# Trendline Dynamics Charts
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**Macro-Trend Analyzer**



The MTA is a long-term trend following system.

Construction:

In the Macro Trend Analyzer the blue line is a 63-day exponential moving average (EMA). The green line is a 102-day EMA. And the red line is a 165-day EMA.

The dots on the bottom of the chart indicate the states of the three averages. The bottom-most row of dots tells whether the 165-day EMA is rising or falling. The middle row of dots tells if the 102-day EMA is rising or falling. And the row above that tells whether the 63-day EMA is rising or falling.

The row of dots at the top of the chart shows the slope of price. Slope is measured as the one-month rate of change in the 126-day double exponential average (DEMA). If slope is greater than or equal to 1, then the dots will be bright green. If slope is between 0.5 and 1 the dots will be dark green. If slope is less than or equal to -1, the dots will be bright red . If it is -0.5 and -1 the dots will be dark red. If the slope is between -0.5 and +0.5, then the dots will be gray, indicating that the slope is essentially horizontal.

Interpretation

The MTA was designed to work with heavily-traded securities like index ETFs and sector ETFs. It can be used with less-liquid ETFs and individual securities, but it may be useful to use auxiliary exit rules.

The simplest interpretation of the MTA is:

    a.   If all three rows of MTA dots turn green, it indicates the long-term trend is up.
    b.   If all three rows of MTA dots turn red, it indicates the long-term trend is down.

If the trend is up and one or two rows of dots turn red, it is a warning that the trend may be changing so investors should keep a close watch on the security. One or two rows of green when the trend is down means the trend may be turning up.

Auxiliary Rule

Large, sudden declines have recently started appearing in market prices. These moves occur so rapidly that they exceed the ability of the MTA to respond. In order to protect our MTA positions, I have added an auxiliary exit rule. The new rule is that if price declines 15% or more from the last high, then exit immediately. We can always get back in if price bounces back up, but it's better to get out rather than standing by and hoping price will bounce back up.

Advanced MTA Interpretation

While the three rows of dots at the bottom of the chart indicate whether the trend is up or down, the single row of dots at the top provides a cursory measure of whether the trend is interesting (worth investing in). For example, if the MTA is indicating the trend is up but the slope dots are gray, then the security may be rolling over and should be monitored carefully.

Another serious warning sign is when price declines below the MTA slow, 165-day EMA twice within four weeks. In a high percentage of cases this marks the start of a large move downward.

**Local Trend**



The Local Trend chart shows a simple 2-average crossover system. It's a medium-term indicator.

Construction

The Local Trend chart displays two moving averages, The green line is an 11-day triangular moving average and the red line is a 29-day triangular moving average.

The triangular moving average (TMA) is a front-weighted, linear-decay, moving average. To illustrate, the difference, here are the formulas for a 5-day Simple Moving Average (SMA) and 5-day TMA:

Simple Moving Average

$$SMA[0] = \frac{P[4] \times 1 + P[3] \times 1 + P[2] \times 1 + P[1] \times 1 + P[0] \times 1}{5}$$

where P[4] is Price 5 bars ago
and P[0] is price for the current bar

## Triangular Moving Average

$$TMA[0] = \frac{P[4] \times 1 + P[3] \times 2 + P[2] \times 3 + P[1] \times 4 + P[0] \times 5}{15}$$

where P[4] is Price 5 bars ago
and P[0] is price for the current bar

In the SMA, the weight for every sample is one so it is normally not shown, but the 5 in the divisor is the implicit sum of the weights. I showed the weights in the SMA because it makes the TMA easier to understand. In the TMA, the weight of the oldest price is 1, the weight of the next oldest is 2, and so on until we get to the current price, where the weight is 5. Just like in the SMA, the divisor is the sum of the weights, except now the sum is 15 instead of 5.

The triangular moving average (TMA) is the middle ground between the simple moving average (SMA) and the exponential moving average (EMA). The SMA is actually a very effective tool; however, it introduces considerable lag.

