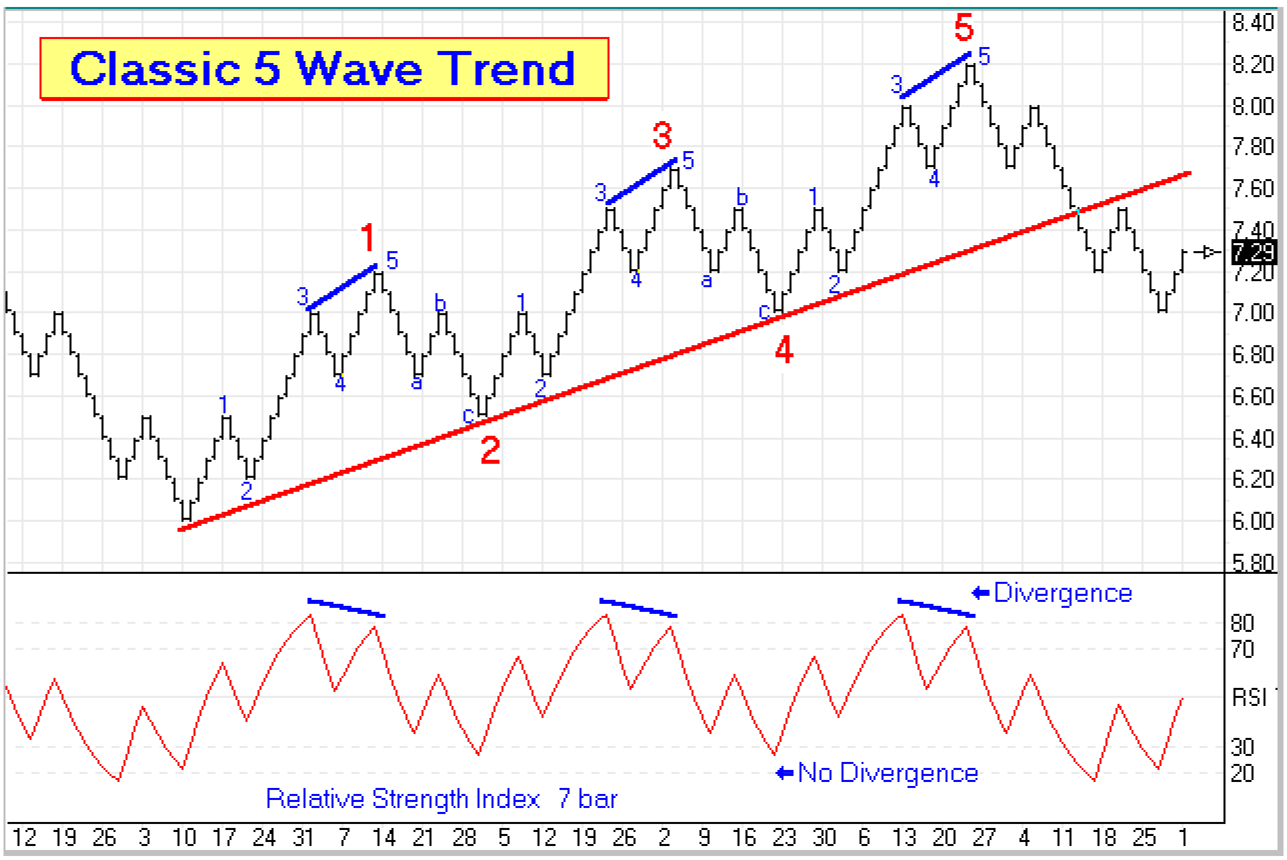
Relative Strength Index

Relative Strength Index was introduced by J. Welles Wilder Jr. in his book, "New Concepts in Technical Trading Systems". RSI is a momentum oscillator which moves between 0 and 100. Many traders use RSI as an overbought condition when above 70, or oversold when below 30. A common use of RSI is to look for divergences as shown on the following chart. Divergence occurs when price swings move higher, but the RSI peaks descend, or price swings move lower but the RSI dips ascend.



