**Technical Analysis**

A form of market analysis that studies demand and supply for securities and commodities based on trading volume and price studies. Using charts and modeling techniques, technicians attempt to identify price trends in a market.

Now we'll introduce technical analysis and explain some commonly mentioned aspects.

1. What is technical analysis?
   Technical analysis attempts to use *past* stock price and volume information to predict *future* price movements. Note the emphasis. It also attempts to time the markets.

2. Does it have any chance of working, or is it just like reading tea leaves?
   There are a couple of plausibility arguments. One is that the chart patterns represent the past behavior of the pool of investors. Since that pool doesn't change rapidly, one might expect to see similar chart patterns in the future. Another argument is that the chart patterns display the action inherent in an auction market. Since not everyone reacts to information instantly, the chart can provide some predictive value. A third argument is that the chart patterns appear over and over again. Even if I don't know why they happen, I shouldn't trade or invest against them. A fourth argument is that investors swing from overly optimistic to excessively pessimistic and back again. Technical analysis can provide some estimates of this situation.

   A contrary view is that it is just coincidence and there is little, if any, causality present. Or that even if there is some sort of causality process going on, it isn't strong enough to trade off of.

   A very contrary view: The past and future performance of a stock may be correlated, but that does not mean or imply causality. So, relying on technical analysis to buy/sell a stock is like relying on the position of the stars in the atmosphere or the phases of the moon to decide whether to buy or sell.

3. I am a fundamentalist. Should I know anything about technical analysis?
   Perhaps. You should consider delaying purchase of stocks whose chart patterns look bad, no matter how good the fundamentals. The market is telling you something is still awry. Another argument is that the technicians won't be buying and they will not be helping the stock move up. On the other hand (as the economists say), it makes it easy for you to buy in front of them. And, of course, you can ignore technical analysis viewpoints and rely solely on fundamentals.

4. What are moving averages?
   Observe that a period can be a day, a week, a month, or as little as 1 minute. Stock and mutual fund charts normally are daily postings or weekly postings. An N period (simple) moving average is computed by summing the last N data points and dividing by N. Moving averages are normally simple unless otherwise specified.

   An exponential moving average is computed slightly differently. Let X[i] be a series of data points. Then the Exponential Moving Average (EMA) is computed by:

   ```
   EMA[i] = (1 - sm) * EMA[i-1] + sm * X[i]

   where sm = 2/(N+1), and EMA[1] = X[1].
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   "sm" is the smoothing constant for an N period EMA. Note that the EMA provides more weighting to the recent data, less weighting to the old data.

5. What is Stage Analysis?
   Stan Weinstein [ref 3] developed a theory (based on his observations) that stocks usually go through four stages in order. Stage 1 is a time period where the stock fluctuates in a relatively narrow range. Little or nothing seems to be happening and the stock price will wander back and forth across the 200 day moving average. This period is generally called "base building". Stage 2 is an advancing stage characterized by the stock rising above the 200 and 50 day moving averages. The stock may drop below the 50 day average and still be considered in Stage 2. Fundamentally, Stage 2 is triggered by a perception of improved conditions with the company. Stage 3 is a "peaking out" of the stock price action. Typically the price will begin to cross the 200 day moving average, and the average may begin to round over on the chart. This is the time to take profits. Finally, the Stage 4 decline begins. The stock price drops below the 50 and 200 day moving averages, and continues down until a new Stage 1 begins. Take the pledge right now: hold up your right hand and say "I will never purchase a stock in Stage 4". One could have avoided the late 92-93 debacle in IBM by standing aside as it worked its way through a Stage 4 decline.

6. What is a whipsaw?
   This is where you purchase based on a moving average crossing (or some other signal) and then the price moves in the other direction giving a sell signal shortly thereafter, frequently with a loss. Whipsaws can substantially increase your commissions for stocks and excessive mutual fund switching may be prohibited by the fund manager.

7. Why a 200 day moving average as opposed to 190 or 210?
   Moving averages are chosen as a compromise between being too late to catch much move after a change in trend, and getting whipsawed. The shorter the moving average, the more fluctuations it has. There are

considerations regarding cyclic stock patterns and which of those are filtered out by the moving average filter. A discussion of filters is far beyond the scope of this FAQ. See Hurst's book on stock transactions for some discussion.

8. Explain support and resistance levels, and how to use them.
   Suppose a stock drops to a price, say 35, and rebounds. And that this happens a few more times. Then 35 is considered a "support" level. The concept is that there are buyers waiting to buy at that price. Imagine someone who had planned to purchase and his broker talked him out of it. After seeing the price rise, he swears he's not going to let the stock get away from him again. Similarly, an advance to a price, say 45, which is repeatedly followed by a pullback to lower prices because a "resistance" level. The notion is that there are buyers who purchased at 45 and have watched a deterioration into a loss position. They are now waiting to get out even. Or there are sellers who consider 45 overvalued and want to take their profits.

   One strategy is to attempt to purchase near support and take profits near resistance. Another is to wait for an "upside breakout" where the stock penetrates a previous resistance level. Purchase on anticipation of a further move up. [See references for more details.]

   The support level (and subsequent support levels after rises) can provide information for use in setting stops. See the "About Stocks" section of the FAQ for more details.

9. What would cause these levels to be penetrated?
   Abrupt changes in a company's prospects will be reacted to in the stock market almost immediately. If the news is extreme enough, the reaction will appear as a jump or gap in prices. More modest changes will result, in general, in more modest changes in price.

10. What is an "upside breakout"?
    If a stock has traded in a narrow range for some time (i.e. built a base) and then advances above the resistance level, this is said to be an "upside breakout". Breakouts are suspect if they do not occur on high volume (compared to average daily volume). Some traders use a "buy stop" which calls for purchase when a stock rises above a certain price.

11. Is there a "downside breakout"?
    Not by that name -- the opposite of upside breakout is called "penetration of support" or "breakdown". Corresponding to "buy stops," a trader can set a "sell stop" to exit a position on breakdown.

12. Explain breadth measurements and how to use them.
    A breadth measurement is something taken across a market. For example, looking at the number of advancing stocks compared to

declining stocks on the NYSE is a breadth measurement. Or looking at the number of stocks above their 200 day moving average. Or looking at the percentage of stocks in Stage 1 and 2 configurations. In general, a technically healthy market should see a lot of stocks advancing, not just the Dow 30. If the breadth measurements are poor in an advancing sense and the market has been advancing for some time, then this can indicate a market turning point (assuming that the advancing breadth is declining) and you should consider taking profits, not entering new long positions, and/or tightening stops. (See the divergence discussion.)

13. What is a divergence? What is the significance?
    In general, a divergence is said to occur when two readings are not moving generally together when they would be expected to. For example, if the DJIA moves up a lot but the S&P 500 moves very little or even declines, a divergence is created. Divergences can signify turning points in the market. At a major market low, the "blue chip" stocks tend to move up first as investors becoming willing to purchase quality. Hence the S&P 500 may be advancing while the NYSE composite is moving very little. Divergences, like everything else, are not 100 per cent reliable. But they do provide yellow or red alerts. And the bigger the divergence, the stronger the signal. Divergence and breadth are related concepts. (See the breadth discussion.)

14. How much are charting services and what ones are available?
    Commercial services aren't cheap. Daily Graphs (weekly charts with daily prices) is $465 for the NYSE edition, $432 for the AMEX/OTC edition. Somewhat cheaper for biweekly or monthly. Mansfield charts are weekly with weekly prices. Mansfield shows about 2.5 years of action, Daily Graphs shows 1 year or 6 months for the less active stocks. Of course there are many charts on the web. See the article elsewhere in the technical analysis section of this FAQ about free charts.

    S&P Trendline Chart Guide is about $145 per year. It provides over 4,000 charts. These charts show one year of weekly price/volume data and do not provide nearly the detail that Daily Graphs do. You get what you pay for. There are other charting services available. These are merely representative examples.

15. Can I get charts with a PC program?
    Yes. There are many programs available for various prices. Daily quotes run about $35 or so a month from Dial Data, for example. Or you can manually enter the data from the newspaper.

16. What would a PC program do that a charting service doesn't?
    Programs provide a wide range of technical analysis computations in addition to moving averages. RSI, MACD, Stochastics, etc., are routinely included. See Murphy's book [Ref 1] for definitions. Frequently you can change the length of the moving averages or other parameters. As

another example, AIQ StockExpert provides an "expert rating" suggesting purchase or short depending on the rating. Intermediate values of the rating are less conclusive.

17. What does a charting service do that a PC doesn't?
    Charts generally contain a fair amount of fundamental information such as sales, dividends, prior growth rates, institutional ownership.

18. Can I draw my own charts?
    Of course. For example, if you only want to follow a handful of mutual funds of stocks, charting on a weekly basis is easy enough. EMAs are also easy enough to compute, but will take a while to overcome the lack of a suitable starting value.

19. What about wedges, exhaustion gaps, breakaway gaps, coils, saucer bottoms, and all those other weird formations?
    The answer is beyond the scope of this FAQ article. Such patterns can be seen, particularly if you have a good imagination. Many believe they are not reliable. There is some discussion in Murphy [ref 1].

20. Are there any aspects of technical analysis that don't seem quite so much like hokum or tea leaf reading?
    The oscillator set known as "stochastics" (a bit of a misnomer) is based on the observation that a stock which is advancing will tend to close nearer to the high of the day than the low. The reverse is true for declining stocks. It compares today's close to the highest high and lowest low of the last five days. This indicator attempts to provide a number which will indicate where you are in the declining/advancing stage.

21. Can I develop my own technical indicators?
    Yes. The problem is validating them via some sort of backtesting procedure. This requires data and work. One suggestion is to split the data into two time periods. Develop your indicator on one half and then see if it still works on the other half. If you aren't careful, you end up "curve fitting" your system to the data.

## What is Technical Analysis?

Technical analysis is the examination of past price movements to forecast future price movements. Technical analysts are sometimes referred to as chartists because they rely almost exclusively on charts for their analysis.


Technical analysis is applicable to stocks, indices, commodities, futures or any tradable instrument where the price is influenced by the forces of supply and demand. Price refers

to any combination of the open, high, low or close for a given security over a specific timeframe. The time frame can be based on intraday (tick, 5-minute, 15-minute or hourly), daily, weekly or monthly price data and last a few hours or many years. In addition, some technical analysts include volume or open interest figures with their study of price action.

## The Basis of Technical Analysis

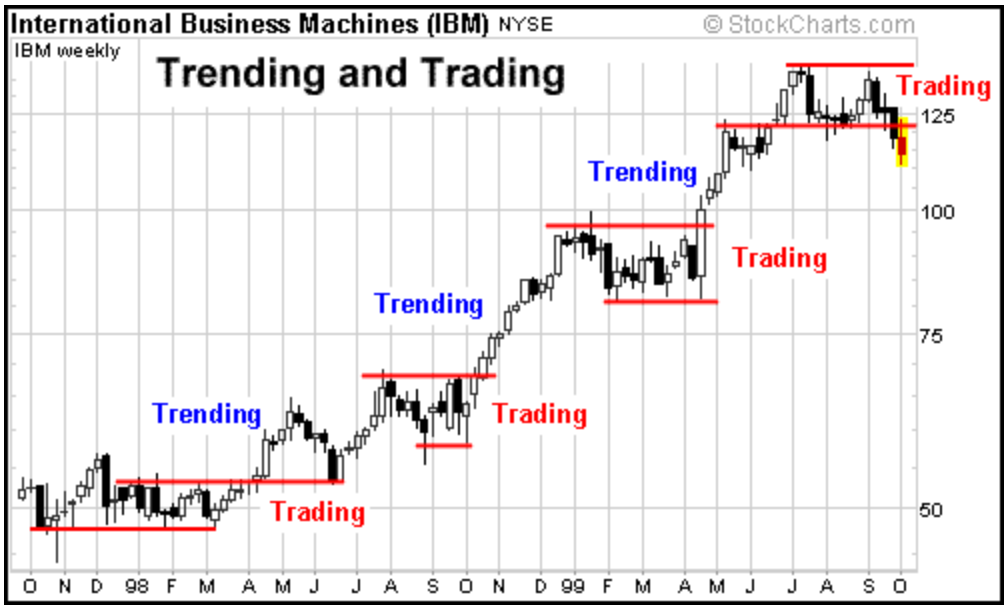
At the turn of the century, the Dow Theory laid the foundations for what was later to become modern technical analysis. Dow Theory was not presented as one complete amalgamation, but rather pieced together from the writings of Charles Dow over several years. Of the many theorems put forth by Dow, three stand out:

- Price Discounts Everything
- Price Movements are not Totally Random
- What is More Important than Why

**Price Discounts Everything:** This theorem is similar to the strong and semi-strong forms of market efficiency. Technical analysts believe that the current price fully reflects all information. Because all information is already reflected in the price, it represents the fair value and should form the basis for analysis. After all, the market price reflects the sum knowledge of all participants, including traders, investors, portfolio managers, buy-side analysts, sell-side analysts, market strategist, technical analysts, fundamental analysts and many others. It would be folly to disagree with the price set by such an impressive array of people with impeccable credentials. Technical analysis utilizes the information captured by the price to interpret what the market is saying with the purpose of forming a view on the future.

**Prices Movements are not Totally Random:** Most technicians agree that prices trend. However, most technicians also acknowledge that there are periods when prices do not trend. If prices were always random, it would be extremely difficult to make money using technical analysis. In his book, **Schwager on Futures: Technical Analysis**, Jack Schwager states:

> "One way of viewing it is that markets may witness extended periods of random fluctuation, interspersed with shorter periods of nonrandom behavior. The goal of the chartist is to identify those periods (i.e. major trends)."




A technician believes that it is possible to identify a trend, invest or trade based on the trend and make money as the trend unfolds. Because technical analysis can be applied to many different timeframes, it is possible to spot both short-term and long-term trends. The IBM chart illustrates Schwager's view on the nature of the trend. The broad trend is up, but it is also interspersed with trading ranges. In between the trading ranges are smaller uptrends within the larger uptrend. The uptrend is renewed when the stock breaks above the trading range. A downtrend begins when the stock breaks below the low of the previous trading range.

**What is more Important than Why:**In his book, **The Psychology of Technical Analysis**, Tony Plummer paraphrases Oscar Wilde by stating, "A technical analyst knows the price of everything, but the value of nothing". Technicians, as technical analysts are called, are only concerned with two things:

1. What is the current price?
2. What is the history of the price movement?

The price is the end result of the battle between the forces of supply and demand for the company's stock. The objective of analysis is to forecast the direction of the future price. By focusing on price and only price, technical analysis represents a direct approach. Fundamentalists are concerned with why the price is what it is. For technicians, the why portion of the equation is too broad and many times the fundamental reasons given are highly suspect. Technicians believe it is best to concentrate on what and never mind why. Why did the price go up? It is simple, more buyers (demand) than sellers (supply). After all, the value of any asset is only what someone is willing to pay for it. Who needs to know why?

## General Steps to Technical Evaluation

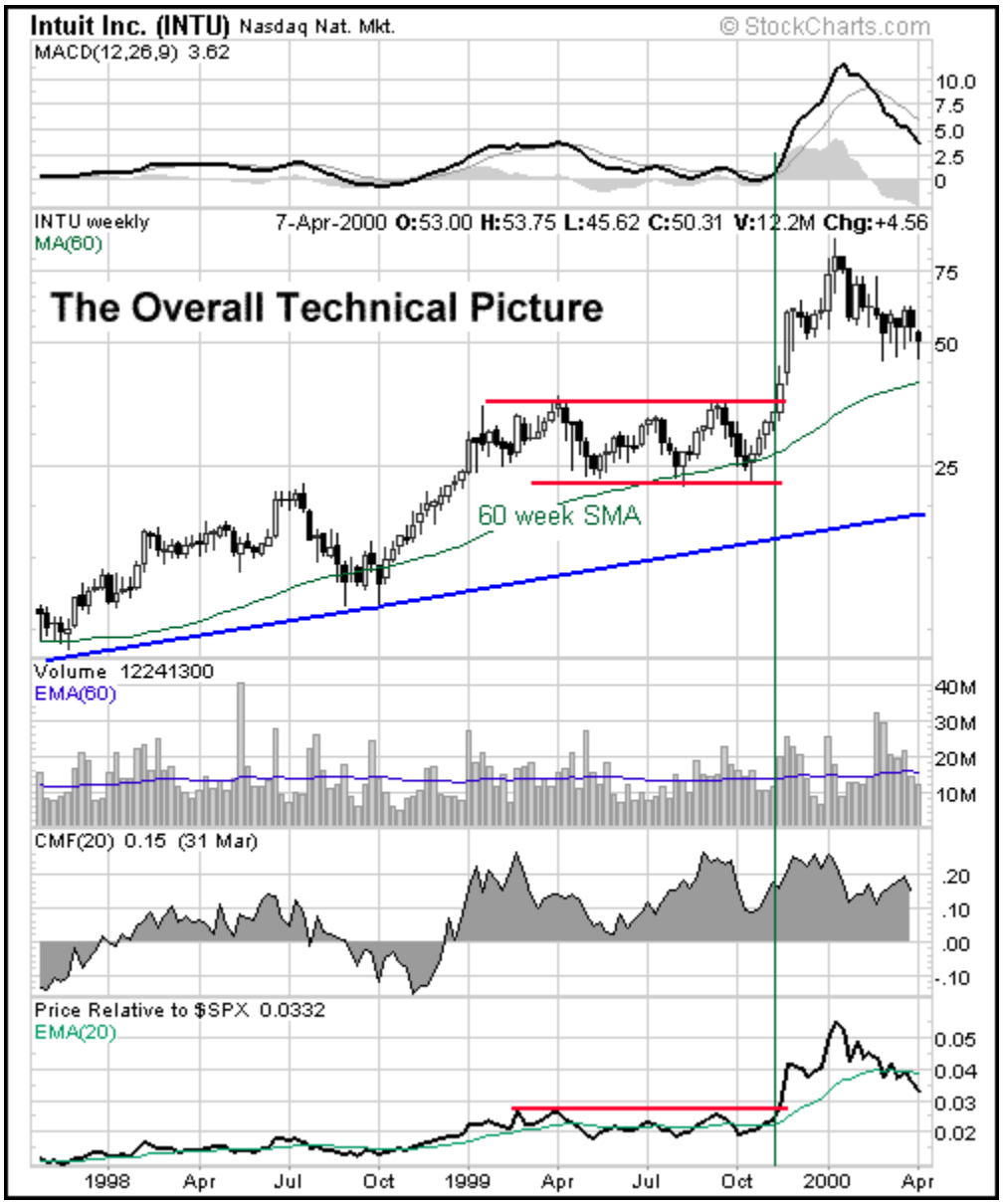
Many technicians employ a top-down approach that begins with broad-based macro analysis. The larger parts are then broken down to base the final step on a more focused/micro perspective. Such an analysis might involve three steps:

1. Broad market analysis through the major indices such as the S&P 500, Dow Industrials, Nasdaq and NYSE Composite.
2. Sector analysis to identify the strongest and weakest groups within the broader market.
3. Individual stock analysis to identify the strongest and weakest stocks within select groups.

The beauty of technical analysis lies in its versatility. Because the principles of technical analysis are universally applicable, each of the analysis steps above can be performed using the same theoretical background. You don't need an economics degree to analyze a market index chart. You don't need to be a CPA to analyze a stock chart. Charts are charts. It does not matter if the timeframe is 2 days or 2 years. It does not matter if it is a stock, market index or commodity. The technical principles of support, resistance, trend, trading range and other aspects can be applied to any chart. While this may sound easy, technical analysis is by no means easy. Success requires serious study, dedication and an open mind.

## Chart Analysis

Technical analysis can be as complex or as simple as you want it. The example below represents a simplified version. Since we are interested in buying stocks, the focus will be on spotting bullish situations.




**Overall** Trend**:** The first step is to identify the overall trend. This can be accomplished with trendlines, moving averages or peak/trough analysis. As long as the price remains above its uptrend line, selected moving averages or previous lows, the trend will be considered bullish.

Support**:** Areas of congestion or previous lows below the current price mark support levels. A break below support would be considered bearish.

Resistance**:** Areas of congestion and previous highs above the current price mark the resistance levels. A break above resistance would be considered bullish.

Momentum**:** Momentum is usually measured with an oscillator such as MACD. If MACD is above its 9-day EMA (exponential moving average) or positive, then momentum will be considered bullish, or at least improving.

**Buying/Selling Pressure:** For stocks and indices with volume figures available, an indicator that uses volume is used to measure buying or selling pressure. When Chaikin Money Flow is above zero, buying pressure is dominant. Selling pressure is dominant when it is below zero.

**Relative Strength:** The price relative is a line formed by dividing the security by a benchmark. For stocks it is usually the price of the stock divided by the S&P 500. The plot of this line over a period of time will tell us if the stock is outperforming (rising) or underperforming (falling) the major index.

The final step is to synthesize the above analysis to ascertain the following:

- Strength of the current trend.
- Maturity or stage of current trend.
- Reward to risk ratio of a new position.
- Potential entry levels for new long position.

## Top-Down Technical Analysis

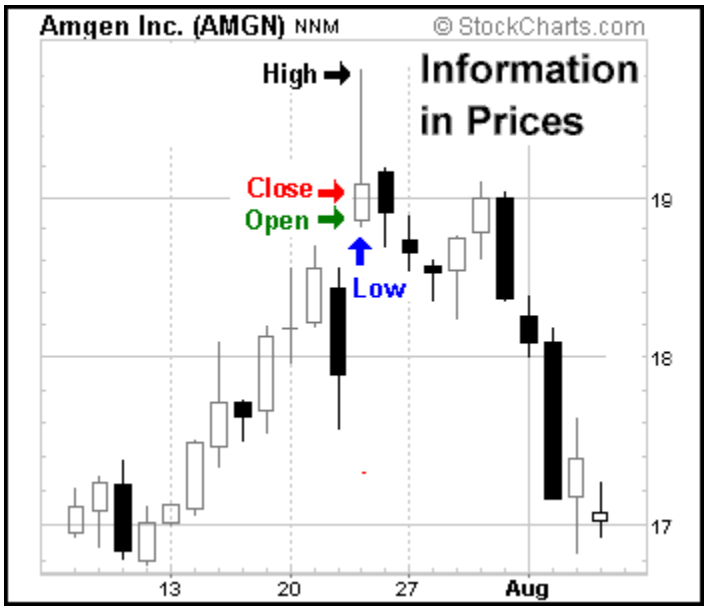
For each segment (market, sector and stock), an investor would analyze long-term and short-term charts to find those that meet specific criteria. Analysis will first consider the market in general, perhaps the S&P 500. If the broader market were considered to be in bullish mode, analysis would proceed to a selection of sector charts. Those sectors that show the most promise would be singled out for individual stock analysis. Once the sector list is narrowed to 3-4 industry groups, individual stock selection can begin. With a selection of 10-20 stock charts from each industry, a selection of 3-4 of the most promising stocks in each group can be made. How many stocks or industry groups make the final cut will depend on the strictness of the criteria set forth. Under this scenario, we would be left with 9-12 stocks from which to choose. These stocks could even be broken down further to find the 3-4 of the strongest of the strong.

## Strengths of Technical Analysis

**Focus on Price:** If the objective is to predict the future price, then it makes sense to focus on price movements. Price movements usually precede fundamental developments. By focusing on price action, technicians are automatically focusing on the future. The market is thought of as a leading indicator and generally leads the economy by 6 to 9 months. To keep pace with the market, it makes sense to look directly at the price movements. More often than not, change is a subtle beast. Even though the market is prone to sudden knee-jerk reactions, hints usually develop before significant moves. A technician will refer to

periods of accumulation as evidence of an impending advance and periods of distribution as evidence of an impending decline.

**Supply, Demand, and Price Action:** Many technicians use the open, high, low and close when analyzing the price action of a security. There is information to be gleaned from each bit of information. Separately, these will not be able to tell much. However, taken together, the open, high, low and close reflect forces of supply and demand.




The annotated example above shows a stock that opened with a gap up. Before the open, the number of buy orders exceeded the number of sell orders and the price was raised to attract more sellers. Demand was brisk from the start. The intraday high reflects the strength of demand (buyers). The intraday low reflects the availability of supply (sellers). The close represents the final price agreed upon by the buyers and the sellers. In this case, the close is well below the high and much closer to the low. This tells us that even though demand (buyers) was strong during the day, supply (sellers) ultimately prevailed and forced the price back down. Even after this selling pressure, the close remained above the open. By looking at price action over an extended period of time, we can see the battle between supply and demand unfold. In its most basic form, higher prices reflect increased demand and lower prices reflect increased supply.

**Support/Resistance:** Simple chart analysis can help identify support and resistance levels. These are usually marked by periods of congestion (trading range) where the prices move within a confined range for an extended period, telling us that the forces of supply and demand are deadlocked. When prices move out of the trading range, it signals that either supply or demand has started to get the upper hand. If prices move above the upper band of the trading range, then demand is winning. If prices move below the lower band, then supply is winning.

**Pictorial Price History:** Even if you are a tried and true fundamental analyst, a price chart can offer plenty of valuable information. The price chart is an easy to read historical account of a security's price movement over a period of time. Charts are much easier to read than a table of numbers. On most stock charts, volume bars are displayed at the bottom. With this historical picture, it is easy to identify the following:

- Reactions prior to and after important events.
- Past and present volatility.
- Historical volume or trading levels.

- Relative strength of a stock versus the overall market.

**Assist with Entry Point:** Technical analysis can help with timing a proper entry point. Some analysts use fundamental analysis to decide what to buy and technical analysis to decide when to buy. It is no secret that timing can play an important role in performance. Technical analysis can help spot demand (support) and supply (resistance) levels as well as breakouts. Simply waiting for a breakout above resistance or buying near support levels can improve returns.

It is also important to know a stock's price history. If a stock you thought was great for the last 2 years has traded flat for those two years, it would appear that Wall Street has a different opinion. If a stock has already advanced significantly, it may be prudent to wait for a pullback. Or, if the stock is trending lower, it might pay to wait for buying interest and a trend reversal.

## Weaknesses of Technical Analysis

**Analyst Bias:** Just as with fundamental analysis, technical analysis is subjective and our personal biases can be reflected in the analysis. It is important to be aware of these biases when analyzing a chart. If the analyst is a perpetual bull, then a bullish bias will overshadow the analysis. On the other hand, if the analyst is a disgruntled eternal bear, then the analysis will probably have a bearish tilt.

**Open to Interpretation:** Furthering the bias argument is the fact that technical analysis is open to interpretation. Even though there are standards, many times two technicians will look at the same chart and paint two different scenarios or see different patterns. Both will be able to come up with logical support and resistance levels as well as key breaks to justify their position. While this can be frustrating, it should be pointed out that technical analysis is more like an art than a science, somewhat like economics. Is the cup half-empty or half-full? It is in the eye of the beholder.

**Too Late:** Technical analysis has been criticized for being too late. By the time the trend is identified, a substantial portion of the move has already taken place. After such a large move, the reward to risk ratio is not great. Lateness is a particular criticism of Dow theory.

**Always Another Level:** Even after a new trend has been identified, there is always another "important" level close at hand. Technicians have been accused of sitting on the fence and never taking an unqualified stance. Even if they are bullish, there is always some indicator or some level that will qualify their opinion.

**Trader's Remorse:** Not all technical signals and patterns work. When you begin to study technical analysis, you will come across an array of patterns and indicators with rules to match. For instance: A sell signal is given when the neckline of a head and shoulders pattern is broken. Even though this is a rule, it is not steadfast and can be subject to other factors such as volume and momentum. In that same vein, what works for one particular stock may not work for another. A 50-day moving average may work great to identify support and resistance for IBM, but a 70-day moving average may work better for Yahoo.

Even though many principles of technical analysis are universal, each security will have its own idiosyncrasies.

## Conclusions

Technical analysts consider the market to be 80% psychological and 20% logical. Fundamental analysts consider the market to be 20% psychological and 80% logical. Psychological or logical may be open for debate, but there is no questioning the current price of a security. After all, it is available for all to see and nobody doubts its legitimacy. The price set by the market reflects the sum knowledge of all participants, and we are not dealing with lightweights here. These participants have considered (discounted) everything under the sun and settled on a price to buy or sell. These are the forces of supply and demand at work. By examining price action to determine which force is prevailing, technical analysis focuses directly on the bottom line: What is the price? Where has it been? Where is it going?

