that the current RSI was 80% above the lowest level of the period, or 20% below the highest level.

## Signals

- Overbought and Oversold Crossovers: If an uptrend has been identified in the underlying security, then a buy signal would be generated when StochRSI advances from oversold (below .20) to above .20. Conversely, if a downtrend has been identified, then a sell signal would be generated when StochRSI declines from overbought (above .80) to below .80.
- Centerline Crossovers: Some traders look for moves above or below .50 (the centerline) to confirm signals and reduce whipsaws. A move from oversold to above .50 could constitute a buy signal and would remain in place until a decline below .50. Conversely, a move from overbought to below .50 would could act as a sell signal that would remain in place until an advance back above .50.
- Positive and Negative Divergences: A positive divergence followed by a confirming advance above .20 could constitute a buy signal and a negative divergence followed by a decline below .80 could act as a sell signal.
- Failures: Chande and Kroll also note that moves back past the trigger lines would indicate a failed signal. An advance back above .80 would indicate a failed signal and traders would be advised to close positions.
- Strong Trend: As with many oscillators, StochRSI can become overbought (or oversold) and remain overbought (or oversold) for an extended period. A move above .80 may imply overbought, but it can also indicate a strong up trend and remain above .80 for a prolonged period. Conversely, a quick move below .20 could indicate the beginning of a strong downtrend. Moves to 1 are considered very strong and moves to 0 very weak.

## Example


(Click here to see a live example of StochRSI)

In the WCOM example above, the stock peaked in Jun-99 and was in a well-established downtrend. A series of lower lows and lower highs confirmed the primary trend as bearish. According to Chande and Kroll, these conditions would best suit StochRSI for identifying overbought levels from which to short the stock. Each time StochRSI advances above .80, an overbought situation would occur. When the indicator declined from its overbought level back below .80, a sell signal would have been given.

From March to June, the indicator gave 4 sell signals, or one per month. The July sell signal was not recognized because there was a possible change in trend. As long as the series of lower highs and lower lows continued, the downtrend remained intact. A higher low in late June was followed by a higher high in July to call into question the strength and validity of the downtrend. Once the higher high arrived, the signals for StochRSI may have required adjustments to protect against whipsaws.

Trying to buy the stock on advances from oversold levels back above .20 would have proved difficult. There were whipsaws in March and May that would have resulted in some bad trades. This choppy action around .20 could have also led to some premature exits from profitable short positions. When a stock is trending lower, it is sometimes prudent to raise the level in order to close short positions (or to generate buy signals). In this case, a trader could have required StochRSI to move from oversold to above .50 before closing short positions. This would have eliminated the March and May whipsaws.

Conclusions

It is important to remember that StochRSI is an indicator of an indicator. It is designed to predict extreme readings in RSI before the actual RSI reaches these extremities. As an indicator of an indicator, it is further removed from the actual price of the underlying security. Because it is actually predicting RSI, but being used to predict price changes in the underlying security, it will have greater sensitivity and be prone to false signals, especially if used incorrectly. As with other indicators, StochRSI should be used in conjunction with other indicators and aspects of technical analysis.

Written by Arthur Hill

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# TRIN

Richard Arms developed the TRIN, or Arms index, as a contrarian indicator to detect overbought and oversold levels in the market. Because of its calculation method, the TRIN has an inverse relationship with the market. Generally, a rising TRIN is bearish and a falling TRIN is bullish. Sometimes (like on the market chart tour) you will see the scale of the TRIN inverted to reflect this inverse relationship.

The TRIN is the advance/decline ratio divided by the advance volume/decline volume ratio:

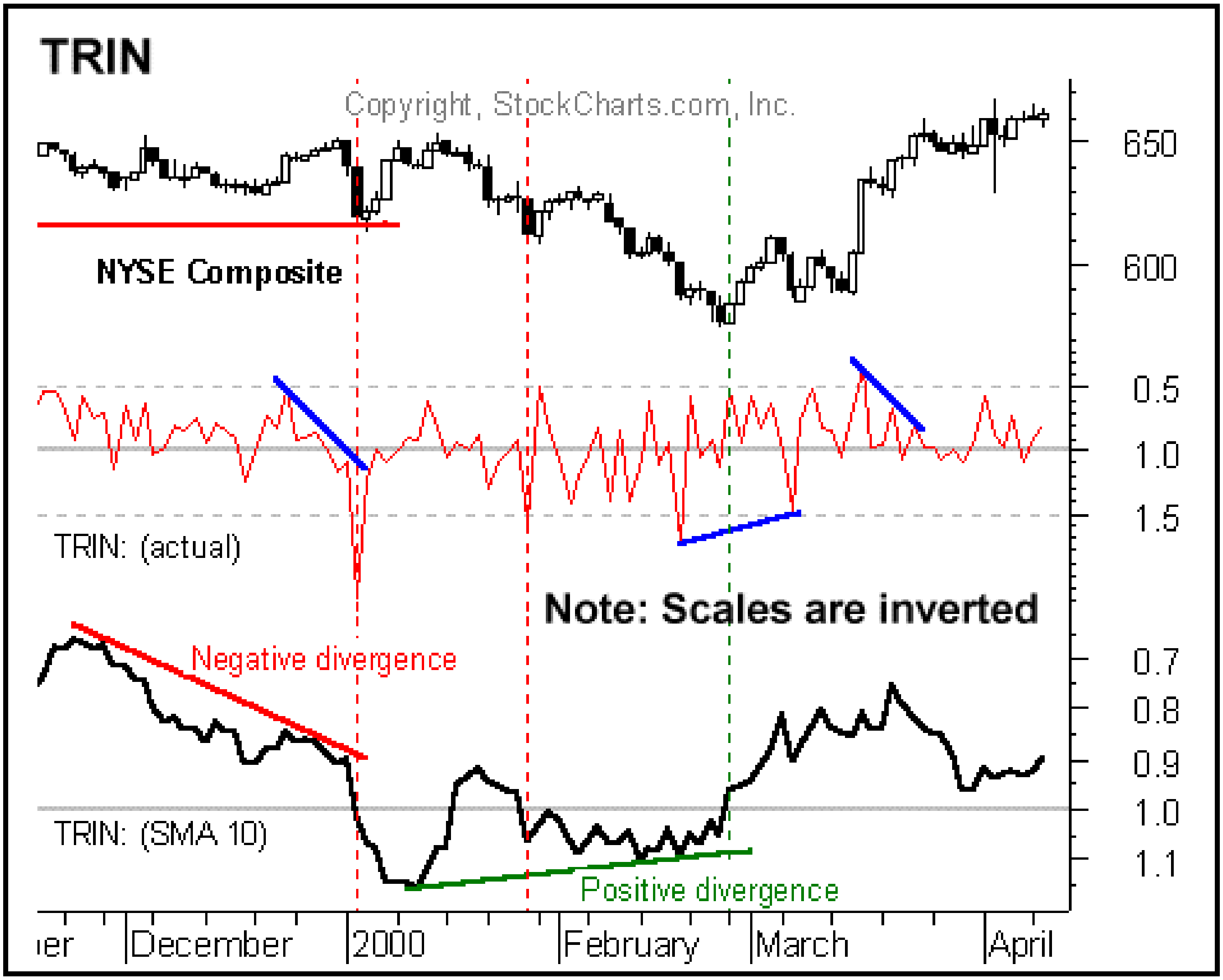
((Advancing issues/declining issues) / (advancing volume/declining volume))

Examples of TRIN calculations:

| | | | |
|---|---|---|---|
| Advances | 2000 | 2100 | 2100 |
| Declines | 1000 | 700 | 700 |
| Advance/decline ratio | 2 | 3 | 3 |
| Advance Volume | 40000 | 35000 | 48000 |
| Decline Volume | 20000 | 25000 | 12000 |
| Advance Vol/decline Vol ratio | 2 | 1.4 | 4 |
| | | | |
| TRIN | 2/2 = 1.00 | 3/1.4 = 2.14 | 3/4 = .75 |
| | | | |
| | | | |

In the first example, the ratios were equal and the TRIN was 1, which indicates a standoff. Volume flowing into advancing stocks was virtually equal to volume flowing into declining stocks. In the second example, the up volume/down volume ratio did not keep up with the advance/decline ratio and the TRIN rose above 1. A TRIN above 1 indicates that the volume in declining stocks outpaced the volume in advancing stocks. In the final example the TRIN was below 1, indicating the volume in advancing stocks was healthy and outpaced the volume in declining stocks.

NYSE




A number of TRIN interpretations have evolved over the years. Richard Arms, the originator, uses the TRIN to detect extreme conditions in the market. He considers the market to be overbought when the 10-day moving average of the TRIN declines below .8 and oversold when it moves above 1.2. Other interpretations seek to use the direction and absolute level of the TRIN to determine bullish and bearish scenarios. In the momentum driven markets, the TRIN can remain oversold or overbought for extended periods of time.

Written by Arthur Hill

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# CBOE Volatility Index (VIX)

(Click here to see a live example of the VIX)

Introduced by the CBOE in 1993, VIX is a weighted measure of the implied volatility for 8 OEX put and call options. The 8 puts and calls are weighted according to time remaining and the degree to which they are in or out of the money. The result forms a composite hypothetical option that is at-the-money and has 30 days to expiration. (An at-the-money option means that the strike price and the security price are the same.) VIX represents the implied volatility for this hypothetical at-the-money OEX option.

OEX Oct 800 Call

| | |
|---|---|
| current date | 11-Sep-00 |
| expiration date | 20-Oct-00 |
| days to expiry | 40 |
| time to expiry | 0.1096 |
| risk-free rate | 5.92% |
| stock price | 807.69 |
| strike price | 800 |
| option price | 27.39 |
| implied volatility | 19.20% |

OEX Oct 800 Put

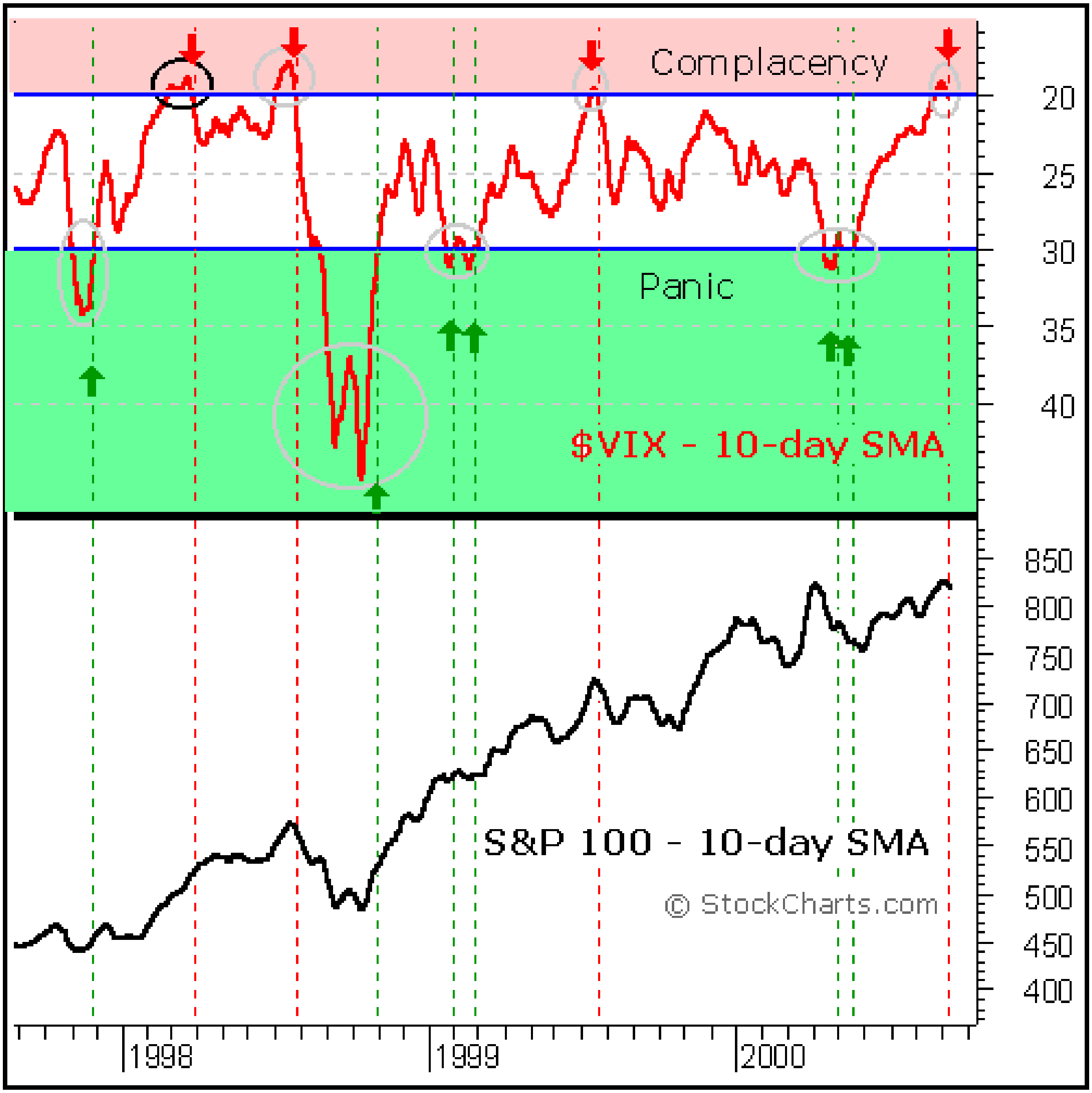
| | |
|---|---|
| current date | 11-Sep-00 |
| expiration date | 20-Oct-00 |
| days to expiry | 40 |
| time to expiry | 0.1096 |
| risk-free rate | 5.92% |
| stock price | 807.69 |
| strike price | 800 |
| price | 14.58 |
| implied volatility | 19.25% |

OEX options are by far the most traded and most liquid index options on the CBOE. Because of their dominant activity, OEX options represent a good proxy for implied volatility of the market as a whole. As OEX trades, VIX is updated throughout the day and can be tracked as an intraday, daily, weekly or monthly indicator of implied volatility and market expectations.