Formula

RSI = 100 – [100 / (1 + (Average Upward Nets / Average Downward Nets))]

Average Upward Nets is an average of positive nets over n-bars.

Average Downward Nets is an average of negative nets over n-bars.

Properties

Bars – This is the number of bars in the period for summing the Upward Nets and Downward Nets.

Average – This parameter is used with the formula selected to create an average of the RSI.

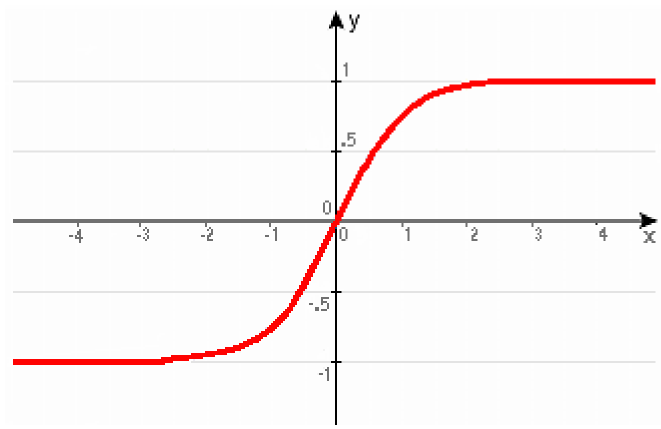
Fisher – This parameter is used when the Fisher Transform box is checked.

Fisher Transform

Every time someone publishes an article about the benefits of a tool or study, a buzz of excitement is created in the investment community. Many traders are eager to have access to the study, hopeful that it will make a favorable difference in their trading performance. Just such a buzz was created by John Ehlers' article 'The Inverse Fisher Transform' published in the May 2004 issue of Technical Analysis of Stocks and Commodities magazine. This article will give a little more insight into the inverse Fisher transform as applied to the Relative Strength Index.

The inverse Fisher transform is : $y = (Exp(2 * x) - 1) / (Exp(2 * x) + 1)$

where x is a value from the original study, and y is the transformed value to be plotted. The following is a plot of the inverse Fisher transform.



The transform creates boundaries on the result so that it is in the range from -1 to 1. Input values larger than 2 generate a result that is nearly 1, and input values less than -2 generate a result that is nearly -1. This boundary characteristic can be put to good use when the Relative Strength Index is the input.

As seen in the plot of the transform, the input data needs to be in the range of approximately -5 to 5. The RSI study data is in the range of 0 to 100, but this can be converted to a range of -5 to 5 using the following formula: $x = 0.1 * (\text{RSI value} -50)$

