Flexible Relativity

The Self-Adjusting RSI

Here's how you can design self-adjusting overbought–oversold benchmarks for the relative strength index so it can be applied to multiple market conditions.

Period (days)	10	14	20	30	40	70	100
Outside the range (%)	35.3%	26.3	18.4	10.4	6.2	1.8	0.9

FIGURE 1: LIMITATIONS OF THE RSI. When using a periodicity other than 14, the RSI (beyond the oversold/overbought levels) deviates far from acceptable levels.

Momentum indicators such as the relative strength index (RSI) measure the speed at which a security's price is changing. One of the main advantages of such indicators is the early signaling for entry and exit points. However, along with their strengths, they do exhibit some limitations.

With that in mind, I designed a new mode of RSI with self-adjusted overbought–oversold benchmarks. The advantage of this is that it could be applied to multiple market conditions without regard to the calculation period. The basic advantage of the indicator is that it expands the functionality to intermediate and long terms, squeezing its way into the traditional domain of trend-following indicators and making it possible to use it in multiframe analysis.

LIMITATIONS IN THE RSI

The application of the popular RSI is conventionally limited to short-term analysis. But detecting a tradable's strength in the intermediate and long terms is an issue that is just as important, if not more. As you are probably aware, the RSI fluctuates around a centerline and highlights overbought and oversold extremes relative to the 30 and 70 benchmarks. But it is usually more accurate when calculated using a 14-day period. Anything beyond tends to yield errors.

If you take a look at Figure 1, you'll see the percentage of RSI values that fall outside the conventional overbought–oversold range (30–70%) for the

by David Sepiashvili

Russell 3000 index. As you can see, beyond the conventional 14-day period, the RSI deviates from the accepted percentage of values (20–30%). This is how much they are supposed to extend from the overbought–oversold levels in order to provide reliable readings of the extremes. The error increases with mid-term and long-term periods, where the 30–70 levels are too wide for the narrowed RSI curve. This causes it to miss most of the overbought and oversold signals.

This happens because of a variable attenuation factor in the stock market time series. The magnitude of this factor is based on the number of days used in the calculation. A higher calculation period results in a greater impact of accumulated losses and the resulting attenuation factor. The statement gives insight into why, in relation to the accepted overbought and oversold benchmarks, the range of the RSI widens when using a period below 14 days and narrows more in the opposite direction as the calculation period deviates from the usual 14 days.

SOLVING THE PROBLEM

So how do you identify these overbought and oversold conditions for any periodicity and apply the RSI beyond the conventional short-term period? There are two ways to make the RSI flexible enough to do this:

1 Adjust the RSI to conventional overbought and oversold benchmarks.

2 Adjust the benchmarks of the RSI with a variable range. To do this, you must apply different, adaptive benchmarks.

LISA HANEY

Index	Test period (years)	Range	Calculation period (days)							Mean
			10	14	20	30	40	70	100	
RUI	13	50 ± 20	32.5	24.2	17.0	9.3	5.8	2.2	1.1	13.2
		50 ± 1.8 SD	23.9	24.0	21.8	21.9	23.6	24.4	29.1	24.1
RUT	18	50 ± 20	45.4	38.4	29.5	21.6	16.5	9.0	6.0	23.8
		50 ± 1.8 SD	28.4	29.4	27.3	23.4	23.6	18.0	17.0	23.9
RUA	18	50 ± 20	35.3	26.3	18.4	10.4	6.2	1.8	0.9	14.2
		50 ± 1.8 SD	23.4	23.4	21.0	20.4	22.1	24.8	27.2	23.2
DJI	40	50 ± 20	38.2	29.3	20.0	10.8	6.4	1.5	0.8	15.3
		50 ± 1.8 SD	22.9	21.3	19.7	19.8	21.2	22.8	24.2	21.7
GSPC	20	50 + 20	33.7	25.7	17.4	10.1	6.2	1.8	0.8	13.7
		50 ± 1.8 SD	23.7	23.2	20.8	21.0	21.4	22.3	28.3	23.0
NDX	19	50 ± 20	33.8	25.5	18.6	10.6	6.2	1.7	0.6	13.9
		50 ± 1.8 SD	23.3	23.2	22.7	22.1	25.2	25.2	22.4	23.4
SML	9	50 ± 20	38.7	30.6	22.4	15.2	10.3	4.2	2.4	17.7
		50 ± 1.8 SD	25.7	27.1	24.2	21.9	21.3	16.1	19.7	22.3
TNX	40	50 ± 20	44.5	36.8	29.2	20.3	13.9	4.7	1.9	21.6
		50 ± 1.8 SD	28.4	27.2	24.5	23.0	22.4	19.4	18.5	23.3
Average mean		50 ± 20								16.7
		50 ± 1.8 SD								23.1

FIGURE 2: OUTSIDE THE RANGE. Here's the percentage of RSI values that fall outside the range of overbought/oversold levels.