Typically, VIX (and by extension implied volatility) has an inverse relationship to the market. A chart of the VIX will usually be shown with the scale inverted to show the low readings at the top and high readings at the bottom. The value of VIX increases when the market declines and decreases when the market rises. It seems that volatility would be a two-way street. However, the stock market has a bullish bias. A rising stock market is viewed as less risky and a declining stock market more risky. The higher the perceived risk is in stocks, the higher the implied volatility and the more expensive the associated options, especially puts. Hence, implied volatility is not about the size of the price swings, but rather the implied risk associated with the stock market. When the market declines, the demand for puts usually increases. Increased demand means higher put prices and higher implied volatilities.

For contrarians, comparing VIX action with that of the market can yield good clues on future direction or duration of a move. The further VIX increases in value, the more panic there is in the market. The further VIX decreases in value, the more complacency there is in the market. As a measure of complacency and panic, VIX is often used as a contrarian indicator. Prolonged and/or extremely low VIX readings indicate a high degree of complacency and are generally regarded at bearish. Some contrarians view readings below 20 as excessively bearish. Conversely, prolonged and/or extremely high VIX readings indicate a high degree or anxiety or even panic among options traders and are regarded at bullish. High VIX readings usually occur after an extended or sharp decline and sentiment is still quite bearish. Some contrarians view readings above 30 as bullish.

Conflicting signals between VIX and the market can yield sentiment clues for the short term, also. Overly bullish sentiment or complacency is regarded as bearish by contrarians. On the other hand, overly bearish sentiment or panic is regarded as bullish. If the market declines sharply and VIX remains unchanged or decreases in value (towards complacency), it could indicate that the decline has further to go. Contrarians might take the view that there is still not enough bearishness or panic in the market to warrant a bottom. If the market advances sharply and VIX increases in value (towards panic), it could indicate that the advance has further to go. Contrarians might take the view that there is not enough bullishness or complacency to warrant a top.




The chart above shows the inverse relationship between VIX and OEX. Generally, VIX decreases in value as OEX rises, and visa versa. A 10-day SMA was applied to both the VIX and OEX for smoothing. Over the last three years (Oct-97 to Sept-00), VIX produced roughly 7 extreme readings greater than 30 (light green) or less than 20 (light red). The four readings above 30 indicated excessive bearishness, panic or an extremely high implied volatility: Nov-97, Sept-98, Feb-99 and Apr-00 (green arrows). The three readings below 20 indicated excessive bullishness, complacency or low implied volatility (red arrows).

Once the extreme readings were recorded, a confirmation signal was given when VIX returned above 20 or below 30 (vertical dotted line). Except for the first bearish signal in Mar-98 (black circle), most of the signals were pretty timely. Two of the bullish signals produced small double bottoms in the VIX that could have led to small whipsaws, but the subsequent "second" signals proved quite profitable. As of this writing (13 September 2000), the VIX 10-day SMA has just risen above 20 and this could be considered the fourth signal of excessive bullishness or complacency among option traders.

Note on Rex Takasugi's VIX chart: Rex inverts VIX by taking the reciprocal of the open, high, low and close. If VIX is 30, then 1/30 = .033.

For more information on options, option pricing and volatility, see the following:

- CBOE Website
- Trading Index Options by James B. Bittman
- Buying and Selling Volatility by Kevin Connolly

Written by Arthur Hill

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# Williams %R

Developed by Larry Williams, Williams %R is a momentum indicator that works much like the Stochastic Oscillator. It is especially popular for measuring overbought and oversold levels. The scale ranges from 0 to -100 with readings from 0 to -20 considered overbought, and readings from -80 to -100 considered oversold.

William %R, sometimes referred to as %R, shows the relationship of the close relative to the high-low range over a set period of time. The nearer the close is to the top of the range, the nearer to zero (higher) the indicator will be. The nearer the close is to the bottom of the range, the nearer to -100 (lower) the indicator will be. If the close equals the high of the high-low range, then the indicator will show 0 (the highest reading). If the close equals the low of the high-low range, then the result will be -100 (the lowest reading).

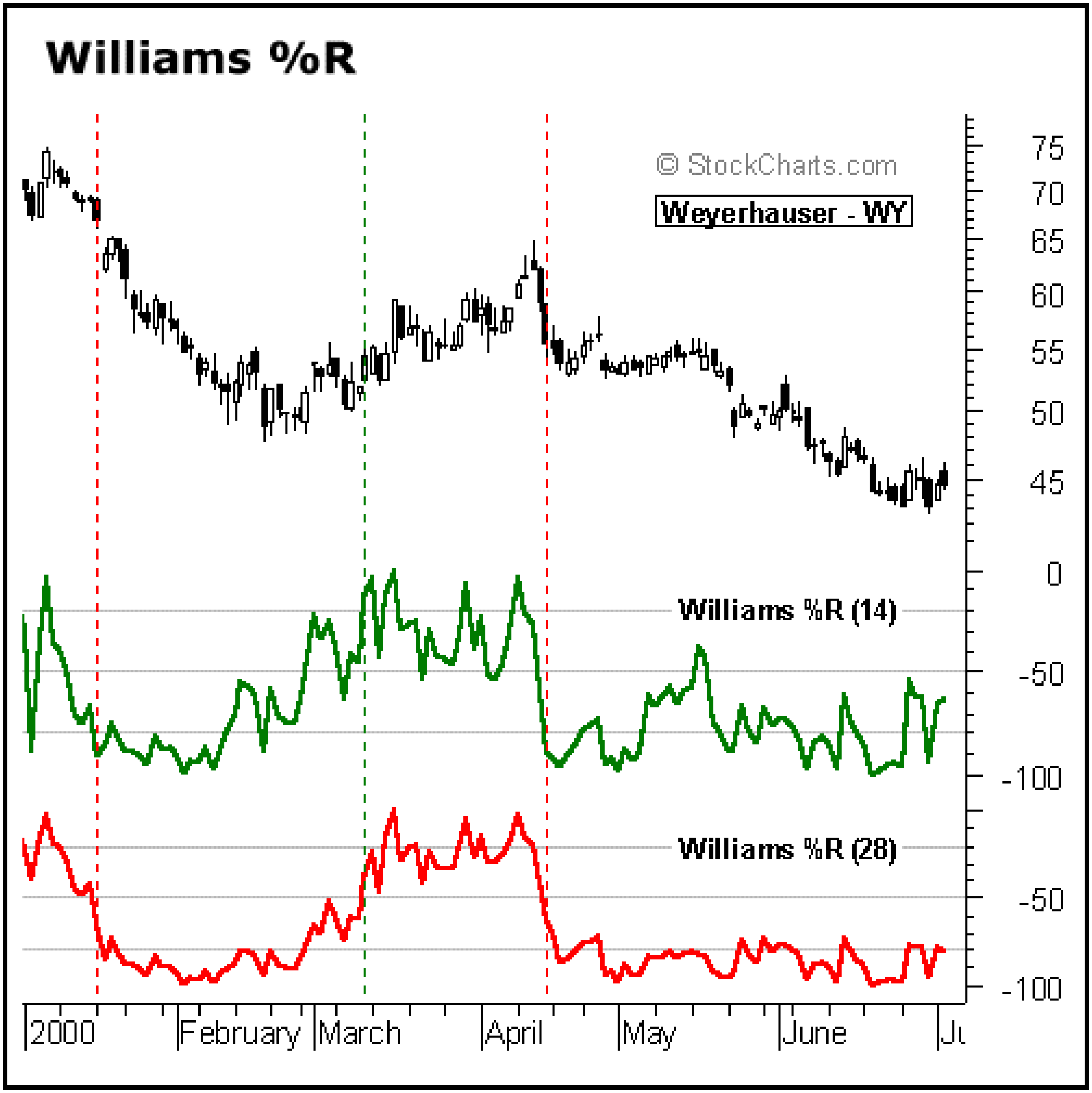
$$\%R = \frac{\text{Highest high over } x \text{ periods} - \text{close}}{\text{highest high over } x \text{ periods} - \text{Lowest low over } x \text{ periods}} \times -100$$

(Click here to see a live example of Williams %R)

Typically, Williams %R is calculated using 14 periods and can be used on intraday, daily, weekly or monthly data. The timeframe and number of periods will likely vary according to desired sensitivity and the characteristics of the individual security.

It is important to remember that overbought does necessarily imply time to sell and oversold does not necessarily imply time to buy. A security can be in a downtrend, become oversold and remain oversold as the price continues to trend lower. Once a security becomes overbought or oversold, traders should wait for a signal that a price reversal has occurred. One method might be to wait for Williams %R to cross above or below -50 for confirmation. Price reversal confirmation can also be accomplished by using other indicators or aspects of technical analysis in conjunction with Williams %R.

One method of using Williams %R might be to identify the underlying trend and then look for trading opportunities in the direction of the trend. In an uptrend, traders may look to oversold readings to establish long positions. In a downtrend, traders may look to overbought readings to establish short positions.




The chart of Weyerhauser with a 14-day and 28-day Williams %R illustrates some key points:

- 14-day %R appears quite choppy and prone to false signals.
- 28-day %R smoothed the data series and the signals became less frequent and more reliable.
- When the 28-day %R moved to overbought or oversold levels, it typically remained there for an extended period and the stock continued its trend.
- Some good entry signals were given with the 28-day %R by waiting for a move above or below -50 for confirmation.

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# ZigZag

The ZigZag feature on SharpCharts is not an indicator per se, but rather a means to filter out random noise and compare relative price movements. The ZigZag can be set to acknowledge minimum price changes and ignore those that do not fit the criteria. The minimum price movements are set in percentage terms and can be based on either the close or high/low range.

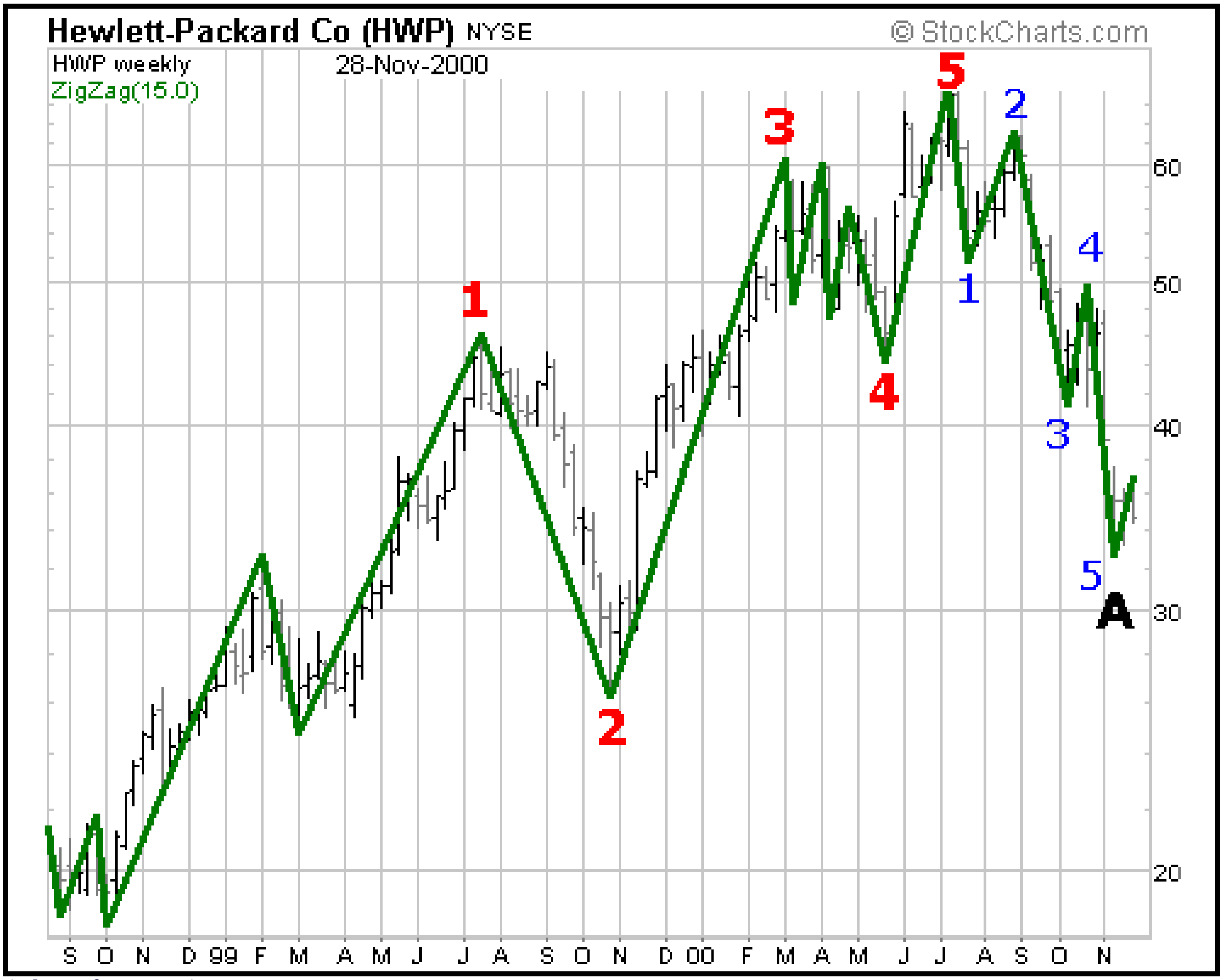
A ZigZag set at 10% with OHCL bars would yield a line that only reverses after a change from high to low of 10% or greater. All movements less than 10% would be ignored. If a stock traded from a low of 100 to a high of 109, the ZigZag would not draw a line because the move was less than 10%. If the stock advanced from a low of 100 to a high of 110, then the ZigZag would draw a line from 100 to 110. If the stock continued on to a high of 112, this line would be extended to 112 (100 to 112). The ZigZag would not reverse until the stock declined 10% or more from its high. From a high of 112, a stock would have to decline 11.2 points (or to a low of 100.8) for the ZigZag to reverse and display another line.