SMA Average Lag = (Period - 1) / 2 so a 9-bar SMA introduces 4 bars of lag

TMA Average Lag = Period x (1 - Sine(45º)) so a 9-bar TMA introduces 2.636 bars of lag

EMA Average Lag = (Period - 1) / 2 so a 9-bar SMA introduces 4 bars of lag

So the TMA introduces about a third less lag than the SMA. And even though the EMA has the same lag as the SMA (see End Notes for why), the EMA has so much front loading that it displays the feature/problem that every time price crosses the EMA, the EMA switches from rising to falling (or falling to rising, depending on the direction of the crossover).

Interpretation



When the green line (TMA(11)) is above the red line, and the slope of the red line (TMA(29)) is greater than zero, the local trend is up. When the green line (TMA(11)) is below the red line, and the slope of the red line (TMA(29)) is less than zero, the local trend is down.

A long entry is shown for VNQ where the slope of the red line (lower row of dots) turns green on March 9th and the green line crosses above the red line (upper row of dots) turns green on the 15th.

Anytime the position of the green line and the slope of the red line disagree, be very cautious. For example, if the green line is above the red line, but the slope of the red line is below zero, then it's a warning that this is probably a false signal from the green line.

KIE also shows a basic entry on February 10th (A) and it shows a high probability entry on April 6th (B). A high probability entry occurs when the local trend is up, the green line pulls back toward the red line, and then the green line pulls up away from the red line. The green line can even cross the red line a little bit. The key to the high probability entry is that the red line continues to advance while the green line dips and then pulls away again.

Caution



When the trend goes flat, the crossover system becomes unproductive. Check the MTA or the green slope line on the CMF chart to see what the longer-term trend is before taking a Local Trend entry signal. You can also look at the ATS chart.



If the trailing stops are seesawing up and down rapidly (as shown here), then the Local Trend signals will probably not be profitable.

**Ahrens Trailing Stop**



The ATS is a fast, tight, adaptive trailing stop designed for position/swing trading. The first time people look at an ATS chart, most of them think it's kind of messy. I normally try to keep my charts simple, but there is no way around the fact that there is a lot of information on the ATS chart. Once you understand all the pieces, then it's easy to find what you're looking for. We will look at a number of charts to illustrate what they all mean and how to use them.

Construction

The ATS is a trailing stop indicator. Once a low trailing stop (a green line) begins, it can either move up or it can move sideways. It can never move down, and it keeps advancing until price turns down and breaks through it. A high trailing stop (a red line) can either move down or it can move sideways. It can never move up. It keeps declining until price turns up and breaks through it. ATS stops closely track price, helping the investor exit quickly and minimize losses once the short-term trend turns against their position.

There are many important pieces of information on the ATS chart:

1.  In the upper left hand corner of the chart is a line of text that tells which stop is active and the latest values for both the high and low stops.

2.  The green diamonds (Sep 28, Nov 5, Nov 30) are entry signals for long positions. The red diamonds (Oct 19, Nov 23) are exit signals.

3.  As described before, the green dotted lines are rising trailing stops and the red dotted lines are declining trailing stops.

4.  The text in the lower left corner of the chart outlines how the ATS has done for this security for the last year. WC stands for Win Count and LC stands for Loss Count. AW is the average Amount Won on the winning trades and AL is the average Amount Lost on the losing trades. All four values are expressed as percentages.

5.  The dots along the bottom of the chart show whether the rising (green) stop is active or the falling (red) stop is active.

Active versus Inactive

The stops are implemented using a "turn-taking" algorithm. This means that once a stop becomes active, it remains active until it is broken by price. Then the other stop can become active, and remain active until it, in turn, is broken by price.

Here's the AAPL ATS chart from the previous page:



If you examine the right side of the AAPL chart, you will notice that the green, rising stop became active on Nov 30 and remained active until Jan 4. During that time several red, high stops briefly came on but none of them became active because the green low stop was still in force. It wasn't until Jan 4 that the green low stop was broken and then the red, high stop that started on Dec 30$^{th}$ could become active (as signaled by the two red dots in the bottom right corner of the chart).