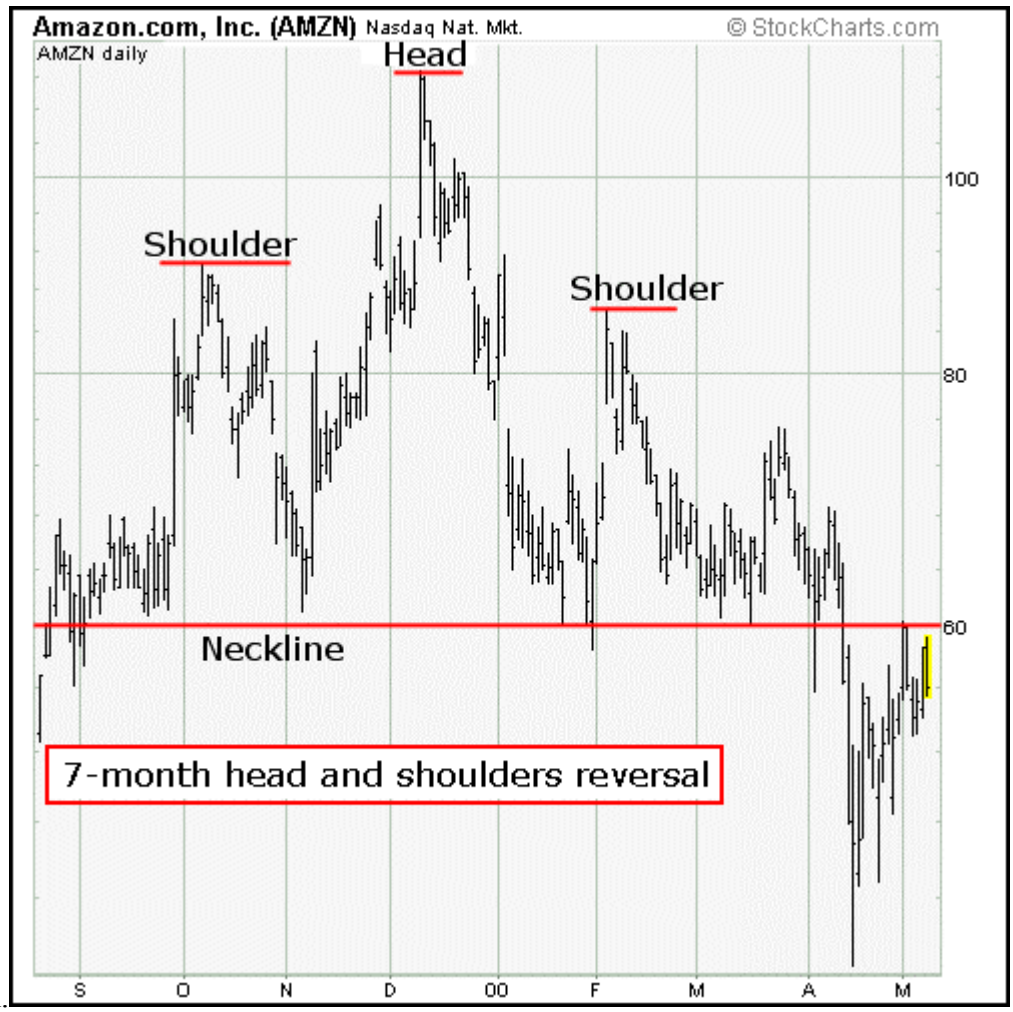
Even though there are some universal principles and rules that can be applied, it must be remembered that technical analysis is more an art form than a science. As an art form, it is subject to interpretation. However, it is also flexible in its approach and each investor should use only that which suits his or her style. Developing a style takes time, effort and dedication, but the rewards can be significant.

## Chart Pattern recognition

There are hundreds of thousands of market participants buying and selling securities for a wide variety of reasons: hope of gain, fear of loss, tax consequences, short-covering, hedging, stop-loss triggers, price target triggers, fundamental analysis, technical analysis, broker recommendations and a few dozen more. Trying to figure out why participants are buying and selling can be a daunting process. Chart patterns put all buying and selling into perspective by consolidating the forces of supply and demand into a concise picture. As a complete pictorial record of all trading, chart patterns provide a framework to analyze the battle raging between bulls and bears. More importantly, chart patterns and technical analysis can help determine who is winning the battle, allowing traders and investors to position themselves accordingly.

Chart pattern analysis can be used to make short-term or long-term forecasts. The data can be intraday, daily, weekly or monthly and the patterns can be as short as one day or as long as many years. Gaps and outside reversals may form in one trading session, while broadening tops and dormant bottoms may require many months to

form.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**An Oldie but Goodie**

Much of our understanding of chart patterns can be attributed to the work of Richard Schabacker. His 1932 classic, Technical Analysis and Stock Market Profits, laid the foundations for modern pattern analysis. In Technical Analysis of Stock Trends (1948), Edwards and Magee credit Schabacker for most of the concepts put forth in the first part of their book. We would also like to acknowledge Messrs. Schabacker, Edwards and Magee, and John Murphy as the driving forces behind these articles and our understanding of chart patterns.

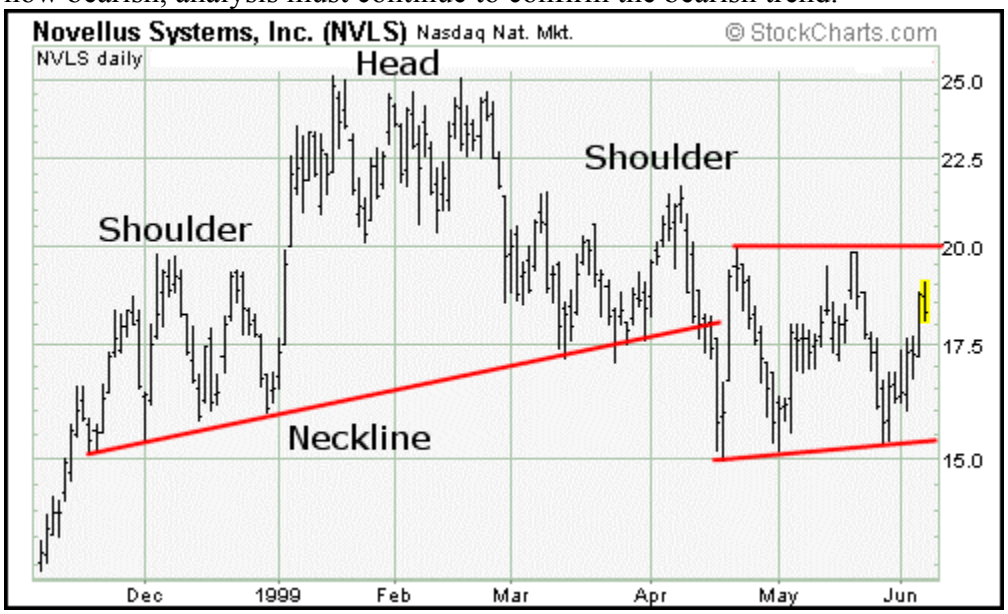
Pattern analysis may seem straightforward, but it is by no means an easy task. Schabacker states:

> The science of chart reading, however, is not as easy as the mere memorizing of certain patterns and pictures and recalling what they generally forecast. Any general stock chart is a combination of countless different patterns and its accurate analysis depends upon constant study, long experience and knowledge of all the fine points, both technical and fundamental, and, above all, the ability to weigh opposing indications against each other, to appraise the entire picture in the light of its most minute and composite details as well as in the recognition of any certain and memorized formula.

Even though Schabacker refers to "the science of chart reading", technical analysis can at times be less science and more art. In addition, pattern recognition can be open to interpretation, which can be subject to personal biases. To defend against biases and confirm pattern interpretations, other aspects of technical analysis should be employed to verify or refute the conclusions drawn. While many patterns may seem similar in nature, no two patterns are exactly alike. False breakouts, bogus reads and exceptions to the rule are all part of the ongoing education.

Careful and constant study are required for successful chart analysis. On the AMZN chart above, the stock broke resistance from a head and shoulders reversal. While the trend is

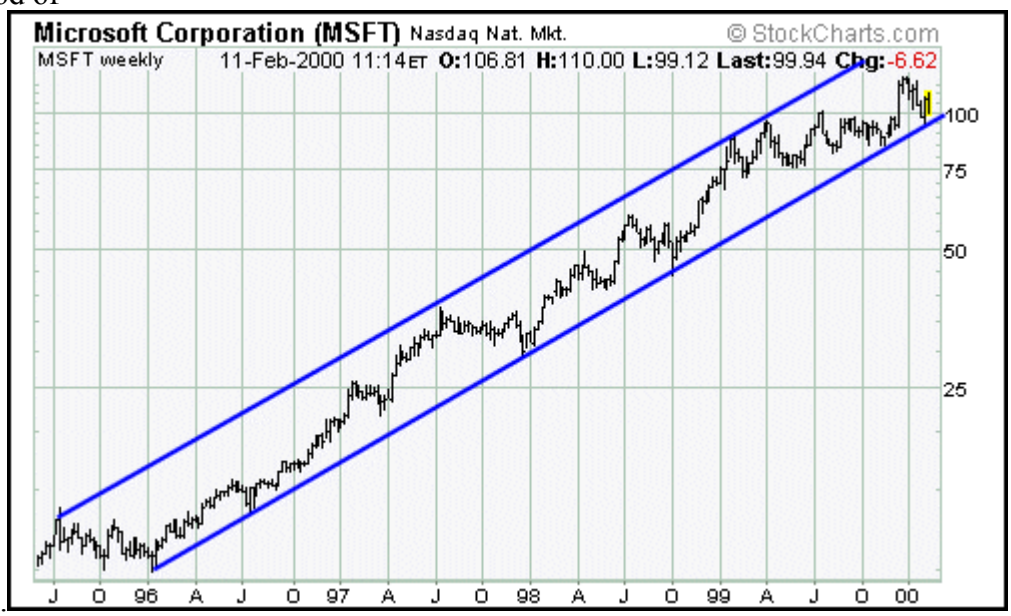
now bearish, analysis must continue to confirm the bearish trend.



Some analysts might have labeled the NVLS chart as a head and shoulders patterns with neckline support around 17.50. Whether or not this is robust remains open to debate. Even though the stock broke neckline support at 17.50, it repeatedly moved back above its support break. This refusal might have been taken as a sign of strength and justify a reassessment of the pattern.

**Two Dominant Groups**

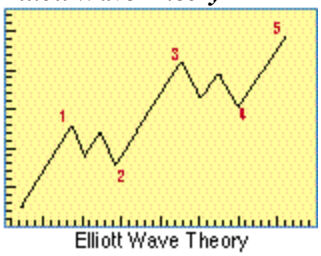
Two basic tenets of technical analysis are that prices trend and that history repeats itself. An uptrend indicates that the forces of demand (bulls) are in control and a downtrend that the forces of supply (bears) are in control. However, prices do not trend forever and as the balance of power shifts, a chart pattern begins to emerge. Certain patterns, such as a parallel channel, denote a strong trend. However, the vast majority of chart patterns fall into two main groups: reversal and continuation. Reversal patterns indicate a change of trend and can be broken down into top and bottom formations. Continuation patterns indicate a pause in trend and indicate that the previous direction will resume after a period of time.



Just because a pattern forms after a significant advance or decline does not mean it is a reversal pattern. Many patterns, such as a rectangle, can be classified as either reversal or continuation. Much depends on the previous price action, volume and other indicators as the pattern evolves. This is where the science of technical analysis becomes the art of technical analysis.

Technical Analysis Chart Patterns and Examples:

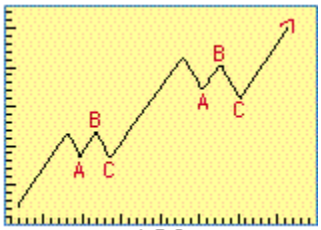
***Elliott Wave Theory***



Elliott Wave Theory

A pattern-recognition technique published by Ralph Nelson Elliott in 1939, which holds that the stock market follows a rhythm or pattern of five waves up and three waves down to form a complete cycle of eight waves. The three waves down are referred to as a "correction" of the preceding five waves up.

***ABC***



A B C

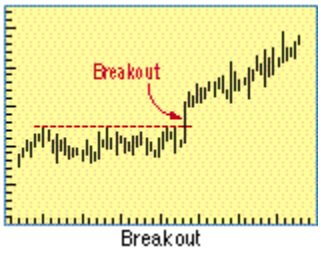
Elliott wave terminology for a three-wave countertrend price movement. Wave A is the first price wave against the trend of the market. Wave B is a corrective wave to Wave A. Wave C is the final price move to complete the countertrend price move. Elliott wave followers study A and C waves for price ratios based on numbers from the Fibonacci series.

***Breakaway Gap***

Breakaway Gap

When a tradable exits a trading range by trading at price levels that leaves a price area where no trading occurs on a bar chart. Typically, these gaps appear at the completion of important chart formations.

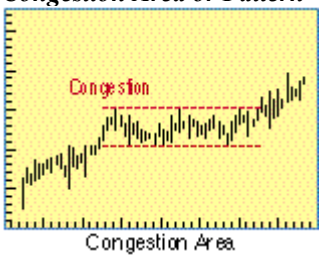
***Breakout***



Breakout

The point when the market price moves out of the trend channel.

***Congestion Area or Pattern***



Congestion Area

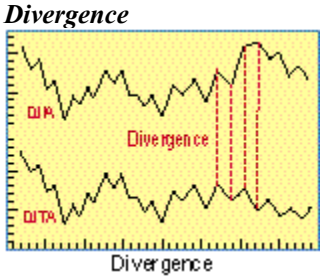
A series of trading days in which there is no visible progress in price.

***Cup and Handle***

Cup and Handle

An accumulation pattern observed on bar charts. The pattern lasts from seven to 65 weeks; the cup is in the shape of a "U" and the handle is usually more than one or two weeks in duration. The handle is a slight downward drift with low trading volume from the right-hand side of the formation.

***Divergence***



Divergence

When two or more averages or indices fail to show confirming trends.

***Failure Swings***

Failure Swings

The inability of price to reaffirm a new high in an uptrend or a new low in a downtrend.

***Failure***

Failure

In Elliott wave theory, a five-wave pattern of movement in which the fifth impulse wave fails to move above the end of the third, or in which the fifth wave does not contain the five subwaves.

***Fibonacci Ratio***

The ratio between any two successive numbers in the Fibonacci sequence, known as phi (f). The ratio of any number to the next higher number is approximately 0.618 (known as the Golden Mean or Golden Ratio), and to the lower number approximately 1.618 (the inverse of the Golden Mean), after the first four numbers of the series. The three important ratios the series provides are 0.618, 1.0 and 1.618.

***Fibonacci Sequence***

The sequence of numbers (0, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233...), discovered by the Italian mathematician Leonardo de Pisa in the 13th century and the mathematical basis of the Elliott wave theory, where the first two terms of the sequence are 0 and 1 and each successive number in the sequence is the sum of the previous two numbers. Technically, it is a sequence and not a series.

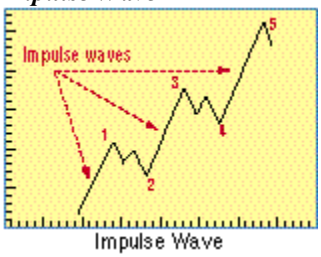
***Gann Theory***

Various analytical techniques developed by legendary trader W.D. Gann.

***Gann's Square of 9***

A trading tool that relates numbers, such as a stock price, to degrees on a circle.

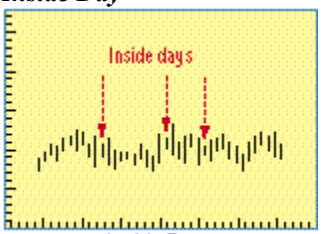
***Impulse Wave***



Impulse Wave

A wave or cycle of waves that carries the current trend further in the same direction.

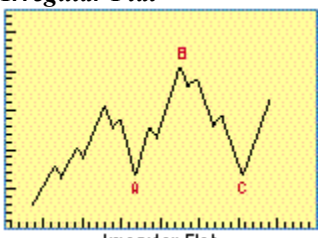
***Inside Day***



Inside Days

A day in which the daily price range is completely within the previous day's daily price range.

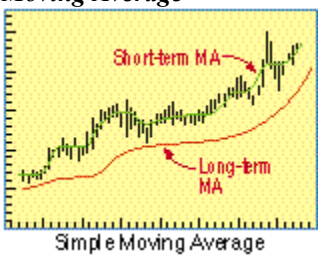
***Irregular Flat***



Irregular Flat

A type of Elliott wave correction that has a 3-3-5 wave pattern, where the B wave terminates beyond the start of wave A. A "flat" is in progress, implying that a larger pattern is developing. It will contain waves of one higher degree than the A-B-C waves just completed.

***Moving Average***



Simple Moving Average

A mathematical procedure to smooth or eliminate the fluctuations in data and to assist in determin ing when to buy and sell. Moving averages emphasize the direction of a trend, confirm trend reversals and smooth out price and volume fluctuations or "noise" that can confuse interpretation of the market; the sum of a value plus a selected number of previous values divided by the total number of values.

***Moving Average Crossovers***

Moving Average Crossover

The point where the various moving average lines intersect each other or the price line on a moving average price bar chart. Technicians use crossovers to signal price-based buy and sell opportunities.

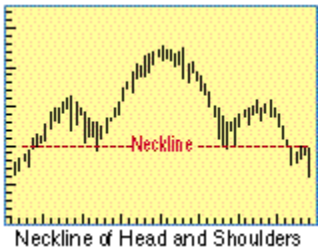
***Moving Average Model***

A time series equation representing an observed value at time t as a linear combination of present and past random shocks et (forecast errors). A moving-average process of order Q, MA(q), may be written: $P_t = e_t - b_1 e_{t-1} - b_2 e_{t-2} \ldots b_q e_{t-q}$

***Moving Average Convergence/ Divergence (MACD)***

The crossing of two exponentially smoothed moving averages that are plotted above and below a zero line. The crossover, movement through the zero line, and divergences generate buy and sell signals.

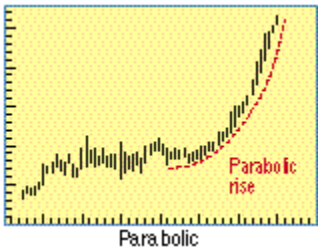
***Neckline***



Neckline of Head and Shoulders

A trendline drawn along the support or resistance points of various reversal and consolidation pattern (i.e., head and shoulder, double and triple top/bottom formations).

***Parabolic***



Parabolic

Of, having the form of or relating to a parabola.

***Support***

Support

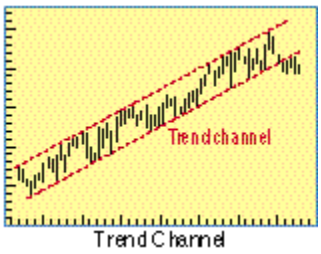
A historical price level at which falling prices have stopped falling and either moved sideways or reversed direction; usually seen as a price chart pattern.

***Trading Range***

Trading Range

The difference between the high and low prices traded during a period of time; in commodities, the high/low price limit established by the exchange for a specific commodity for any one day's trading.

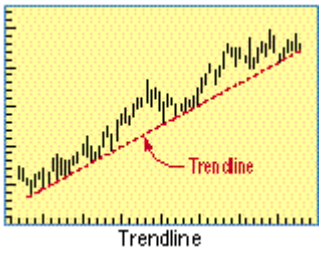
***Trend Channel***



Trend Channel

A parallel probable price range centered about the most likely price line. Historically, this term has been used to denote the area between the base trendline and the reaction trendline defined by price moves against the prevailing trend.

***Trendline***




Trendline

A line drawn that connects either a series of highs or lows in a trend. The trendline can represent either support as in an uptrend line or resistance as in a downtrend line. Consolidations are marked by horizontal trendlines.

# Dow Theory Part 1

## Introduction

The Dow theory has been around for almost 100 years, yet even in today's volatile and technology-driven markets, the basic components of Dow theory still remain valid. Developed by Charles Dow, refined by William Hamilton and articulated by Robert Rhea, the Dow theory addresses not only technical analysis and price action, but also market philosophy. Many of the ideas and comments put forth by Dow and Hamilton became axioms of Wall Street. While there are those who may think that it is different this time, a read through **The Dow Theory** will attest that the stock market behaves the same today as it did almost 100 years ago.

The Dow theory presented below has been taken from Robert Rhea's book, **The Dow Theory**. Although Dow theory is attributed to Charles Dow, it is William Hamilton's writings that serve as the corner stone for this book and the development of the theory. Also, it should be noted that most of the theory was developed with the Dow Jones Rail and Industrial averages in mind. Even though many concepts can be applied to individual stocks, please keep in mind that these are broad concepts and best applied to stocks as a group or index. When possibly, we have also attempted to link some of the realities of today's market with the Dow theory as explained by Dow, Hamilton and Rhea.

## Background

Charles Dow developed the Dow theory from his analysis of market price action in the late 19th century. Until his death in 1902, Dow was part owner as well as editor of **The Wall Street Journal**. Although he never wrote a book on the subject, he did write some editorials that reflected his views on speculation and the role of the rail and industrial averages.

Even though Charles Dow is credited with developing the Dow theory, it was S.A. Nelson and William Hamilton who later refined the theory into what it is today. Nelson wrote **The ABC of Stock Speculation** and was the first to actually use the term "Dow theory." Hamilton further refined the theory through a series of articles in **The Wall**

**Street Journal** from 1902 to 1929. Hamilton also wrote **The Stock Market Barometer** in 1922, which sought to explain the theory in detail.

In 1932, Robert Rhea further refined the analysis of Dow and Hamilton in **The Dow Theory**. Rhea read, studied and deciphered some 252 editorials through which Dow (1900-1902) and Hamilton (1902-1929) conveyed their thoughts on the market. Rhea also referred to Hamilton's **The Stock Market Barometer**. **The Dow Theory** presents the Dow theory as a set of assumptions and theorems.

## Assumptions

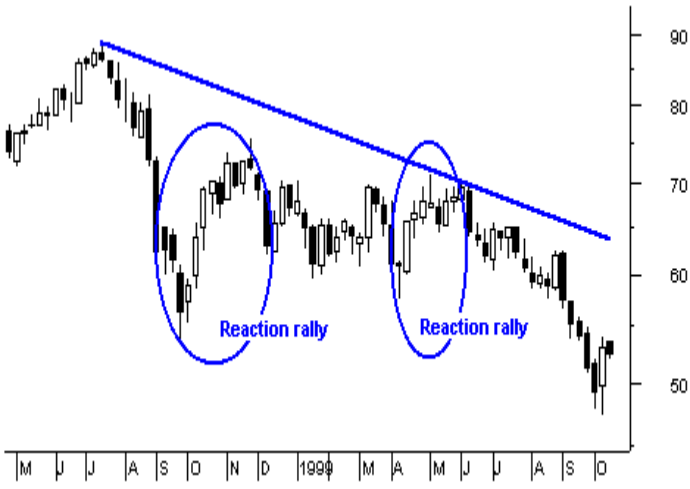
Before one can begin to accept the Dow theory, there are a number of assumptions that must be accepted. Rhea stated that for the successful application of the Dow theory, these assumptions must be accepted without reservation.

### Manipulation

The first assumption is: The manipulation of the primary trend is not possible. When large amounts of money are at stake, the temptation to manipulate is bound to be present. Hamilton did not argue against the possibility that speculators, specialists or anyone else involved in the markets could manipulate the prices. He qualified his assumption by asserting that it was not possible to manipulate the primary trend. Intraday, day-to-day and possibly even secondary movements could be prone to manipulation. These short movements, from a few hours to a few weeks, could be subject to manipulation by large institutions, speculators, breaking news or rumors. Today, Hamilton would likely add message boards and day-traders to this list.

Hamilton went on to say that individual shares could be manipulated. Examples of manipulation usually end the same way: the security runs up and then falls back and continues the primary trend. Examples include:

- PairGain Technology rose sharply due to a hoax posted on a fake Bloomberg site. However, once the hoax was revealed, the stock immediately fell back and returned to its primary trend.
- Books-A-Million rose from 3 to 47 after announcing an improved web site. Three weeks later, the stock settled around 10 and drifted lower from there.
- In 1979/80, there was an attempt to manipulate the price of silver by the Hunt brothers. Silver skyrocketed to over 50$ per ounce, only to come back down to earth and resume its long bear market after the plot to corner the market was unveiled.

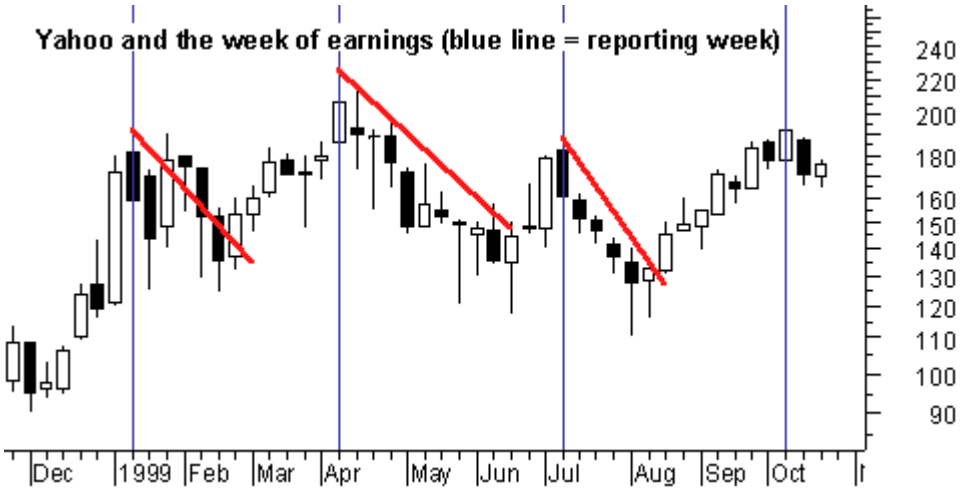



While these shares were manipulated over the short term, the long-term trends prevailed after about a month. Hamilton also pointed out that even if individual shares were being manipulated, it would be virtually impossible to manipulate the market as a whole. The market was simply too big for this to occur.

**Averages Discount Everything**
The market reflects all available information. Everything there is to know is already reflected in the markets through the price. Prices represent the sum total of all the hopes, fears and expectations of all participants. Interest rate movements, earnings expectations, revenue projections, presidential elections, product initiatives and all else are already priced into the market. The unexpected will occur, but usually this will affect the short-term trend. The primary trend will remain unaffected.

The chart below of Coca-Cola is a recent example of the primary trend remaining intact. The downtrend for Coca-Cola began with the sharp fall from above 90. The stock rallied with the market in October and November 1998, but by December started to decline again. According to Dow Theory, the October/November rally would be called a secondary move (against the primary trend). It is likely that the stock was caught up in the general market advance at the time. However, when the major indices were hitting new highs in December, Coca-Cola was starting to flounder and resume its primary trend.

Hamilton noted that sometimes the market would react negatively to good news. For Hamilton, the reasoning was simple: the market looks ahead. By the time the news hits the street, it is already reflected in the price. This explains the old Wall Street axiom, "buy the rumor, sell the news". As the rumor begins to filter down, buyers step in and bid the price up. By the time the news hits, the price has been bid up to fully reflect the news. Yahoo! and the run up to earnings is a classic example. For the past three quarters, Yahoo! has been bid up leading right up to the earnings report. Even though earnings have exceeded expectations each time, the stock has fallen by about 20%.




**Theory Not Perfect**
Hamilton and Dow readily admit that the Dow theory is not a sure-fire means of beating the market. It is looked upon as a set of guidelines and principles to assist investors and traders with their own study of the market. The Dow theory provides a mechanism for investors to use that will help remove some of the emotion. Hamilton warns that investors should not be influenced by their own wishes. When analyzing the market, make sure you

are objective and see what is there, not what you want to see. If an investor is long, he or she may want to see only the bullish signs and ignore any bearish signals. Conversely, if an investor is out of the market or short, he or she may be apt to focus on the negative aspects of the price action and ignore any bullish developments. Dow Theory provides a mechanism to help make decisions less ambiguous. The methods for identifying the primary trend are clear-cut and not open to interpretation.

Even though the theory is not meant for short-term trading, it can still add value for traders. No matter what your time frame, it always helps to be able to identify the primary trend. According to Hamilton (writing in the early part of the 20th century), those who successfully applied the Dow theory rarely traded more than four or five times a year. Remember that intraday, day-to-day and possibly even secondary movements can be prone to manipulation, but the primary trend is immune from manipulation. Hamilton and Dow sought a means to filter out the noise associated with daily fluctuations. They were not worried about a couple of points, or getting the exact top or bottom. Their main concern was catching the large moves. Both Hamilton and Dow recommended close study of the markets on a daily basis, but they also sought to minimize the effects of random movements and concentrate on the primary trend. It is easy to get caught up in the madness of the moment and forget the primary trend. After the October low, the primary trend for Coca-Cola remained bearish. Even though there were some sharp advances, the stock never forged a higher high.

End of Part 1

*In* Part 2 *we talk about the different market movements (daily fluctuations, secondary and primary) and the three phases of bull and bear markets.*

# Dow Theory Part 2

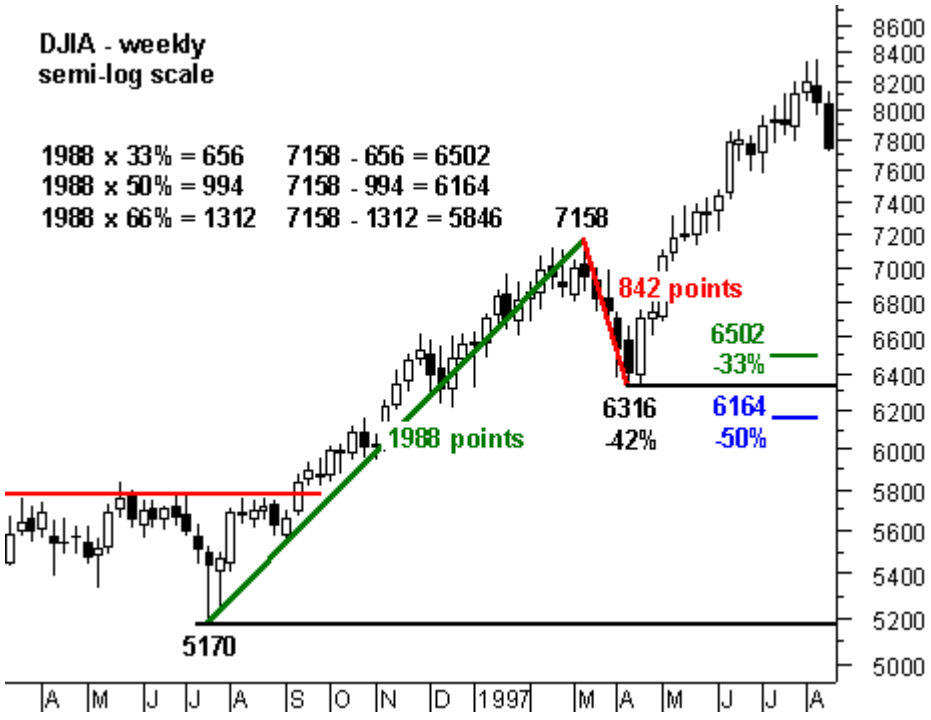
## Market Movements

Dow and Hamilton identified three types of price movements for the Dow Jones Industrial and Rail averages: primary movements, secondary movements and daily fluctuations. Primary moves last from a few months to many years and represent the broad underlying trend of the market. Secondary (or reaction) movements last from a few weeks to a few months and move counter to the primary trend. Daily fluctuations can move with or against the primary trend and last from a few hours to a few days, but usually not more than a week.