## Uses of ZigZag

Filter: Volatility and daily price fluctuations can produce erratic movements or noise. The ZigZag can be used to filter this noise. If price movements smaller than 5% are deemed insignificant, then the ZigZag can be set at 5% and all movements less than 5% will be ignored.

Elliott Wave: The ZigZag can be used to identify waves for Elliott Wave counts. (Note: The object of this article is not Elliott Wave Theory, but simply to illustrate methods of using the ZigZag.)

## Elliott Wave

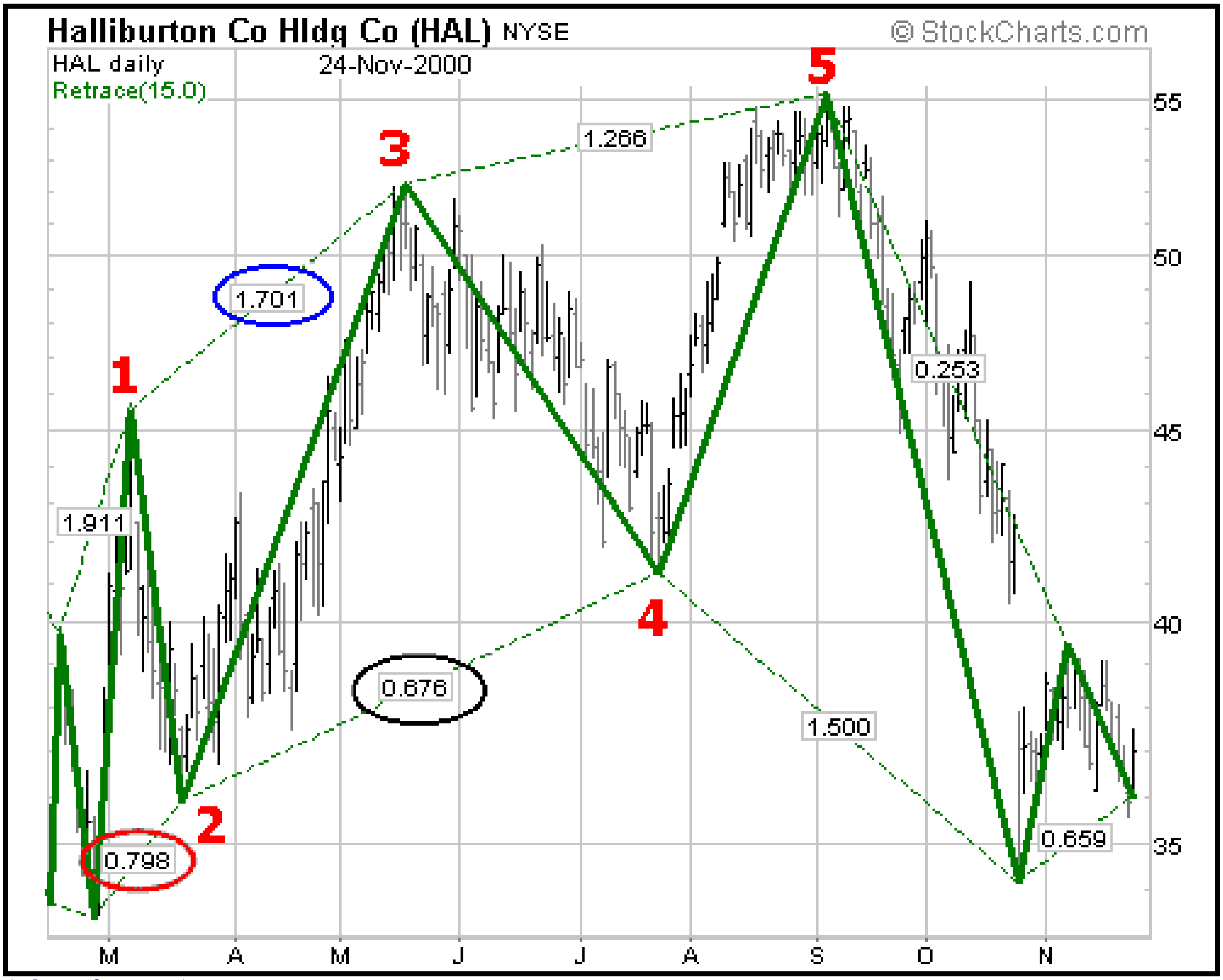



(Chart for HWP)

The HWP example set the ZigZag at 15%. All moves 15% or greater were drawn and those less that 15% ignored. A large advance began in Oct-99 and formed a 5-wave structure that lasted until mid 2000. Within this larger structure, other smaller waver counts can also be deciphered.

Retracements: The ZigZag can be used to measure retracements. After an advance, it is common for a security to retrace a portion of its advance with a correction. After a decline, it is common for a security to retrace part of its decline with a reaction rally. According to Dow Theory, 1/3, 1/2 and 2/3 retracements are most likely. Based on Fibonacci numbers, 38.2% or 61.8% retracement levels are deemed significant.

Retracements

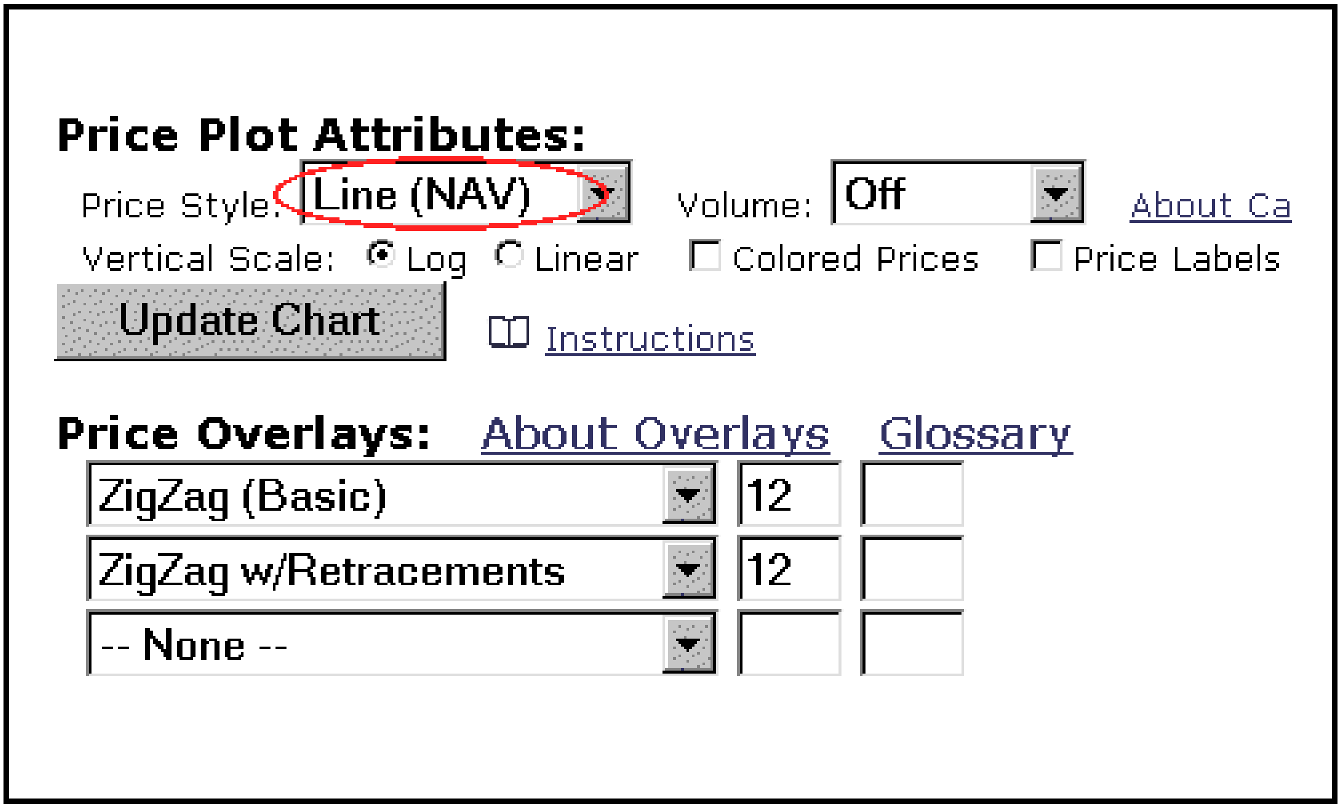



(Chart for HAL)

During the advance from 34 to 55, HAL corrected twice (waves 2 and 4) and fulfilled two Fibonacci retracement targets: .618 and .786. Perhaps the most important Fibonacci number is .618, which is the golden mean. The square root of .618 is .786 (78.6%), another Fibonacci number used frequently by Scott Carney. In Mar-00, HAL retraced 79.8% of its wave 1 advance (red oval). From the Mar-00 low, the stock advanced 1.70 times its previous decline to form wave 3, which is close to a Fibonacci 1.618. The correction on wave 4 retraced 67.6% of the wave 3 advance. While 67.6% and 79.8% are not exact Fibonacci retracements, they are close enough to 61.8% and 78.6% to warrant attention.

Projections: The ZigZag can be used to measure primary price movements. As opposed to a correction or reaction rally, a primary price movement is in the direction of the underlying trend. Instead of retracing a portion of the previous move, primary moves extend past the previous reaction high or low. Many analysts that use Elliott Wave and Fibonacci sequences project the length of an advance or decline by multiplying a ratio to the previous retracement. If the previous decline (correction) was 50 points and a Fibonacci specialist was looking for new highs on the subsequent advance, the projection might be 1.618 times the previous move, or 81 points (50 x 1.618 = 81). The 81 points would be added to the beginning of the advance for a price target. For more on price projections using Fibonacci numbers, see Scott Carney's articles.

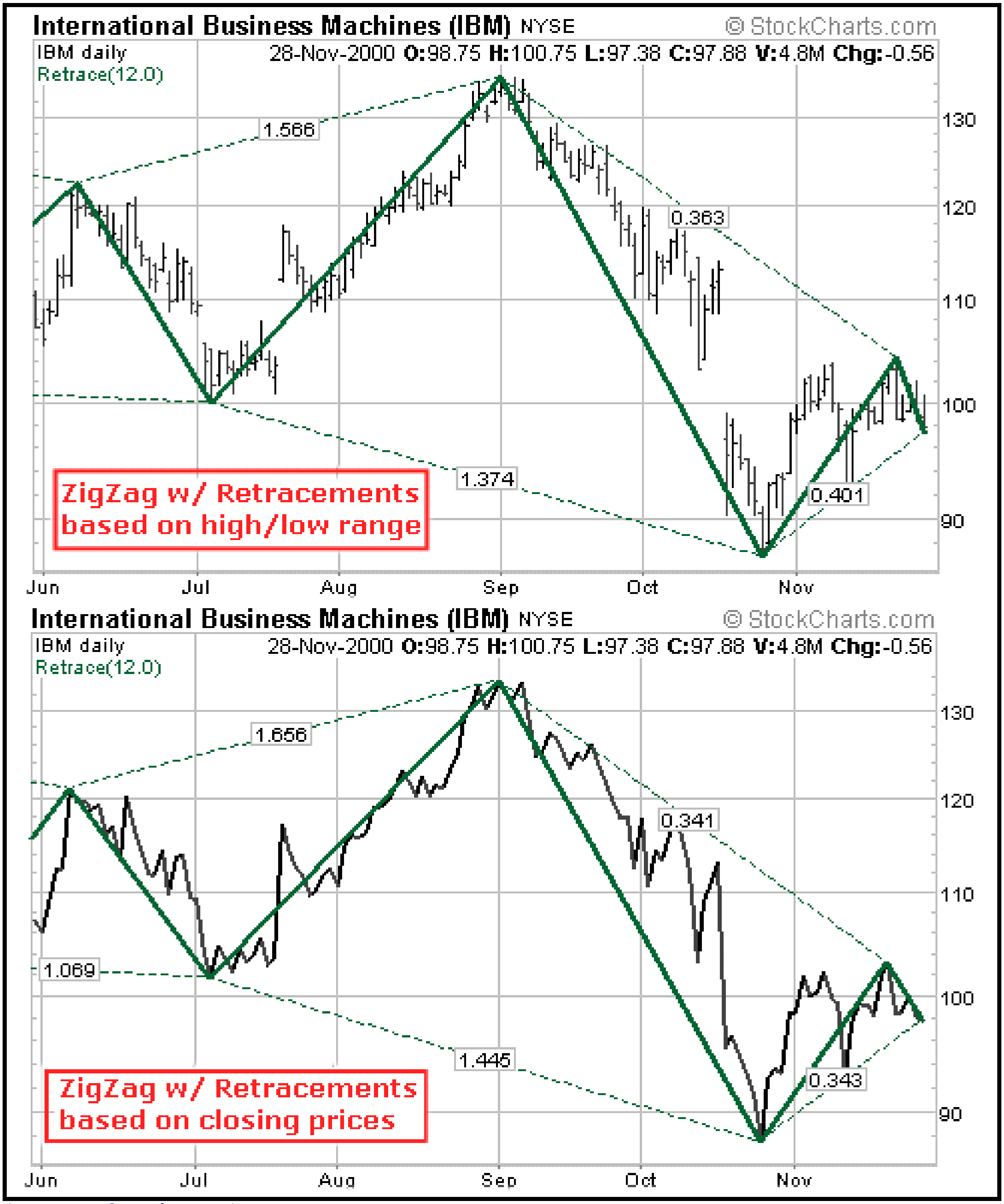
SharpCharts Application




There are two ZigZag options on SharpCharts: the ZigZag (Basic) and the ZigZag w/Retracements. Both plot the same line, but the ZigZag w/Retracments adds labels and dotted lines for retracement ratios.