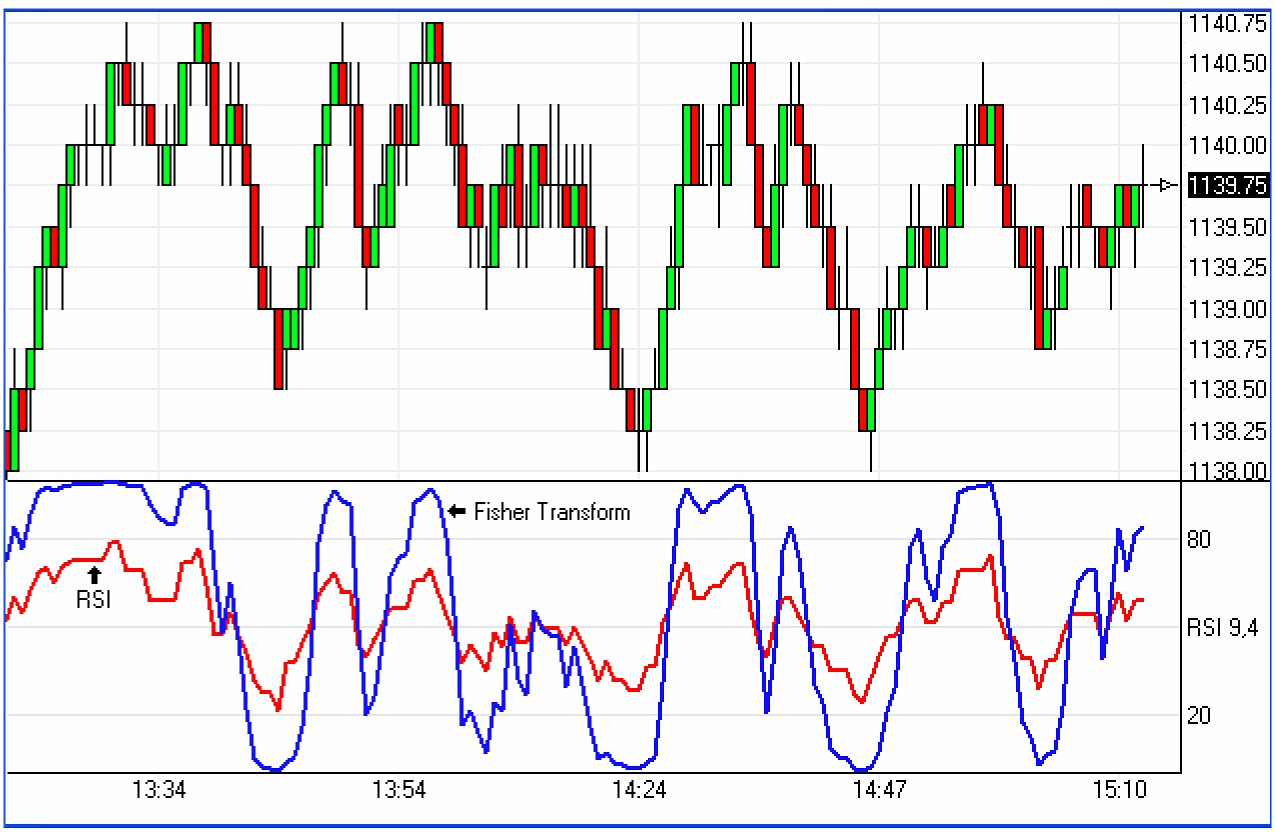
The following table illustrates the conversion of RSI data to the output of the inverse Fisher transform:

RSI value	x Input	y Output	Normalized
100	5	1.000	100
90	4	0.999	99.9
80	3	0.995	99.8
70	2	0.964	98.2
65	1.5	0.905	95.3
60	1	0.762	88.1

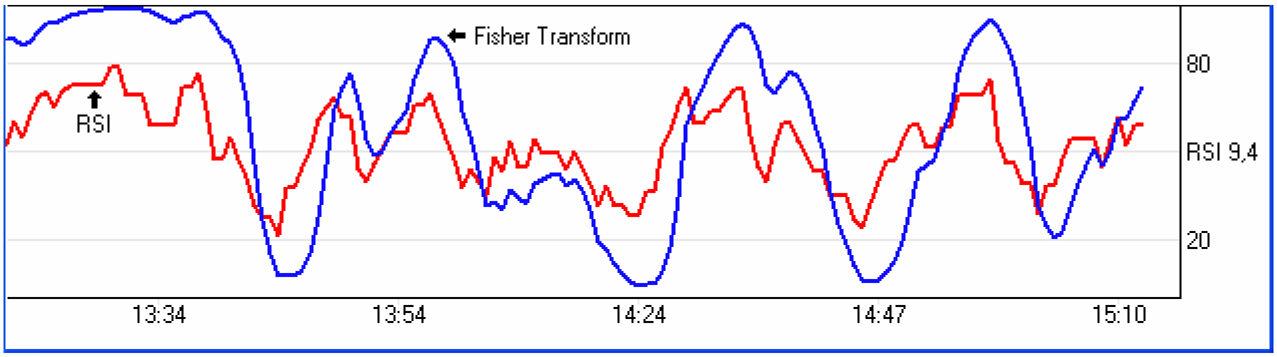
55	.5	0.462	73.1
50	0	0.000	50
45	-0.5	-0.462	26.9
40	-1	-0.762	11.9
35	-1.5	-0.905	4.7
30	-2	-0.964	1.8
20	-3	-0.995	0.2
10	-4	-0.999	0.1
0	-5	-1.000	0

The output of the inverse Fisher transform was normalized back to the range of 0 to 100 using this formula. Normalized data is then easier to compare with the original RSI input data.
Normalized = 50 * (y +1)

The table illustrates how original RSI values would be plotted when the inverse Fisher transform is performed on the data. RSI values above 60 will be squeezed into the top 12 percent of the range and RSI values below 40 will be squeezed into the bottom 12 percent of the range. The transform is causing the RSI transition from below 40 to above 60 to be plotted as a sharper swing from very low levels to very high levels. Here is a comparison plot of an RSI in red and its inverse Fisher transform in blue.