If you decide to go with the first alternative, you have to leave the conventional benchmarks 30–70 and construct a new RSI curve that will account for a variable attenuation factor of a time series. This wide-range RSI will widen when the number of periods used in the calculation is above 14, and narrow when it is below 14. In this article I will not be discussing the first method; instead, I will be discussing the second approach, which keeps the conventional RSI unchanged but adjusts the overbought and oversold benchmarks.

SELF-ADJUSTED BENCHMARKS

The magnitude of the RSI fluctuations around the centerline varies based on the calculation period. The shorter the period, the wider the range; the longer the period, the narrower the range. In an effort to create overbought and oversold benchmarks adequate to these conditions, the volatility of RSI has been considered since it contains information on the process parameter, or the degree of expansion and contraction of the range. The volatility is calculated as the standard deviation of RSI from its mean. A standard deviation is added to the centerline to create the overbought benchmark, and is subtracted from the centerline to construct the oversold benchmark:

Overbought benchmark: $\text{Upper} = 50 + k * SD_n(RSI_n)$

Oversold benchmark: $\text{Lower} = 50 - k * SD_n(RSI_n)$

where n is a calculation period and SD is the standard deviation. The standard deviation calculation is not provided here since it is straightforward.

Using a smoothed absolute deviation of RSI from its mean is simpler in construction than the standard deviation and is just as effective in calculating overbought–oversold benchmarks.

Overbought benchmark:
$$\text{Upper} = 50 + c * SMA_n \left| RSI_n - SMA_n(RSI_n) \right|$$

Oversold benchmark:
$$\text{Lower} = 50 - c * SMA_n \left| RSI_n - SMA_n(RSI_n) \right|$$

The multipliers k and c are selected to ensure that approximately 70–80% of RSI values confine within the range of overbought and oversold levels. When the RSI moves above the upper benchmark it indicates an overbought market, and when it moves below the lower benchmark the market is oversold. My research shows that the multipliers that satisfy this condition should, on average, be $k = 1.8$ and $c = 2.0$.

Regardless of which deviation measure you use in calculating self-adjusted benchmarks, you get similar results. The formula of the RSI curve remains the same as in the case of $n = 14$:

$$RSI_n = \left(\frac{U_n}{(U_n + D_n)} \right) * 100$$

where:
U_n = n-point SMA of (Price – Previous price) positive values
D_n = n-point SMA of (Price – Previous price) negative values

EMPIRICAL EVIDENCE

Figure 2 displays empirical evidence to support the calculation. Some of the most popular US stock market indexes were

Index	Test period (years)	Calculation period (days); range			
		14;(50±20)	14;(50±1.8 SD)	40;(50±1.8 SD)	100;(50±1.8 SD)
RUI	13	(30-70) / 24.2	(29-71) / 24.0	(37.5-62.5) / 23.6	(42-58) / 29.1
RUT	18	(30-70) / 38.4	(28-72) / 29.4	(34-66) / 23.6	(38.5-61.5) / 16.7
RUA	18	(30-70) / 26.3	(29-71) / 23.4	(37-63) / 22.1	(41.5-58.5) / 27.2
DJI	40	(30-70) / 29.3	(28-72) / 21.3	(37-63) / 21.2	(42-58) / 24.2
GSPC	20	(30-70) / 25.7	(29-71) / 23.2	(37.5-62.5) / 21.4	(42-58) / 28.3
NDX	19	(30-70) / 25.5	(30-70) / 23.2	(38-62) / 25.2	(42-58) / 22.1
SML	9	(30-70) / 30.6	(27.5-72.5) / 27.1	(34-66) / 21.3	(37.5-62.5) / 19.7
TNX	40	(30-70) / 36.8	(27.5-72.5) / 27.2	(35.5-64.5) / 22.4	(40-60)/ 18.4

FIGURE 3: USING IT IN A MULTIFRAME ANALYSIS. Here you see an averaging of overbought/oversold levels for the more popular stock indexes for 14 days, 40 days, and 100 days.

selected and tested over a sufficiently long period. The table provides the percentage of RSI values that fall outside the range specified (50 + 1.8 standard deviation). They are supposed to be within the interval of 20–30%. For comparison purposes, the values are also calculated for the conventional range (50 + 20).

In the table, you see an overview of the actual values of the percentage of RSI values that fall outside the range for the conventional preset overbought–oversold levels (30–70%). The percentage of values outside the range decreases inverse to the length of the period used in the calculation. The RSI of the shorter period is usually more volatile, with the values falling outside the range more often than for a longer-period RSI.