The ZigZag (Basic) plots a line based on a minimum percentage change in price. The price change can be based on closing levels or the high/low range. To calculate the ZigZag based on closing prices only, select "Line (NAV)" in Price Style box under the heading Price Attributes. To calculate the ZigZag based on the high/low range, select OHCL Bars, HLC Bars or Candlesticks as the price style.

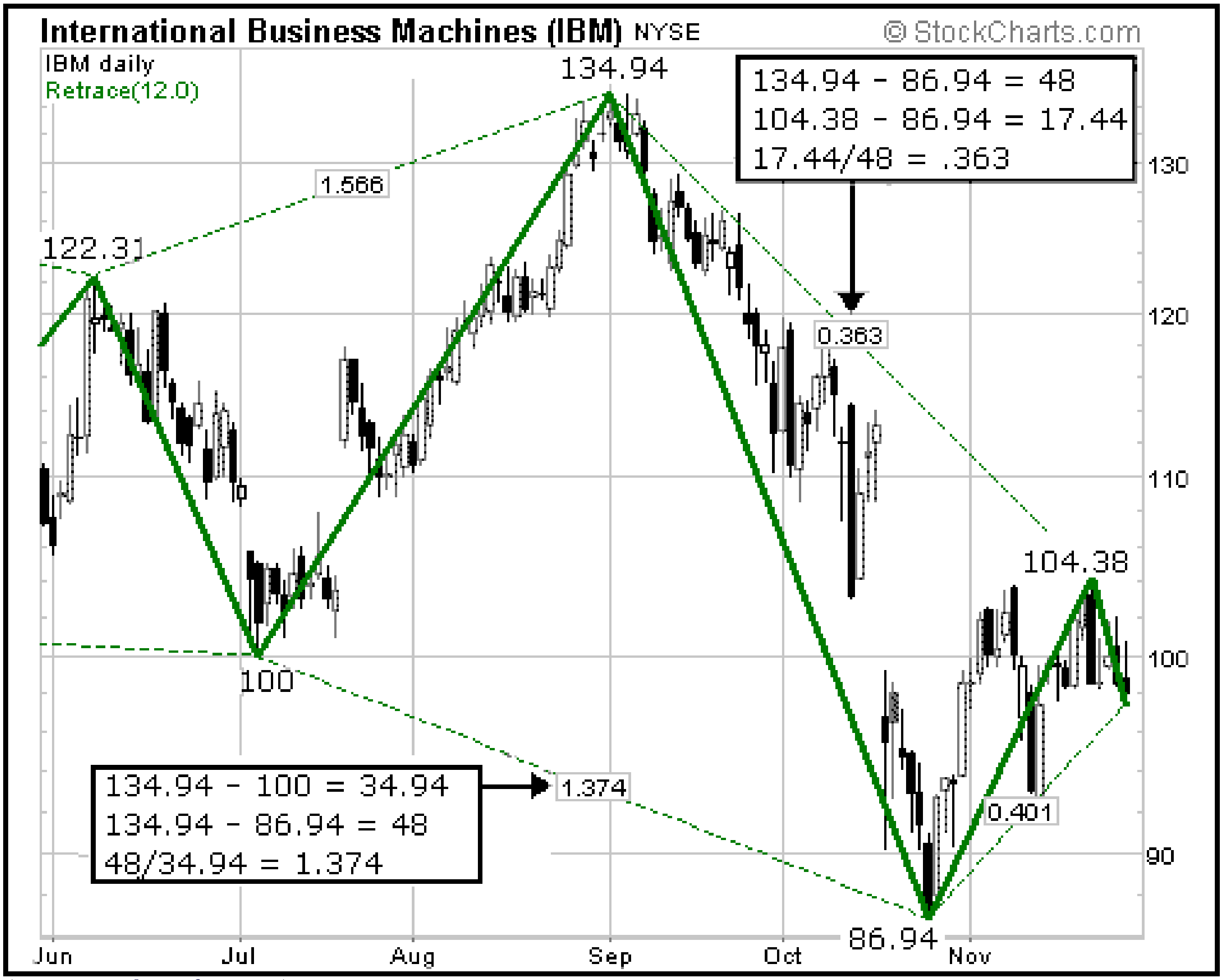
ZigZag (Basic)




(Current Chart for IBM)

The percentage price change for the ZigZag can changed with the first box to the right. The default setting is 5%. In the example, the indicator was set at 12, or 12 percent. All price movements greater than or equal to 12% will produce a ZigZag line. All price movements less than 12% will be ignored. The ZigZag is plotted as a thick line on top of the price plot.

ZigZag w/Retracements




(Current Chart for IBM)

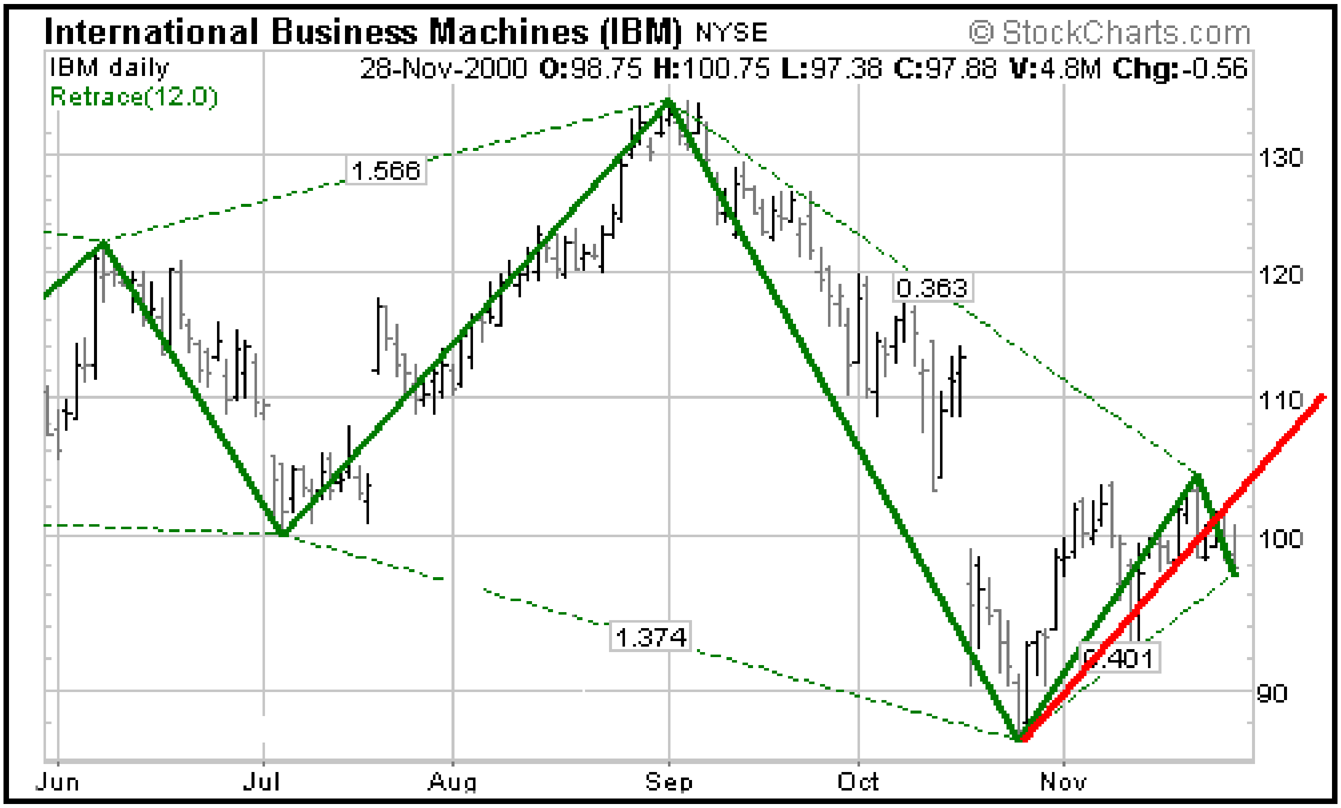
The ZigZag w/Retracements includes ratios of adjacent price movements. For the IBM example, the ZigZag w/Retracements was set at 12% to filter out all price movements less than 12%. Three pairs of price movements were compared from the Jun-00 to Nov-00. Dotted lines connect the relevant highs or relevant lows and the ratio is labeled in the middle of the dotted line. The first ratio is 1.566, representing an advance that was 156.6% of the previous decline. The formula is calculated in three steps:

- First Price Move - Decline: 122.31 - 100 = 22.31
- Second Price Move - Advance: 134.94 - 100 = 34.94
- Advance/Decline Ratio: 34.94/22.31 = 1.566

Calculations for the other two ratios (1.374 and .309) are shown on the corresponding chart.

ZigZag Warning
The ZigZag has zero predictive power and draws lines base on hindsight. Any predictive power will come from applications such as Elliott Wave or Fibonacci retracements and projections.

Warning




The final line for the ZigZag is subject to change. On the IBM example above, the current ZigZag high is 104.38. Because of the recent decline, the ZigZag continued down from 104.38. However, the current decline is well short of the 12% minimum. Should the current decline fail to exceed 12% and should IBM advance above 104.38, then the line from 86.94 would be extended to the new high and the ratio (.363) would change. The red line in the example above provides an idea of what would happen should IBM turn up from current levels and move to 110. The green lines extending from the October low would be replaced by a line extending straight up to 110.

Written by Arthur Hill

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Chart School

# Indicators Part 1

## Introduction

This article is designed to introduce the concept of indicators and explain how to use them in your analysis. We will shed light on the difference between leading and lagging indicators, as well as look into the benefits and drawbacks. Many, if not most, popular indicators are shown as oscillators. With this in mind, we will also show how to read oscillators and explain how signals are derived. Later in this series on indicators, we will turn our focus to specific indicators and provide examples of signals in action.

## What is an Indicator?

An indicator is a series of data points that are derived by applying a formula to the price data of a security. Price data includes any combination of the open, high, low or close over a period of time. Some indicators may use only the closing prices, while others incorporate volume and open interest into their formulas. The price data is entered into the formula and a data point is produced.

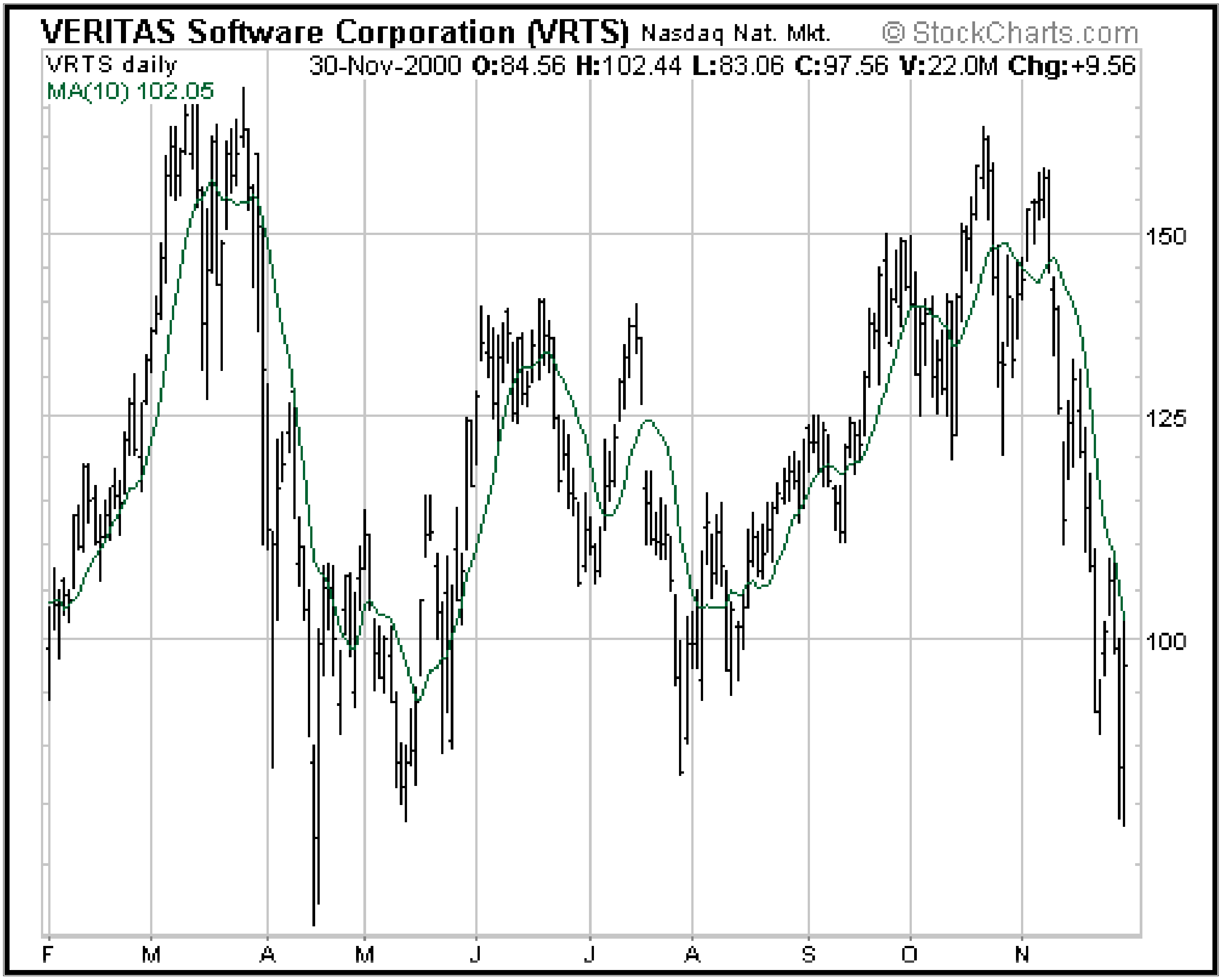
For example, the average of 3 closing prices is one data point ((41+43+43)/3=42.33). However, one data point does not offer much information and does not an indicator make. A series of data points over a period of time is required to create valid reference points to enable analysis. By creating a time series of data points, a comparison can be made between present and past levels. For analysis purposes, indicators are usually shown in a graphical form above or below a security's price chart. Once shown in graphical form, an indicator can then be compared with the corresponding price chart of the security. Sometimes indicators are plotted on top of the price plot for a more direct comparison.