**Primary Movements**
Primary movements represent the broad underlying trend of the market and can last from a few months to many years. These movements are typically referred to as bull and bear markets. Once the primary trend has been identified, it will remain in effect until proven otherwise. (We will address the methods for identifying the primary trend in Part 3 of this Dow Theory article.) Hamilton believed that the length and the duration of the trend were largely indeterminable. Hamilton did study the averages and came up with some general guidelines for length and duration, but warned against attempting to apply these as rules for forecasting.

Many traders and investors get hung up on price and time targets. The reality of the situation is that nobody knows where and when the primary trend will end. The objective of Dow theory is to utilize what we do know, not to haphazardly guess about what we don't know. Through a set of guidelines, Dow theory enables investors to identify the primary trend and invest accordingly. Trying to predict the length and the duration of the trend is an exercise in futility. Hamilton and Dow were mainly interested in catching the big moves of the primary trend. Success, according to Hamilton and Dow, is measured by the ability to identify the primary trend and stay with it.

**Secondary Movements**
Secondary movements run counter to the primary trend and are reactionary in nature. In a bull market a secondary move is considered a correction. In a bear market, secondary moves are sometimes called reaction rallies. In part one of the Dow theory, a chart of Coca-Cola is used to illustrate reaction rallies (or secondary movements) within the confines of a primary bear trend. Below is a chart illustrating a correction within the confines of a primary bull trend.




In Sept-96, the DJIA recorded a new high, thereby establishing the primary trend as bullish. From trough to peak, the primary advance rose 1988 points. During the advance from Sept-96 to Mar-97, the DJIA never declined for more than two consecutive weeks. By the end of March, after three consecutive weeks of decline, it became apparent that this move was not in the category of daily fluctuations and could be considered a secondary move. Hamilton noted some characteristics that were common to many secondary moves in both bull and bear markets. These characteristics should not be construed as rules, but rather as loose guidelines to be used in conjunction with other analysis techniques. The first three characteristics have been applied to the example above.

1. Based on historical observation, Hamilton estimated that secondary movements retrace 1/3 to 2/3 of the primary move, with 50% being the typical amount. In actuality, the secondary move in early 1997 retraced about 42% of the primary move. (7158 - 5170 = 1988; 7158 - 6316 = 842, 842/1988 = 42.35%).

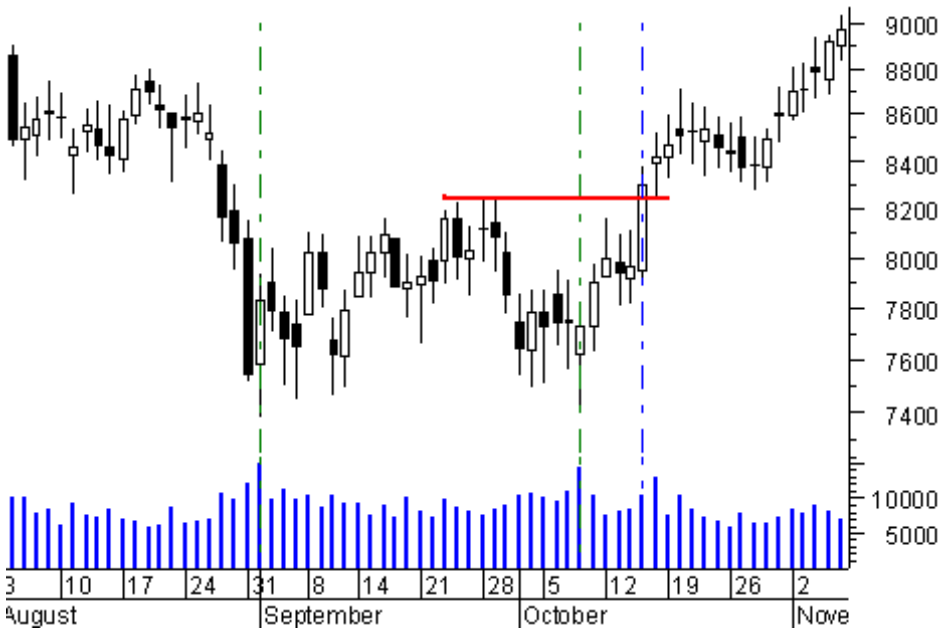
2. Hamilton also noted that secondary moves tend to be faster and sharper than the preceding primary move. Just with a visual comparison, we can see that the secondary move was sharper that the preceding primary advance. The primary move advanced 38% (1988/5178 = 38%) and lasted from Jul-96 to Mar-97, about 8 months. The secondary move witnessed a correction of 11.7% (842/7158 = 11.7%) and lasted a mere five weeks.

3. At the end of the secondary move, there is usually a dull period just before the turnaround. Little price movement, a decline in volume, or a combination of the two can mark this dullness. Below is a daily

4. chart focusing on the Apr-97 low for the secondary move outlined above.

April 7 through 10 marked the dull point (red line on volume). There was little price movement and volume was the lowest since the decline began. The DJIA then gapped down on an increase in volume. After the down gap, there was a reversal day and then the DJIA proceeded with a gap up and breakout to a reaction high on increasing volume (green line on volume). The new reaction high combined with the increase in volume indicated that the secondary move was over and the primary trend had resumed.

5. Lows are sometimes accompanied by a high-volume washout day. The September/October lows in 1998 were accompanied by record volume levels. At the time, the low on Sept-1 witnessed the highest volume ever recorded and the Oct-8 low recorded the second highest volume ever. Although these high-volume lows were not a signal in and of themselves, they helped form a pattern that preceded a historical advance. This advance took the DJIA from below 8000 to over 11000 in less than one year. Further confirmation of a change in trend came in the form of a new reaction high with high volume on Oct-15.



**Dow Theory Note:** There is still debate as to whether the crash of 1998 was a bear market or merely a secondary move within the confines of a larger bull market. In hindsight, it would appear to be a secondary move. Even though the DJIA recorded a lower low on August 4 and had lost just over 20% by September 4, the two-month time frame makes it difficult to justify as a bear market.

Hamilton characterized secondary moves as a necessary phenomenon to combat excessive speculation. Corrections and counter moves kept speculators in check and added a healthy dose of guesswork to market movements. Because of their complexity and deceptive nature, secondary movements require extra careful study and analysis. Investors often mistake a secondary move for the beginning of a new primary trend. How far does a secondary move have to go before the primary trend is affected? This issue will be addressed in Part 3 of this article, when we analyze the various signals based on Dow theory.

**Daily Fluctuations**

Daily fluctuations, while important when viewed as a group, can be dangerous and unreliable individually. Due to the randomness of the movements from day to day, the forecasting value of daily fluctuations is limited at best. At worst, too much emphasis on daily fluctuation will lead to forecasting errors and possibly losses. Getting too caught up in the movement of one or two days can lead to hasty decisions that are based on emotion. It is vitally important to keep the whole picture in mind when analyzing daily price movements. Think of the pieces of a puzzle. Individually, a few pieces are meaningless, yet at the same time they are essential to complete the picture. Daily price movements are important, but only when grouped with other days to form a pattern for analysis. Hamilton did not disregard daily fluctuations, quite to the contrary. The study of daily price action can add valuable insight, but only when taken in context of the larger picture. There is little structure in one, two or even three days' worth of price action. However, when a series of days is combined, a structure will start to emerge and analysis becomes better grounded.

## The Three Stages of Primary Bull Markets and Primary Bear Markets

Hamilton identified three stages to both primary bull markets and primary bear markets. These stages relate as much to the psychological state of the market as to the movement of prices. A primary bull market is defined as a long sustained advance marked by improving business conditions that elicit increased speculation and demand for stocks. A primary bear market is defined as a long sustained decline marked by deteriorating business conditions and subsequent decrease in demand for stocks. In both primary bull markets and primary bear markets, there will be secondary movements that run counter to the major trend.

**Primary Bull Market - Stage 1 - Accumulation**

Hamilton noted that the first stage of a bull market was largely indistinguishable from the last reaction rally of a bear market. Pessimism, which was excessive at the end of the bear

market, still reigns at the beginning of a bull market. It is a period when the public is out of stocks, the news from corporate America is bad and valuations are usually at historical lows. However, it is at this stage that the so-called "smart money" begins to accumulate stocks. This is the stage of the market when those with patience see value in owning stocks for the long haul. Stocks are cheap, but nobody seems to want them. This is the stage where Warren Buffet stated in the summer of 1974 that now was the time to buy stocks and become rich. Everyone else thought he was crazy.

In the first stage of a bull market, stocks begin to find a bottom and quietly firm up. When the market starts to rise, there is widespread disbelief that a bull market has begun. After the first leg peaks and starts to head back down, the bears come out proclaiming that the bear market is not over. It is at this stage that careful analysis is warranted to determine if the decline is a secondary movement (a correction of the first leg up). If it is a secondary move, then the low forms above the previous low, a quiet period will ensue as the market firms and then an advance will begin. When the previous peak is surpassed, the beginning of the second leg and a primary bull will be confirmed.

**Primary Bull Market - Stage 2 - Big Move**
The second stage of a primary bull market is usually the longest, and sees the largest advance in prices. It is a period marked by improving business conditions and increased valuations in stocks. Earnings begin to rise again and confidence starts to mend. This is considered the easiest stage to make money as participation is broad and the trend followers begin to participate.

**Primary Bull Market - Stage 3 - Excess** The third stage of a primary bull market is marked by excessive speculation and the appearance of inflationary pressures. (Dow formed these theorems about 100 years ago, but this scenario is certainly familiar.) During the third and final stage, the public is fully involved in the market, valuations are excessive and confidence is extraordinarily high. This is the mirror image to the first stage of the bull market. A Wall Street axiom: When the taxi cab drivers begin to offer tips, the top cannot be far off.

**Primary Bear Market - Stage 1 - Distribution**
Just as accumulation is the hallmark of the first stage of a primary bull market, distribution marks the beginning of a bear market. As the "smart money" begins to realize that business conditions are not quite as good as once thought, they start to sell stocks. The public is still involved in the market at this stage and become willing buyers. There is little in the headlines to indicate a bear market is at hand and general business conditions remain good. However, stocks begin to lose a bit of their luster and the decline begins to take hold.

While the market declines, there is little belief that a bear market has started and most forecasters remain bullish. After a moderate decline, there is a reaction rally (secondary move) that retraces a portion of the decline. Hamilton noted that reaction rallies during bear markets were quite swift and sharp. As with his analysis of secondary moves in general, Hamilton noted that a large percentage of the losses would be recouped in a matter of days or perhaps weeks. This quick and sudden movement would invigorate the bulls to proclaim the bull market alive and well. However, the reaction high of the

secondary move would form and be lower than the previous high. After making a lower high, a break below the previous low would confirm that this was the second stage of a bear market.

**Primary Bear Market - Stage 2 - Big Move**
As with the primary bull market, stage two of a primary bear market provides the largest move. This is when the trend has been identified as down and business conditions begin to deteriorate. Earnings estimates are reduced, shortfalls occur, profit margins shrink and revenues fall. As business conditions worsen, the sell-off continues.

**Primary Bear Market - Stage 3 - Despair**
At the top of a primary bull market, hope springs eternal and excess is the order of the day. By the final stage of a bear market, all hope is lost and stocks are frowned upon. Valuations are low, but the selling continues as participants seek to sell no matter what. The news from corporate America is bad, the economic outlook bleak and not a buyer is to be found. The market will continue to decline until all the bad news is fully priced into stocks. Once stocks fully reflect the worst possible outcome, the cycle begins again.

*In* part 3*, we address Dow theory signals and talk about how to identify a change in the primary trend, why the averages must confirm, and how volume comes into play. Also, we address common criticisms of Dow theory and draw a few of our own conclusions*

# Dow Theory Part 3

## Signals

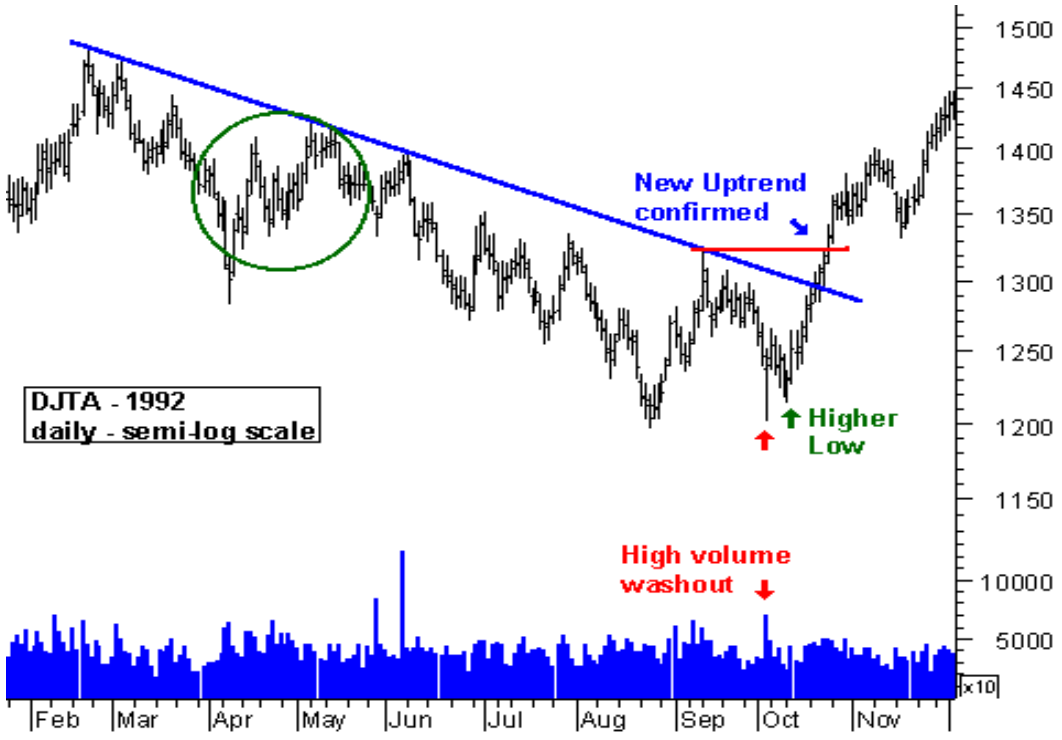
Through the writings of Dow and Hamilton, Rhea identified 4 separate theorems that addressed trend identification, buy and sell signals, volume, and trading ranges. The first two were deemed the most important and serve to identify the primary trend as bullish or bearish. The second two theorems, dealing with volume and trading ranges, were not considered instrumental in primary trend identification by Hamilton. Volume was looked upon as a confirming statistic and trading ranges were thought to identify periods of accumulation and distribution.

## Identification of the Trend

The first step in identifying the primary trend is to identify the individual trend of the Dow Jones Industrial Average (DJIA), and Dow Jones Transportation Average (DJTA), individually. Hamilton used peak and trough analysis in order to ascertain the identity of the trend. An uptrend is defined by prices that form a series of rising peaks and rising troughs (higher highs and higher lows). In contrast, a downtrend is defined by prices that form a series of declining peaks and declining troughs (lower highs and lower lows).

Once the trend has been identified, it is assumed valid until proven otherwise. A downtrend is considered valid until a higher low forms and the ensuing advance off of the higher low surpasses the previous reaction high. Below is a chart of the Dow Jones Transportation Average in 1992. Even though Hamilton and Dow did not make specific references to trendlines, a line has been drawn to emphasize the downward trajectory of the trend. Since the peak in February, a series of lower lows and lower highs formed to make a downtrend. There was a secondary rally in April and May (green circle), but the March high was not surpassed.

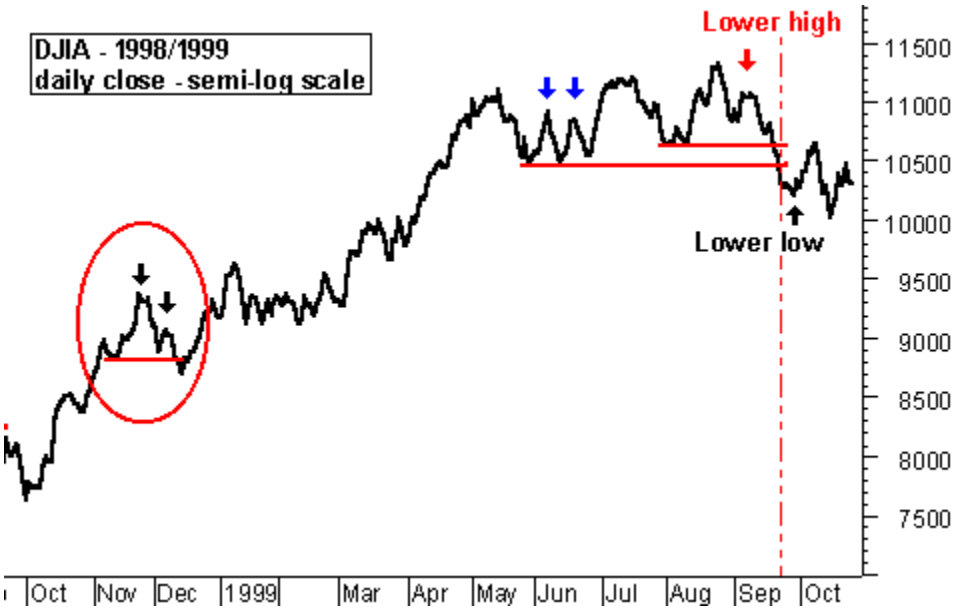
The DJTA




continued down until the high volume washout day (red arrow). As discussed in part 2 of this article, high volume days signal that a possible change is looming. Alone, a high volume washout day is not a buy signal, but rather an indication to monitor price action a little closer. After this high volume day, the DJTA dipped again and then moved above 1250, creating a higher low (green arrow). Even after the higher low is in place, it is still too early to call for a change in trend. The change of trend is not confirmed until the previous reaction high is surpassed (blue arrow).

Conversely, an uptrend is considered in place until a lower low forms and the ensuing decline exceeds the previous low. Below is a line chart of the closing prices for the DJIA. An uptrend began with the Oct-98 lows and the DJIA formed a series of higher highs and higher lows over the next 11 months. Twice, in Dec-98 (red circle) and Jun-99 (blue arrows), the validity of the uptrend came into question, but the uptrend prevailed until late September. (The Dec-98 price action is addressed below.) There were lower highs in Jun-99, but there were never any lower lows to confirm these lower highs and support held. Any bears that jumped the gun in June were made to sit through two more all-time highs in July and August. The change in trend occurred on September 23 when the June lows were violated. Some traders may have concluded that the trend changed when the late August lows were violated. This may indeed be the case, but it is worth noting that the June lows represented a more convincing support area. Keep in mind that the Dow theory is not a science and Hamilton points this out numerous times. The Dow theory is meant to offer insights and guidelines from which to begin careful study of the market movements and price action.

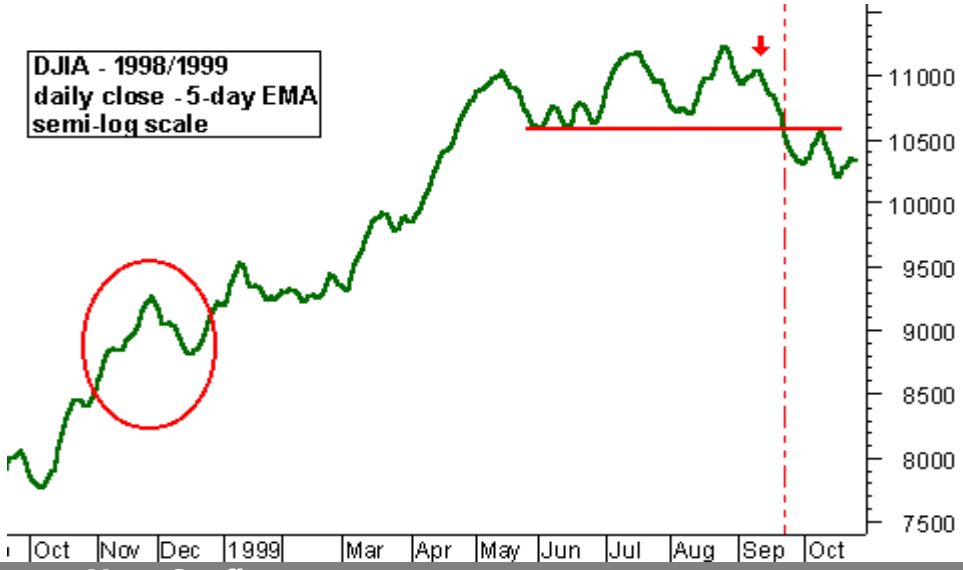
**DJIA 1998/1999**



Looking at the line chart above (DJIA 1998/1999 daily close semi-log scale), it may be difficult to distinguish between a valid change in trend and a simple correction. For instance: Was a change in trend warranted when the December low penetrated the November low? (red circle) After the November peak, a lower high formed in December and then the November reaction low was broken. In order to eliminate false signals, Hamilton suggested excluding moves of less than 3%. This was not meant to be a hard and fast rule, but the idea is worth noting. With the increased volatility of today's markets comes the need to smooth the daily fluctuations and avoid false readings.

Hamilton and Dow were interested in catching the big moves and would have been apt to use weekly charts to establish reaction highs and lows. However, in today's fast moving markets, weekly charts may not portray the detail that investors need. One possible solution is to apply a short moving average to the price plot. Although not mentioned by Hamilton and Dow, a 5-day moving average could be applied to smooth the price series and still allow for detail. The chart below (DJIA 1998/1999 daily close 5-EMA) uses a 5-day exponential moving average to smooth the price plot. Notice that the November reaction low now appears quite immaterial. Also, the September reaction high (red arrow) still shows up.

**DJIA 1998/1999**




## Averages Must Confirm

When the Dow theory was being developed at the turn of the century, the railroads were a vital link in the economy. Hamilton argued that many times activity would begin in the Rail Average before the Industrial Average. He attributed this to the fact that before economic activity began, raw materials would have to be moved from the suppliers to manufacturers. Before General Motors could increase production, more steel would need to be transported. Therefore, an increase in activity among the rail stocks would foreshadow an increase in business activity for the industrial stocks.

**Why the Rails?**

There is no doubt that today's economy is much different and the makeup of the DJTA has changed to favor the airlines. However, there is still some credibility in using the DJTA to confirm movements in the DJIA. Transport stocks are much more dependent on the economic environment than the average stock and will likely foreshadow economic growth.

- The airline business is cyclical and revenues are highly susceptible to economic changes.
- Airline companies typically carry above average levels of debt and will be more vulnerable to changes in interest rates.
- Energy and Labor costs form a large portion of expenses.

To reflect the added risks above, airline stocks have traditionally sold significantly below market multiples. If the PE for the S&P 500 is 28, the average airline might sell for only 8-10 times earnings.

Even though we are possibly entering into a "new economy," the majority of businesses will somehow be affected by changes in economic activity, interest rates, energy costs and labor costs. Airline companies, bearing the burden of all of the above, are still likely to act as a leading indicator of the general economic environment.v

However, one caveat must be added as well. Possibly the greatest fear of the airlines is that people will stop flying in airplanes. Business travel accounts for a large portion of airline revenues, especially the high margin revenues. With the development of the Internet and networking, the need for business travel could be greatly reduced in the future. Federal Express has already experienced a slowdown in the quantity of business documents being shipped. This could ultimately spill over into the business of the airlines.

**How Averages Confirm**

Hamilton and Dow stressed that for a primary trend buy or sell signal to be valid, both the Industrial Average and the Rail Average must confirm each other. If one average records a new high or new low, then the other must soon follow for a Dow theory signal to be considered valid.


Combining the guidelines set forth for trend identification with the theorem on confirmation, it is now possible to classify the primary trend of the market. The chart above shows an array of signals that occurred during a 7-month period in 1998.

1. In April, both the DJIA and DJTA recorded new all-time highs (blue line). The primary trend was already bullish, but this confirmation validated the primary trend as bullish.

2. In July, trouble began to surface when the DJTA failed to confirm the new high set by the DJIA. This served as a warning sign, but did not change the trend. Remember, the trend is assumed to be in force until proven otherwise.

3. On July 31, the DJTA recorded a new reaction low. Two days later, the DJIA recorded a new reaction low and confirmed a change in the primary trend from bullish to bearish (red line). After this signal, both averages went on to record new reaction lows.

4. In October, the DJIA formed a higher low while the DJTA recorded a new low. This was another non-confirmation and served notice to be on guard for a possible change in trend.

5. After the higher low, the DJIA followed through with a higher high later that month. This effectively changes the trend for the average from down to up.

6. It was not until early November that the DJTA went on to better its previous reaction high. However, at the same time the DJIA was also advancing higher and the primary trend had changed from bearish to bullish.

## Volume

The importance of volume was alluded to in part 2 with the chart of the Apr-97 bottom in the DJIA. Rhea notes that while Hamilton did analyze volume statistics, price action was the ultimate determinant. Volume is more important when confirming the strength of advances and can also help to identify potential reversals.

### Volume Confirmation

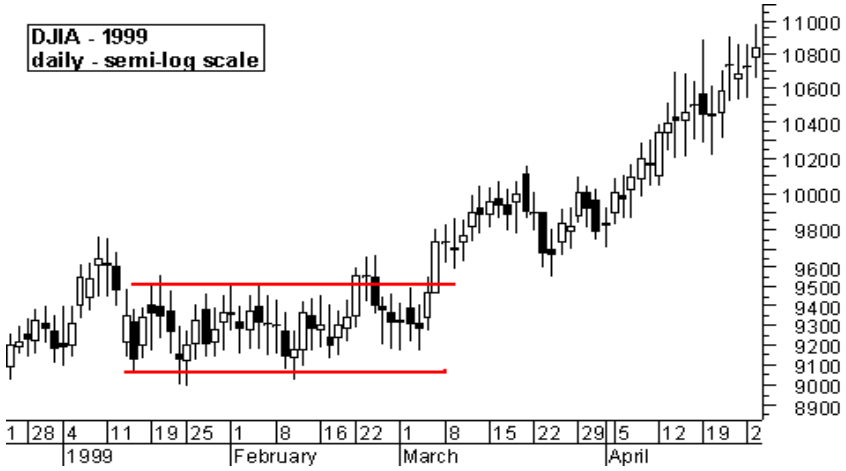
Hamilton thought that volume should increase in the direction of the primary trend. In a primary bull market, volume should be heavier on advances than during corrections. Not only should volume decline on corrections, but participation should also decrease. As Hamilton put it, the market should become "dull and narrow" on corrections, "narrow" meaning that the number of declining issues should not be expanding dramatically. The opposite is true in a primary bear market. Volume should increase on the declines and decrease during the reaction rallies. The reaction rallies should also be narrow and reflect poor participation of the broader market. By analyzing the reaction rallies and corrections, it is possible to judge the underlying strength of the primary trend.

### Volume and Reversals

Hamilton noted that high volume levels could be indicative of an impending reversal. A high volume day after a long advance may signal that the trend is about to change or that a reaction high may form soon. In his StockCharts.com commentary on 25-Jun-99, Rex Takasugi discusses the correlation between volume and peaks in the market. Even though his analysis reveals a lag time between volume peaks and market reversals, the relationship still exists. Takasugi's analysis reveals that since 1900 there have been 14 cycles and volume peaked on average 5.6 months ahead of the market. He also notes that the most recent volume peak occurred in Apr-99.

## Trading Ranges a.k.a. Lines

In his commentaries over the years, Hamilton referred many times to "lines." Lines are horizontal lines that form trading ranges. Trading ranges develop when the averages move sideways over a period of




time and make it possible to draw horizontal lines connecting the tops and bottoms. These trading ranges indicate either accumulation or distribution, but it was virtually impossible to tell which until there was a break to the upside or the downside. If there were a break to the upside, then the trading range would be considered an area of accumulation. If there were a break to the downside, then the trading range would be considered an area of distribution. Hamilton considered the trading range neutral until a breakout occurred. He also warned against attempting to anticipate the breakout.