The percentage outside of the range for the conventional RSI ($n = 14$) should be within the interval of 20–30%, but indexes of small-cap companies demonstrate that percentage to be above 30%. For example, for the Russell 2000 (RUT), the RSI fell outside the range 38.4% of the time. For the S&P Small Cap Index (SML), the percentage was 30.6%. A similar scenario can be seen for the 10-year Treasury note (TNX), with the percentage being 36.8%.

The self-adjusted overbought–oversold benchmarks with the recommended number of standard deviations above and below the centerline (50 ± 1.8 SD) provide stability for RSI values falling beyond the overbought–oversold benchmarks. In the case of Russell 3000 index, the values for the conventional benchmarks lie within the 0.9–35.3 interval. The self-adjusted overbought–oversold benchmarks for the same index remain within the 20.4–27.2 interval, which is five times less.

For all the indexes tested during the seven time periods (10 days to 100 days), the values are distributed within 16.1–29.4%. The percentage of RSI values that fall outside the accepted constant overbought–oversold levels (30–70) vary within an interval of 0.9–45.4%, which is wide. The results support the statement that readings of the RSI extremes relative to the self-adjusted benchmarks can reliably identify overbought–oversold conditions.

As you can see from Figure 2, the percentage outside the range of overbought–oversold levels is dictated not only by the length of the period used in calculation but also varies from index to index, depending on the type of index being considered. If you follow the values across different indexes, we will see that mean values lie within the 21.7–24.1% interval for the self-adjusted benchmarks, and within 13.2–23.8% for the conventional constant benchmarks.

Note that the indexes of small-cap companies display high average values for the percentage of RSI values outside the conventional preset overbought–oversold levels: RUT (23.8%); SML (17.7%). An analogous picture can be observed with 10-year Treasury notes (TNX, 21.6%).

It is interesting to see how the range bordered by self-adjusted overbought and oversold benchmarks varies as a function of the calculation period. Figure 3 gives you an overview of the averaged overbought–oversold benchmarks for the most popular US stock market indexes over three different periods (14 days, 40 days, and 100 days). The corresponding RSI values falling outside the range are also presented.

Using the RSI for different periods gives you a balanced view, or a "big picture."

CTXS - Citrix Systems, Inc.   Jan 02-2002 to Jul-01-2004 (Daily)   Copyright © 1998-2004 David Sepiashvili - Alticom, Inc.
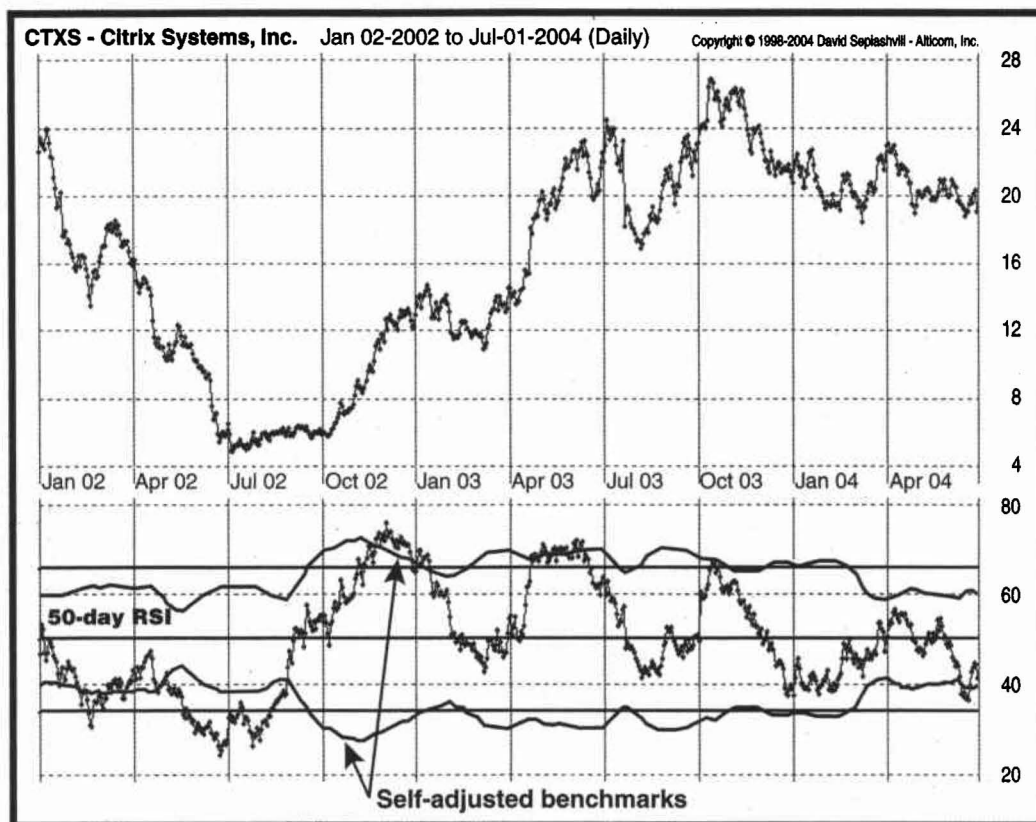
FIGURE 4: RSI WITH SELF-ADJUSTED OVERBOUGHT AND OVERSOLD BENCHMARKS: Here you see how the 50-day RSI highlights overbought and oversold extremes, indicates divergences, and provides bullish and bearish readings to identify and monitor the current trend.