## What does an Indicator Offer?

An indicator offers a different perspective from which to analyze the price action. Some, such as moving averages, are derived from simple formulas and the mechanics are relatively easy to understand. Others, such as Stochastics, have complex formulas and require more study to fully understand and appreciate. Regardless of the complexity of the formula, indicators can provide unique perspective on the strength and direction of the underlying price action.

A simple moving average is an indicator that calculates the average price of a security over a specified number of periods. If a security is exceptionally volatile, then a moving average will help to smooth the data. A moving average filters out random noise and offers a smoother perspective of the price action. Veritas (VRTS) displays a lot of volatility and an analyst may have difficulty discerning a trend. By applying a 10-day simple moving average to the price action, random fluctuations are smoothed to make it easier to identify a trend.

Veritas (VRTS)




## Why Use Indicators?

Indicators serve three broad functions: to alert, to confirm and to predict.

- An indicator can act as an alert to study price action a little more closely. If momentum is waning, it may be a signal to watch for a break of support. Or, if there is a large positive divergence building, it may serve as an alert to watch for a resistance breakout.
- Indicators can be used to confirm other technical analysis tools. If there is a breakout on the price chart, a corresponding moving average crossover could serve to confirm the breakout. Or, if a stock breaks support, a corresponding low in the On-Balance-Volume (OBV) could serve to confirm the weakness.
- Some investors and traders use indicators to predict the direction of future prices. In his column on 29-Oct, Rex Takasugi shows how the Commodity Channel Index (CCI)can be used to generate buy signals for the Russell 2000.

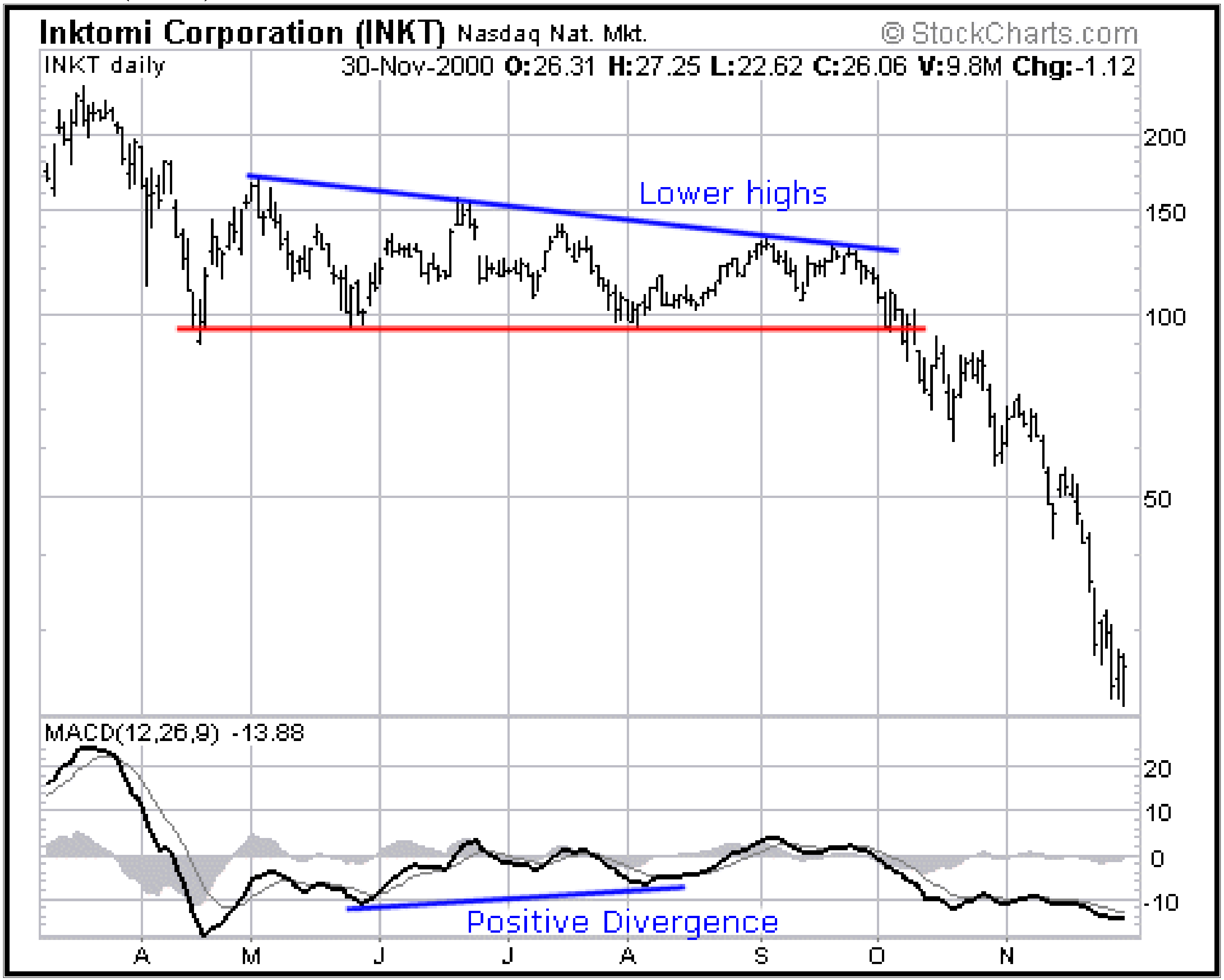
## Tips for Using Indicators

Indicators indicate. This may sound straightforward, but sometimes traders ignore the price action of a security and focus solely on an indicator. Indicators filter price action with formulas. As such, they are derivatives and not direct reflections of the price action. This should be taken into consideration when applying analysis. Any analysis of an indicator should be taken with the price action in mind. What is the indicator saying about the price action of a security? Is the price action getting stronger? Weaker?

Even though it may be obvious when indicators generate buy and sell signals, the signals should be taken in context with other technical analysis tools. An indicator may flash a buy signal, but if the chart pattern shows a descending triangle with a series of declining peaks, it may be a false signal.

On the Inktomi (INKT) chart, MACD MACD improved from April to August and formed a positive divergence in August. All the earmarks of a MACD buying opportunity were present, but the stock failed to break above the resistance and exceed its previous reaction high. This non-confirmation from the stock should have served as a warning sign against a long position. For the record, a sell signal occurred when the stock broke support from the descending triangle in early Oct-00 .

Inktomi (INKT)




As always in technical analysis, learning how to read indicators is more of an art than a science. The same indicator may exhibit different behavioral patterns when applied to different stocks. Indicators that work well for IBM might not work the same for Delta Airlines. Through careful study and analysis, expertise with the various indicators will develop over time. As this expertise develops, certain nuances as well as favorite setups will become clear.

There are hundreds of indicators in use today, with new indicators being created every week. Technical analysis software programs come with dozens of indicators built in, and even allow users to create their own. Given the amount of hype that is associated with indicators, choosing an indicator to follow can be a daunting task. Even with the introduction of hundreds of new indicators, only a select few really offer a different perspective and are worthy of attention. Strangely enough, the indicators that usually merit the most attention are those that have been around the longest time and have stood the test of time.

When choosing an indicator to use for analysis, choose carefully and moderately. Attempts to cover more than five indicators are usually futile. It is best to focus on two or three indicators and learn their intricacies inside and out. Try to choose indicators that complement each other, instead of those that move in unison and generate the same signals. For example, it would be redundant to use two indicators that are good for showing overbought and oversold levels, such as Stochastics and RSI. Both of these indicators measure momentum and both have overbought/oversold levels.

Written by Arthur Hill

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# Indicators Part 2

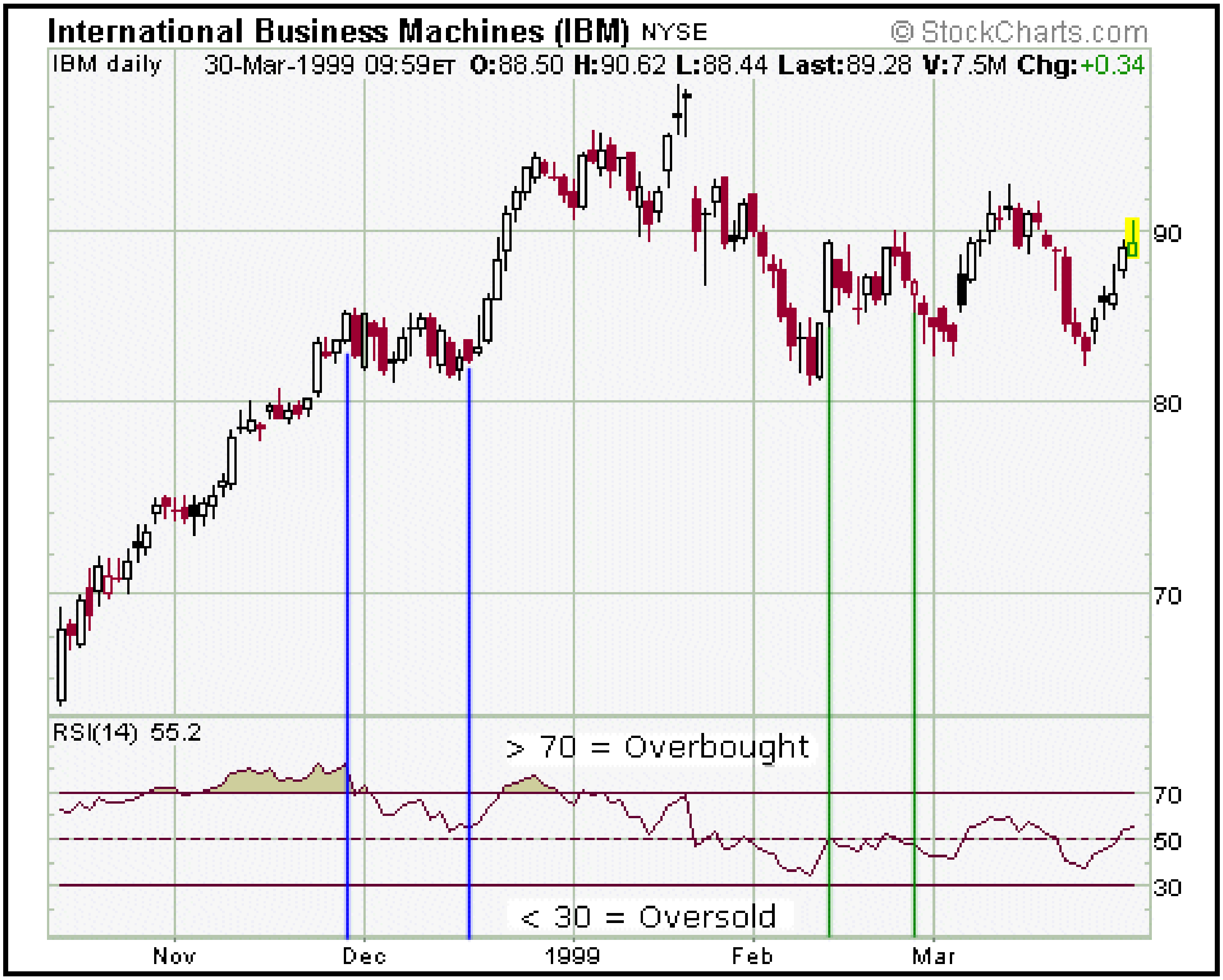
## Leading Indicators

As their name implies, leading indicators are designed to lead price movements. Most represent a form of price momentum over a fixed look-back period, which is the number of periods used to calculate the indicator. For example, a 20-day Stochastic Oscillator would use the past 20 days of price action (about a month) in its calculation. All prior price action would be ignored. Some of the more popular leading indicators include Commodity Channel Index (CCI), Momentum, Relative Strength Index (RSI), Stochastic Oscillator and Williams %R.

### Momentum Oscillators

Many leading indicators come in the form of momentum oscillators. Generally speaking, momentum measures the rate-of-change of a security's price. As the price of a security rises, price momentum increases. The faster the security rises rises (the greater the period-over-period price change), the larger the increase in momentum. Once this rise begins to slow, momentum will also slow. As a security begins to trade flat, momentum starts to actually decline from previous high levels. However, declining momentum in the face of sideways trading is not always a bearish signal. It simply means that momentum is returning to a more median level.

### RSI




Momentum indicators employ various formulas to measure price changes. RSI (a momentum indicator) compares the average price change of the advancing periods with the average change of the declining periods. On the IBM chart, RSI advanced from October to the end of November. During this period, the stock advanced from the upper 60s to the low 80s. When the stock traded sideways in the first half of December, RSI dropped rather sharply (blue lines). This consolidation in the stock was quite normal and actually healthy. From these lofty levels (near 70), flat price action would be expected to cause a a decline in RSI (and momentum). If RSI were trading around 50 and the stock began to trade flat, the indicator would not be expected to decline. The green lines on the chart mark a period of sideways trading in the stock and in RSI. RSI started from a relatively median level, around 50. The subsequent flat price action in the stock also produced relatively flat price action in the indicator and it remains around 50.