## Performance of the Dow Theory

Mark Hulbert, writing in the **New York Times** - 6-Sept-98, notes a study that was published in the Journal of Finance by Stephen Brown of New York University and William Goetzmann and Alok Kumar of Yale. They developed a neural network that incorporated the rules for identifying the primary trend. The Dow theory system was tested against buy-and-hold for the period from 1929 to Sept-98. When the system identified the primary trend as bullish, a long position was initiated in a hypothetical index fund. When the system signaled a bearish primary trend, stocks were sold and the money was placed in fixed income instruments. By taking money out of stocks after bear signals, the risk (volatility) of the portfolio is significantly reduced. This is a very important aspect of the Dow theory system and portfolio management. In the past few years, the concept of risk in stocks has diminished, but it is still a fact that stocks carry more risk than bonds.

Over the 70-year period, the Dow theory system outperformed a buy-and-hold strategy by about 2% per year. In addition, the portfolio carried significantly less risk. If compared as risk-adjusted returns, the margin of outperformance would increase. Over the past 18 years, the Dow theory system has underperformed the market by about 2.6%

per year. However, when adjusted for risk, the Dow theory system outperformed buy-and-hold over the past 18 years. Keep in mind that 18 years is not a long time in the history of the market. The Dow theory system was found to underperform during bull markets and outperform during bear markets.

## Criticisms of Dow Theory

The first criticism of the Dow theory is that it is really not a theory. Neither Dow nor Hamilton wrote proper academic papers outlining the theory and testing the theorems. The ideas of Dow and Hamilton were put forth through their editorials in the Wall Street Journal. Robert Rhea stitched the theory together by poring over these writings.

Secondly, the Dow theory is criticized for being too late. The trend does not change from bearish to bullish until the previous reaction high has been surpassed. Many traders feel that this is simply too late and misses much of the move. Dow and Hamilton sought to catch the meat of the move and enter during the second leg. Even though this is where the bulk of the move will take place, it is also after the first leg and part way into the second leg. And, if one has to wait for confirmation from the other average, it could even be later in the move.

Thirdly, because it uses the DJIA and DJTA, the Dow theory is criticized as being outdated and no longer an accurate reflection of the economy. This may be a valid point, but as outlined earlier, the DJTA is one of the most economically sensitive indices. The stock market has always been seen as a great predictor of economic growth. To at least keep the industrials up to speed, Home Depot, Intel, Microsoft and SBC Corp have been added to the average to replace Chevron, Goodyear, Sears and Union Carbide, as of 1-Nov-99.

## Conclusions

The goal of Dow and Hamilton was to identify the primary trend and catch the big moves. They understood that the market was influenced by emotion and prone to over-reaction both up and down. With this in mind, they concentrated on identification and following: identify the trend and then follow the trend. The trend is in place until proven otherwise. That is when the trend will end, when it is proven otherwise.

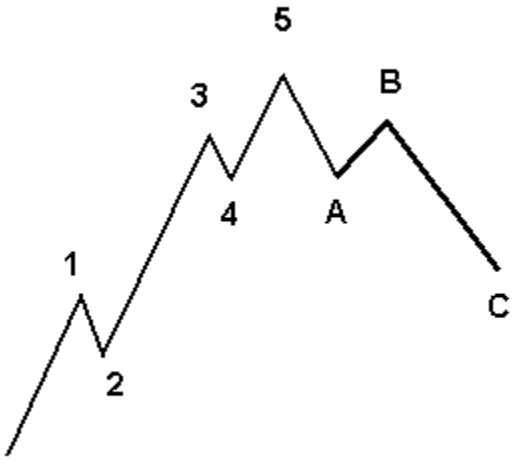
Dow theory helps investors identify facts, not make assumptions or forecast. It can be dangerous when investors and traders begin to assume. Predicting the market is a difficult, if not impossible, game. Hamilton readily admitted that the Dow theory was not infallible. While Dow theory may be able to form the foundation for analysis, it is meant as a starting point for investors and traders to develop analysis guidelines that they are comfortable with and understand.

Reading the markets is an empirical science. As such there will be exceptions to the theorems put forth by Hamilton and Dow. They believed that success in the markets required serious study and analysis that would be fraught with successes and failures. Success is a great thing, but don't get too smug about it. Failures, while painful, should be looked upon as learning experiences. Technical analysis is an art form and the eye grows keener with practice. Study both successes and failures with an eye to the future.

## Elliot Wave Theory

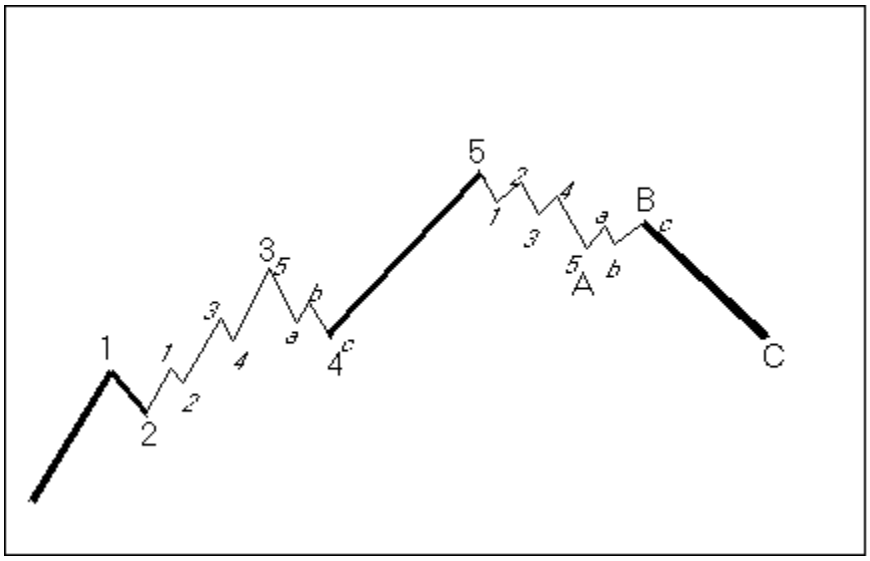
R. N. Elliott believed markets had well-defined waves that could be used to predict market direction. In 1939, Elliott detailed the Elliott Wave Theory, which states that stock prices are governed by cycles founded upon the Fibonacci series (1-2-3-5-8-13-21...).

According to the Elliott Wave Theory, stock prices tend to move in a predetermined number of waves consistent with the Fibonacci series. Specifically, Elliott believed the market moved in five distinct waves on the upside and three distinct on the downside. The basic shape of the wave is shown below.




Waves one, three and five represent the 'impulse', or minor upwaves in a major bull move. Waves two and four represent the 'corrective,' or minor downwaves in the major bull move. The waves lettered A and C represents the minor downwaves in a major bear move, while B represents the one upwave in a minor bear wave.

Elliott proposed that the waves existed at many levels, meaning there could be waves within waves. To clarify, this means that the chart above not only represents the primary wave pattern, but it could also represent what occurs just between points 2 and 4. The diagram below shows how primary waves could be broken down into smaller waves.



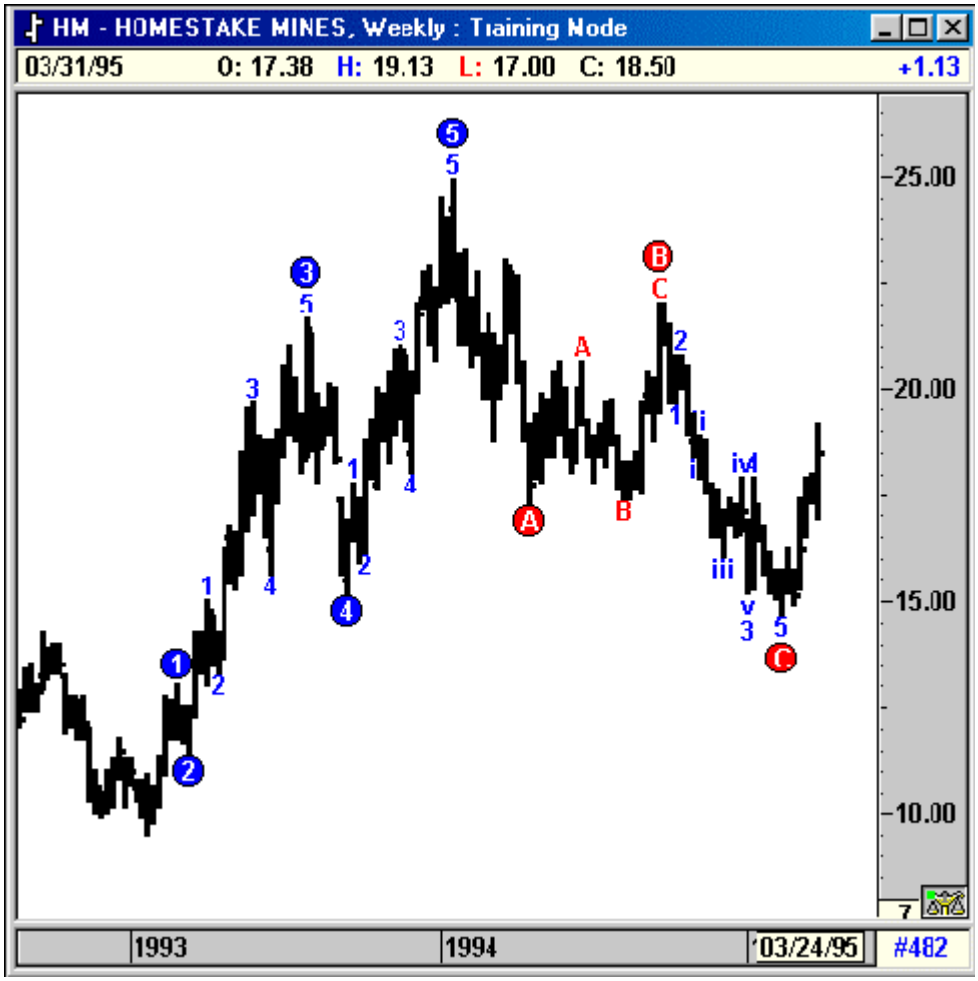

Elliott Wave theory ascribes names to the waves in order of descending size:

1. Grand Supercycle
2. Supercycle
3. Cycle
4. Primary
5. Intermediate
6. Minor
7. Minute
8. Minuette
9. Sub-Minuette

The major waves determine the major trend of the market, and minor waves determine minor trends. This is similar to the manner in which Dow Theory postulates primary and secondary trends. Elliott provided numerous variations on the main wave, and placed particular importance on the golden mean, 0.618, as a significant percentage for retracement.

Trading using Elliott Wave patterns is quite simple. The trader identifies the main wave or supercycle, enters long, and then sells or shorts, as the reversal is determined. This continues in progressively shorter cycles until the cycle completes and the main wave resurfaces. The caution to this is that much of the wave identification is taken in hindsight and disagreements arise between Elliott Wave technicians as to which cycle the market is in.

Here is an example of a classic Elliott Wave cycle that occurred in Homestake Mines (HM) over the course of 1993 and 1994.




## Why Analyze Securities?

### Security Analysis - Does it Matter?

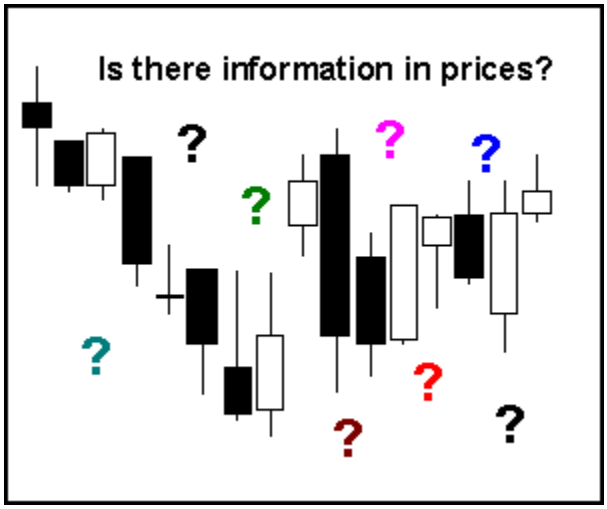
Wall Street has scores of analysts, strategists and portfolio managers hired to do one thing: beat the market. Analysts are hired to find undervalued stocks. Strategists are hired to predict the direction of the market and various sectors. Portfolio managers are hired to put it all together and outperform their benchmark, usually measured as the S&P 500. Granted, there are many studies and disputes raging on the performance of equity mutual funds, but it is safe to assume that about 75% of equity mutual funds underperform the S&P 500. With these kinds of stats, individual investors would surely be better off simply investing in an index fund rather than attempting to beat the market. But that wouldn't be any fun, would it? After all, half the fun is actually doing the analysis.

The added value of analysis is in the eye of the beholder. A fundamental analyst believes that analyzing strategy, management, product, financial stats and many other readily and not-so-readily quantifiable numbers will help choose stocks that will outperform the market. They are also likely to believe that there is little or no value in analyzing past prices and that technical analysts would be better off star gazing. Star gazing! Hmmmmph. The technical analyst believes that the chart, volume, momentum and an array of funny and not-so-funny indicators hold the keys to superior performance. In addition, the technician might add that fundamentals are hogwash pure and simple. There is good news though. The battle between fundamental analysis and technical analysis has been settled by the Random Walk theory. The Random Walkers believe that both are useless as is any attempt to try and outwit the market.

So whom do we believe? Is fundamental analysis worth the time and effort? Are technicians a bunch of quacks? Or is it all a lesson in futility? First, it will help to look at the efficient market hypothesis and see where the fundamentalists, technicians and Random Walkers stand on the question of market efficiency. After we have explored this area, we will then take a closer look at the random walk theory, fundamental analysis and technical analysis.

## Are Markets Efficient?

The question concerning the value of analysis begins with the debate on market efficiency. Just what is represented by the current price of a security? Is a security's current price an accurate reflection of its fair value? Or, do anomalies exist that allow traders and investors the opportunity to beat the market by finding undervalued or overvalued securities?




Aswath Damodaran, of the Stern Business School at NYU, defines an efficient market as one where the market price is an unbiased estimate of the true value of the investment. Fair enough, but it is not quite that simple. In an efficient market, the current price of a security fully reflects all available information and is the fair value. "All" because the price is the sum value of all views (bullish, bearish or otherwise) held by market participants. It is the fair value because the market agreed on a price to buy and sell the security. As new information becomes available, the market assimilates the information by adjusting the security's price up (buying) and down (selling). In an efficient market,

deviations above and below fair value are possible, but these deviations are considered to be random. Over the long run, the price should accurately reflect fair value.

The hypothesis further asserts that if markets are efficient, then it should be virtually impossible to outperform the market on a sustained basis. Even though deviations will occur and there will be periods when securities are over- or undervalued, these anomalies will disappear as quickly as they appeared, thus making it almost impossible to profit from them.

From experience, most of us would agree that the market is not perfectly efficient. Anomalies do exist and there are investors and traders that outperform the market. Therefore, there are varying degrees of market efficiency, which have been broken down into three levels. These three levels also happen to correspond to the beliefs of the fundamentalists, technicians and random walkers.

## Strong-form: Technicians

The strong-form of market efficiency theorizes that the current price reflects all information available. It does not matter if this information is available to the public or privy to top management; if it exists at all, then it is already reflected in the current price. Because all possible information is already reflected in the price, investors and traders will not be able to find or exploit inefficiencies based on fundamental information. Generally, pure technical analysts believe that the markets are strong-form efficient and all information is reflected in the price.

## Semi-Strong Form: Random Walkers (academics)

The semi-strong form of market efficiency theorizes that the current price reflects all readily available information. This information will likely include annual reports, SEC filings, earnings reports, announcements and other relevant information that can be readily gathered. However, there is other information not readily available to the public that is not fully reflected in the price. This could be information held by insiders, competitors, contractors, suppliers or regulators, among others. Anomalies exist when information is withheld from the public and the only way to profit is by using information not yet known to the public. This is sometimes called insider trading. Once this information becomes public knowledge, prices adjust instantaneously and it is virtually impossible to profit from such news. Academics and Random Walkers believe that the markets are semi-strong efficient. Prices reflect public information and it is virtually impossible to profit from this information.

Why do academics believe it is not possible to profit from efficient markets? There is an old joke among economists that relates to market efficiency. Two economists are walking down the street and one spots a $20 bill lying on the ground. He turns to the other economist and says, "Look, a $20 bill". The other economist looks at him in disbelief and answers, "If it were a real $20 bill, someone would have already picked it up". Academics feel that if a security is selling for 10 and one year from now it will be worth 20, what is to keep it from going to 20, or at least 18 immediately? If it were really worth 20 in one year, the price would reflect this today.

## Weak-form: Fundamentalists

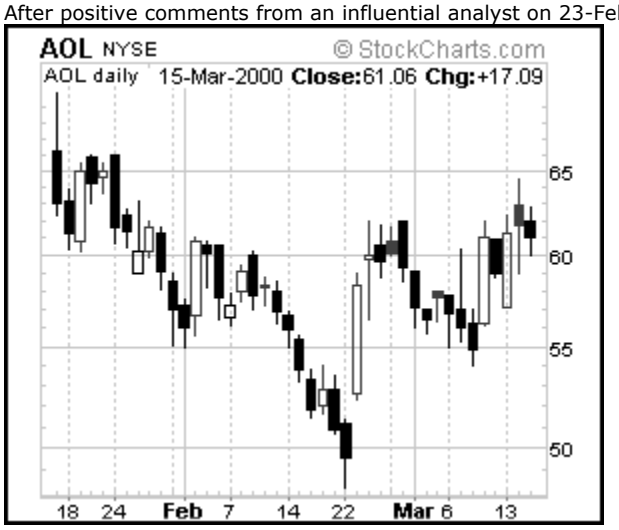
The weak-form of market efficiency theorizes that the current price does not reflect fair value and is only a reflection of past prices. Furthermore, the future price cannot be determined using past or current prices (sorry technical analysts). Fundamental analysts are champions of weak-form market efficiency and believe that the true value of a security can be ascertained through financial models using information readily available. The current price will not always reflect fair value and these models will help identify anomalies.

## Which Form Exists in the Market Today?

Many in academia, including Gordon Gemmill of London City University Business School and Aswath Damodaran of NYU, believe that security prices are semi-strong efficient. Recall that semi-strong efficient implies that all public knowledge is reflected in the price and it is virtually impossible to exploit deviations from the true value based on public information. Only new information will affect the price. Judging from the reaction of many stocks to news events, there seems to be evidence to support this case. The flow of information has become faster with the internet and surprises are factored in instantly. Few will argue that a surprise, both positive and negative, can violently move the price of a security. A few examples include:

- After pre-announcing that earnings would come in below expectations on 6-Jan-00, Lucent fell from 73 to 53 in one day.

- After positive comments from an influential analyst on 23-Feb-00, AOL shot up 49 to 59 in 2 days.




- After reporting earnings that were below expectations on 15-Feb, Abercrombie and Fitch fell from 24 to 15.


Even though these are but a few examples, it is obvious that new information can move the price of a security. Many academics also argue that price movements are largely random and only influenced by the introduction of new information. Many academics do acknowledge that some drift exists in security prices, but never a trend. Random, are prices really random?


## A Random Walk

**A Random Walk Down Wall Street**, written by Burton Malkiel in 1973, has become a classic in investment literature. Random walk theory jibes with the semi-strong efficient hypothesis in its assertion that it is impossible to outperform the market on a consistent basis. Malkiel puts both technical analysis and fundamental analysis to the test and reasons that both are largely a waste of time. In fact, he goes to great lengths to show that there is no proof to suggest that either can consistently outperform the market. Any success outperforming the market with technical analysis or fundamental analysis can be attributed to lady luck. If enough people try, some are bound to outperform the market, but most are still likely to underperform.

The basic random walk premise is that price movements are totally random. Judging from the chart, the price movements of Newmont Mining over this 5-month period would appear to be quite random. Prices have no memory, therefore past and present prices cannot be used to predict future prices (as implied in technical analysis). Prices move at random and adjust to new information as it comes available. The adjustment to this new information is so fast that it is impossible to profit from it. Furthermore, news and events are also random and trying to predict these (fundamental analysis) is also a lesson in futility.

Malkiel maintains that a buy and hold strategy is best and individuals should not attempt to time (or beat) the market. Attempts based on technical, fundamental or any other analysis are futile. Admittedly, he does have a point. Statistics have shown that the majority of equity mutual funds fail to outperform the market, as measured by the S&P 500. Investors can easily buy index-based securities with very low transactions costs.

## Should random walkers take a hike?

While there are some good points to be gleaned from the random walk theory, it appears to be a bit dated and does not accurately reflect the current investment climate.

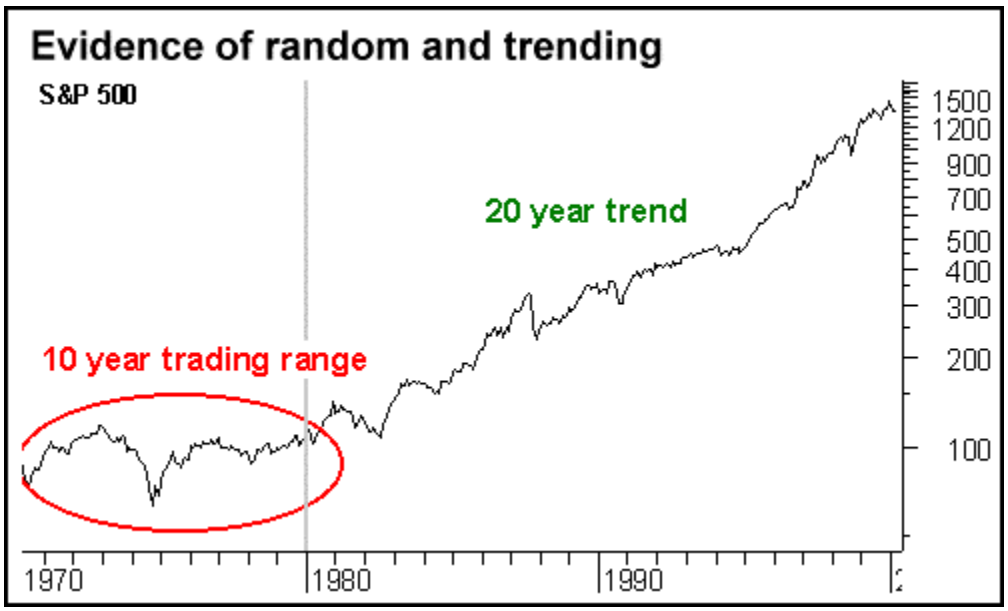
Random walk theory was introduced over 25 years ago when institutions dominated the market. These institutions had superior access to resources and the individual was at the mercy of the large brokerage houses for quality research. With the advent of online trading, power and influence are shifting from the institutions to the individual. Resources are now widely available to all at minimal cost, if not free. Not only can individuals access information, but the internet ensures that everyone will receive it almost instantaneously. They also have access to real time data and can trade like the pros. With the availability of real time data and almost instant executions, individuals can act on information like never before.

As little as 5 years ago, transactions costs were high and figured into any investment or trading strategy. Again, with the advent of online trading, transactions costs have become minimal. This has increased the amount of trading volume and probably volatility. Higher volatility increases the possibility that anomalies will develop. With better trading resources and low commissions, more traders and investors than ever are able to capitalize on potential anomalies.

For obvious reasons, the Wall Street establishment is not thrilled about Random Walk theory. After all, Wall Street is in the business of analysis, strategy and money management. However, it is a fact that about 75% of equity mutual funds underperform the S&P 500 year after year. Some of this underperformance can be blamed on transactions cost and management fees. However, with the advent of index-linked securities, the onus will be on the money managers to figure out a way to outperform the market or lose business.

In truth, 75% of equity mutual funds underperforming is not as bad as it sounds. When the Random Walk theory was introduced in 1973, or even 15 years ago, around 90% of equity mutual funds underperformed the market. Since this number seems to have risen, it would appear that either stock picking is getting better or fees are getting smaller, or both. 15 years ago, the stock market and mutual funds were much more homogeneous. Even though there were tech stocks, they did not exert nearly as much influence. With the explosion of the Nasdaq, tech stocks play a much larger role in today's market. Internet stocks, which have also come to the forefront, did not even exist 15 years ago. With an increase in specialty mutual funds catering to tech and internet, the total number of mutual funds has proliferated over the last few years. With the increase in mutual funds has also come and increase in the diversity of such funds. There are funds for almost every sector, industry or index imaginable and investors have a wide array of choices. The more homogeneous mutual funds there are, the less chance there is to outperform. However, this specialization has created a hierarchy among mutual funds and helped to increase the percentage funds that outperform the S&P 500 from 10% to 25%.

History has proven that a buy and hold strategy outperforms most attempts to time the market in absolute returns. In risk-adjusted returns, the argument looses some of its credibility. Buy and hold may take the guesswork out of beating the market, but it does little to compensate for the risk associated with a continuous investment in the market. There is a direct correlation with risk and return: the higher the expected return, the higher the associated risk. A portfolio with a timing strategy that seeks to move into risk-free treasuries when a bear market is signaled (Dow Theory for example), significantly reduces the amount of risk associated with that portfolio.




The New York Times on 6-Sept-98, notes a study that was published in the Journal of Finance by Stephen Brown of New York University and William Goetzmann and Alok Kumar of Yale. The Dow theory system was tested against buy-and-hold for the period from 1929 to Sept-98. Over the 70-year period, the Dow theory system outperformed a buy-and-hold strategy by about 2% per year. In addition, the portfolio carried significantly less risk. If compared as risk-adjusted returns, the margin of outperformance would even be greater. Over the past 18 years, the Dow theory system has underperformed the market by about 2.6% per year. However, when adjusted for risk, the Dow theory system outperformed buy-and-hold over the past 18 years. Keep in mind that 18 years is not a long time in the history of the market.

## A Non-Random Walk Down Wall Street

There is another school of thought that considers the markets efficient yet predictable. One of the leading proponents is Andrew Lo. Lo earned his Ph.D in economics at the University of Chicago and is currently a Professor of Finance at the Sloan School of Management at MIT. Lo is a bit of an odd ball among academics because of his beliefs regarding the efficient market hypothesis and his attraction to technical analysis. Lo and Mackinlay's book **A Non-Random Walk Down Wall Street** debunks many of the theories put forth in the 1973 classic with a similar name. (Remember that most academics subscribe to the random walk theory.) Lo's research concluded the following:


Financial markets are predictable to some degree, but far from being a symptom of inefficiency or irrationality, predictability is the oil that lubricates the gears of capitalism.

It is not only plausible that markets are efficient, but participants can also profit from efficient markets. However, Lo asserts that even though it is possible to outperform the markets, it requires ongoing research, continuous improvement and constant innovation. Beating the market does not come easy, nor is it something that is easy to maintain. Lo likens the pursuit of above-average returns to that of a company trying to maintain its competitive advantage. After introducing a hot new product, a company cannot just sit back and wait for the money to roll in. In order to remain above the competition, management must be flexible and look for ways to continuously improve and innovate. Otherwise the competition will overtake them. Money managers, traders and investors who find ways to outperform the market must also remain flexible and innovative. Just because a method works today, does not mean it will work tomorrow. In an interview with Technical Analysis of Stocks and Commodities, Lo sums it up by stating:

> "The more creativity you bring to the investment process, the more rewarding it will be. The only way to maintain ongoing success, however, is to constantly innovate. That's much the same in all endeavors. The only way to continue making money, to continue growing and keeping your profit margins healthy, is to constantly come up with new ideas."

## Conclusions

These rebuttals to random walk theory are not meant to suggest that the vast majority of individuals are going to suddenly start outperforming the market. Even though this may be true over the past 3 years, history suggests that it is not likely to be the case 10 years from now. In other words, history suggests that this is an anomaly and there will be a reversion to the mean. Nonetheless, the investment and trading landscape has changed drastically over the last 20 years, even over the last 5 years. Individuals have access to

more information and tools, transactions costs are negligible, trades are executed almost instantaneously, equity mutual funds have improved their performance and the buy and hold strategy does not appear to be a profit maximizing strategy. It should come as no surprise that analysis can make a difference. The only question is which type: fundamental analysis, technical analysis or both?

# 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.

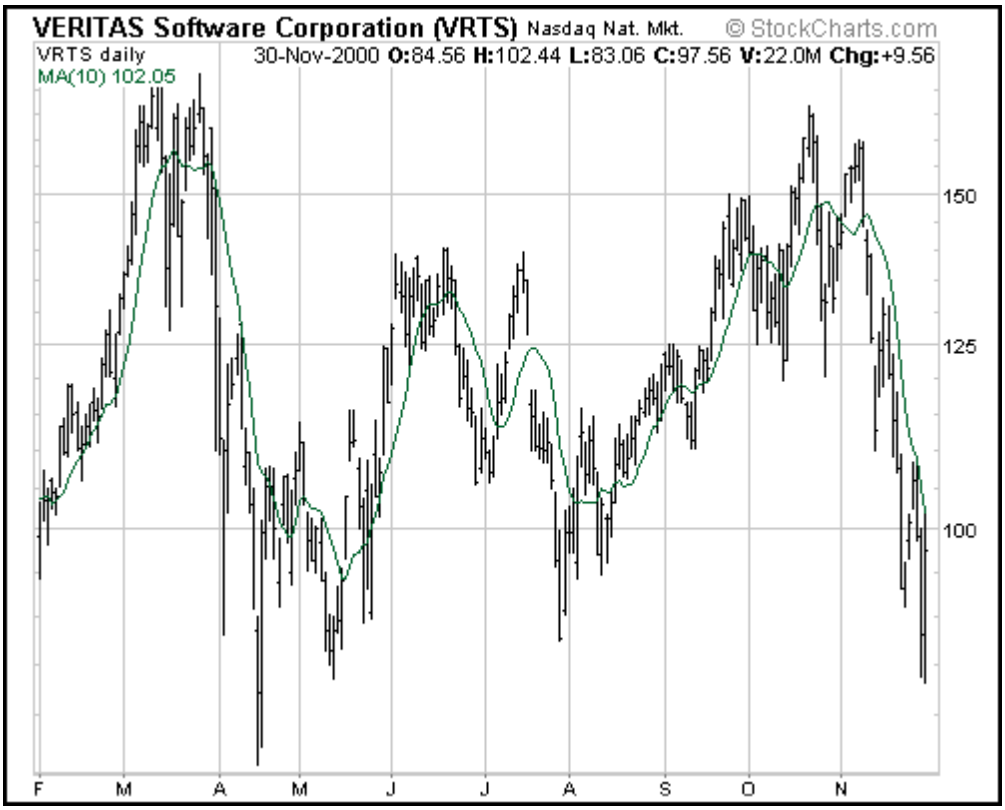
## What is an Indicator?

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?