VZ - Verizon Communications   2003–2004 (Daily)   Copyright © 1998-2004 David Sepiashvili - Alticom, Inc.
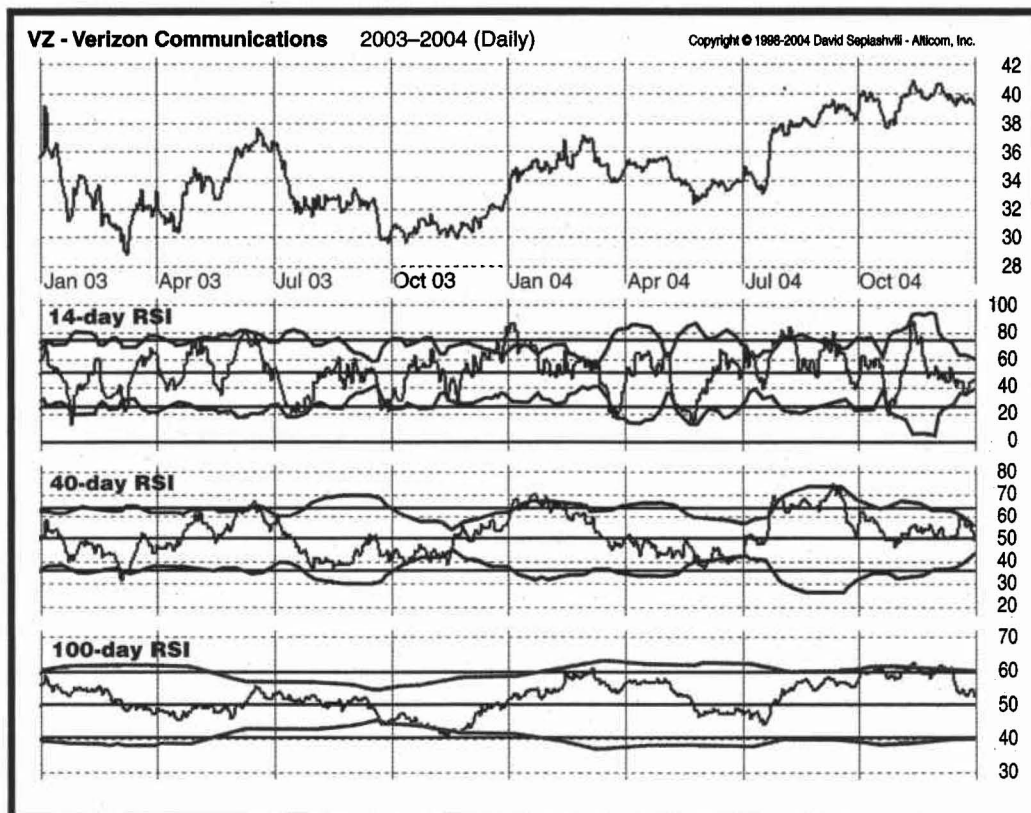
FIGURE 5: MULTIFRAME REPRESENTATION. A set of RSI indicators of different time frames (for example, 14-day, 40-day, and 100-day periods) complement each other by demonstrating the advantages in estimating momentums behind the security of different terms.

From the table, you can see that the range of overbought/oversold levels of the self-adjusted RSI of the large-cap indexes nearly matches the conventional one. For the more volatile indexes of small-cap companies and for the 10-year Treasury note, the range is wider. For the RUT, the range is 10% higher, and 12.5% higher for the SML and TNX than the conventional one.

By increasing the time period, the overbought–oversold levels tighten, on average, about 1.5 times for the 40-day calculation period for all indexes considered, and more than twice for the 100-day calculation period. As for RUT, SML, and TNX, the overbought values remain higher than the average values, while the oversold levels remain lower than the average ones.

INTERPRETING IT

Interpreting the RSI with self-adjusted overbought–oversold benchmarks is, with minor reservations, similar to that of the classic 14-day RSI with the conventional preset benchmarks. You can use the indicator to identify overbought–oversold areas relative to the benchmarks, positive and negative divergences from the price trend, and for crosses above and below the centerline. In addition, smoothing with averaging period benchmarks SMA(upper, M) and SMA(lower, m) can give you information about mean values, which further help in identifying overbought–oversold conditions.