### Benefits and Drawbacks of Leading Indicators

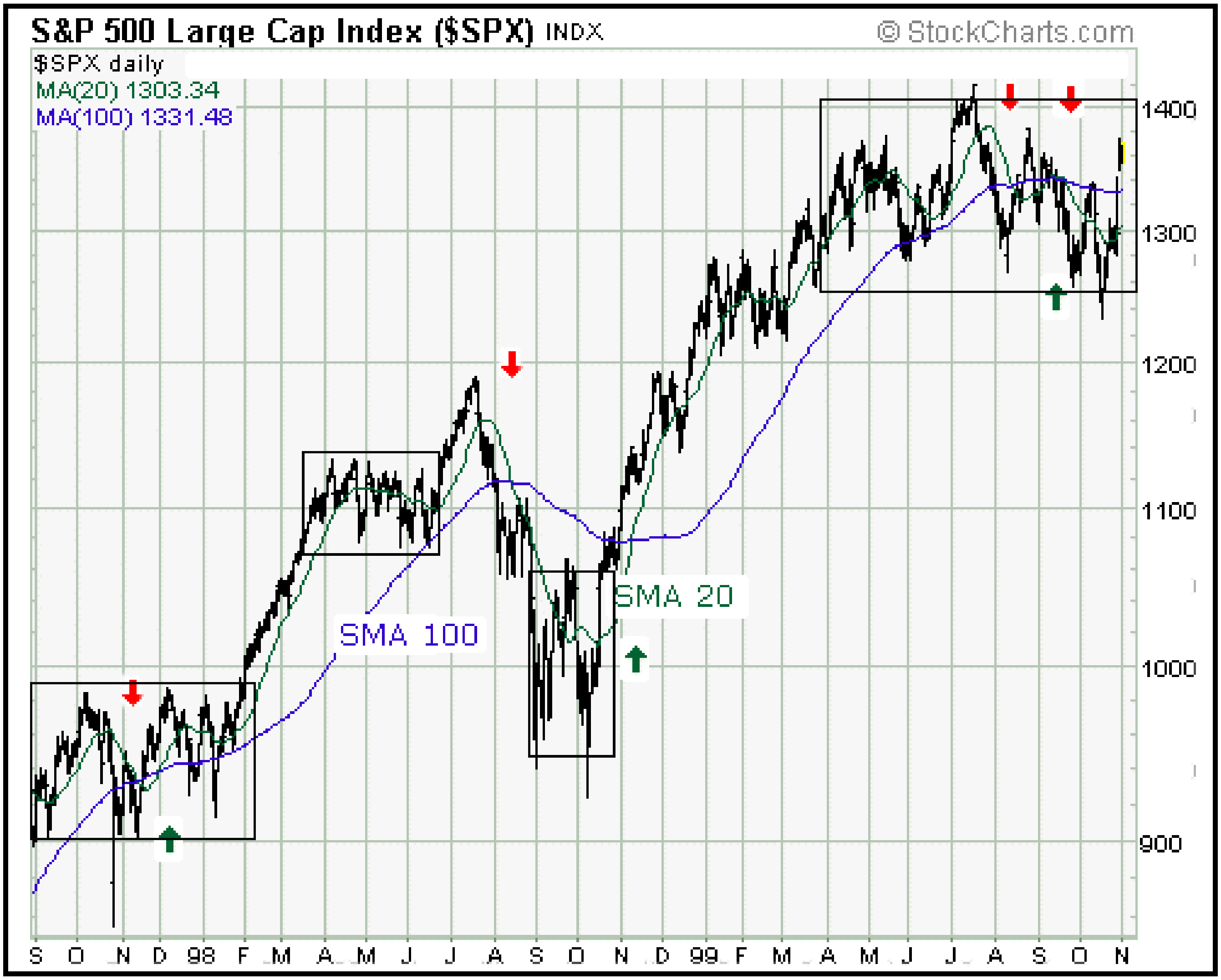
There are clearly many benefits to using leading indicators. Early signalling for entry and exit is the main benefit. Leading indicators generate more signals and allow more opportunities to trade. Early signals can also act to forewarn against a potential strength or weakness. Because they generate more signals, leading indicators are best used in trading markets. These indicators can be used in trending markets, but usually with the major trend, not against it. In a market trending up, the best use is to help identify oversold conditions for buying opportunities. In a market that is trending down, leading indicators can help identify overbought situations for selling opportunities.

With early signals comes the prospect of higher returns and with higher returns comes the reality of greater risk. More signals and earlier signals mean that the chances of false signals and whipsaws increase. False signals will increase the potential for losses. Whipsaws can generate commissions that can eat away profits and test trading stamina.

## Lagging Indicators

As their name implies, lagging indicators follow the price action and are commonly referred to as trend-following indicators. Rarely, if ever, will these indicators lead the price of a security. Trend-following indicators work best when markets or securities develop strong trends. They are designed to get traders in and keep them in as long as the trend is intact. As such, these indicators are not effective in trading or sideways markets. If used in trading markets, trend-following indicators will likely lead to many false signals and whipsaws. Some popular trend-following indicators include moving averages (exponential, simple, weighted, variable) and MACD.

S&P 500




The chart above shows the S&P 500 with the 20-day simple moving average and the 100-day simple moving average. Using a moving average crossover to generate the signals, there were seven signals over the two years covered in the chart. Over these two years, the system would have been enormously profitable. This is due to the strong trends that developed from Oct-97 to Aug-98 and from Nov-98 to Aug-99. However, notice that as soon as the index starts to move sideways in a trading range, the whipsaws begin. The signals in Nov-97 (sell), Aug-99 (sell) and Sept-99 (buy) were reversed in a matter of days. Had these moving averages been longer (50- and 200-day moving averages), there would have been fewer whipsaws. Had these moving average been shorter (10 and 50-day moving average), there would have been more whipsaws, more signals, and earlier signals.

Benefits and Drawbacks of Lagging Indicators

One of the main benefits of trend-following indicators is the ability to catch a move and remain in a move. Provided the market or security in question devlopes a sustained move, trend-following indicators can be enormously profitable and easy to use. The longer the trend, the fewer the signals and less trading involved.

The benefits of trend-following indicators are lost when a security moves in a trading range. In the S&P 500 example, the index appears to have been range-bound at least 50% of the time. Even though the index trended higher from 1982 to 1999, there have also been large periods of sideways movement.

From 1964 to 1980, the index traded within a large range bound by 85 and 110.

Another drawback of trend-following indicators is that signals tend to be late. By the time a moving average crossover occurs, a significant portion of the move has already occurred. The Nov-98 buy signal occurred at 1130, about 19% above the Oct-98 low of 950. Late entry and exit points can skew the risk/reward ratio.

## The Challenge of Indicators

For technical indicators, there is a trade-off between sensitivity and consistency. In an ideal world, we want an indicator that is sensitive to price movements, gives early signals and has few false signals (whipsaws). If we increase the sensitivity by reducing the number of periods, an indicator will provide early signals, but the number of false signals will increase. If we decrease sensitivity by increasing the number of periods, then the number of false signals will decrease, but the signals will lag and and this will skew the reward-to-risk ratio.

The longer a moving average is, the slower it will react and fewer signals will be generated. As the moving average is shortened, it becomes faster and more volatile, increasing the number of false signals. The same holds true for the various momentum indicators. A 14 period RSI will generate fewer signals than a 5 period RSI. The 5 period RSI will be much more sensitive and have more overbought and oversold readings. It is up to each investor to select a time frame that suits his or her trading style and objectives.

*In Part 3, we look at Oscillators in depth, and address the various methods used to generate buy and sell signals. Also, we analyze the mechanics of a very special oscillator that is neither a pure trend follower nor a leader, but part of both camps.*

Written by Arthur Hill

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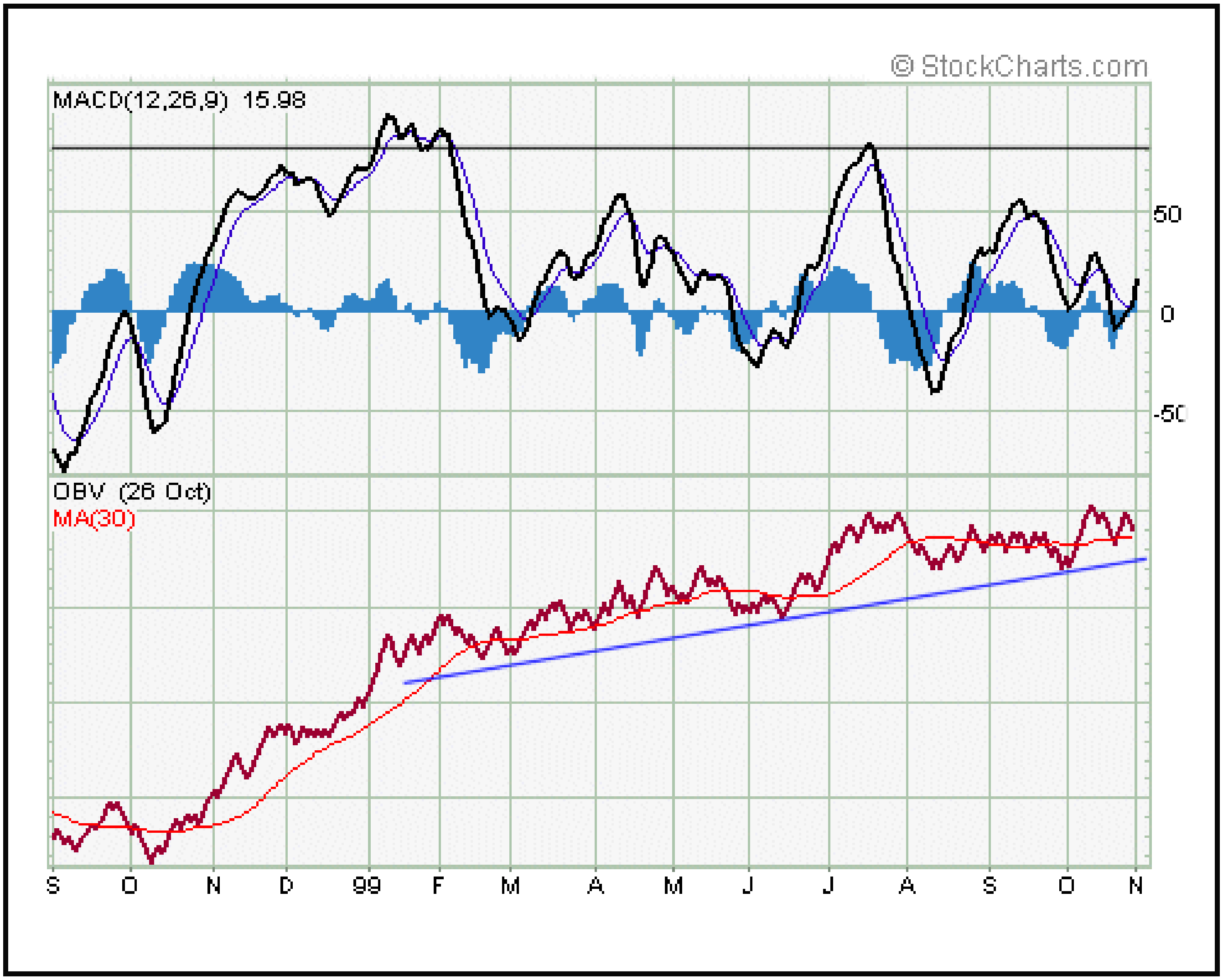
# Indicators Part 3

## Oscillator Types

An oscillator is an indicator that fluctuates above and below a centerline or between set levels as its value changes over time. Oscillators can remain at extreme levels (overbought or oversold) for extended periods, but they cannot trend for a sustained period. In contrast, a security or a cumulative indicator like On-Balance-Volume (OBV) can trend as it continually increases or decreases in value over a sustained period of time.




As the indicator comparison chart shows, oscillator movements are more confined and sustained movements (trends) are limited, no matter how long the time period. Over the two year period, Moving Average Convergence Divergence (MACD) fluctuated above and below zero, touching the zero line about twelve times. Also notice that each time MACD surpassed +80 the indicator pulled back. Even though MACD does not have an upper or lower limit on its range of values, its movements appear confined. OBV, on the other hand, began an uptrend in September 1998 and advanced steadily for the next year. Its movements are not confined and long-term trends can develop.

There are many different types of oscillators and some belong to more than one category. The breakdown of oscillator types begins with two types: centered oscillators which fluctuate above and below a center point or line, and banded oscillators which fluctuate between overbought and oversold extremes. Generally, centered oscillators are best suited for analyzing the direction of price momentum, while banded oscillators are best suited for identifying overbought and oversold levels.