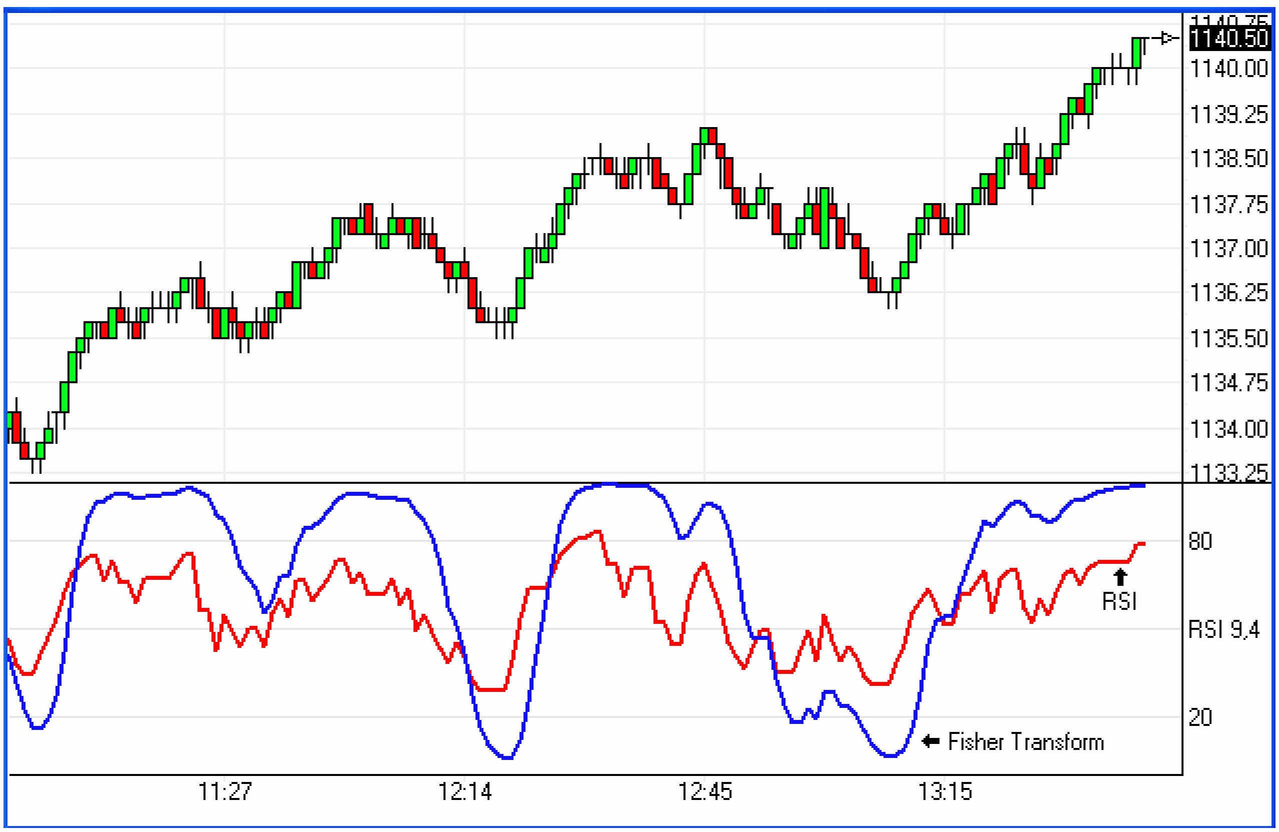


The next technique that is typically performed is to do the transform on an average of the RSI instead of the raw RSI values. Since the input will be smoother, the resulting plot of the transform is also smoother. The following plot shows the original RSI, but the transform is being performed on a 9 period exponentially smoothed RSI.