In Figure 4, the 50-day RSI of Citrix Systems (CTXS) with self-adjusted overbought and oversold benchmarks (blue) and their mean values (shown as horizontal

line, purple) is displayed. Note the importance of the trading signals when there are overbought and oversold crossovers. You can also look for divergences opposite to the prevailing trend. Prices in an upward trend lasting from August 2002 to November 2003 are continually reaching new highs, while peaks of the mid-term RSI get lower and lower. This suggests that a trend reversal could be in the offing. This indicator can also be used to identify bullish and bearish readings by looking for centerline crossovers.

THE BIG PICTURE

The time series of securities contain a number of cycles with different lengths that exist in several time frames simultaneously. Expanding the application area of RSI with self-adjusted overbought–oversold benchmarks allows you to use the indicators during different time frames without regard to the calculation period. Using the RSI for different periods gives you a balanced view, or a "big picture," which reflects the momentum characteristics of the constituent cycles simultaneously as a whole.

A multiframe set of the 14-day, 40-day, and 100-day RSI in Figure 5 of Verizon Communications (VZ) shows that the most dominating cycle is the 40-day. If the first cycle is not confirmed by the 100-day RSI, the two successive cycles are supported by its readings, signaling that the upward price trend has not yet lost momentum. As you can see, the common rule is in effect: When the longer-period indicator supports the lower-period one, the chances of success are enhanced. The 14-day RSI provides more detailed information about the process, thus generating earlier entry and exit signals.

David Sepiashvili is a doctoral candidate in signal processing (Carnegie Mellon University, Pittsburgh, PA). One of the applications of his scientific efforts is financial time-series analysis. He is president of Alticom, Inc., which has developed a number of solutions for stock market technical analysis (www.alticom.com). He can be reached via email at dasepi@qanalyst.org.

SUGGESTED READING

Sepiashvili, David [2004]. "Trend-Quality Indicator," *Technical Analysis of* STOCKS & COMMODITIES, Volume 22: April.

‡Alticom

†See Traders' Glossary for definition
‡See Editorial Resource Index

S&C
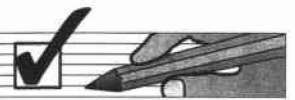
Here is this month's selection of Traders' Tips, contributed by various developers of technical analysis software, all to help readers more easily implement some of the strategies presented in this issue.

*Internet users will also find these and most previous Traders' Tips at our website at www.**Traders.com**. To locate the various tips, use our site's search engine, or click on the STOCKS & COMMODITIES magazine link on the left-hand side of our homepage, then scroll down to the "**This month in S&C**" section on the left-hand side and look for "Traders' Tips." For previously published Traders' Tips, click on the "**Back issues archive**" located under the "This month in S&C" section, or use the search engine. Code can then be copied and pasted into your program.*

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✦ TRADESTATION: SELF-ADJUSTING RSI

David Sepiashvili's article, "The Self-Adjusting RSI," presents a technique to adjust the traditional RSI overbought and oversold thresholds so as to ensure that 70–80% of RSI values lie between the two thresholds. Sepiashivili presents two algorithms for adjusting the thresholds. One is based on standard deviation, the other on a simple moving average of the RSI. No explicit technique to ensure the 70–80% conformance is presented.

Both threshold adjustment options are available in the following indicator code. The algorithm used depends on the user's setting of the "type" input. Altogether, three sets of EasyLanguage code are provided here: the basic self-adjusted RSI indicator; a tool for ensuring the 70–80% conformance is achieved; and a simple strategy. To download this code, search for the file "SelfAdjRsi.eld" in the "TradeStation and EasyLanguage Support" discussion forum at the TradeStation Support Center at TradeStation.com.

Indicator: _SelfAdjRSI

```
inputs:
    Type( 1 ), { Enter 1 for StdDev, 2 for SMA }
    Length( 14 ),
    K( 2.8 ),
    StdOverBought( 80 ),
    StdOverSold( 20 ) ;

variables:
    MyRSI( 0 ),
    AvgMyRSI( 0 ),
    KAbsAvg( 0 ),
    OverBought( 0 ),
    OverSold( 0 ),
    KSDMyRSI( 0 ) ;

MyRSI = RSI( Close, Length ) ;

if Type = 1 then
    begin
    AvgMyRSI = Average( MyRSI, Length ) ;
    KAbsAvg = K * Average( AbsValue( MyRSI - AvgMyRSI ),
     Length ) ;
    OverBought = 50 + KAbsAvg ;
```

```
    OverSold = 50 - KAbsAvg ;
    end
else
    begin
    KSDMyRSI = K * StdDev( MyRSI, Length ) ;
    OverBought = 50 + KSDMyRSI ;
    OverSold = 50 - KSDMyRSI ;
    end ;

if CurrentBar > 3 * Length then { starting-point
 dependent calculations complete }
    begin
    Plot1( OverBought, "OverBought" ) ;
    Plot2( OverSold, "Oversold" ) ;
    Plot3( MyRSI, "RSI" ) ;
    Plot4( StdOverBought, "OB" ) ;
    Plot5( StdOverSold, "OS" ) ;
    end ;
```