1-Year Performance

The text in the lower left corner of the chart tells you how the ATS has been performing for this particular security in the recent past. This information is presented to provide you with a reasonable estimate of what you can expect in the near future.

Successful trading is a game of probabilities. Just as trends persist, probabilities persist. If the system has not been performing well for a given security in the past, there is no reason to believe it will suddenly start performing well for that security today. Just as you don't bet against the dominant trend, don't bet against past performance without compelling information.

The 1-year performance numbers are a measure of the ATS operating without the assistance of other indicators. It is the ATS running in a vacuum. If it is doing all right all by itself, then the deft addition of other indicators should improve its statistical performance. If it is not doing all right by itself, don't push your luck.

As we look at the numbers, we see that the WC (win count) and the LC (loss count) are equal. That means each signal has an equal chance of being a winning trade or a losing trade. Since each entry signal is no better than flipping a coin, you may not be impressed. But AW (the average win) has yielded a 13.3% gain and the AL (average loss) has only been 6.4%. For AAPL, AW/AL (the reward-to-risk ratio) for the last year has been just over 2-to-1.

So let's say someone offered to play a game with you got to flip a coin. Every time it came up heads, then you would win $2, and every time it came up tails you would lose a dollar. Would you be willing to play that game? I would be happy to play that game over and over.

**Interpretation**

The other charts for a security can be used to provide perspective on ATS signals.

The first rule of any position-trading system is "Never try to buck the dominant trend." We use the MTA to gauge the dominant trend and for ATS trades: a) if the MTA is going up, only take long positions; and b) if the MTA is going down, only take short positions. (If you want to look at the MTA for a security that is not available on our website, it can easily be reproduced using StockCharts.COM.)

Now, let's turn the clock back to 28-Sep-20, so we can see conditions just as AAPL broke the high trailing stop by closing above it. It's easy to look at a signal in the middle of a chart and think, "Oh, yeah, that's an obvious winner." It's another thing to see that same signal on the hard, right edge of the chart without the advantage of being able to see into the future.

We start by looking at the MTA to see what the dominant trend is.



Examination of the MTA chart shows that the MTA is solidly up. It also reveals that in late September, price bounced up off a 5-month, confirmed rising trend that ran through the lows at point A, B, and C. These are both positive signs.



Looking at the ATS chart, we see that the WC/LC ratio is 1.5 and the AW/AL ratio is over 2. This says the ATS has been performing well with AAPL for the last year. Price just bounced up off that 5-month , rising trendline, and the CMF and OBV (not shown) are both saying that money is starting to flow into AAPL stock. So this looks like a high probability entry signal.

Since the entry signal arrived on Sep 28th, then we buy at the open on the 29th at $114.55 and, in time, we get an exit signal on Oct 19th. The green stop line has a nice upward slope to it. Price wasn't quite so kind. We sell at the open on Oct 20th at $116.20. So we made $1.65. Not much of a win, but on the other hand, it's better than losing money.



The next entry signal arrives on Nov 5th. The MTA is still up. No worrisome signs in the other charts.



This time was worse than the first. The entry signal on the 5th got us in on the 6th at 118.32 and the exit signal on the 23rd got us out on the 24th at $113.91 for a loss of 3.7%.



By now you're probably wondering why I started off with a break-even trade and then a losing trade. First and foremost, this is how trend following works. Many of your positions won't pay off. If I were a salesman, then I would have cherry-picked some nice, big winners to show you. I am not a salesman. Second, it's important to see how a system works on losing trades. Does it minimize losses or follow losers into the ground? These are the important points when evaluating a system.

On Nov 30th there was another entry signal. The MTA was still up. In the Local Trend chart the slower average was very gradually rising, but on Nov 30th something interesting happened.