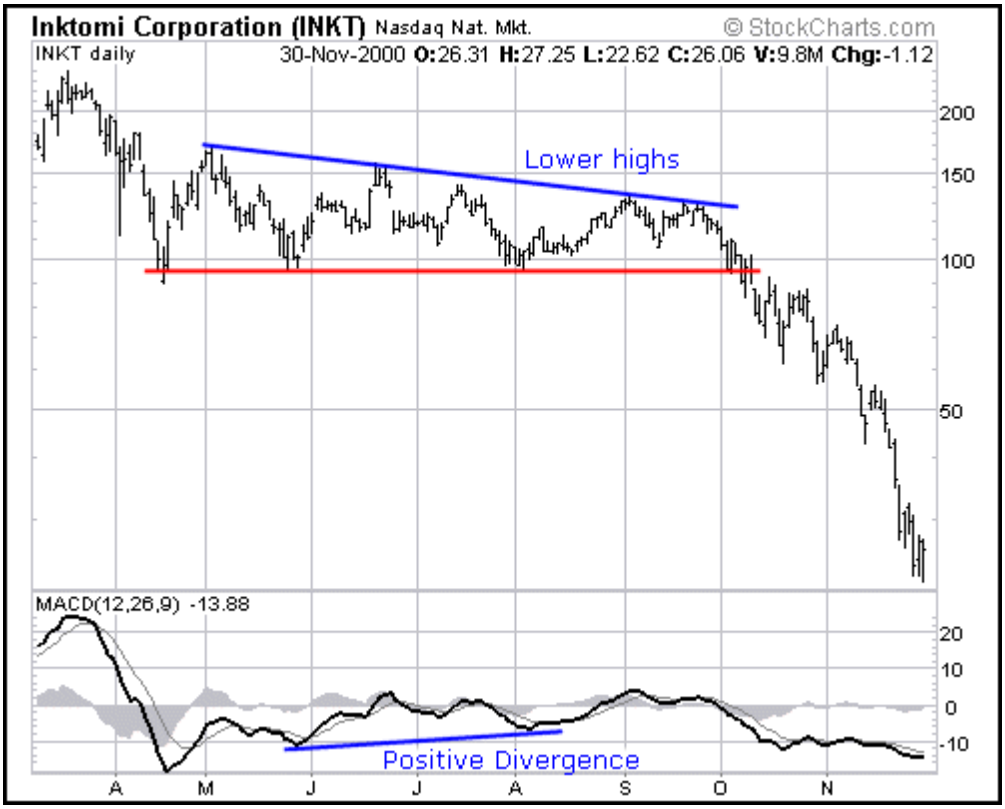
Indicators serve three broad functions: to alert, to confirm and to predict.

- 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.

## 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 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.

# Indicators Part 2

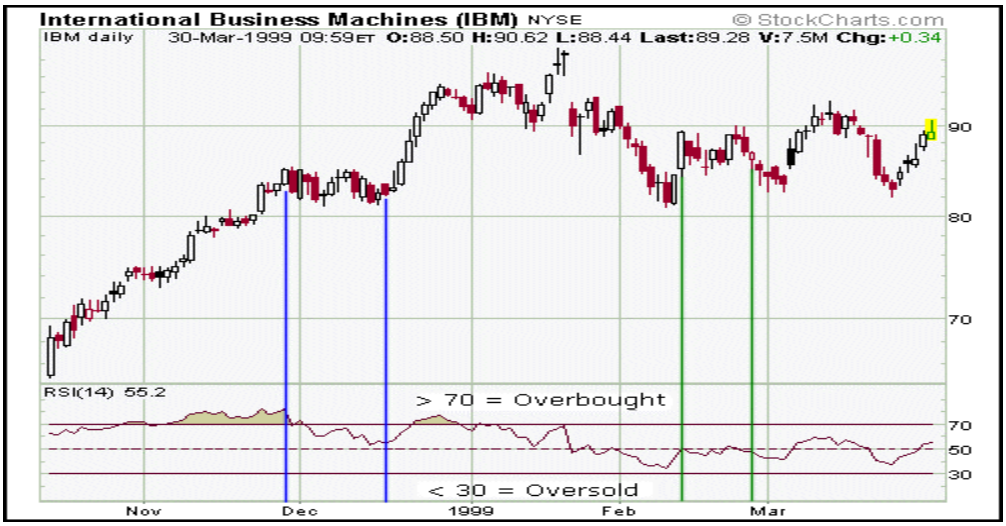
## Leading Indicators

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 (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**

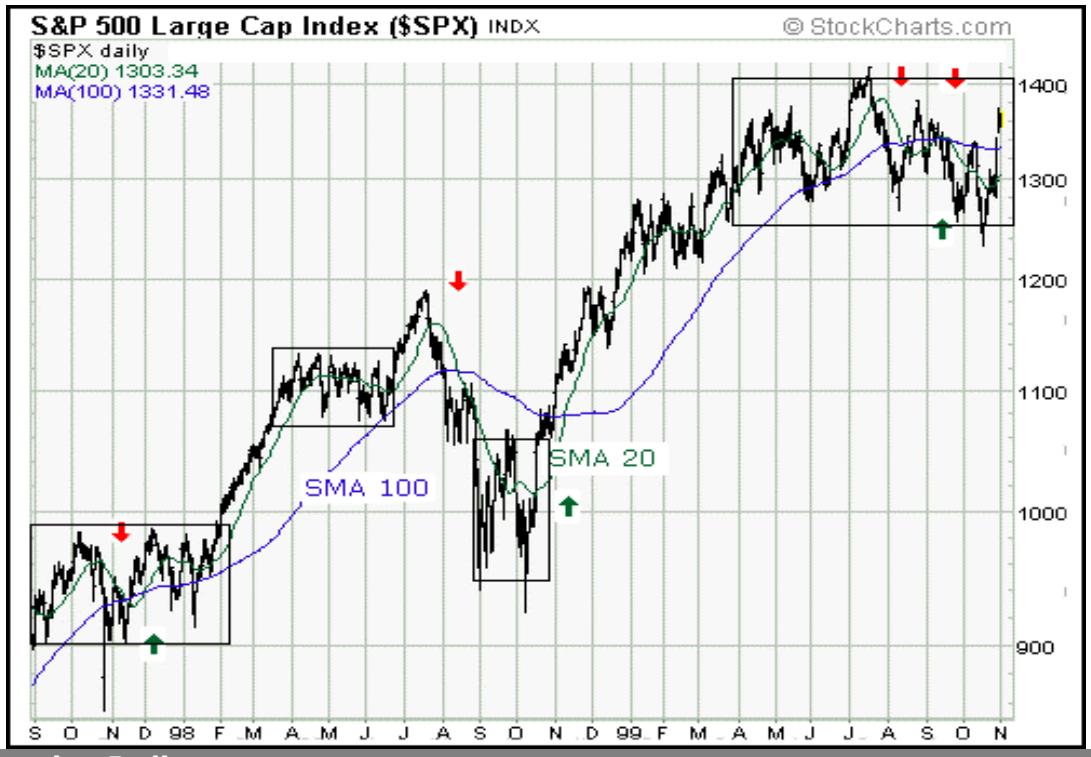



Momentum indicators employ various formulas to measure price changes. RSI (a momentum indicator) compares the average price change of the advancing periods with the average change of the declining periods. On the IBM chart, RSI advanced from October to the end of November. During this period, the stock 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 signaling 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 devlops 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.

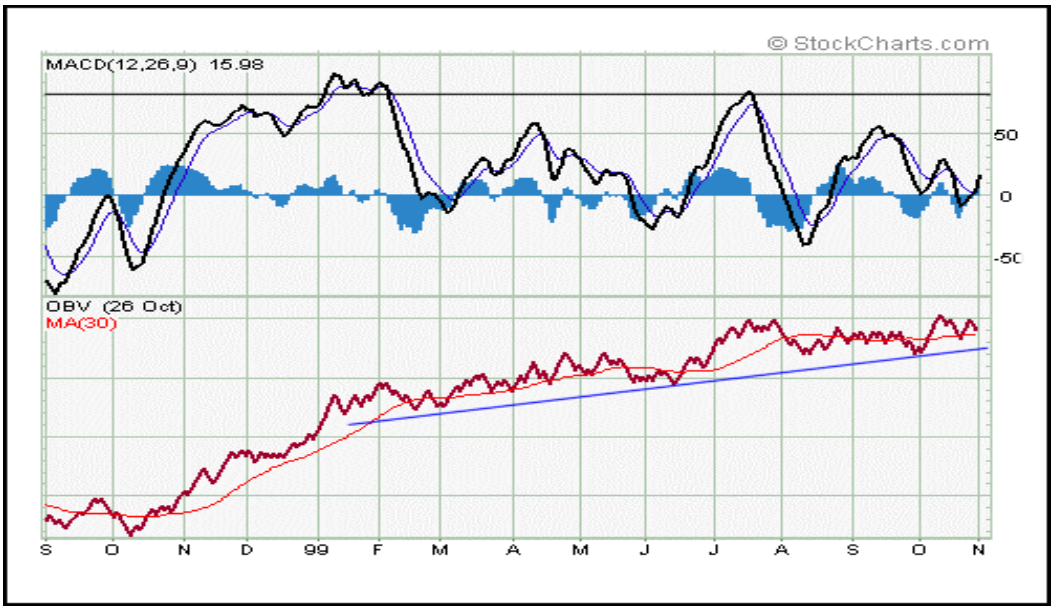
Another drawback of trend-following indicators is that signals tend to be late. By the time a moving average crossover occurs, a significant portion of the move has already occurred. The Nov-98 buy signal occurred at 1130, about 19% above the Oct-98 low of 950. Late entry and exit points can skew the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




# 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.

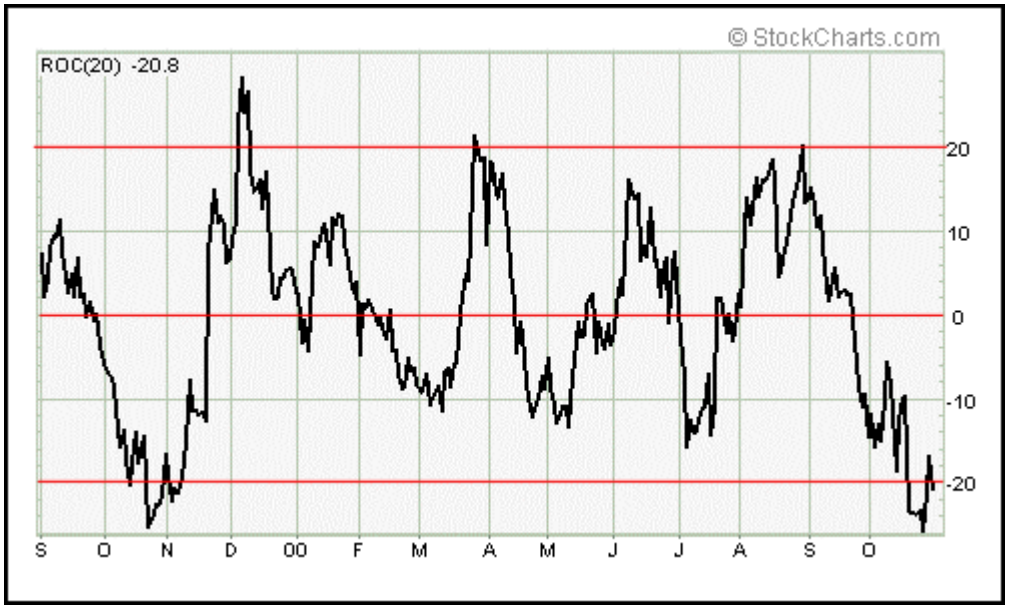
**Centered Oscillators**
Centered oscillators fluctuate above and below a central point or line. These oscillators are good for identifying the strength or weakness, or direction, of momentum behind a security's move. . In its purest form, momentum is positive (bullish) when a centered oscillator is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

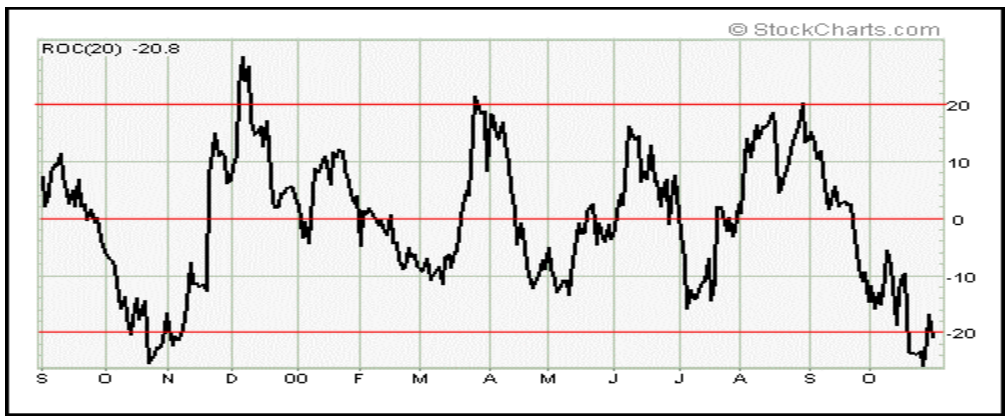
**ROC 20-period**



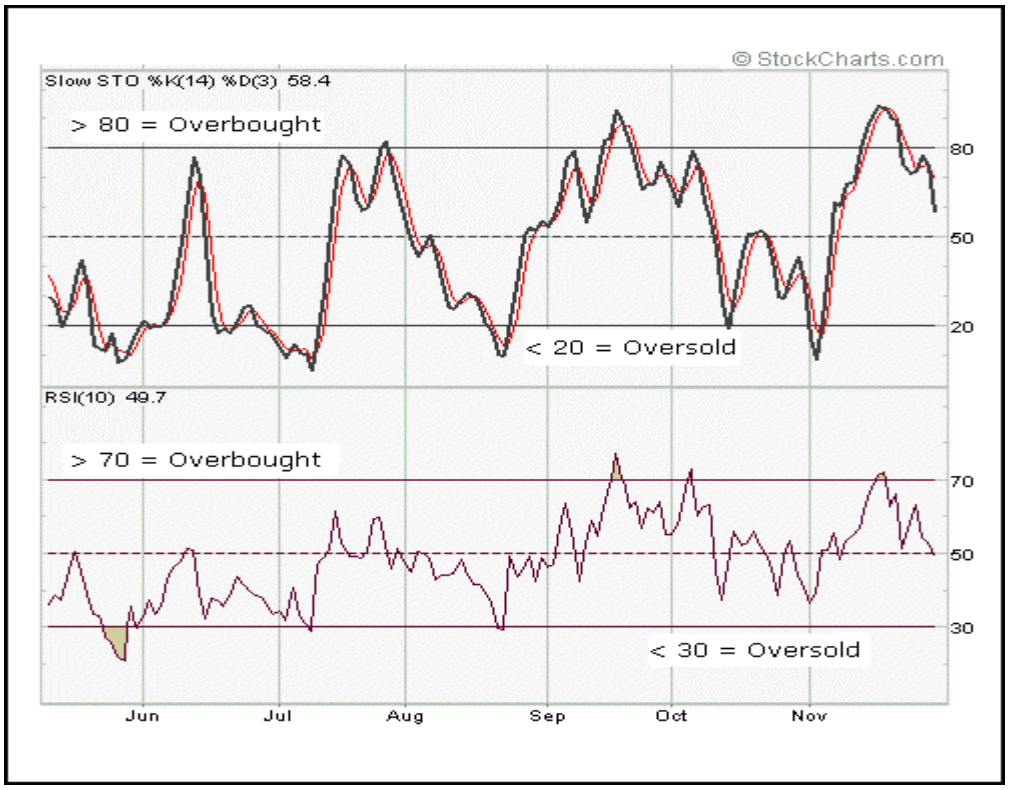

As with MACD, ROC is not bound by upper or lower limits. This is typical of most centered oscillators and can make it difficult to spot overbought and oversold conditions. The ROC chart indicates that readings above +20% and below -20% represent extremes and are unlikely to last for an extended period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



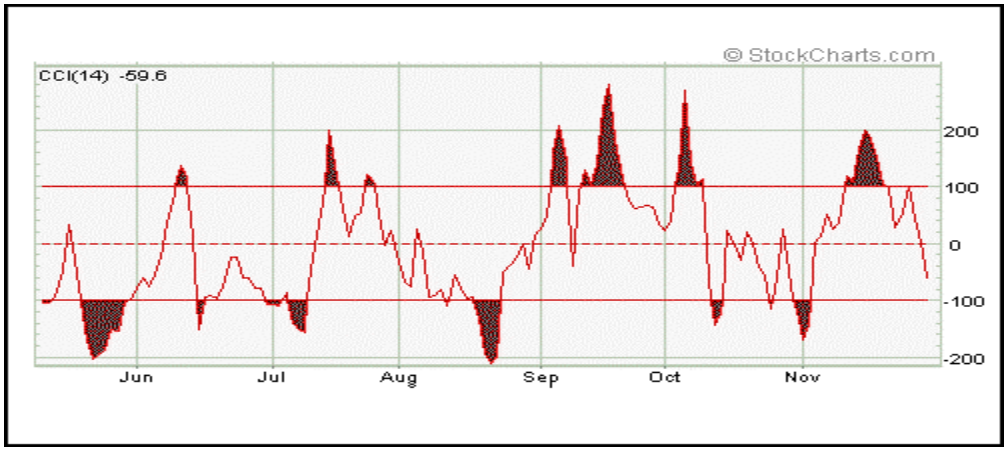
**Stochastics/RSI**




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 is the MACD and the thin line is the 9-day EMA of the 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.

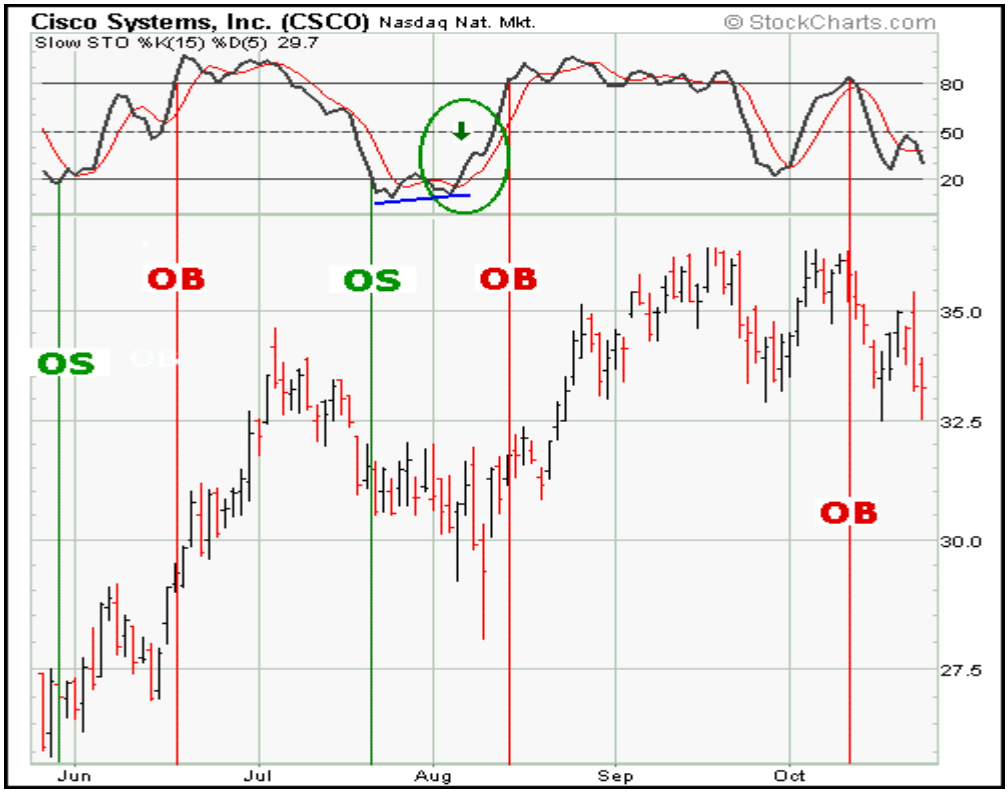
When the trend is strong, banded oscillators can remain near overbought or oversold levels for extended periods. An overbought condition does not indicate that it is time to sell, nor does an oversold condition indicate that it is time to buy. In a strong uptrend, an oscillator can reach an overbought 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, savey 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.

# Indicators Part 4

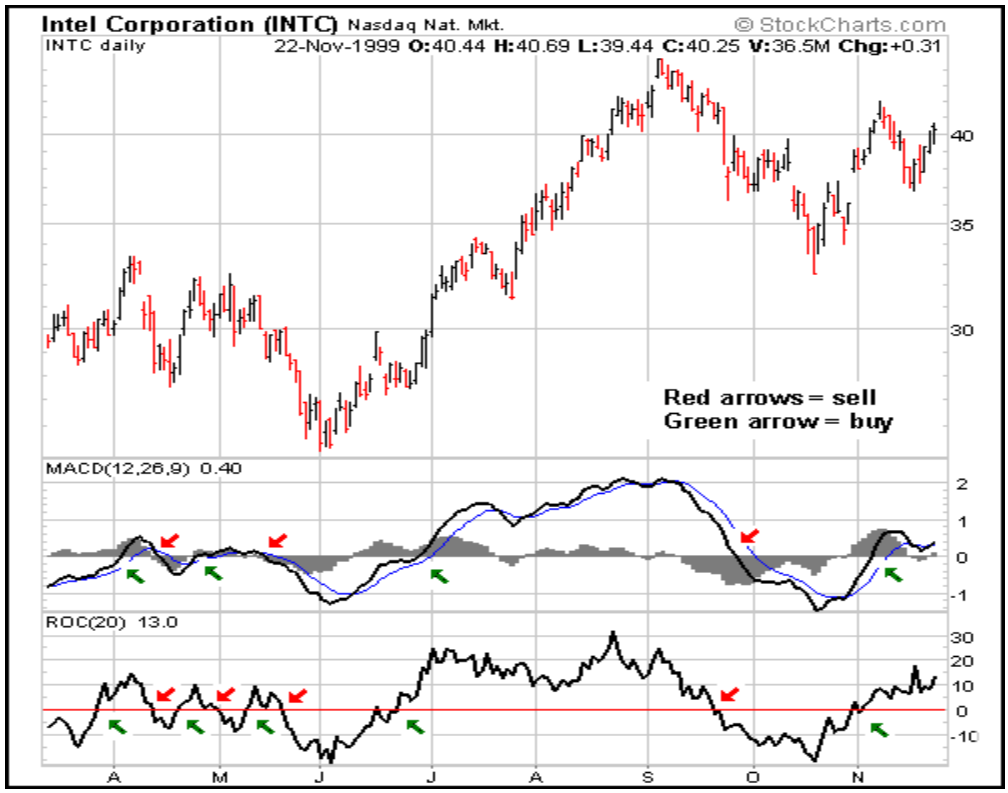
## Centerline Crossovers

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.

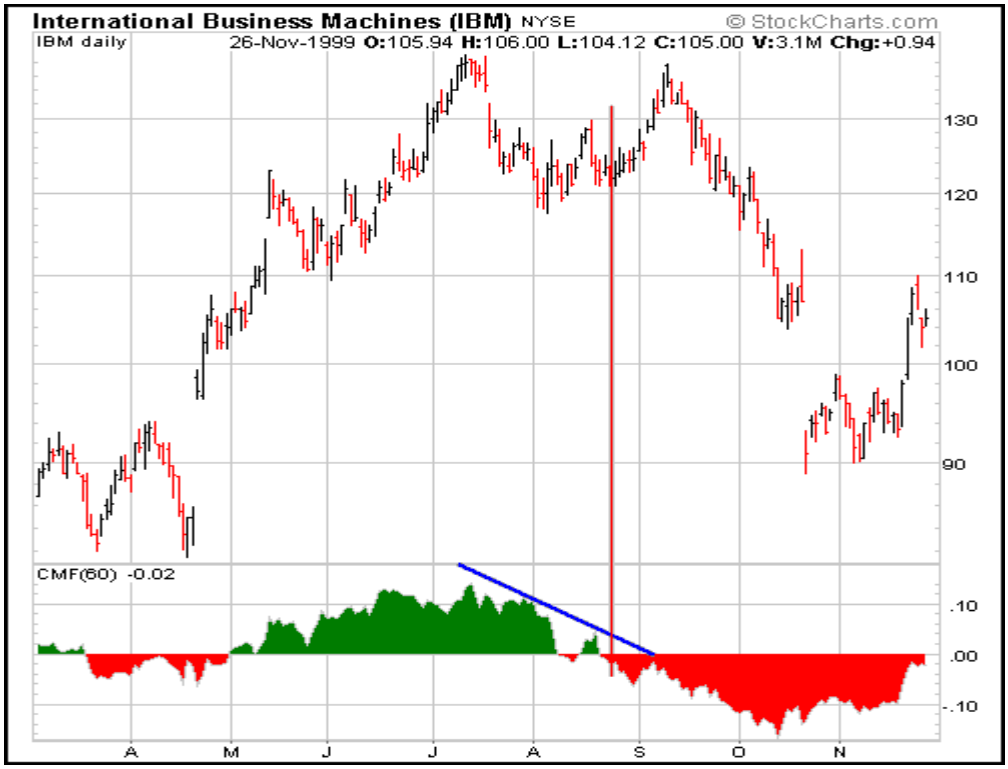
**Intel**


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.

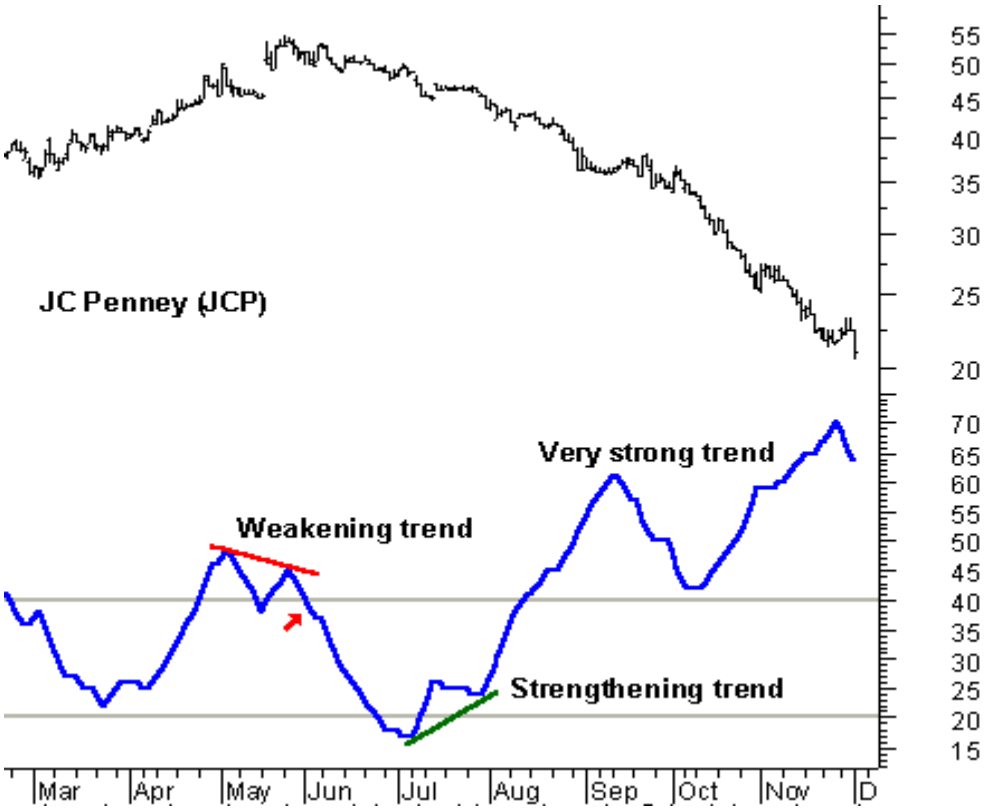
And finally, oscillators are most effective when used in conjunction with pattern analysis, support/resistance identification, trend identification and other technical analysis tools. By being aware of the broader picture, oscillator signals can be put into context. It is important to identify the current 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.

## 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.




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).