Indicator: _SelfAdjRSI_PctCheck

```
inputs:
    Type( 1 ), { Enter 1 for StdDev, 2 for SMA }
    Length( 14 ),
    K( 2 ),
    UpperGoal( 80 ),
    LowerGoal( 70 ) ;

variables:
    MyRSI( 0 ),
    AvgMyRSI( 0 ),
    KAbsAvg( 0 ),
    OverBought( 0 ),
    OverSold( 0 ),
    KSDMyRSI( 0 ),
    TripleLength( 0 ),
    Count( 0 ),
    PctCheck( 0 ) ;

MyRSI = RSI(Close,Length) ;

if Type = 1 then
    begin
    AvgMyRSI = Average( MyRSI, Length ) ;
    KAbsAvg = K * Average( AbsValue( MyRSI - AvgMyRSI ),
     Length ) ;
    OverBought = 50 + KAbsAvg ;
    OverSold = 50 - KAbsAvg ;
    end
else
    begin
    KSDMyRSI = K * StdDev( MyRSI, Length ) ;
    OverBought = 50 + KSDMyRSI ;
    OverSold = 50 - KSDMyRSI ;
    end ;

TripleLength = 3 * Length ;

if CurrentBar > TripleLength then { starting-point
 dependent calculations complete }
    begin
    if MyRSI > OverSold and MyRSI < OverBought then
            Count = Count + 1 ;
    PctCheck = Count / ( CurrentBar - TripleLength ) * 100 ;
    Plot1( PctCheck, "PctCheck" ) ;
    Plot2( UpperGoal, "UpperGoal" ) ;
    Plot3( LowerGoal, "LowerGoal" ) ;
    end ;
```

Strategy: _SelfAdjRSI

```
inputs:
    Length( 14 ),
    K( 2 ) ;

variables:
```

```
MyRSI( 0 ),
KSDMyRSI( 0 ),
OverBought( 0 ),
OverSold( 0 ) ;

MyRSI = RSI( Close, Length ) ;
KSDMyRSI = K * StdDev( MyRSI, Length ) ;
OverBought = 50 + KSDMyRSI ;
OverSold = 50 - KSDMyRSI ;

if MyRSI crosses over OverSold then
    Buy next bar market ;

if MyRSI crosses under OverBought then
    Sell short next bar at market ;
```

—Mark Mills
TradeStation Securities, Inc.
A subsidiary of TradeStation Group, Inc.
www.TradeStationWorld.com

FIGURE 1: WEALTH-LAB, SELF-ADJUSTING RSI. The adaptive benchmarks used for entry/exit signals (shown as blue lines in the RSI pane) change according to the RSI volatility. The system performs well with Bea Systems (BEAS) during the test period shown.

MetaStock®

✦ METASTOCK: SELF-ADJUSTING RSI

David Sepiashvili's article, "The Self-Adjusting RSI," describes two methods of adjusting the width of the overbought and oversold bands for the RSI.

Both of these methods have been incorporated into a single MetaStock indicator. This formula will prompt for the length of the RSI; the constants used to calculate the bands; and the method to calculate the bands.

To enter this indicator into MetaStock:

1. In the **Tools** menu, select **Indicator Builder**.
2. Click **New** to open the Indicator Editor for a new indicator.
3. Type the name of the formula.
4. Click in the larger window and type in the following formula:

```
Name:  Self-Adjusting RSI
Formula:
x:=Input("number of periods for RSI",1,2000,14);
k1:=Input("standard deviation constant",0.1,5,1.8);
c1:=Input("SMA constant",0.1,5,2);
m1:=Input("method <1=SD/2=SMA>",1,2,1);
top:=If(m1=1,
50+(k1*Stdev(RSI(x),x)),
50+(c1*Mov(Abs(RSI(x)-Mov(RSI(x),x,S)),x,S)));
bottom:=If(m1=1,
50-(k1*Stdev(RSI(x),x)),
50-(c1*Mov(Abs(RSI(x)-Mov(RSI(x),x,S)),x,S)));
RSI(x);
top;
bottom
```

5. Click **OK** to close the Indicator Editor.

—William Golson
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✦ WEALTH-LAB: SELF-ADJUSTING RSI

Visit www.wealth-lab.com to try out this month's ChartScript adaptation by searching the public ChartScript titles for the words "self-adjusting RSI," and then entering a symbol of your choice. The ChartScript trading system is available to all Wealth-Lab Pro and Developer users via the Community| Download ChartScripts action.