### Centered Oscillators

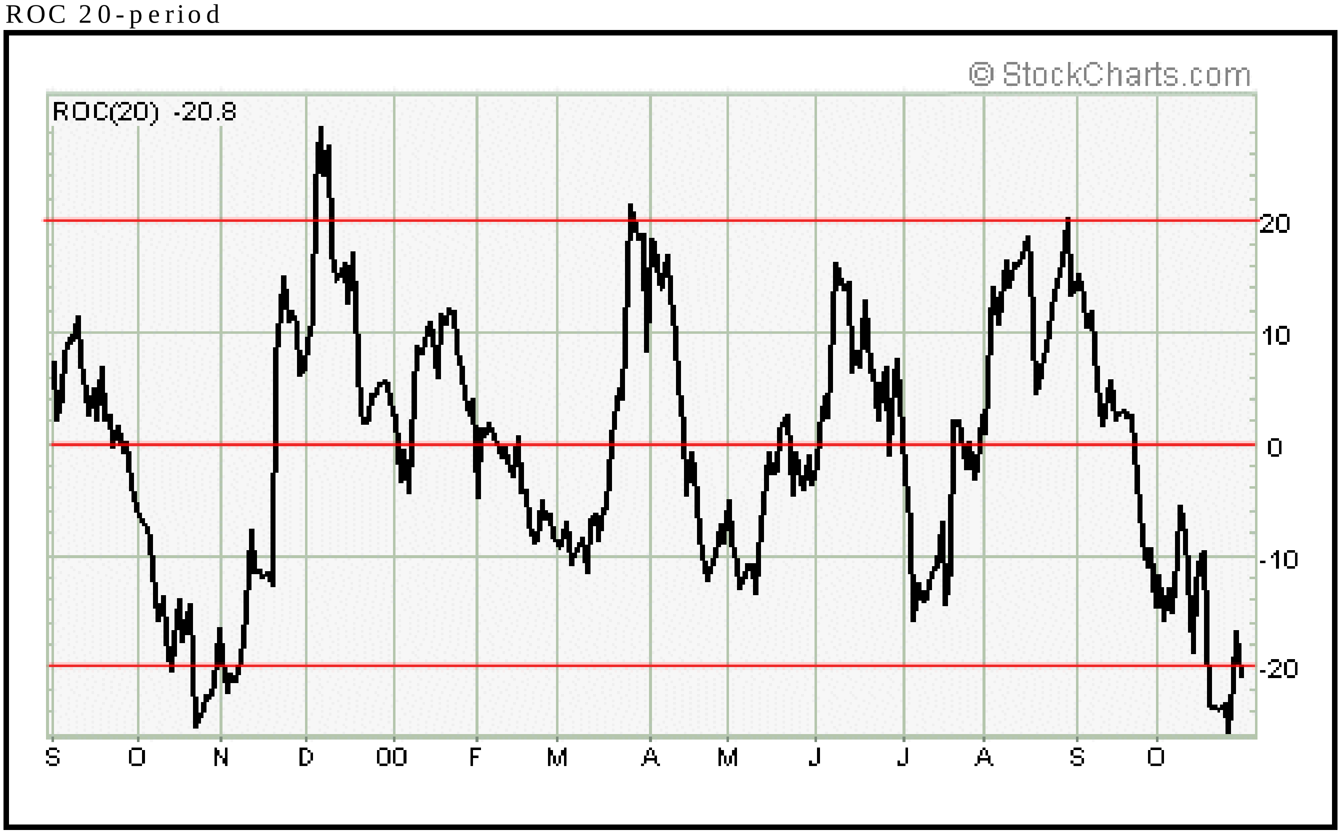
Centered oscillators fluctuate above and below a central point or line. These oscillators are good for identifying the strength or weakness, or direction, of momentum behind a security's move. . In its purest form, momentum is positive (bullish) when a centered oscillator is trading above its center line and negative (bearish) when the oscillator is trading below its center line.

MACD is an example of a centered oscillator that fluctuates above and below zero. MACD is the difference between the 12-day EMA and 26-day EMA of a security. The further one moving average moves away from the other, the higher the reading. Even though there is no range limit to MACD, extremely large differences between the two moving averages are unlikely to last for long.

MACD is unique in that it has lagging elements as well as leading elements. Moving averages are lagging indicators and would be classified as trend-following or lagging elements. However, by taking the differences in the moving averages, MACD incorporates aspects of momentum or leading elements. The difference between the moving averages represents the rate of change. By measuring the rate-of-change, MACD becomes a leading indicator, but still with a bit of lag. With the integration of both moving averages and rate-of-change, MACD has forged a unique spot among oscillators as both a lagging and a leading indicator.

Rate-of-change (ROC) is a centered oscillator that also fluctuates above and below zero. As its name implies, ROC measures the percentage price change over a given time period. For example: 20 day ROC would measure the percentage price change over the last 20 days. The bigger the difference between the current price and the price 20 days ago, the higher the value of the ROC Oscillator. When the indicator is above 0, the percentage price change is positive (bullish). When the indicator is below 0, the percentage price change is negative (bearish).

ROC 20-period




As with MACD, ROC is not bound by upper or lower limits. This is typical of most centered oscillators and can make it difficult to spot overbought and oversold conditions. The ROC chart indicates that readings above +20% and below -20% represent extremes and are unlikely to last for an extended period of time. However, the only way to gauge that +20% and -20% are extreme readings is from past observations.

Also, +20% and -20% represent extremes for this particular security and may not be the same for other securities. Banded oscillators offer a better alternative to gauge extreme price levels.

Banded Oscillators

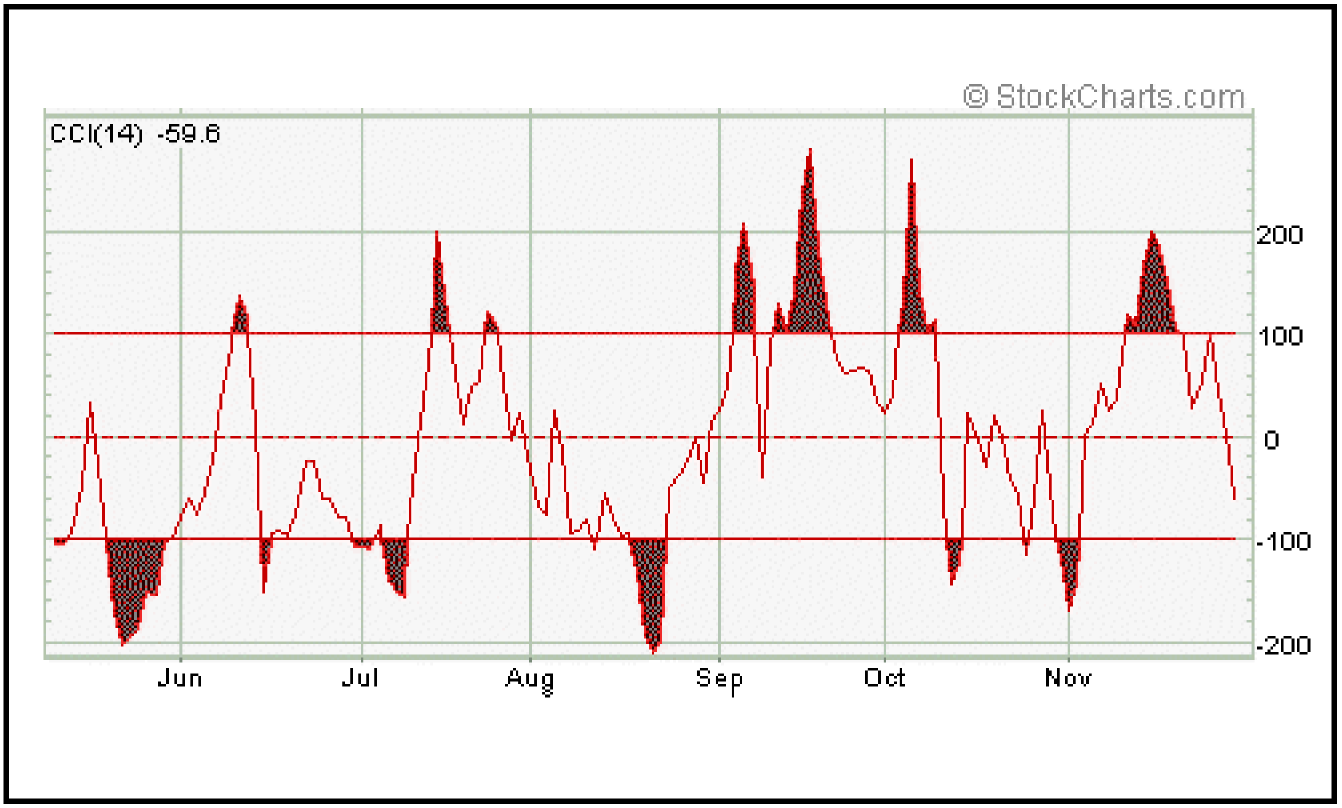
Banded oscillators fluctuate above and below two bands that signify extreme price levels. The lower band represents oversold readings and the upper band represents overbought readings. These set bands are based on the oscillator and change little from security to security, allowing the users to easily identify overbought and oversold conditions. The Relative Strength Index (RSI) and the Stochastic Oscillator are two examples of banded oscillators. (Note: The formulas and rationale behind RSI and the Stochastic Oscillator are more complicated than those for MACD and ROC, As such, calculations are addressed in separate articles.)

Stochastics/RSI


For RSI, the bands for overbought and oversold are usually set at 70 and 30 respectively. A reading greater than 70 would be considered overbought and a reading below 30 would be considered oversold. For the Stochastic Oscillator, a reading above 80 is overbought and a reading below 20 oversold. Even though these are the recommended band settings, certain securities may not adhere to these ranges and might require more fine-tuning. Making adjustments to the bands is usually a judgment call that will reflect a trader's preferences and the volatility of the security.

Many, but not all, banded oscillators fluctuate within set upper and lower limits. The Relative Strength Index (RSI) is range-bound by 0 and 100 and will never go higher than 100 nor lower than zero. The Stochastic Oscillator is another oscillator with a set range and is bound by 100 and 0 as well. However, the Commodity Channel Index (CCI) is a banded oscillator that is not range bound.

CCI




Conclusions
Centered oscillators are best used to identify the underlying strength or direction of momentum behind a move. Broadly speaking, readings above the center point indicate bullish momentum and readings below the center point indicate bearish momentum. The biggest difference between centered oscillators and banded oscillators is the latter's ability to identify extreme readings. While it is possible to identify extreme readings with centered oscillators, they are not ideal for this purpose. Banded oscillators are best suited to identify overbought and oversold conditions.

## Oscillator Signals

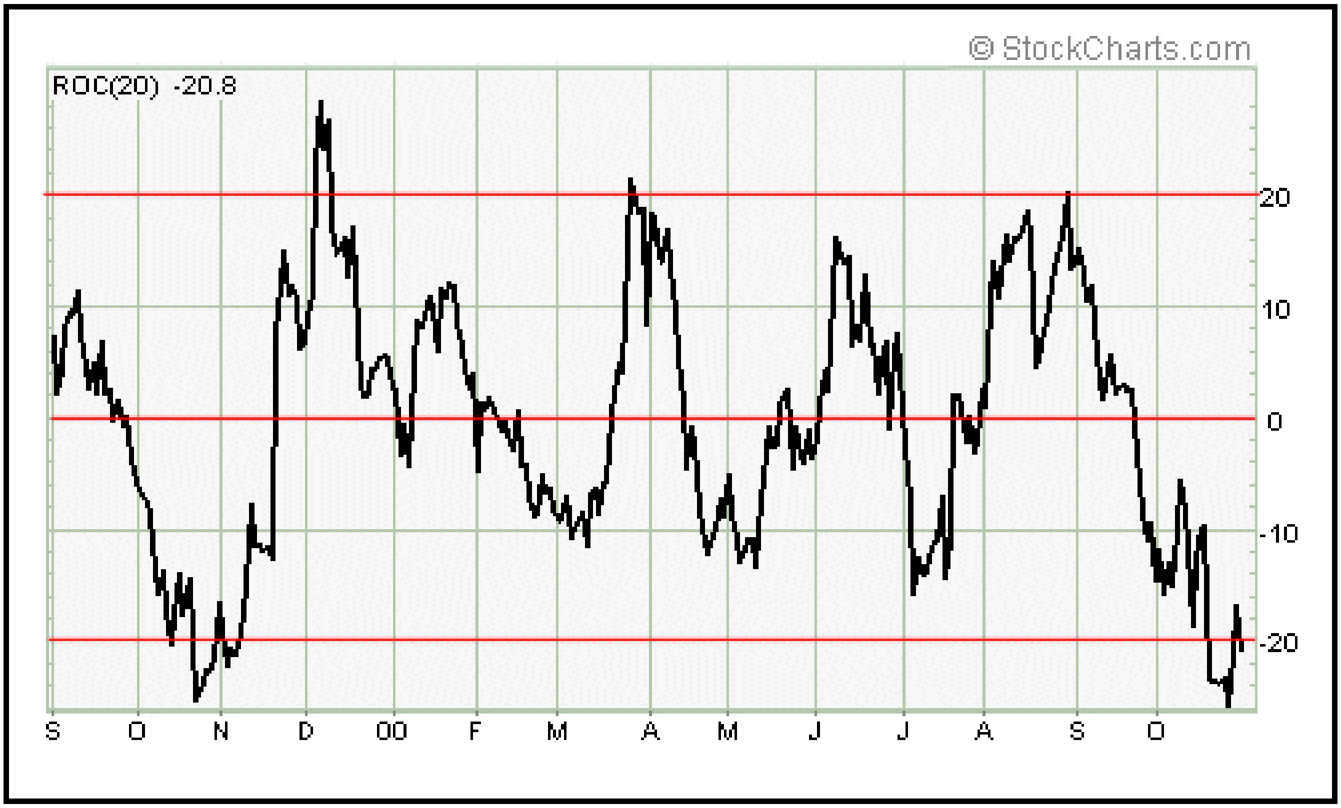
Oscillators generate buy and sell signals in various ways. Some signals are geared towards early entry, while others appear after the trend has begun. In addition to buy and sell signals, oscillators can signal that something is amiss with the current trend or that the current trend is about to change. Even though oscillators can generate their own signals, it is important to use these signals in conjunction with other aspects of technical analysis. Most oscillators are momentum indicators and only reflect one characteristic of a security's price action. Volume, price patterns and support/resistance levels should also be taken into consideration.

Positive and Negative Divergences
Divergence is a key concept behind many signals for oscillators as well as other indicators. Divergences can serve as a warning that the trend is about to change or set up a buy or sell signal. There are two types of divergences: positive and negative. In its most basic form, a positive divergence occurs when the indicator advances and the underlying security declines. A negative divergence occurs when an indicator declines and the underlying security advances.

Merrill Lynch


On the Merrill Lynch (MER) chart, MACD formed a positive divergence in late October. While MER was trading below its previous reaction low, MACD had yet to penetrate its previous low (green arrows). However, MACD had not turned up and the positive divergence was still just a possibility. When MACD turned up and traded above its 9-day EMA, a positive divergence was confirmed. At this point, other signals came together to create a buy signal. Not only had the stock reached support and gapped up, but there was also a MACD positive divergence and a MACD bullish crossover. (Note: The thick line and the thin line is the 9-day EMA of MACD, which acts as a trigger line. A bullish crossover occurs when MACD moves above its 9-day EMA and a bearish crossover occurs when MACD moves below its 9-day EMA.) After these MACD signals, the stock gapped up the very next day on a huge increase in volume.