On page 4 I described a Local Trend chart high probability entry signal as: A high probability entry occurs when the local trend is up, the green line pulls down toward the red line, and then the green line pulls up away from the red line. If you look at the lower, right-hand corner of the Local Trend chart, this is what that high probability entry signal looks like when it first appears on the chart.

The slow average is rising. The fast average swings down close to the slow average. Then the fast average pulls back up. At this point we don't know for sure that the fast average will pull up, but we do know that price has risen for the last 4 days and we know that on Nov 30th it closed about $2 above both averages. These are both signs of a turn up. All things considered, this looks like a good entry signal.



This time price takes off, and the ATS follows along, just far enough out of the way to avoid giving an exit signal until January 4th for a 6.5% return in 5 weeks.

Good News, Bad News

The good news is that ATS provides good, objective entry and exits signals. The not-so-good news is that ATS does not provide you much help in figuring out if any given trade will pay off. For a few, heavily traded securities, you could actually run the ATS as a fully automated indicator and make good money. However, there will generally be a significant number of small losses mixed in with the big wins — just like any other trend following system.

One of the basic rules of technical analysis is: Never try to trade using a single indicator by itself. You don't need a dozen different indicators, but a few well-chosen indicators that work together provide much more information than a single indicator does.

Auxiliary Indicators

- MTA — Returns from taking ATS long signals improve when the long-term MTA indicator is up.

- RelStr — The intermediate term Slope of a security definitely improves ATS returns.

- Local Trend — Paying attention to the shorter term Local Trend also improves ATS returns.

- On-Balance Volume — The short-term OBV indicator tells you whether money is flowing into a security or out of it.

The Mid-Day Trade/Using the Chart Numbers

If you are able to take 10-15 minutes for yourself in the middle of your work day, you may be able to turn the numbers in the upper left-hand corner of the ATS chart to your advantage. Consider the following scenarios:

Scenario 1. On March 10th, the price of GLD breaks up through the ATS high stop so you take a long position in GLD on March 11th when the market opens at $161.47. Since the ATS is a short-term trading system, you check your position every day after the new charts are posted in the evening.

On March 29th, you notice that price has closed below the ATS low stop, generating an ATS exit signal. You put in an at-the-market sell order and are filled at $157.94 when the market opened on march 30th.  You lose $3.53, about 2.2%.

2. As before, you take a long position in GLD on March 11<sup>th</sup> at $161.47. But instead of waiting until the new charts are posted in the evening to make your exit decision, you check your position about an hour before the market closes each day. This only takes a minute or two for each open position.

From the previous day's chart, you know what today's exit level. In this case, the ATS chart from the previous market day, March 26<sup>th</sup>, said "Low Stop is Active: $161.29". So you know that if the price of GLD closes below that level, it will generate an exit signal.



GLD – ATS (11-Feb-21 to 26-Mar-21)    (c) TrendlineDynamics.COM
High Stop: $163.51 – Low Stop is Active: $161.29
1-Year Performance – WC: 29% LC: 71% – AW: 2.9% AL: 2.4%

About an hour or so before the close on the 29<sup>th</sup>, you bring up today's GLD chart on BigCharts.com and see that the current price of GLD is at $160.51. You also see there is little chance that it is going to make it back above $161.29 before the market closes. Since the odds are high that GLD is quite likely to close below the ATS low stop, you quickly put in a sell order, and close your position at $160.44 before the market closes the day at $160.31.



GLD – ATS (12-Feb-21 to 29-Mar-21)    (c) TrendlineDynamics.COM
High Stop is Active: $163.33 – Low Stop is Broken: $161.29
1-Year Performance – WC: 24% LC: 76% – AW: 3.5% AL: 2.3%

In scenario 2, you were able to close your GLD at $160.44 on the 29<sup>th</sup> instead of waiting for the open on the 30<sup>th</sup> that would have gotten you out at $157.94. Instead of losing $3.53 per share, you lose $1.03 per share. That's a difference of $2.50 per share.