Averaging the input data has created a smoother transform plot. The turning points are still sharply peaked with a rapid transition from one extreme to the other. The example is of a sideways market with a narrow range, which is very difficult to trade.

Now, lets investigate the RSI and its inverse Fisher transform in a trending market.

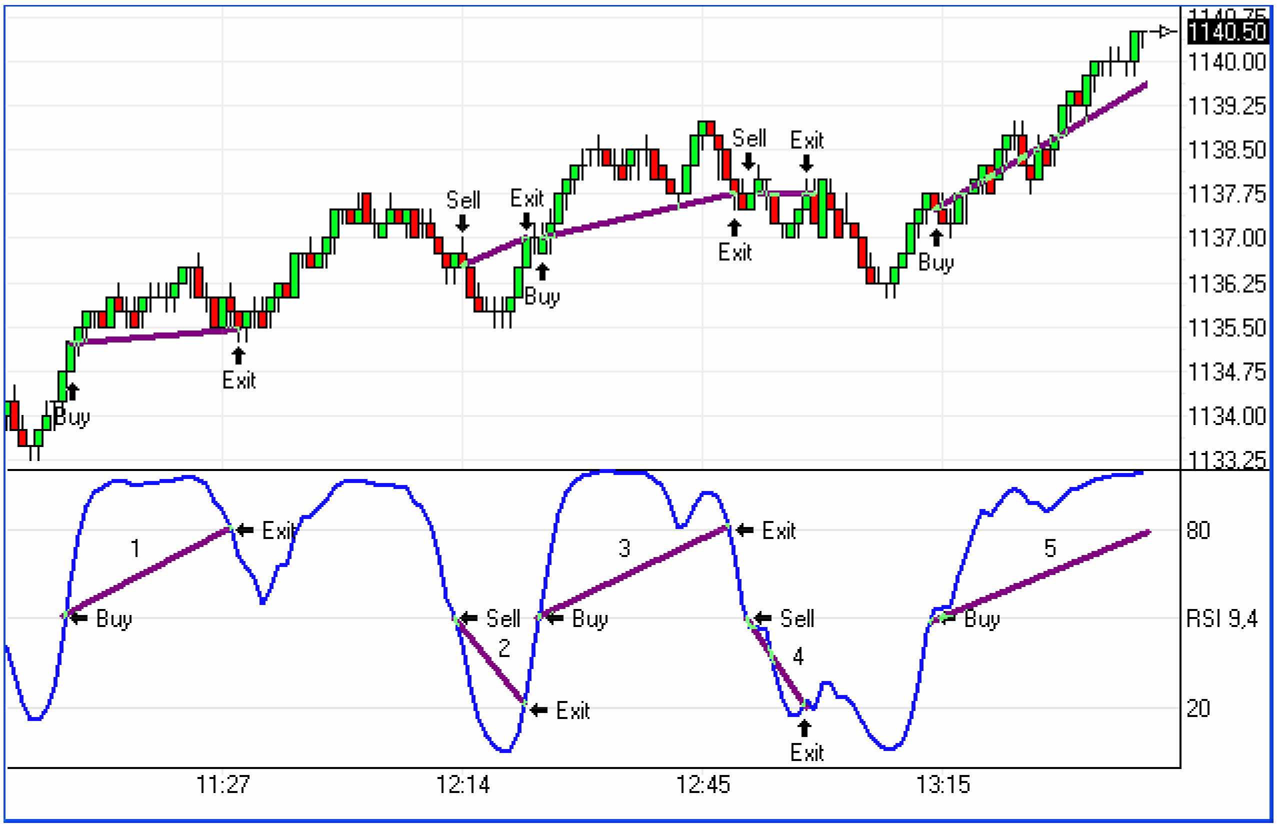


In this example, the inverse Fisher transform of the averaged RSI is showing smooth swings. Let's see if we can identify some trading signals from this plot of the inverse Fisher transform. Though there are an infinite number of possibilities, lets incorporate one of the characteristics of the Fisher transform. Remember it will make a rapid transition from one extreme to the other. Thus the crossing of the midpoint or 50% level will typically be a crisp crossing, as is demonstrated in the example shown above.