Intel




On the Intel (INTC) chart, the ROC Oscillator formed a negative divergence just prior to the decline that began in September. When INTC recorded a record high in early September, the ROC Oscillator failed to surpass its previous high. The stock then began to decline and the ROC Oscillator turned lower as well, thus completing the lower high and the negative divergence. As there was little else to go on at the time, this negative divergence should have been taken as a warning signal. However, when the ROC Oscillator continued to deteriorate and broke below 0 (centerline), it was clear that the stock was weak and vulnerable to a further decline.

## Overbought and Oversold Extremes

Banded oscillators are designed to identify overbought and oversold extremes. Since these oscillators fluctuate between extremes, they can be difficult to use in trending markets. Banded oscillators are best used in trading ranges or with securities that are not trending. In a strong trend, users may see many signals that are not really valid. If a stock is in a strong uptrend, buying on oversold conditions will work much better than selling on overbought conditions.

In a strong trend, oscillator signals against the direction of the underlying trend are less robust than those with the trend. The trend is your friend and can be dangerous to fight it. Even though securities develop trends, they also fluctuate within those trends. If a stock is in a strong uptrend, buying when oscillators reach oversold conditions (and near support tests) will work much better than selling on overbought conditions. During a strong downtrend, selling when oscillators reach overbought conditions would work much better. If the path of least resistance is up (down), then acting on only bullish (bearish) signals would be in harmony with the trend. Attempts to trade against the trend carry added risk.

When the trend is strong, banded oscillators can remain near overbought or oversold levels for extended periods. An overbought condition does not indicate that it is time to sell, nor does an oversold condition indicate that it is time to buy. In a strong uptrend, an oscillator can reach an overbought condition and remain so as the underlying security continues to advance. A negative divergence may form, but a bearish signal against the uptrend should be considered suspect. In a strong downtrend, an oscillator can reach an oversold condition and remain so as the underlying security continues to decline. Similarly, a positive divergence may form, but a bullish signal against the downtrend should be considered suspect. This does not mean counter-trend signals won't work, but they should be viewed in proper context and considered with other aspects of technical analysis.

The first step in using banded oscillators is to identify the upper and lower bands that mark the extremities. For RSI, anything below 30 and above 70 represents an extremity. For the Stochastic Oscillator, anything below 20 and above 80 represents an extremity. We know that when RSI is below 30 or the Stochastic Oscillator is below 20, an oversold condition exists. By that same token, when RSI is above 70 and the Stochastic Oscillator is above 80, an overbought condition exists. Identification of an overbought or oversold condition should serve as an alert to monitor other technical aspects (price pattern, trend, support, resistance, candlesticks, volume or other indicators) with extra vigilance.

The simplest method to generate signals is to note when the upper and lower bands are crossed. If a security is overbought (above 70 for RSI and 80 for the Stochastic Oscillator) and moves back down below the upper band, then a sell signal is generated. If a security is oversold (below 30 for RSI and 20 for the Stochastic Oscillator) and moves back above the lower band, then a buy signal is generated. Keep in mind that these are the simplest methods.

Simple signals can also be combined with divergences and moving average crossovers to create more robust signals. Once a stock becomes oversold, traders may look for a positive divergence to develop in the RSI and then a cross above 30. With the Stochastic Oscillator overbought, traders may look for a negative divergence and combine that with a moving average crossover and a break below 80 to generate a signal. (Note: The Stochastic Oscillator is usually plotted with a 3-day simple moving average that acts as the trigger line. When the Stochastic Oscillator crosses above the trigger line it is a bullish moving average crossover, and when it crosses below it is bearish).

Cisco

The Cisco (CSCO) chart shows that the Stochastic Oscillator can change from oversold to overbought quite quickly. Much depends on the number of time periods used to calculate the oscillator. A 10-day Slow Stochastic Oscillator will be more volatile than a 20-day. The thin green lines indicate when the Stochastic Oscillator touched or crossed the oversold line at 20. The thin red lines indicate when Stochastic Oscillator touched or crossed the overbought line. CSCO was in a strong up trend at the time and experiencing little selling pressure. Therefore, trying to sell when the oscillator crossed back below 80 would have been against the uptrend and not the proper strategy. When a security is trending up or has a bullish bias, traders would be better off looking for oversold conditions to generate buying opportunities.

We can also see that much of the upside for the stock occurred after the Stochastic Oscillator advanced above 80 (thin red lines). The green circle in August shows a buy signal that was generated with three separate items: one, the oscillator moved above 20 from oversold conditions; two, the oscillator moved above its 3-day MA; and three, the oscillator formed a positive divergence. Confirmation from these three items makes for a more robust signal. After the buy signal, the oscillator was in overbought territory a mere 4 days later. However, the stock continued its advance for 2-3 weeks before reaching its high.

Airborne Freight

The Airborne Freight (ABF) chart reveals trading opportunities with the Relative Strength Index (RSI). Because a 14-period RSI rarely moved below 30 and above 70, a 10-period RSI was chosen to increase sensitivity. With the intermediate-term and long-term trends decidedly bearish, savy traders could have sold short each time RSI reached overbought (black vertical lines). More aggressive traders could have played the long side each time RSI dipped below 30 and then moved back above this oversold level. The first two buy signals were generated with a positive divergence and a move above 30 from oversold conditions. The third buy signal came after RSI briefly dipped below 30. Keep in mind that these three signals were against the larger downtrend and trading strategies should be adjusted accordingly.

Written by Arthur Hill

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# Indicators Part 4

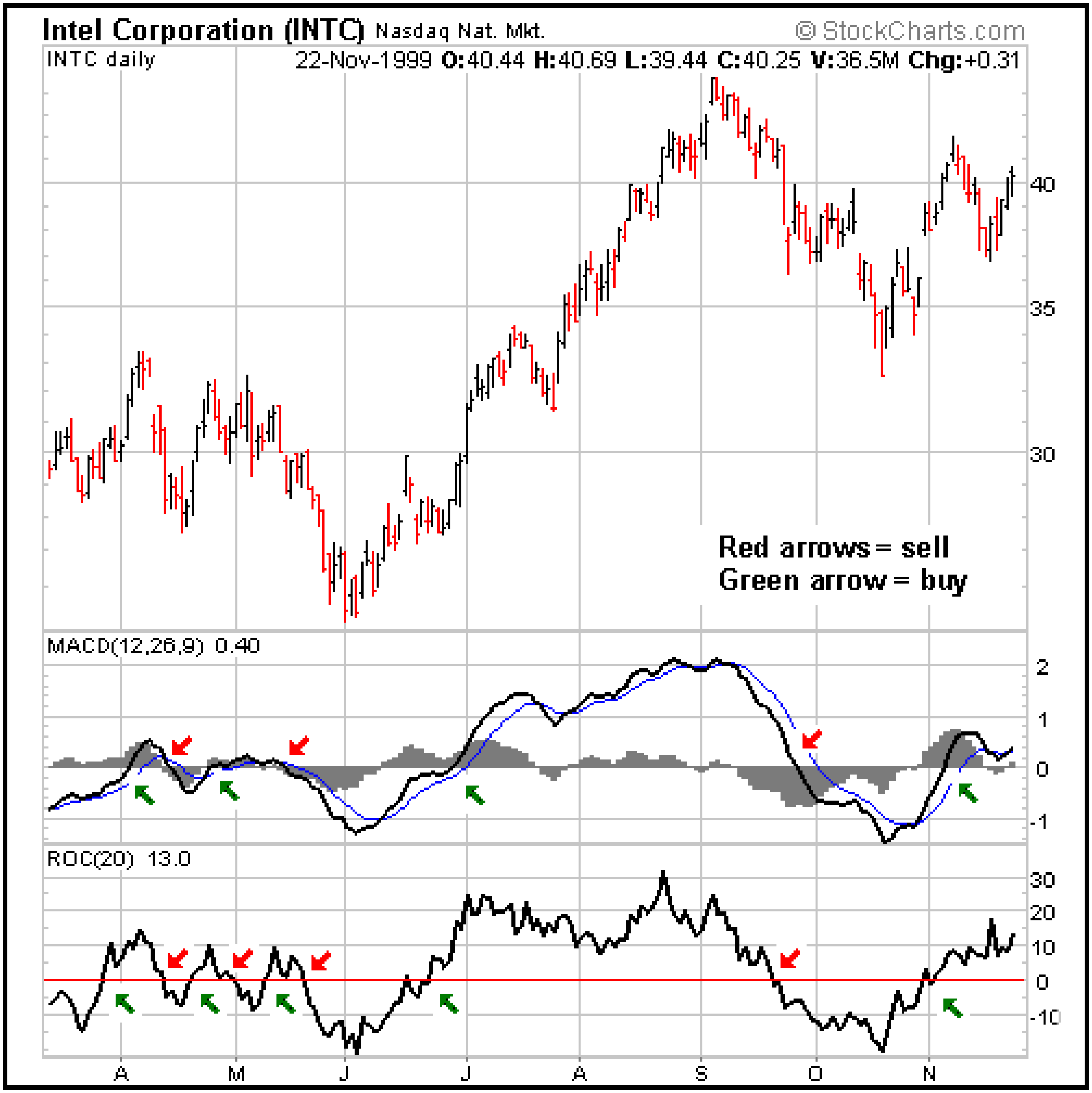
## Centerline Crossovers

As the name implies, centerline crossover signals apply mainly to centered oscillators that fluctuate above and below a centerline. Traders have been also known to use centerline crosses with RSI in order validate a divergence or signal generated from an overbought or oversold reading. However, most banded oscillators, such as RSI and Stochastics, rely on divergences and overbought/oversold levels to generate signals. The middle ground is a bit of a no man's land for banded oscillators and is probably best left to other tools. For our purposes, the analysis of centerline crossovers will focus on centered oscillators such as Chaikin Money Flow, MACD and Rate-of-Change (ROC).

A centerline crossover is sometimes interpreted as a buy or sell signal. A buy signal would be generated with a cross above the centerline and a sell signal with a cross below the centerline. For MACD or ROC, a cross above or below zero would act as a signal.

Movements above or below the centerline indicate that momentum has changed from either positive to negative or negative to positive. When a centered momentum oscillator advances above its centerline, momentum turns positive and could be considered bullish. When a centered momentum oscillator declines below its centerline, momentum turns negative and could be considered bearish.

Intel




On this Intel chart with MACD and ROC, there have been a number of signals generated from the centerline crossover. There were a couple of excellent signals, but there were also plenty of false signals and whipsaws. This highlights some of the challenges associated with trading oscillator signals. Also, it stresses the importance of combining various signals in order to create more robust buy and sell signals. Some traders also criticize centerline crossover signals as being too late and missing too much of the move.

A centerline crossover can also act as a confirmation signal to validate a previous signal or reinforce the current trend. If there were a positive divergence and bullish moving average crossover, then a subsequent advance above the centerline would confirm the previous buy signal. Failure of the oscillator to move above the centerline could be seen as a non-confirmation and act as an alert that something was amiss.

Intel


On the Intel chart with MACD, the centerline crossover acts as the third in a series of bullish signals. Even after the third signal, Intel still has plenty of upside left.

1. There was the higher low forming that signaled a potential positive divergence.
2. There was the bullish moving average crossover to confirm the positive divergence.
3. And finally, there was the bullish centerline crossover.

Some traders would worry about missing too much of the move by waiting for the third and final confirmation. However, this can be a more reliable signal and help to avoid whipsaws and false signals. It is true that waiting for the third signal will reduce profits, but it can also help reduce risk.

IBM


Chaikin Money Flow is an example of a centered oscillator that places importance on crosses above and below the centerline. Divergences, overbought levels and oversold levels are all secondary to the absolute level of the indicator. The direction of the oscillator's movement is important, but needs to be placed in the context of the absolute level. The longer the oscillator is above zero, the more evidence of accumulation. The longer the oscillator is below zero, the more evidence of distribution. Hence, Chaikin Money Flow is considered to be bullish when the oscillator is trading above zero and bearish when trading below zero.

On the IBM chart, Chaikin Money Flow began to turn down in July. At this time, the stock was declining with the market and the decline in the oscillator was normal. However, in the second half of August, concerns began to grow when the oscillator failed to continue up with the stock and fell below zero. As the stock advanced further, Chaikin Money Flow continued to deteriorate. This served as a signal that something was amiss.

## Oscillator Signals - Conclusions

Banded oscillators are best used to identify overbought and oversold conditions. However, overbought is not meant to act a sell signal and oversold is not meant to act as a buy signal. Overbought and oversold situations serve as an alert that conditions are reaching extreme levels and close attention should be paid to the price action and other indicators.

To improve the robustness of oscillator signals, traders can look for multiple signals. The criteria for a buy or sell signal could depend on three separate yet confirming signals. A buy signal might be generated with an oversold reading, positive divergence and bullish moving average crossover. Conversely, a sell signal might be generated from a negative divergence, bearish moving average crossover and bearish centerline crossover.

Traditional chart pattern analysis can also be applied to oscillators. This is a bit trickier, but can help to identify the strength behind an oscillator's move. Looking for higher highs or lower lows can help confirm previous analysis. A trendline breakout can signal that a change in the direction of the momentum is imminent.

It is dangerous to trade an oscillator signal against the major trend of the market. In bull moves, it is best to look for buying opportunities through oversold signals, positive divergences, bullish moving average crossovers and bullish centerline crossovers. In bear moves, it is best to look for selling opportunities through overbought signals, negative divergences, bearish moving average crossovers and bearish centerline crossovers.

And finally, oscillators are most effective when used in conjunction with pattern analysis, support/resistance identification, trend identification and other technical analysis tools. By being aware of the broader picture, oscillator signals can be put into context. It is important to identify the current trend or even to ascertain if the security is trending at all. Oscillator readings and signals can have different meaning in differing circumstances. By using other analysis techniques in conjunction with oscillator reading, the chances of success can be greatly enhanced.

Written by Arthur Hill

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