## Average True Range (ATR)

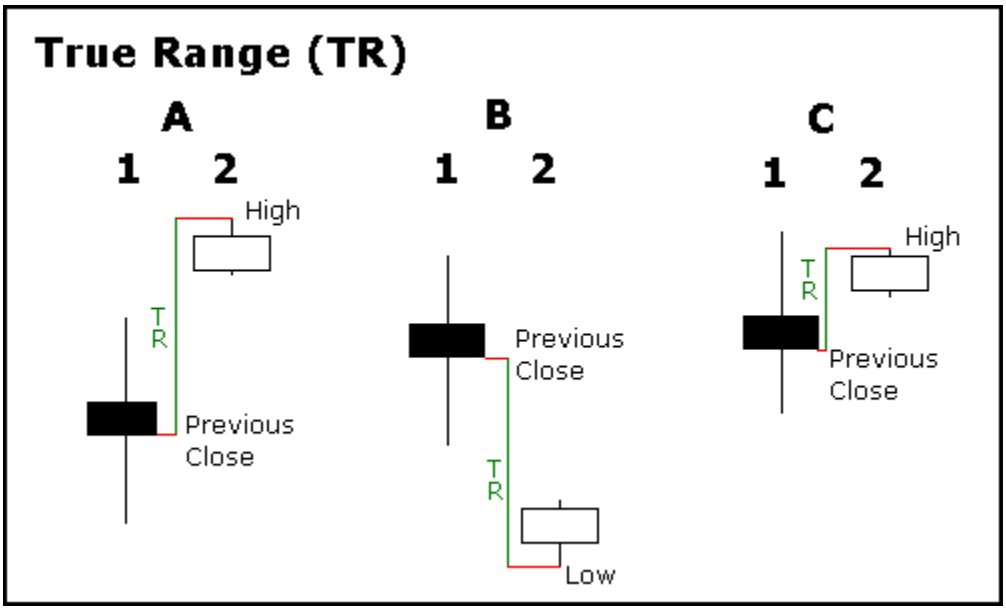
Developed by J. Welles Wilder and introduced in his book, New Concepts in Technical Trading Systems (1978), the Average True Range (ATR) indicator measures a security's volatility. As such, the indicator does not provide an indication of price direction or duration, simply the degree of price movement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

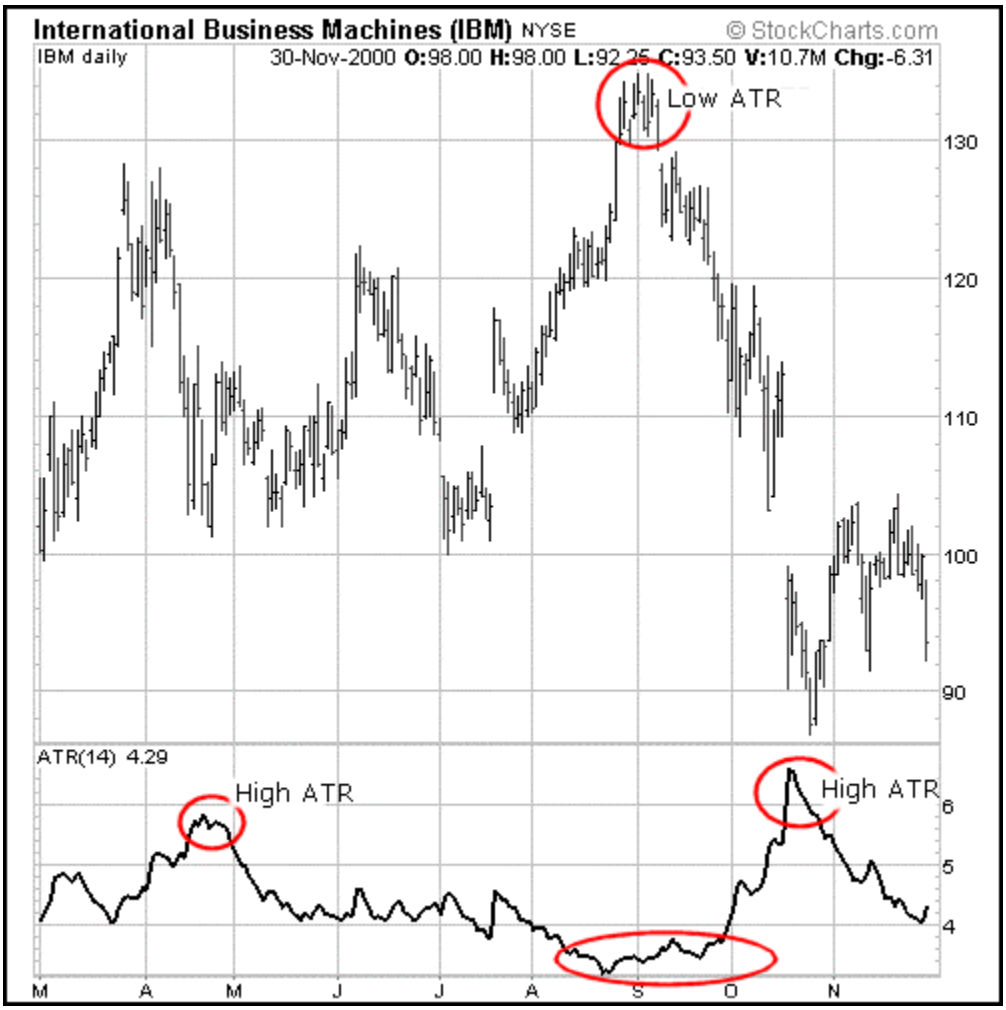

The chart above corresponds with the Excel spreadsheet calculations for Sun Microsystems from 23-Oct 2000 to 7-Dec 2000.

- 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.

**Note:** Because the ATR shows volatility as an absolute level, 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.

# 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.

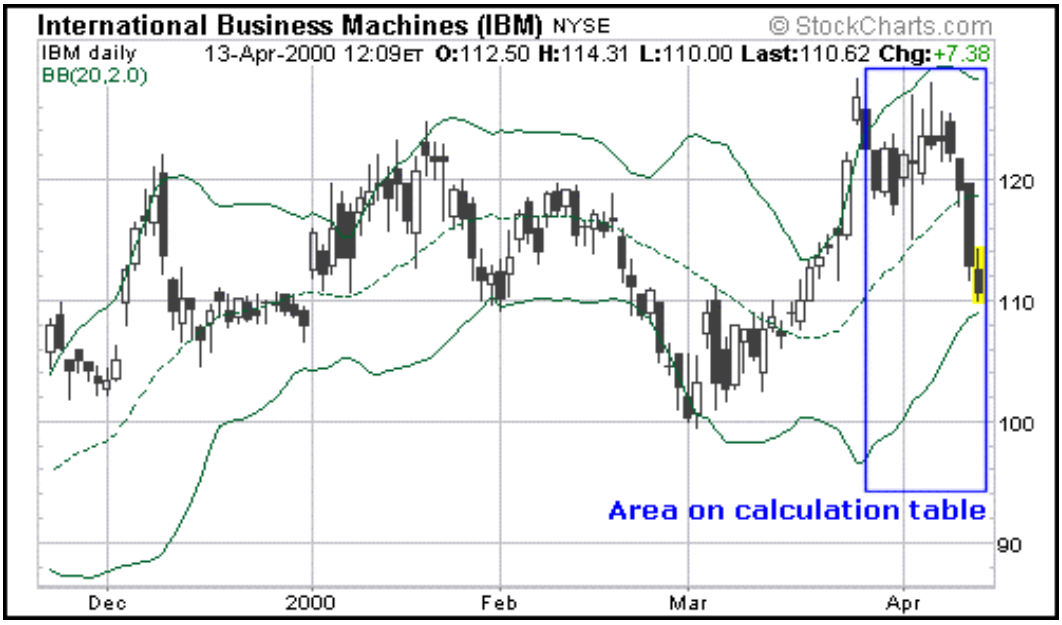
1. A simple moving average in the middle
2. An upper band (SMA plus 2 standard deviations)
3. A lower band (SMA minus 2 standard deviations)

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**




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.

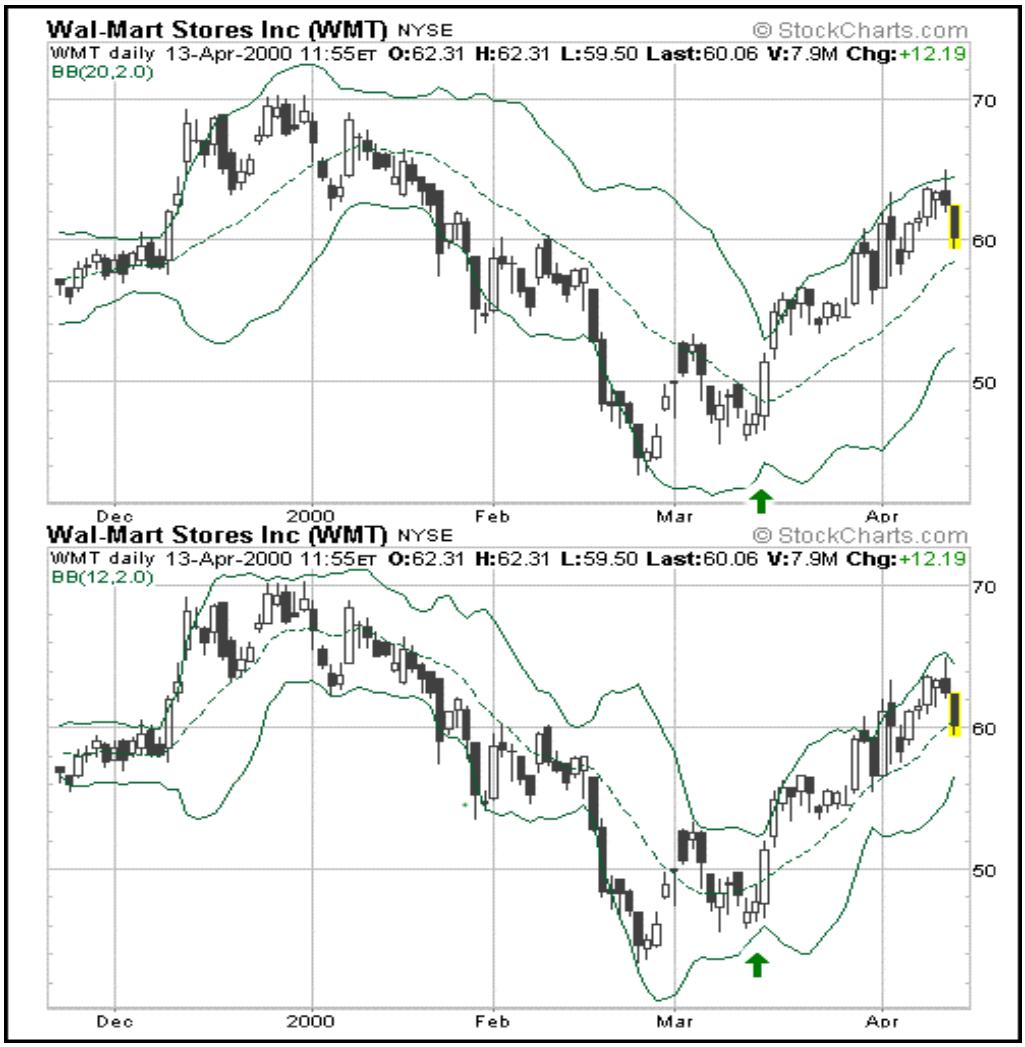
## Settings

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.

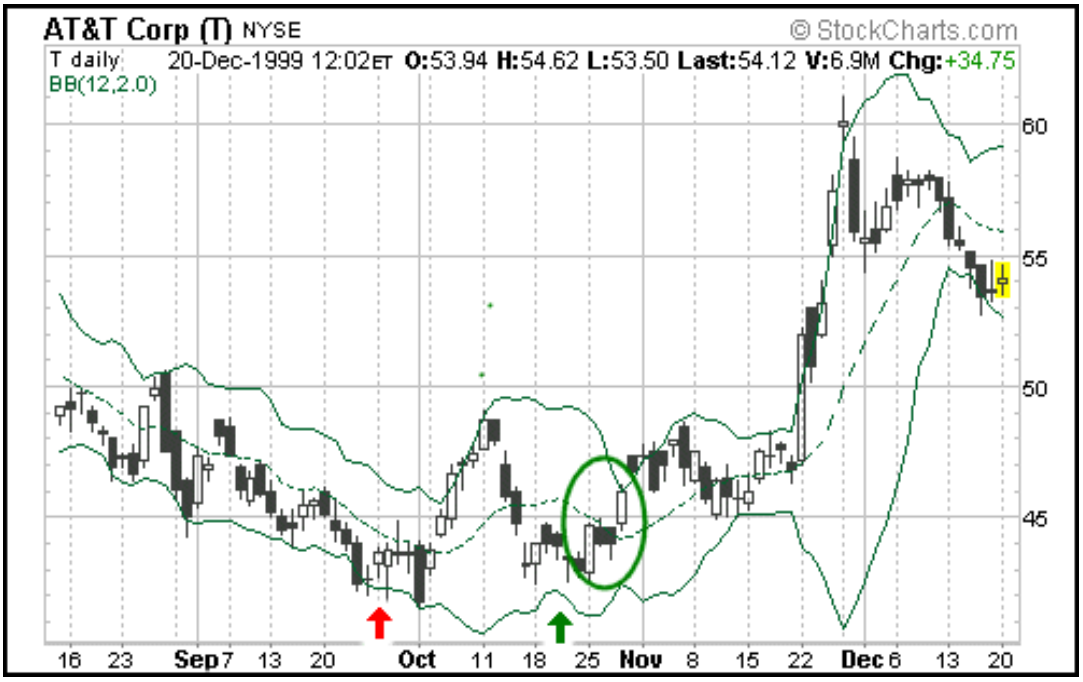
For general timeframes, Bollinger recommends a 10-day moving average for the short term, a 20-day moving average for the intermediate term and 50-day moving average for the long term.

## 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**

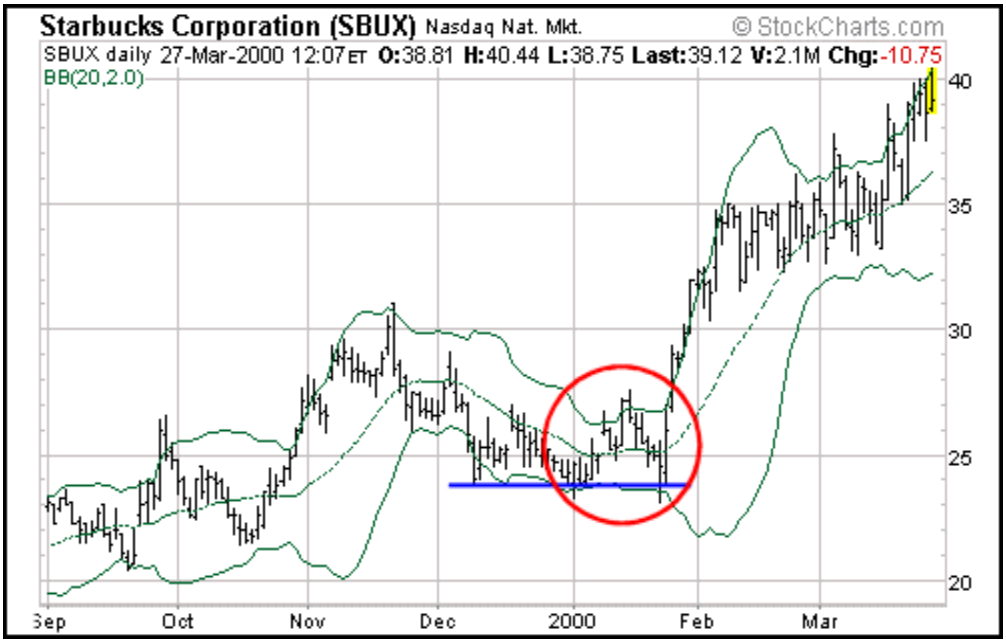



T provides an example of a double bottom buy signal. The stock penetrated the lower band in late September (red arrow) and then held above on the subsequent test in October. The October breakout above the middle band (green circle) provided the bullish confirmation.

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.

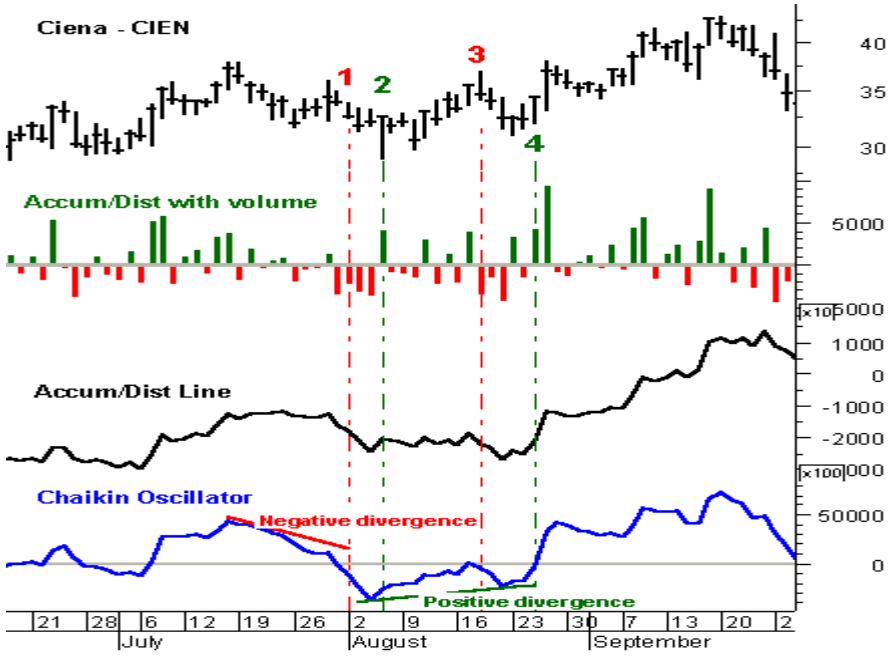
# Chaikin Oscillator

## 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.

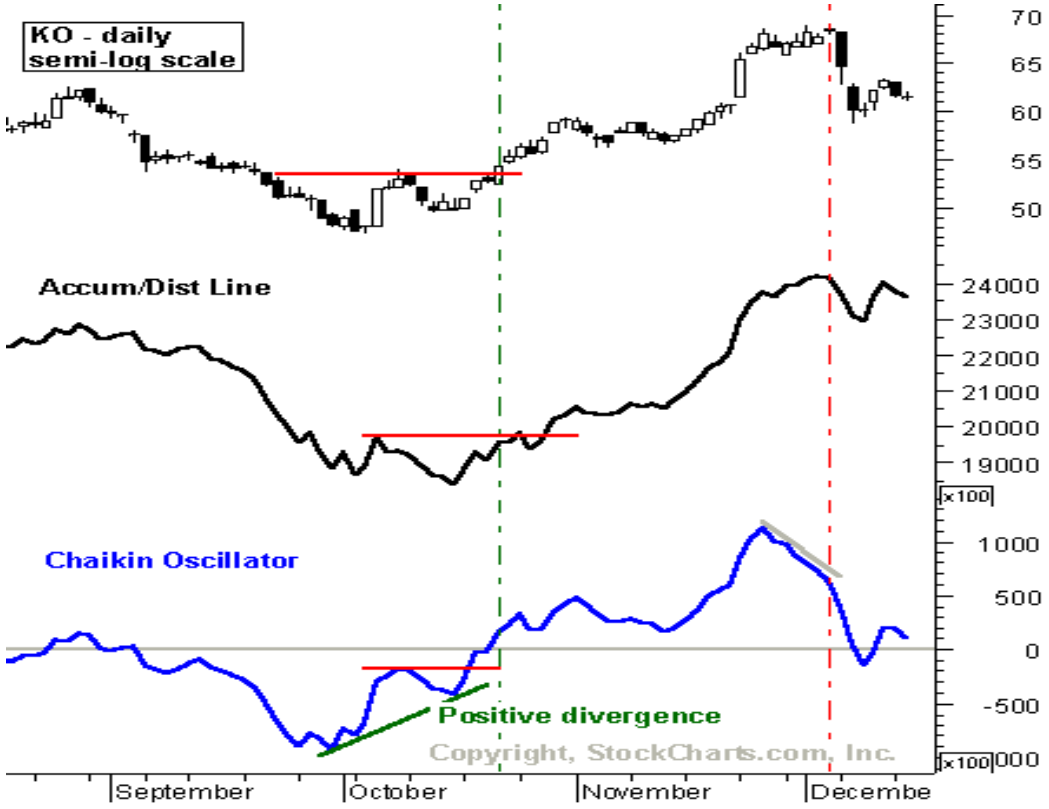
1. The July negative divergence in the Chaikin Oscillator foreshadowed the impending weakness in the Accumulation/Distribution Line. This was a slant type divergence that is characterized by its lack of distinctive peaks to form the divergence. The Chaikin Oscillator peaked about a week before the Accumulation/Distribution 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 centerline 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.**



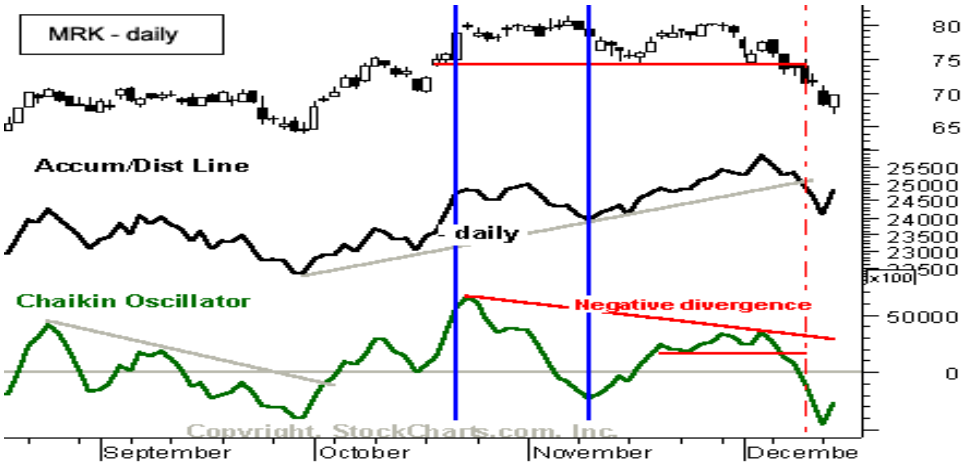

1. The positive divergence is sharp and pronounced. When using an indicator of an indicator, it is preferable to take only strong signals. Note the steepness of the positive divergence.

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 bearish signal is rendered. The chart for MRK shows a recent bearish signal that coincided with a support break in the stock.




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 changing the moving averages on the indicator(an option available in our SharpCharts 'Indicator Windows') to further smooth the fluctuations. This indicator should definitely be used in conjunction with other aspects of technical analysis.

## MACD Part 1

### The Combination Oscillator

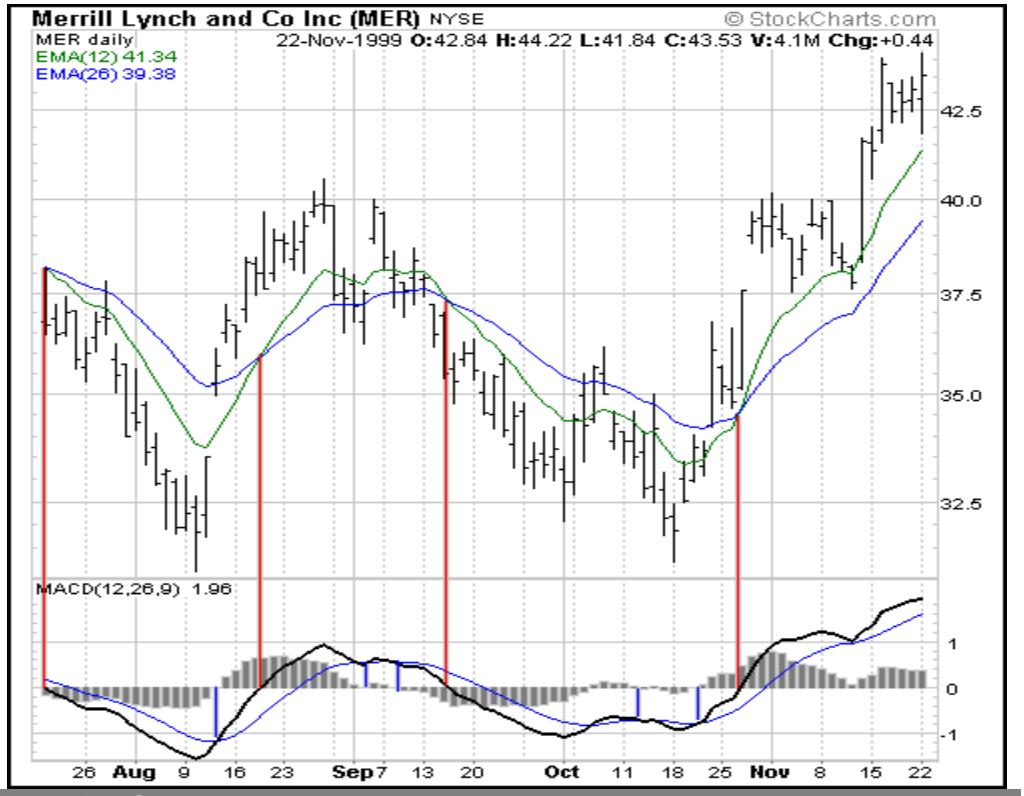
Developed by Gerald Appel, Moving Average Convergence Divergence (MACD) is one of the simplest and most reliable indicators available. MACD uses moving averages, which are lagging indicators, to include some trend-following characteristics. These lagging indicators are turned into a momentum oscillator by subtracting the longer moving average from the shorter 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, 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.

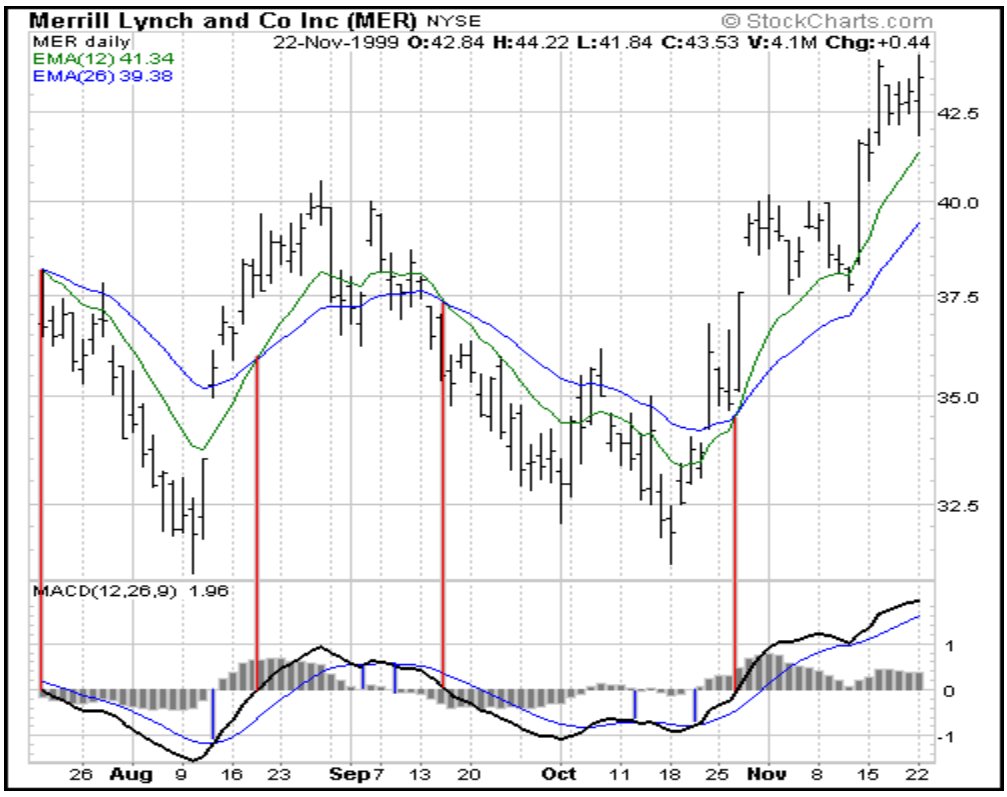
Of the two moving averages that make up MACD, the 12-day EMA is the faster and the 26-day EMA is the slower. Closing prices are used to form the moving averages. Usually, a 9-day EMA of MACD is plotted along side to act as a trigger line. A bullish crossover occurs when MACD moves above its 9-day EMA 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.