Summary

The ATS gives you a running tally of the number of recent wins and losses, as well as the average amount of how much was won and how much was lost. This gives you a clear picture of how the indicator has been doing recently. It also provides objective, clear-cut, entry and exit signals, so you never have to wonder about when it is time to get in or get out. Unlike black box systems that issue obtuse buy and sell signals, the ATS lets you see what is going on in the context of each security's chart.

The ATS does not work for all securities. It works best for securities with very high liquidity; however, since you can see the recent performance of the ATS for every security we chart, it is easy to see which ones it is currently working for and which ones it is not working for.



For example, on 25-May-21, VTI shows a very strong 1-year performance with Win Count (60%) fifty percent higher than Loss Count at (40%) and average Amount Won (5.0%) more than three times higher than average Amount Lost (1.6%).

Combine the ATS with the Local trend or other auxiliary indicators and use trading near the end of the market day (instead of trading on the following market open) and you can produce a fairly steady stream of income.

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**Wilder's Relative Strength Indicator**

Welles Wilder's RSI is a short term trend following system.

Construction:

Wilder had a unique approach to calculating indicators. His RSI calculations were:

1. Current_Gain = sum of price advances over the last 14 bars / 14
2. Current_Loss = sum of price declines over the last 14 bars / 14
3. Average_Gain = [(previous Average_Gain) x 13 + Current_Gain] / 14
4. Average_Loss = [(previous Average_Loss) x 13 + Current_Loss] / 14
5. RS = Average_Gain / Average_Loss * -1
6. RSI = 100 - 100 / (1 + RS)

Current Loss in Step 2 is negative and the "-1" in step 5 makes RS positive. Step 6 rescales the RSI to a range of 0..100.

There is good basic RSI coverage (and a spreadsheet) at StockCharts.COM Chart School page for RSI

If you untangle Wilder's odd notation, steps 3 and 4 are just 27-bar exponential moving averages when the RSI period = 14. (If you want to implement your own RSI, then for any given RSI period, the equivalent EMA_period = RSI_Period * 2 - 1.)

Interpretation:

The brilliant thing Wilder did was to start by summing the advances and the declines separately. Something that is seldom mentioned is that separating price action into sum(gains) and sum(losses) created a zero-lag indicator.

Most people don't notice the fact that RSI has no lag. I didn't recognize it myself until I spent 4-5 months working with just the RSI and experimented with changing the period all the way from 2 bars to 6 months (126 bars). When I started stacking up several RSI charts with different periods I had one of those Asimov Moments*. I noticed that the peaks in the different RSI charts continued to line up. When you stack up moving average charts, the peaks in the longer averages are always displaced to the right because longer averages have greater lag.

But with the RSI, changing the period doesn't cause either the peaks or the valleys to drift out of alignment. I marked a few on this chart. Notice that all three RSI's put in peaks (P) and valleys (V) at the same time as the SPX.