The Chartscript provided uses the traditional RSI rules, going long when the RSI indicator crosses over its lower benchmark and exiting when it crosses below the upper benchmark. Lower and upper benchmarks are calculated in lines 10-14 of the script according to the article's explanation. Similar to the example presented in the article, we use a period n of 50 days and a multiplier c of 2 (Figure 1).

```
var bar, rsi1, upper, lower, rsipane: integer;

const n = 50;  //Period for RSI
const c = 2;   //Multiplier

//Creating indicator
rsi1 := RSISeries(#Close,n);

//Creating upper/lower benchmarks
upper :=
SMASeries(ABSSeries(SubtractSeries(RSISeries(#Close,n),
SMASeries(RSISeries(#Close, n),n))),n);
upper := MultiplyseriesValue(upper,c);
lower := MultiplySeriesValue(upper,-1);
upper := AddSeriesValue(upper,50);
lower := AddSeriesValue(lower,50);

// Charting
rsipane := CreatePane(100, true, true);
PlotSeriesLabel(upper, rsipane,#blue,#thick,'Upper  benchmark
('+inttostr(n)+')');
PlotSeriesLabel(rsi1, rsipane,#black,#thin,'RSI ('+inttostr(n)+')');
PlotSeriesLabel(lower, rsipane,#blue,#thick,'Lower  benchmark
('+inttostr(n)+')');
```
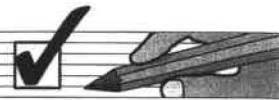
```
for Bar := n*3 to BarCount - 1 do //n*3 is needed to stabilize the
RSI indicator
begin
  if not LastPositionActive then
  begin
   if CrossOver(Bar, rsi1, lower) then
     BuyAtMarket(Bar+1, 'Long');
  end
  else If CrossUnder(Bar, rsi1, upper) then
    SellAtMarket(Bar+1, LastPosition, 'Exit Long');
end;
```

— José Cruset
www.wealth-lab.com

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✦ AMIBROKER: SELF-ADJUSTING RSI

In "The Self-Adjusting RSI," author David Sepiashvili presents an idea for using dynamic overbought/oversold zones with the classic RSI indicator. Implementing dynamic self-adjusting benchmark lines is easy and straightforward in AmiBroker's Formula Language. Ready-to-use code is provided in Listing 1. After applying the indicator, the parameter window can be used to control the parameters such as averaging period.

LISTING 1
```
p = Param("Periods", 14, 2, 100, 1 );
r = RSI( p );
w = 1.8 * StDev( r, p );

Plot( r, "RSI(" + p +")", colorBlack, styleThick );
Plot( 50 + w, "OB", colorLightBlue, styleThick );
Plot( 50 - w, "OS", colorLightBlue, styleThick );

allbars = LastValue( Cum(1) ) - 2 * p - 1;

Plot( LastValue( MA( 50 + w, allbars ) ), "MeanOB",
    colorRed, styleNoLabel );
Plot( LastValue( MA( 50 - w, allbars ) ), "MeanOS",
    colorRed, styleNoLabel  );
```

This code is also available at www.Traders.com or www.amibroker.com/members/.

—Tomasz Janeczko, AmiBroker.com
www.amibroker.com

eSignal

✦ eSIGNAL: SELF-ADJUSTING RSI

For this month's article by David Sepiashvili, "The Self-Adjusting RSI," we've provided the following eSignal formula, named "SelfAdjRSI.efs." The study plots the standard RSI and the self-adjusting RSI overbought-oversold benchmarks.

Through the Edit Studies option in the Advanced Chart, there are several study parameters that may be customized. The study parameters allow you to set the number of periods for the RSI, the adjustment type (standard deviation or smoothed absolute deviation), as well as the *k* and *c* values for the respective adjustment types.