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

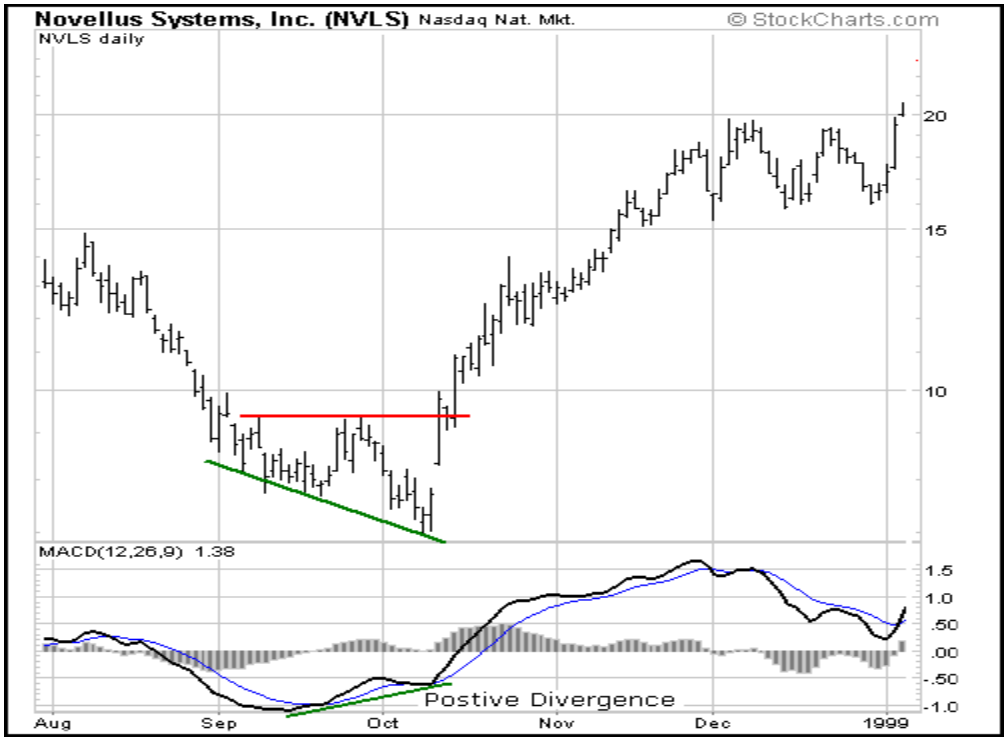
MACD generates bullish signals from three main sources:

1. Positive divergence

2. Bullish moving average crossover

3. Bullish centerline crossover

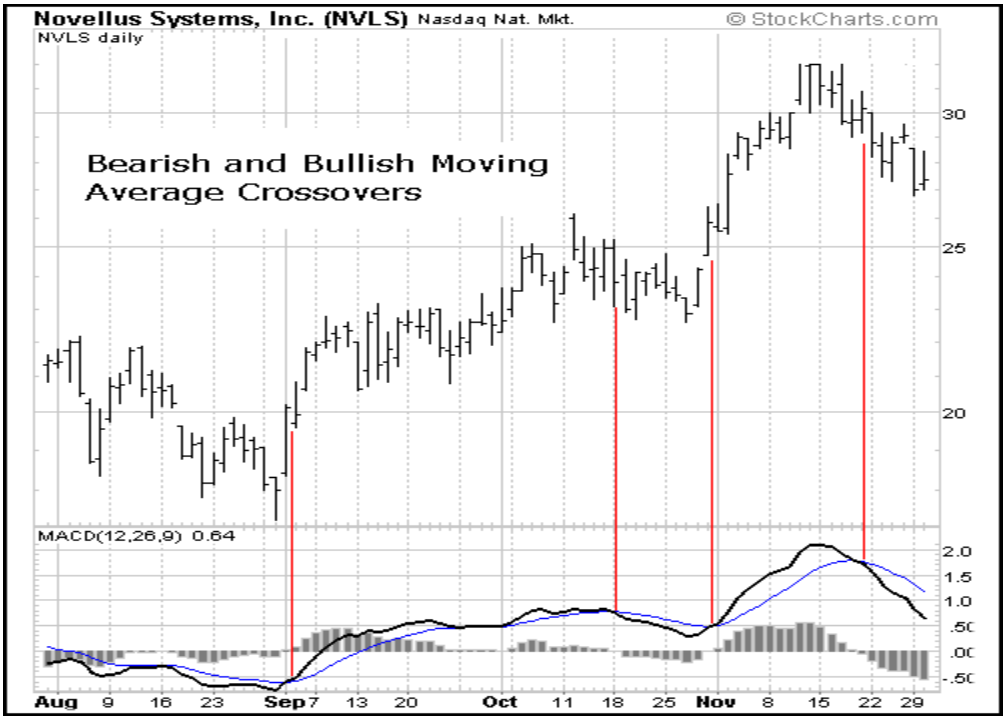
**Positive DivergenceNovellus**



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**

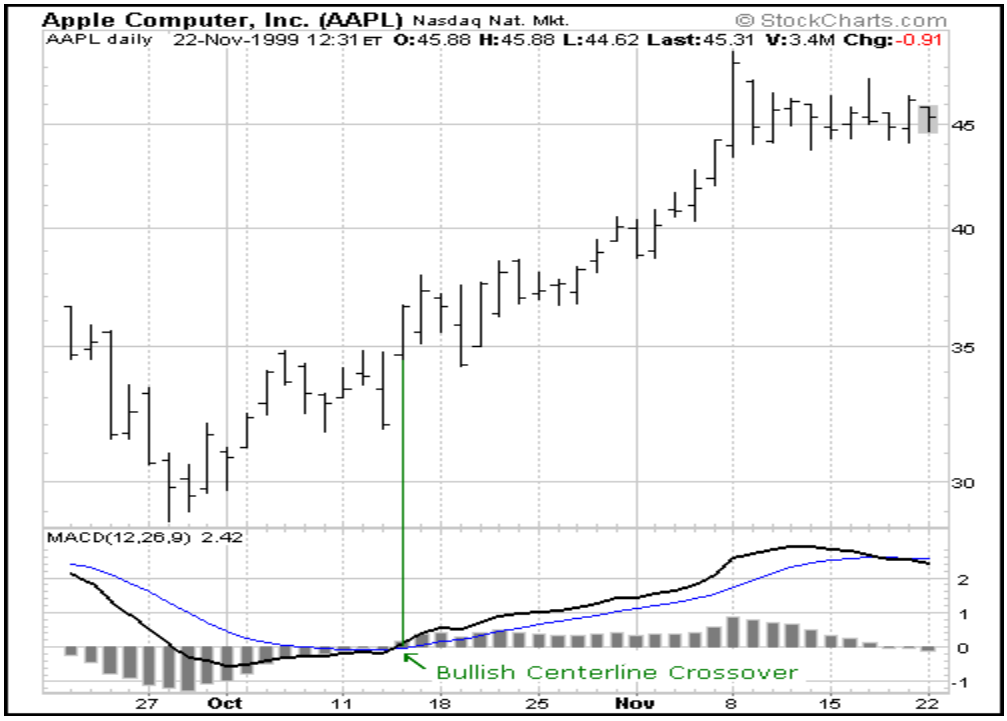

Novellus Systems, Inc. (NVLS) Nasdaq Nat. Mkt.
© StockCharts.com
NVLS daily
Bearish and Bullish Moving Average Crossovers
30
25
20
MACD(12,26,9) 0.64
2.0
1.5
1.0
.5
.0
-.5
Aug 9 16 23 Sep 7 13 20 Oct 11 18 25 Nov 8 15 22 29

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**

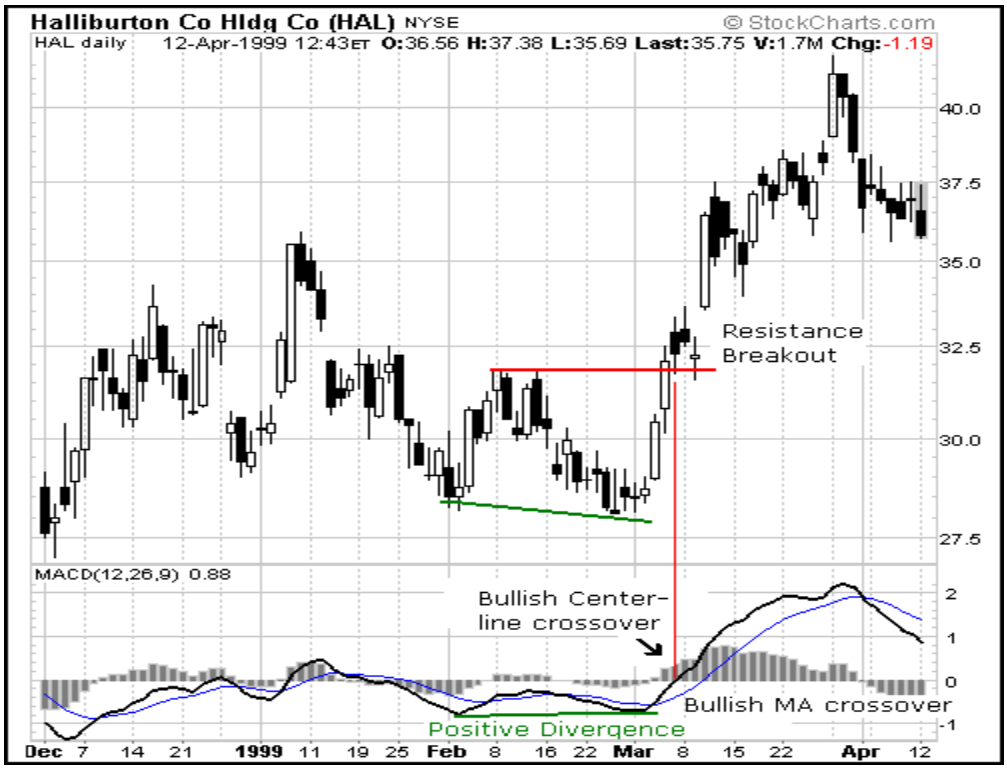
**Apple**


Apple Computer, Inc. (AAPL) Nasdaq Nat. Mkt.
© StockCharts.com
AAPL daily 22-Nov-1999 12:31 ET O:45.88 H:45.88 L:44.62 Last:45.31 V:3.4M Chg:-0.91
45
40
35
30
MACD(12,26,9) 2.42
2
1
0
-1
Bullish Centerline Crossover
27
Oct
11
18
25
Nov
8
15
22

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.*

# MACD Part 2

## Bearish Signals

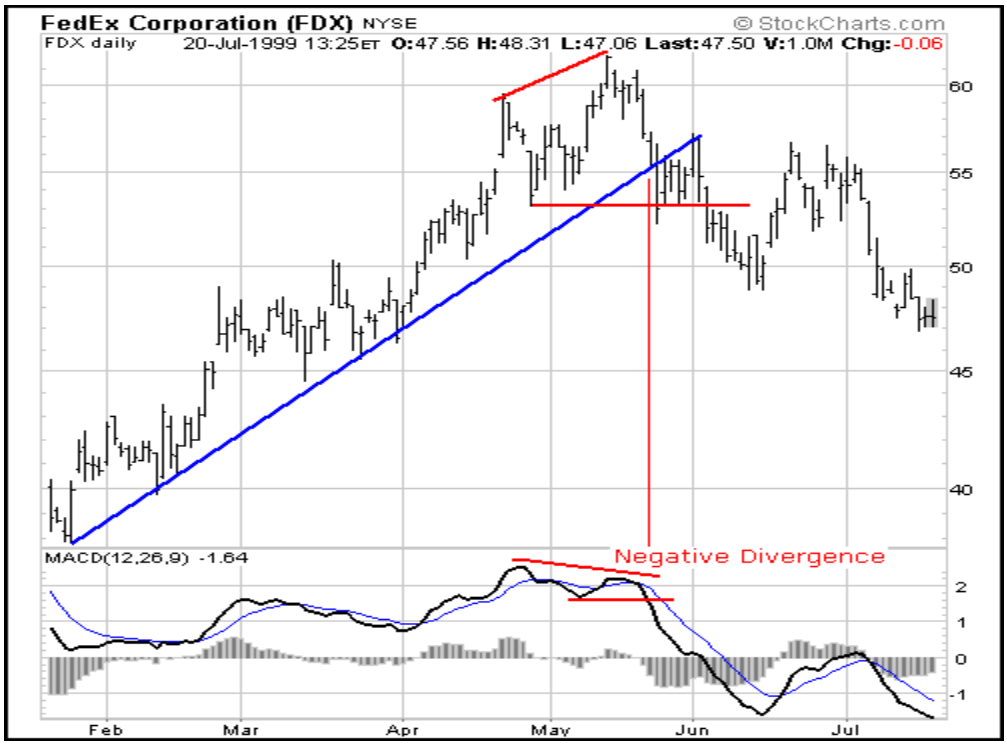
MACD generates bearish signals from three main sources. These signals are mirror reflections of the bullish signals.

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**



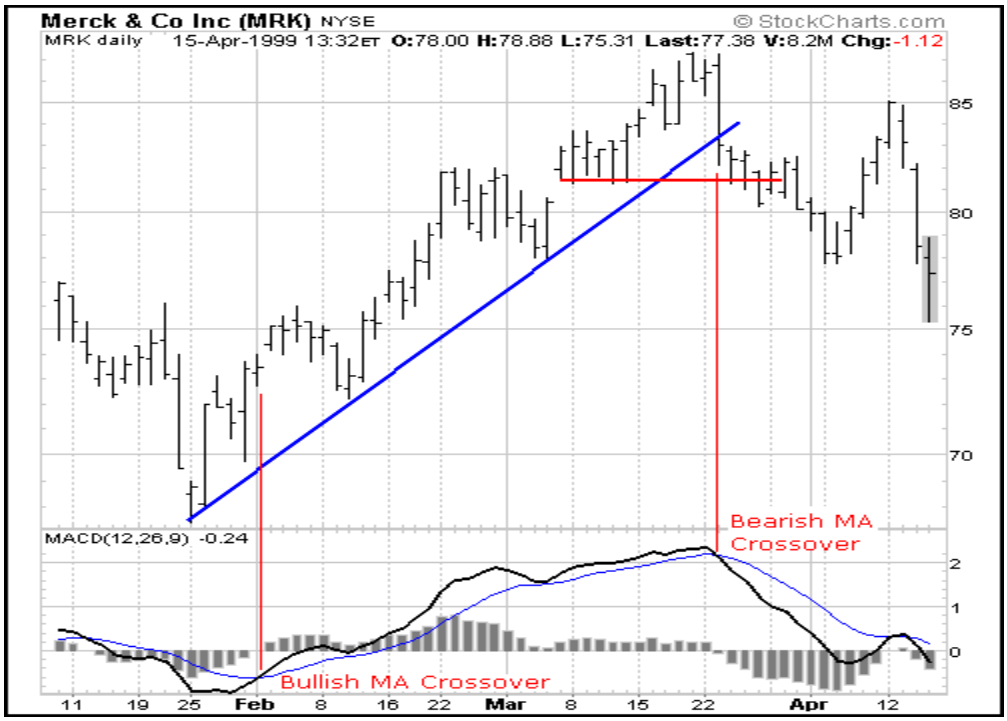
The FDX chart shows a negative divergence when MACD formed a lower high in May and the stock formed a higher high at the same time. This was a rather blatant negative divergence and signaled that momentum was slowing. A few days later, the stock broke the uptrend line and MACD formed a lower low.

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**


Merck & Co Inc (MRK) NYSE
© StockCharts.com
MRK daily 15-Apr-1999 13:32ET O:78.00 H:78.88 L:75.31 Last:77.38 V:8.2M Chg:-1.12
85
80
75
70
MACD(12,26,9) -0.24
Bearish MA Crossover
2
1
0
Bullish MA Crossover
11 19 25 Feb 8 16 22 Mar 8 15 22 Apr 12

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**


Unisys Corp (UIS) NYSE
© StockCharts.com
UIS daily 12-Oct-1999 13:44 ET O:43.12 H:43.69 L:42.56 Last:43.12 V:3.6M Chg:+0.25
47.5
45.0
42.5
40.0
37.5
Volume 3581900
3M
2M
1M
MACD(12,26,9) -0.13
Bearish MA Crossover
2.0
1.5
1.0
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.00
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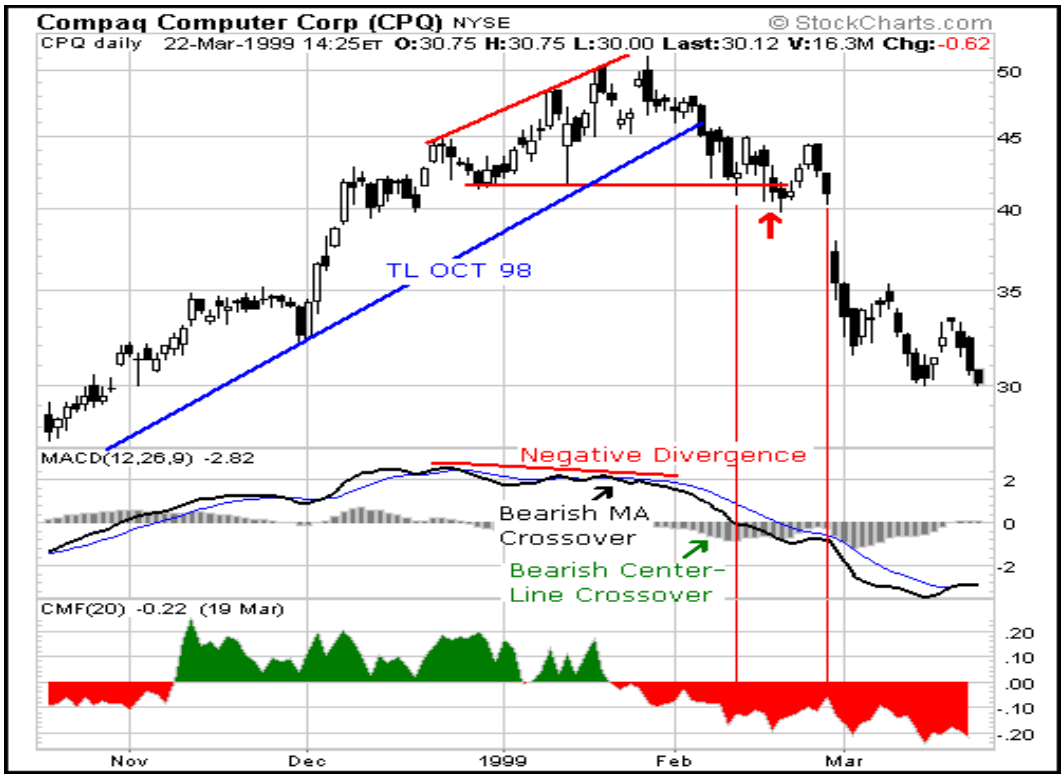



The significance of the centerline crossover will depend on the previous movements of MACD as well. If MACD is positive for many weeks, begins to trend down and then crosses into negative territory, it would be considered bearish. However, if MACD has been negative for a few months, breaks above zero 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 that occurs just off the right edge of the chart. 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 blue trendline extending up from Apr-99 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.*

## 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.

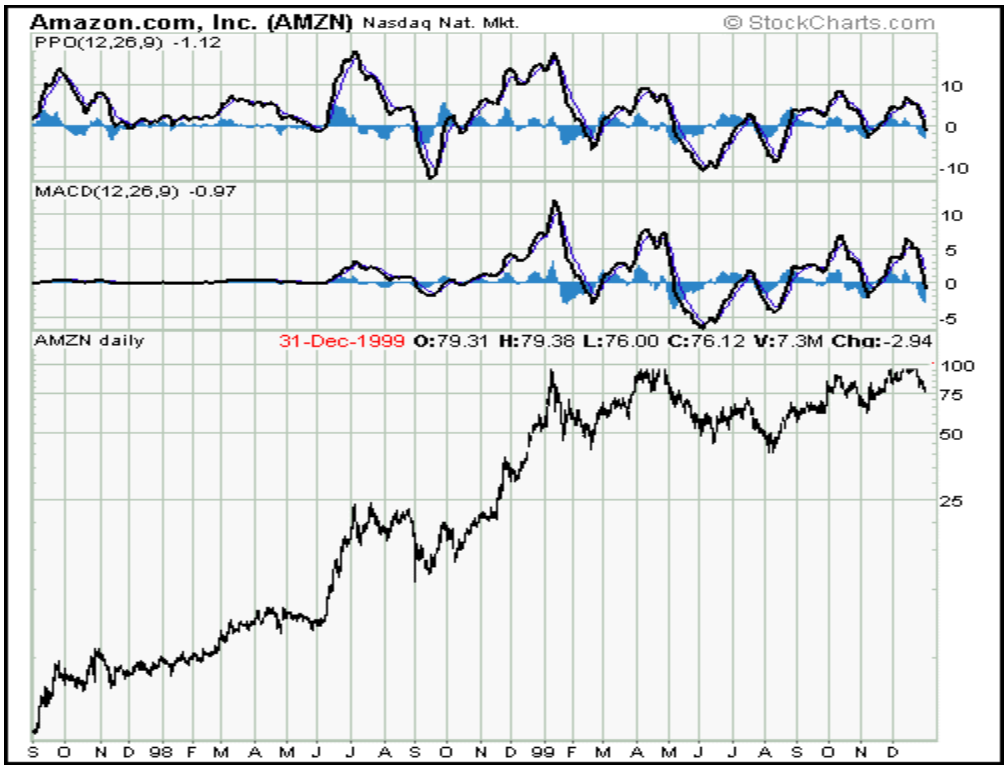
## MACD Drawbacks

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**


Amazon.com, Inc. (AMZN) Nasdaq Nat. Mkt.
© StockCharts.com
PPO(12,26,9) -1.12
10
0
-10
MACD(12,26,9) -0.97
10
5
0
-5
AMZN daily
31-Dec-1999 O:79.31 H:79.38 L:76.00 C:76.12 V:7.3M Chg:-2.94
100
75
50
25
S O N D 98 F M A M J J A S O N D 99 F M A M J J A S O N D

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.

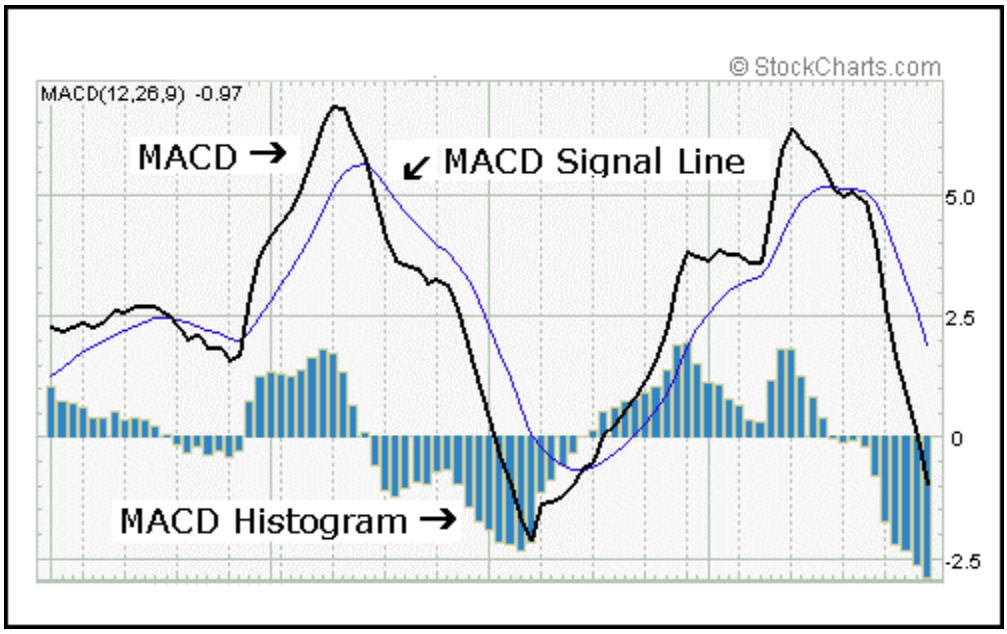
*In* Part 4*, we examine the benefits and drawbacks of MACD-Histogram.*

## 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**


© StockCharts.com
MACD(12,26,9) -0.97
MACD
MACD Signal Line
MACD Histogram
5.0
2.5
0
-2.5

## 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.

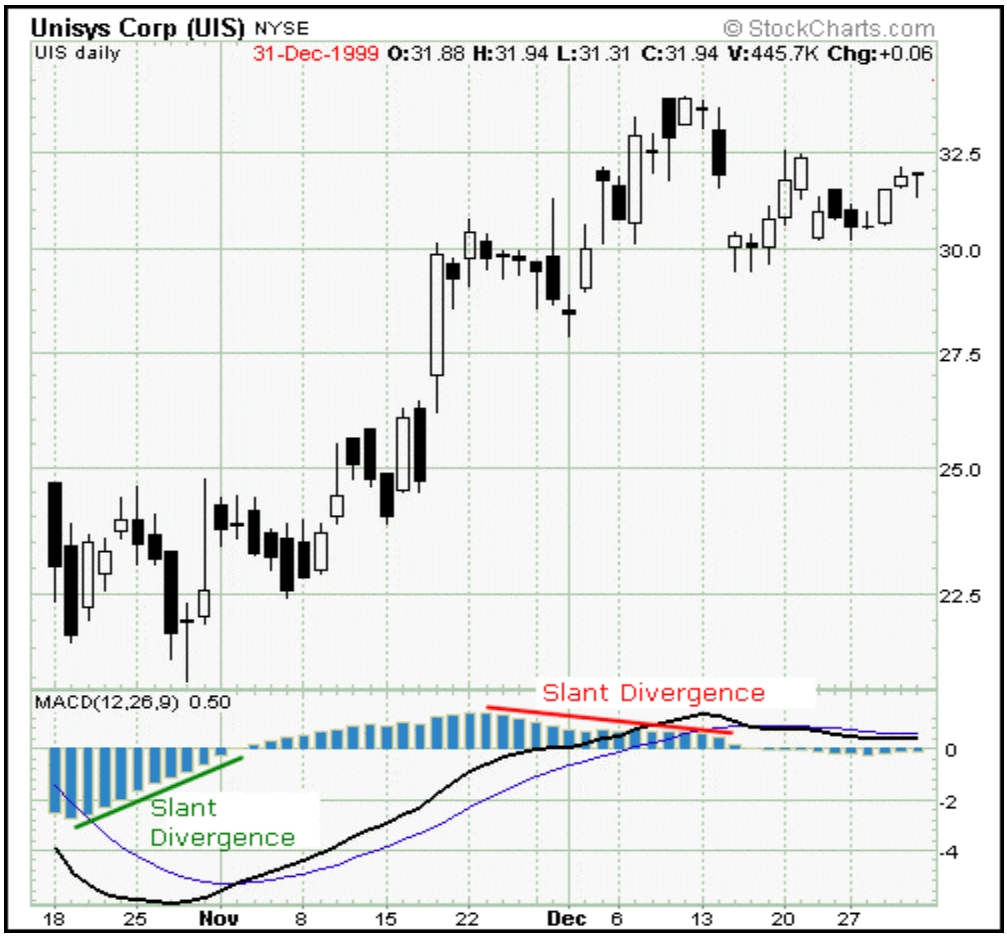
In his book, Technical Analysis of the Financial Markets, John Murphy asserts that the MACD-Histogram is best used to identify periods when the gap between MACD and its 9-day EMA is either widening or shrinking. Broadly speaking, a widening gap indicates strengthening momentum and a shrinking gap indicates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


Unisys Corp (UIS) NYSE
© StockCharts.com
UIS daily
31-Dec-1999 O:31.88 H:31.94 L:31.31 C:31.94 V:445.7K Chg:+0.06
32.5
30.0
27.5
25.0
22.5
MACD(12,26,9) 0.50
Slant Divergence
Slant
Divergence
0
-2
-4
18
25
Nov
8
15
22
Dec
6
13
20
27

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.

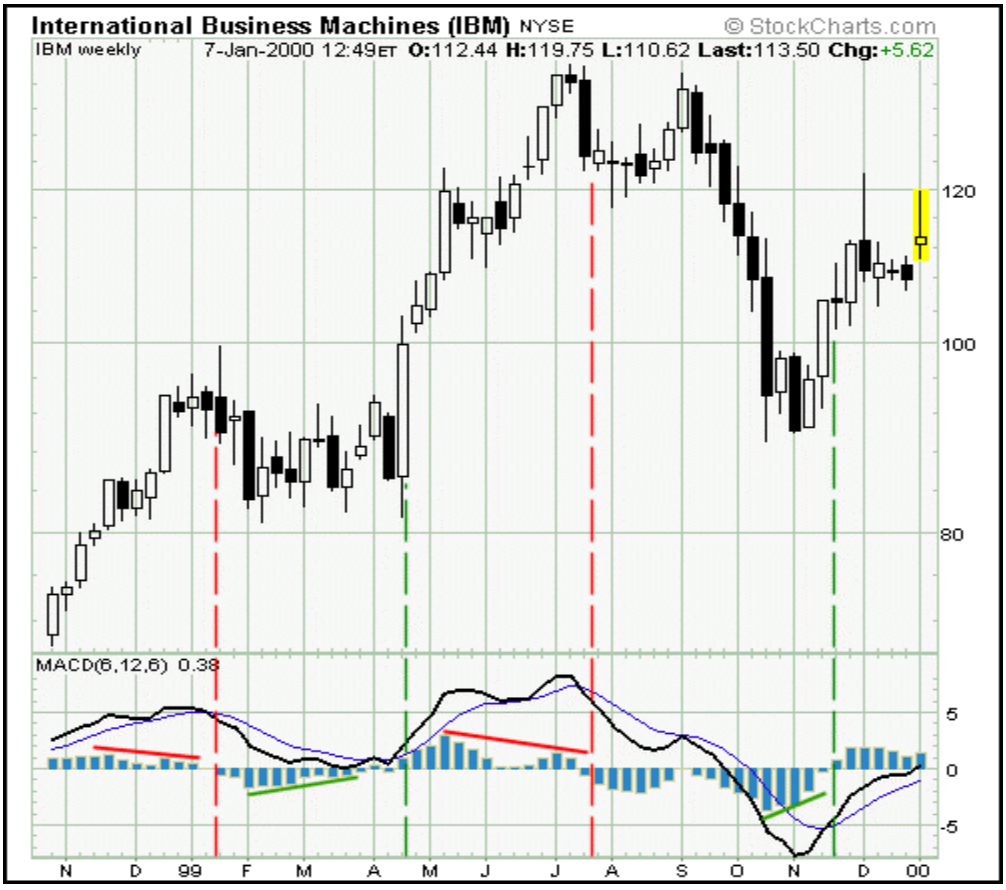
## MACD-Histogram Benefits

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 agree with the major trend would be considered. If the long-term trend were bullish, only negative divergences with bearish centerline crossovers would be considered valid for the MACD-Histogram. If the long-term trend were bearish, only positive divergences with bullish centerline crossovers would be considered valid.