Also notice that when we change the period on the RSI from 5 to 14 to 42, instead of changing the lag, it changes the Y-axis scale. This makes the RSI different from almost all other indicators.
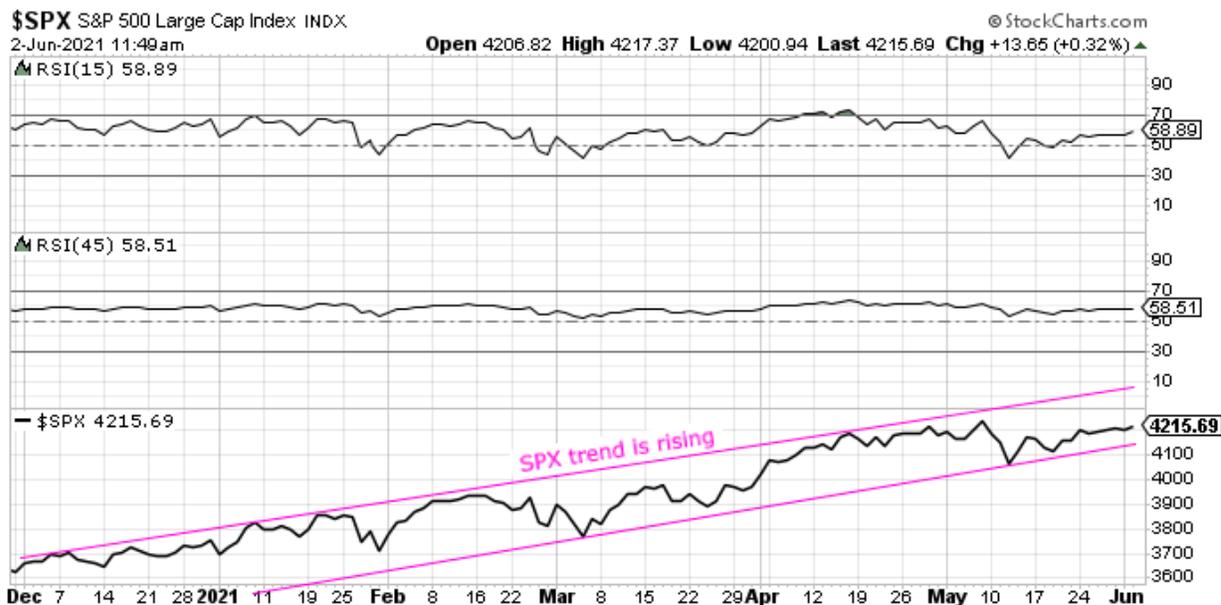


Here are a 15-day RSI and a 45-Day RSI. As discussed on the previous page, the highs and lows of both RSI charts correspond to the highs and lows in the SPX. But two interesting things happen to the 45-day RSI. One is that its Y-scale range is much smaller than the Y-scale range of the 15-day RSI.

The second is that it spends all of its time above 50. This is because the RSI (regardless of period) displays trend bias. *Trend bias* means that an indicator gets shifted up or down to some degree by the trend in price. The shorter the RSI period, the less trend bias affects it. The longer the period, the more influence trend bias has.

In this case, the SPX shows a steady rising trend from December to June. That trend is enough to push the (reduced range) 45-day RSI entirely above the chart center line value of 50. But wait, there's more! Even the 15-day RSI has been pushed up slightly. Notice that the 15-day RSI touches the 70 level several times and even gets slightly above it in April. However, the 15-day RSI never gets below 40, even when the SPX declines for a whole week in May.

So RSI shows a clear trend bias. That bias is a bug if you don't know about it, but it may be a feature if you are aware it is there. Look at the 45-day RSI. The fact that it's riding along above 50 means the SPX is in a steady up trend. So, if we wanted to, we could use a long-period RSI as a trend indicator.

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More about interpreting the RSI

A lot of people will tell you:

1. When the RSI is under 30 it's oversold and when it's over 70 it's overbought.
2. When the RSI goes below 30 then you should buy when it gets back above 30.
3. When it's above 70 then you should sell, maybe, uh, er, hmm. . .

Rule 1 doesn't take trend bias into account. Rule 2 isn't good advice, either.  Rule 2 is why some people erroneously think the RSI has lag. They have been taught to misinterpret the indicator. Rule 3 frequently misfires  because the RSI can stay "overbought" for a very long time.

Market price movements are not symmetric. People talk about it but not many of them really **think** about it. Declines tend to be shorter and steeper than advances. This is why people say that the market climbs the stairs and then jumps out the window. They're talking about long, slow rises followed by sudden, steep declines, or V-shaped bottoms and wide, rounded tops.

The RSI is a fast, symmetric, trend-biased indicator in a sometimes slow, asymmetric market. So:

1. The RSI is better at signaling bottoms than it is at signaling tops. Like I said, the RSI can stay "overbought" for a very long time. Use additional indicators to help you interpret what the market is telling you when the RSI gets above 70.
2. If the RSI gets oversold, don't wait until it gets back above 30 to take a position. If you do, you'll miss a lot of the rally. As soon as the RSI goes below 30, starting looking for the bottom. Use short term trendlines, a fast MACD, a trailing stop, or look for an ABC setup to go long while the RSI is still below 30. [See End Notes on RSI]
3. If you're in a long-term rising trend, don't expect the RSI to go below 30. Take the trend bias into account. Somewhere near 30 may be as close as you're going to get.
4. 50 is another useful level to watch. When the RSI comes down close to 50 and then turns back up again, I look for a price advance. As before, use additional indicators to help you interpret what the market is telling you.