For the investigation, lets work with the following rules to define the buy, sell and exit signals.

- **Buy** - When the Fisher crosses 50 going up.
- **Sell** - When the Fisher crosses 50 going down.
- **Exit Longs** - When the Fisher is above 80 and crosses below 80.
- **Exit Shorts** - When the Fisher is below 20 and crosses above 20.

These rules are simple enough. The following plot shows where the signals would occur.



The chart shows a 7 point move over a 3 hour period. And the hope is that the sharper swings from the inverse Fisher transform will help us profitably pocket a good chunk of that move. Here are the results of the 5 trades from our trading signals defined above and marked on the chart with thick purple lines.

Trade	Points
1	+ 0.25
2	- 1.00
3	+ 0.75
4	0
5	+ 2.25

Unfortunately, the results are not as favorable as the initial impression had been. For the trading results, the execution price used was the Close of the bar that gives the signal. No commission is factored into the results. After 5 trades over a 3 hour period, in a fairly typical trend in the ES market, 2 small winners pay for 1 small loser. One trade was a wash. And the 5th trade represents the total profit for our exercise. The Net for the 5 trades is + 2.25 points, before commissions and slippage are factored in.

A quick examination of the signals in the choppy market shown in the 2nd chart result in 13 losing trades in a row, and no winners. The 13 losses are all small, but they do add up and the fact there are 13 trades without a winner is painful.

In summary, our trading rules seemed so promising and the rapid transition of the Fisher plot from one extreme to the other seemed so clear and useful. Yet, in a typical trending market our system had marginal results and in a choppy market the results were pathetically painful. Some may argue the fault with our trading system was in the selection of the rules, that our entries are too late, or that our exits were either too soon or too late or based on the wrong criteria altogether. Research on variations of the ideas presented in this article should generate better system results.

Finding a trading system based on the inverse Fisher transform of an averaged RSI was not the intent of the article. John Ehlers article in Stocks and Commodities started out with this thesis, "How often have you been indecisive about entering or exiting a trade? Here's one way to get a clear indication." While the inverse Fisher transform may indeed make the signal clearer, it does NOTHING to make the signal better. Pointing out that fact is the purpose of writing this article. A signal that is late, or wrong, is still going to make for a bad trade.

Fisher's article stated that "using the inverse Fisher transform [will] alter the probability distribution function of your indicators." I guess I misread what that meant upon first reading. I had hoped it meant that it would improve on the probability of success in using a study for a trade signal. Now that I have gone through the exercise of programming the Fisher transform into Ensign 10 for the RSI study, and experimented with this study to write this article, I think it is safer to make no claim that using a Fisher transform is going to improve study signals.

The Fisher transform is basically just stretching the middle of the RSI plot outward. Compressing the top 40% of the RSI chart into a 12% band at the top, and compressing the bottom 40% of the RSI chart into a 12% band at the bottom, is the essence of what is happening. This effect is shown by the values in the table for the RSI and its normalized transform.

In this article we used 80% and 20% as trigger levels for the transform signals. These transform levels are achieved when the RSI input is around 57% and 43%. Whether you use the inverse Fisher transform levels of 80% and 20%, or the original RSI input levels of 57% and 43%, it is the same signal trigger! The Fisher transform does nothing to change the quality or probability of the signal or the success of your system rules. Success in designing a trading system that incorporates the inverse Fisher transform of an averaged RSI will have to factor in the characteristics that have been pointed out in this article.

When an article is published, sometimes our desire for finding a 'holy grail' lets our expectations get carried away. We want to attribute sacredness to a new study that we do not yet understand, and proceed with blind hope that somehow yet another mathematical massage of the underlying price data will give us that elusive trading advantage. Having the inverse Fisher transform in your trading tool arsenal is not going to magically change your trading success. It is just another level of mathematical crunching of the price data, but one worthy of additional research.

Article by Howard Arrington