**IBM**


International Business Machines (IBM) NYSE
© StockCharts.com
IBM weekly
7-Jan-2000 12:49ET O:112.44 H:119.75 L:110.62 Last:113.50 Chg:+5.62
120
100
80
MACD(6,12,6) 0.38
5
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N
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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.

# Moving Averages - Part 1

## Introduction

Moving averages are one of the most popular and easy to use tools available to the technical analyst. They smooth a data series and make it easier to spot trends, something that is especially helpful in volatile markets. They also form the building blocks for many other technical indicators and overlays.


The two most popular types of moving averages are **the Simple Moving Average (SMA)** and **the Exponential Moving Average (EMA)**. They are described in more detail below.

## Simple Moving Average (SMA)

A simple moving average is formed by computing the average (mean) price of a security over a specified number of periods. While it is possible to create moving averages from the Open, the High, and the Low data points, most moving averages are created using the closing price. For example: a 5-day simple moving average is calculated by adding the closing prices for the last 5 days and dividing the total by 5.

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

$$60 \div 5 = 12$$

The calculation is repeated for each price bar on the chart. The averages are then joined to form a smooth curving line - the **moving** average line. Continuing our example, 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 simple moving average would be calculated as follows:

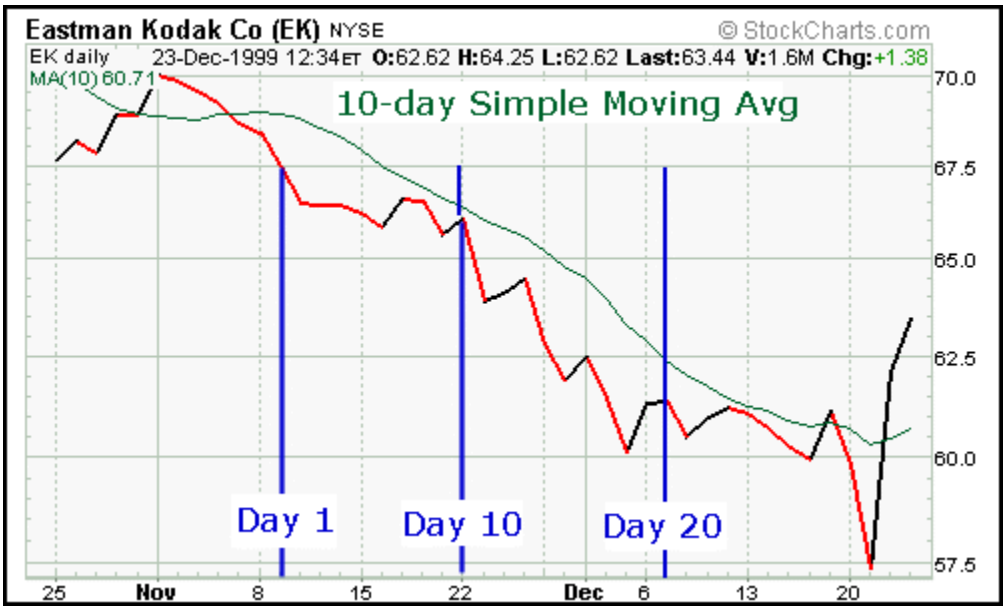
$$11 + 12 + 13 + 14 + 15 = 65$$

$$65 \div 5 = 13$$

Over the last 2 days, the SMA 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 simple moving average. As the calculation continues, the newest day is added and the oldest day is subtracted. The 10-day SMA 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 SMA 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 simple moving average begins on day 10 and continues.

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

## Exponential Moving Average (EMA)

In order to reduce the lag in simple moving averages, technicians often use exponential moving averages (also called exponentially weighted moving averages). EMAs 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 specified period of the moving average. The shorter the EMA's period, 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% while a 20-period EMA weighs the most recent price 9.52%. As we'll see, the calculating and EMA is much harder than calculating an SMA. 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. Here's the calculation formula.

**Exponential Moving Average Calculation**

Exponential Moving Averages can be specified in two ways - as a percent-based EMA or as a period-based EMA. A percent-based EMA has a percentage as it's single parameter while a period-based EMA has a parameter that represents the duration of the EMA.

The formula for an exponential moving average is:

> **EMA(current) = ( (Price(current) - EMA(prev) ) x Multiplier) + EMA(prev)**
>
> For a percentage-based EMA, "Multiplier" is equal to the EMA's specified percentage.
> For a period-based EMA, "Multiplier" is equal to 2 / (1 + N) where N is the specified number of periods.

For example, a 10-period EMA's Multiplier is calculated like this:

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

This means that a 10-period EMA is equivalent to an 18.18% EMA.

Note: StockCharts.com only support period-based EMAs.

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) = (61.33 - 63.682) = -2.352
2. (C - P) x K = -2.352 x .181818 = -0.4276
3. ((C - P) x K) + P = -0.4276 + 63.682 = 63.254

| EMA Period (N): | | | 10 | |
|---|---|---|---|---|
| Smoothing Constant (K): | | | 0.181818 | |
| Period | Date | Close ( C ) | Previous Period's EMA (P) | 10-Day EMA (X) |
| 1 | 09-Nov-99 | $ 64.75 | | |
| 2 | 10-Nov-99 | $ 63.79 | | |
| 3 | 11-Nov-99 | $ 63.73 | | |
| 4 | 12-Nov-99 | $ 63.73 | | |
| 5 | 15-Nov-99 | $ 63.55 | | |
| 6 | 16-Nov-99 | $ 63.19 | | |
| 7 | 17-Nov-99 | $ 63.91 | | |
| 8 | 18-Nov-99 | $ 63.85 | | |
| 9 | 19-Nov-99 | $ 62.95 | | |
| 10 | 22-Nov-99 | $ 63.37 | | $ 63.682 - * |
| 11 | 23-Nov-99 | $ 61.33 | $ 63.682 | $ 63.254 |
| 12 | 24-Nov-99 | $ 61.51 | $ 63.254 | $ 62.937 |
| 13 | 26-Nov-99 | $ 61.87 | $ 62.937 | $ 62.743 |
| 14 | 29-Nov-99 | $ 60.25 | $ 62.743 | $ 62.290 |
| 15 | 30-Nov-99 | $ 59.35 | $ 62.290 | $ 61.755 |
| 16 | 01-Dec-99 | $ 59.95 | $ 61.755 | $ 61.427 |
| 17 | 02-Dec-99 | $ 58.93 | $ 61.427 | $ 60.973 |
| 18 | 03-Dec-99 | $ 57.68 | $ 60.973 | $ 60.374 |
| 19 | 06-Dec-99 | $ 58.82 | $ 60.374 | $ 60.092 |
| 20 | 07-Dec-99 | $ 58.87 | $ 60.092 | $ 59.870 |

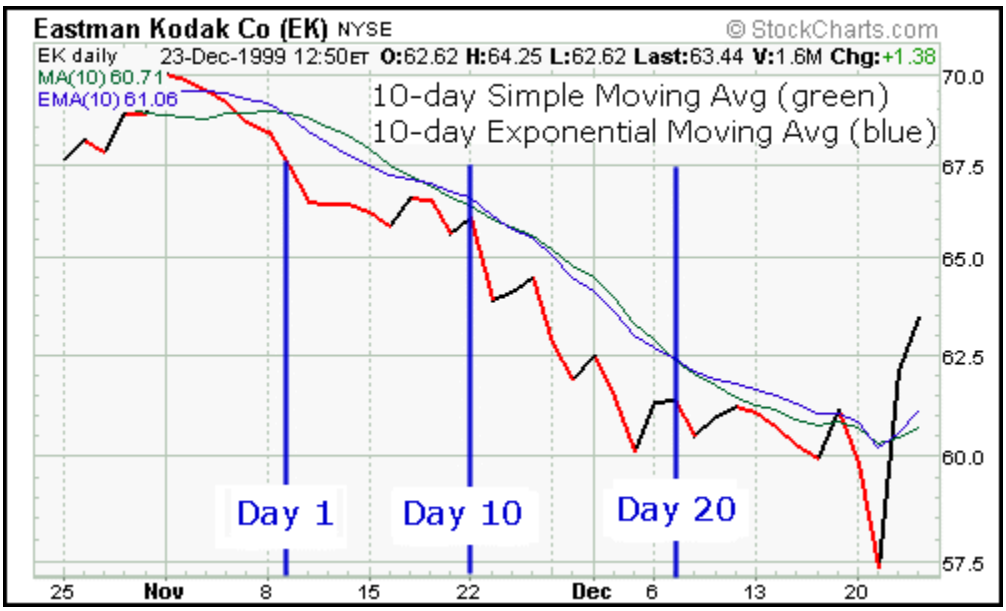
*The 10-period simple moving average is used for the first calculation only. After that the previous period's EMA is used.

Note that, in theory, every previous closing price in the data set is used in the calculation of each EMA that makes up the EMA line. While the impact of older data points diminishes over time, it never fully disappears. This is true regardless of the EMA's specified period. The effects of older data diminish rapidly for shorter EMAs than for longer ones but, again, they never completely disappear.

## Simple Versus Exponential

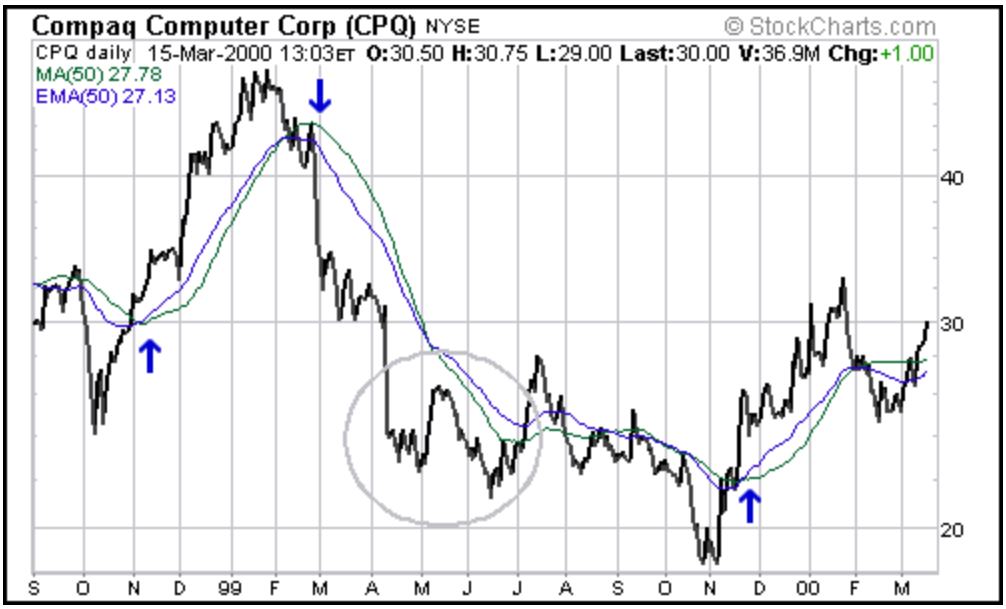
From afar, it would appear that the difference between an exponential moving average and a simple moving average is minimal. For this example, which uses only 20 trading days, the difference is minimal, but a difference nonetheless. The exponential moving average is consistently closer to the actual 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.*

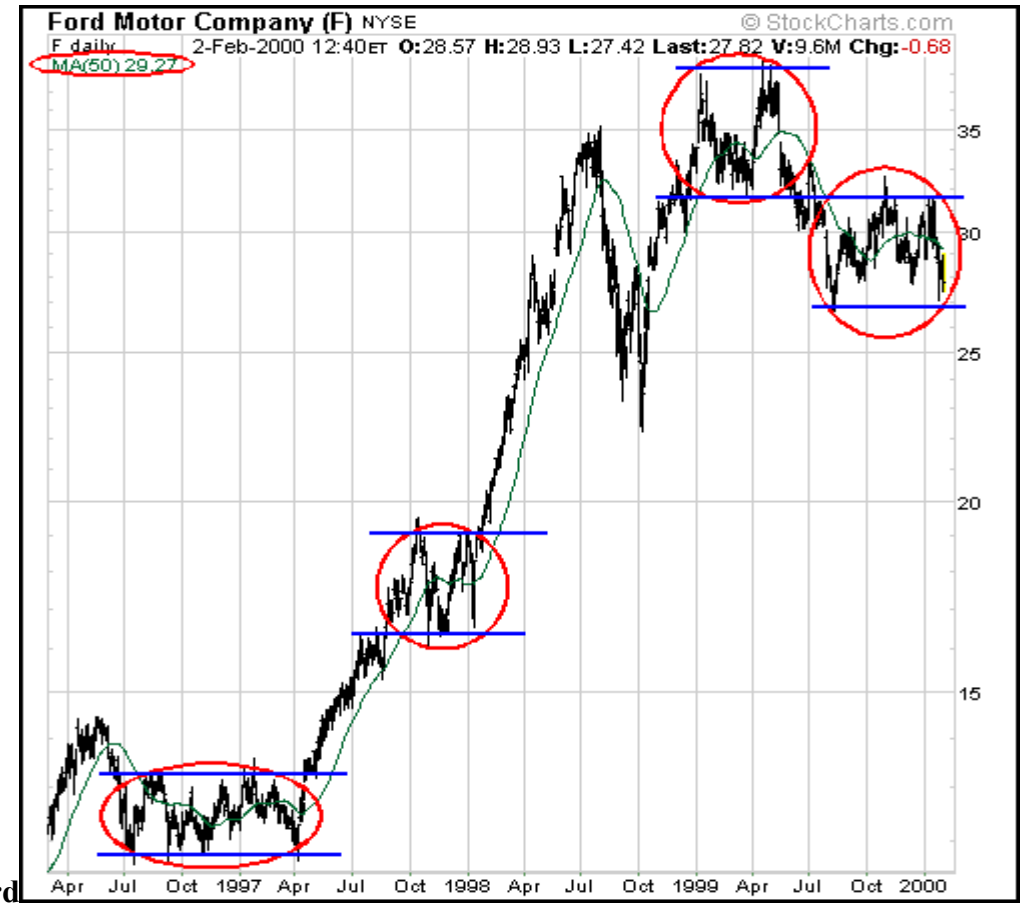
# Moving Averages – Part 2

## 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.

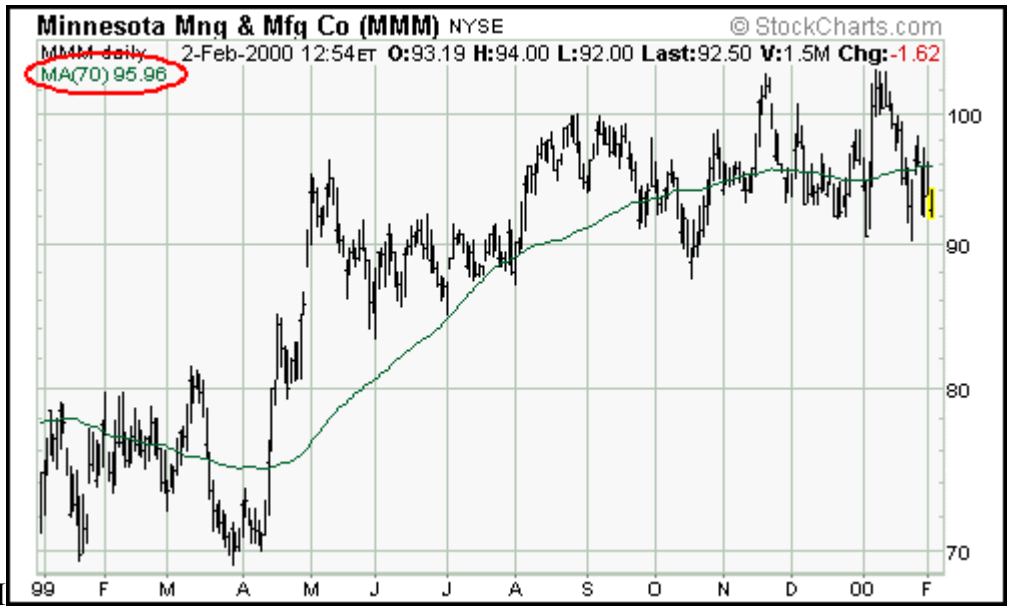
In its simplest form, a security's price can be doing only one of three things: trending up, trending down or trading in a range. An uptrend is established when a security forms a series of higher highs and higher lows. A downtrend is established when a security forms a series of lower lows and lower 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.b




**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

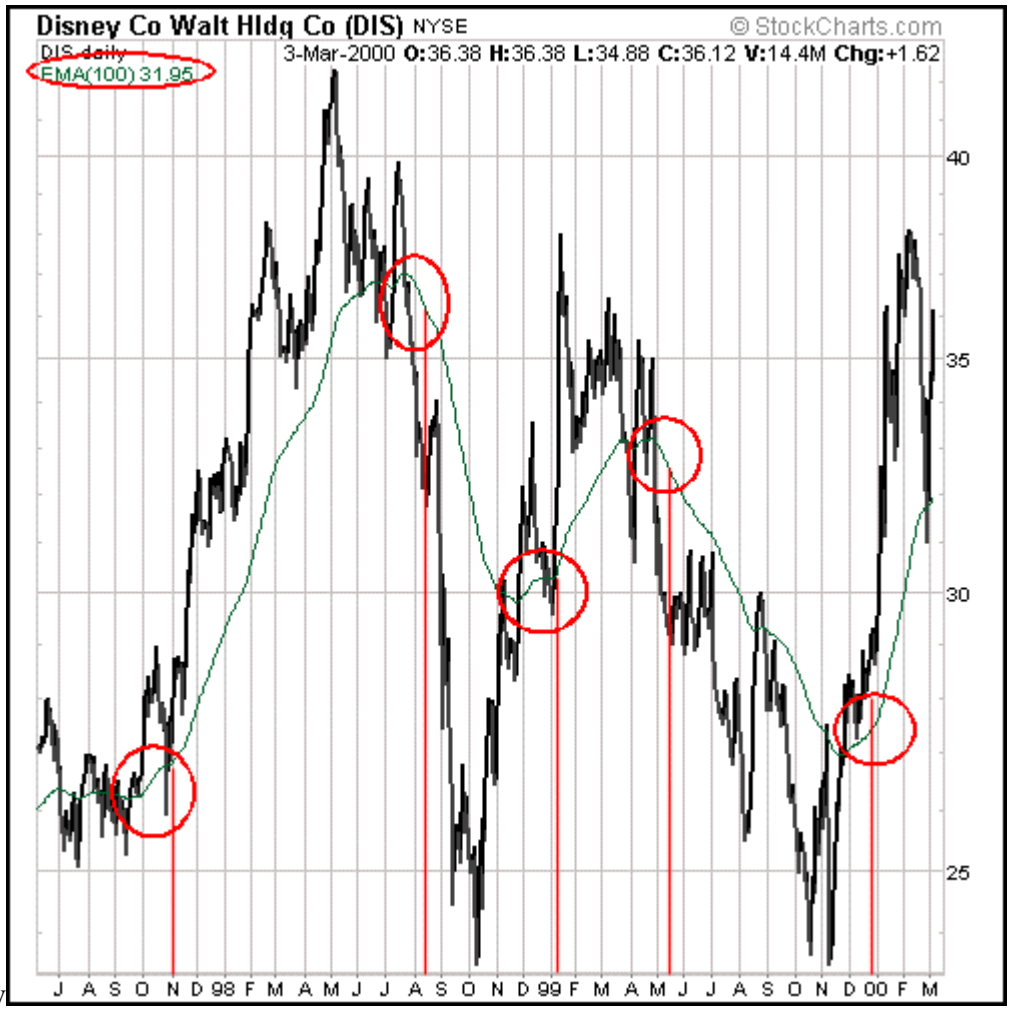
There are many uses for moving averages, but three basic uses stand out:

- 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.

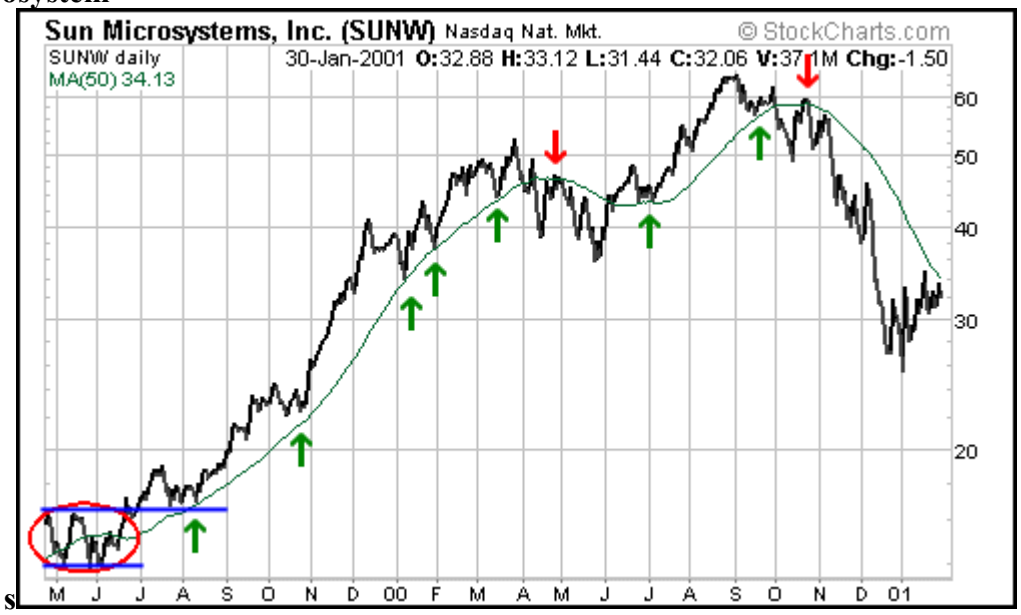

**Xircom**

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 Microsystem**




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.

## 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.

## 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

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

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

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

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

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

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 |

Here's how lines 14 and 15 were calculated:

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

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

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

$$\text{RSI (line 15)} = 100 - \frac{100}{1 + .9409} = 48.477$$

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. Note: If the Average Loss ever becomes zero, RSI becomes 100 by definition.

**Important Note:** The more data points that are used to calculate the RSI, the more accurate the results. The smoothing factor is a continuous calculation that - in theory - takes into account *all* of the closing values in the dataset. If you start an RSI calculation in the middle of an existing dataset, your values will only approximate the true RSI value. SharpCharts uses *at least* 250 datapoints prior to the starting date of any chart (assuming that much data exists) when calculating its RSI values. To duplicate its RSI number, you'll need to use at least that much data also.

## 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


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.

## 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.

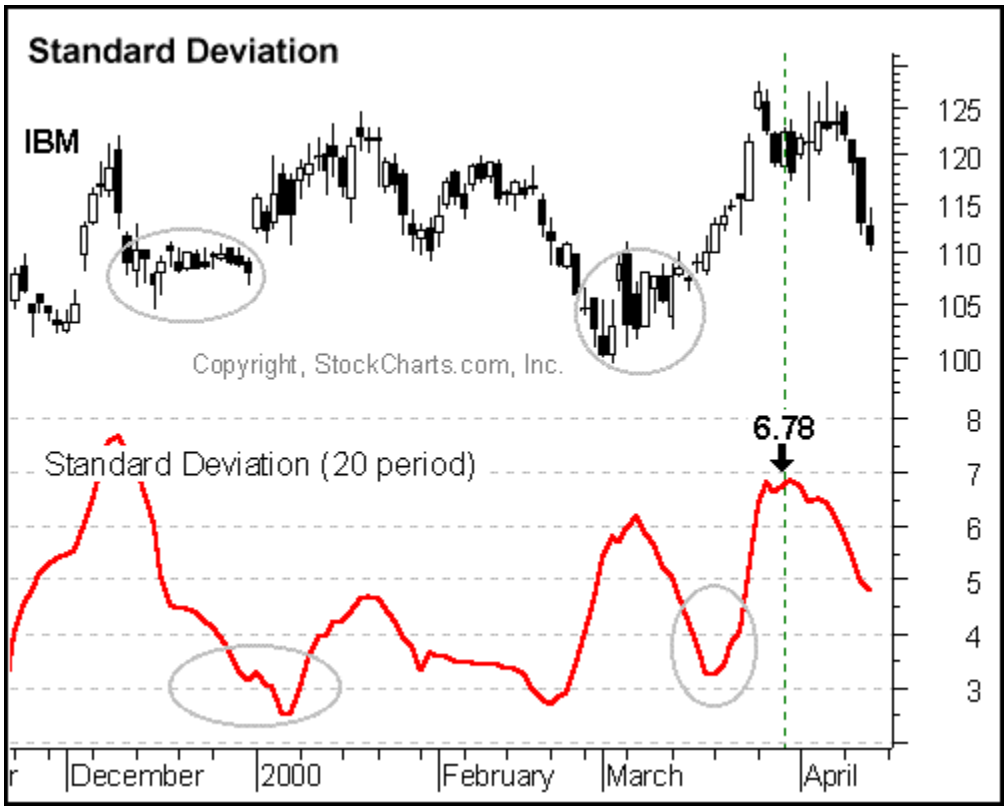
The steps for calculating a 20-period standard deviation are as follows:

1. Calculate the simple average (mean) of the closing price. i.e., Sum the last 20 closing prices and divide by 20.
2. For each period, subtract the average closing price from the actual closing price. This gives us the deviation for each period.
3. Square each period's deviation.
4. Sum the squared deviations.
5. Divide the sum of the squared deviations by the number of periods (20 in our example below).
6. The standard deviation is then equal to the square root of that number.

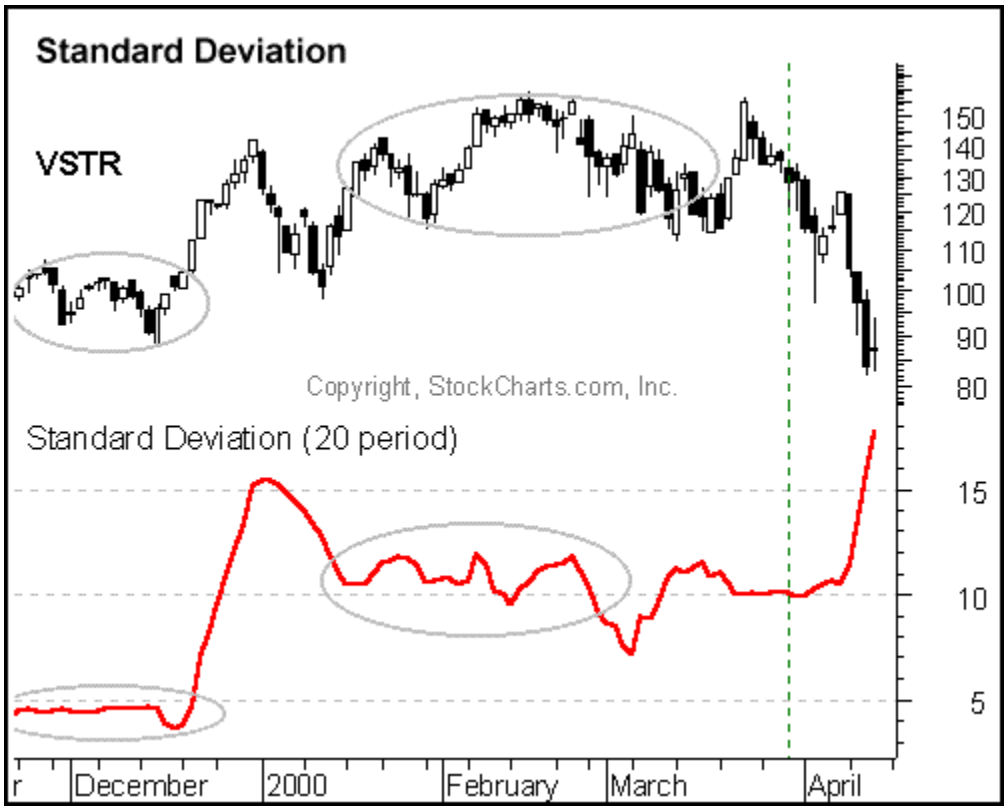
| | Close | 20-day Mean | Deviation | Deviation squared |
|---|---|---|---|---|
| 1 | 109.00 | 112.30 | -3.30 | 10.91 |
| 2 | 103.06 | 112.30 | -9.24 | 85.38 |
| 3 | 102.75 | 112.30 | -9.55 | 91.26 |
| 4 | 108.00 | 112.30 | -4.30 | 18.52 |
| 5 | 107.56 | 112.30 | -4.74 | 22.47 |
| 6 | 105.25 | 112.30 | -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 20-period standard deviation for the data above is 6.787. Note that this is the "full population" version of the Standard Deviation. There is a different kind of Standard Deviation calculation that is used when you are taking a statistical sample of a population, but that version is not used in technical analysis since all of the data points are known.

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.

## 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 ( | Recent Close – Lowest Low (n) / 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 ( | 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.

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.

# 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:**

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

$$RS = \frac{(Total\ Gains/n)}{(Total\ Losses/n)}$$

n = number of RSI periods

**Stochastics:**

$$\%K = 100 \times \left( \frac{Recent\ Close - Lowest\ Low\ (n)}{Highest\ High(n) - Lowest\ Low(n)} \right)$$

%D = 3-period moving average of %K

(n)= Number of periods used in calculation

**StochRSI:**

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

(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


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.