**Appel's Moving Average Convergence/Divergence**

      Coming Soon

**Chaikin Money Flow**

      Coming Soon

**Volume and On-Balance Volume**

      Coming Soon

**End Notes**

**MTA**

In the years before computers, there were technicians using the EMA, but they usually used EMA multipliers like 0.10 and 0.05 because they made the calculations easier. 0.10 produced an EMA that was roughly equivalent to a 19-bar SMA and 0.05 generated an EMA that was roughly equivalent to a 39-bar SMA. If you wanted an actual 20-bar EMA, the multiplier would have been 0.095238095, and nobody was willing to punch something like that into an adding machine.

The first recorded use of an exponential moving average for stock market data on a general purpose computer was done by Pete Haurlan. He was an actual rocket scientist at JPL in Pasadena CA. After work when nobody was using the JPL mainframe, Pete loaded stock market data onto the system to analyze trends. I'm reasonably sure it was Pete who chose the formula for the EMA multiplier, "alpha".

The formula "alpha = 2.0 / (period + 1.0)" set the multiplier to a value that gave his EMA the same average lag as an SMA. For an SMA, lag = (period - 1) / 2. For his EMA, lag = (1 - alpha) / alpha, but that came out the same as the SMA because he used alpha = 2 / (period - 1) for his EMA.

1. "FILTER PRICE DATA: Moving Averages vs. Exponential Moving Averages" by Jack K. Hutson, Stocks & Commodities V. 2:3 (102-103):

2. "Signal Analysis Concepts" by Dr. John Ehlers ( http://www.technicalanalysis.org.uk/moving-averages/Ehle.pdf )

**ATS**

I mentioned using BigCharts.COM if you are trading near the end of the market day. This is because BigCharts.COM will display intraday prices (e.g., 5-day chart with 15-minute bars, and 2-day chart with 5-minute bars). These charts let you see where the market spent the day. This lets you see the probabilities of price making it back up to the low trailing stop before the close.

**RSI**

ABC Setup (also known as a 1-2-3 Setup)

An ABC setup is local low point (A), followed by a local high (B), followed by a higher low (C). When price rises above the level of the local high (B), then it is time to buy.

"Asimov Moment"

Isaac Asimov observed: The most exciting phrase to hear in science, the one that heralds new discoveries, is not "Eureka" but "That's funny..."


Fast MACD

The MACD doesn't have to be calculated with the conventional "12, 26, 9" parameters. If you divide those numbers in half (and round), you get "6, 13, 5". You can even divide them by 3 to get "4, 9, 3" which gives you a really fast MACD.


Trend Bias

This is a characteristic which occurs in many oscillators (e.g., the RSI and MACD). *Trend Bias* is the tendency of an oscillator to spend more time above its center line when the trend in price is rising, and to spend more time below its center line when the trend in price is falling. In the case of the MACD, its center line is zero. For the RSI, its centerline is 50.

The unpleasant side effect problem of trend bias is this: For any given oscillator that is affected by trend bias, if interpretation of the oscillator is based on fixed levels, then during rising or falling trends, those levels become compromised or even meaningless.

In the following pair of charts, the price of AAPL is swinging up and down, but the long-term trend is essentially horizontal during the months of March-June. While the price trend is flat, the RSI swings from below 30 (oversold) to above 70 (overbought).

Backing up about a year, AAPL is in a steady, rising trend. In this period — due to trend bias — the RSI is centered around 80 and never even touches 50. This is, of course, an extreme case. But it shows you how much influence trend bias can have.