To discuss this study or to download a complete copy of the formula, visit the **EFS Library Discussion Board forum** under the Bulletin Boards link at www.esignalcentral.com. The eSignal formula script (EFS) is also available for copying and pasting from the STOCKS & COMMODITIES website at Traders.com.

```
/*****************************************
Provided By : eSignal (c) Copyright 2005
Description:  Self-Adjusting RSI - by David Sepiashvili

Version 1.0  12/07/2005

Notes:
February 2006 Issue of Stocks & Commodities magazine

* Study requires version 7.9 or higher.

Formula Parameters:            Defaults:
RSI Periods                    14
Adjustment Type                Standard Deviation
    [Standard Deviation, Smoothed Abs Deviation]
k Value (Standard Deviation)   1.8
c Value (Smoothed Abs Deviation)  2.0
*****************************************/
function preMain() {
    setStudyTitle("Self-Adjusting RSI ");
    setShowTitleParameters(false);
    setCursorLabelName("SA Upper", 0);
    setCursorLabelName("RSI", 1);
    setCursorLabelName("SA Lower", 2);
    setDefaultBarThickness(2, 0);
    setDefaultBarThickness(2, 1);
    setDefaultBarThickness(2, 2);
    setDefaultBarFgColor(Color.aqua, 0);
    setDefaultBarFgColor(Color.navy, 1);
    setDefaultBarFgColor(Color.aqua, 2);
    addBand(65, PS_SOLID, 2, Color.magenta, "upper");
    addBand(35, PS_SOLID, 2, Color.magenta, "lower");
    setStudyMax(100);
    setStudyMin(0);

    var fp1 = new FunctionParameter("nRSIlen",
FunctionParameter.NUMBER);
    fp1.setName("RSI Periods");
    fp1.setDefault(14);
    var fp2 = new FunctionParameter("sType",
FunctionParameter.STRING);
    fp2.setName("Adjustment Type");
    fp2.addOption("Standard Deviation");
    fp2.addOption("Smoothed Abs Deviation");
    fp2.setDefault("Standard Deviation");
    var fp3 = new FunctionParameter("nK",
FunctionParameter.NUMBER);
    fp3.setName("k Value (Standard)");
    fp3.setLowerLimit(0);
    fp3.setDefault(1.8);
    var fp4 = new FunctionParameter("nC",
FunctionParameter.NUMBER);
    fp4.setName("c Value (Smoothed Abs)");
    fp4.setLowerLimit(0);
    fp4.setDefault(2);
}
```
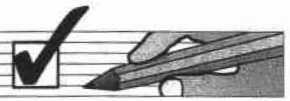
[***Editor's note:*** The eSignal code has been truncated here for space considerations. The rest of the code can be found at eSignal's website or at Traders.com.]

—Jason Keck
eSignal, a division of Interactive Data Corp.
800 815-8256, www.esignalcentral.com

✦ NEUROSHELL TRADER: SELF-ADJUSTING RSI

The self-adjusting RSI indicator described by David Sepiashvili in his article in this issue can be easily implemented in NeuroShell Trader by combining a few of NeuroShell Trader's 800+ indicators.

To implement the overbought and oversold benchmarks, select "New Indicator ..." from the Insert menu and use the Indicator Wizard to create the following indicators:

RSI Overbought Volatility Benchmark
    Add2(50, Mult2(*1.8*, StndDev(RSI(*Close*, N), N)))

RSI Oversold Volatility Benchmark
    Subtract(50, Mult2(*1.8*, StndDev(RSI(*Close*, N), N)))

RSI Overbought Absolute Deviation Benchmark
    Add2(50, Mult2(*2.0*, MovAvg(Abs(Subtract(RSI(*Close*, N), MovAvg(RSI(*Close*, N), N)))))

RSI Oversold Absolute Deviation Benchmark
    Subtract(50, Mult2(*2.0*, MovAvg(Abs(Subtract(RSI(*Close*, N), MovAvg(RSI(*Close*, N), N)))))

For more information on NeuroShell Trader, visit www.NeuroShell.com.

—*Marge Sherald, Ward Systems Group, Inc.*
301 662-7950, sales@wardsystems.com
www.neuroshell.com

✦ INVESTOR/RT: SELF-ADJUSTING RSI

The overbought and oversold benchmarks involved in the self-adjusting RSI, as described by David Sepiashvili in his article in this issue, can be implemented in Investor/RT as custom indicators with the following syntax:

Overbought Benchmark
50 + 1.8 * STD(RSI, 14)

Oversold Benchmark
50 - 1.8 * STD(RSI, 14)

—*Chad Payne, Linn Software*
info@linnsoft.com, www.linnsoft.com

✦ AIQ SYSTEMS: SELF-ADJUSTING RSI

The AIQ code is given below for the two versions of David Sepiashvili's self-adjusting RSI. To test the effectiveness of the self-adjusting overbought and oversold bands, I created a classic RSI entry rule as follows:

Enter a long position if:
1. Yesterday the 14-day RSI is below the oversold benchmark, and
2. Today the 14-day RSI is above the oversold benchmark.

Exit all long positions after five trading days.

Enter a short position if:
1. Yesterday the 14-day RSI is above the overbought benchmark, and
2. Today the 14-day RSI is below the overbought benchmark.

Exit all short positions after five trading days.

The long entries were tested during a bullish-to-sideways period of 10/15/2002 to 12/06/2005 using the NASDAQ 100 stock list. The key statistics from this test are summarized in Table 1 [not shown here but can be viewed at the Traders' Tips section at our website, www.Traders.com—*Editor*].

Both version 1 and version 2 of the self-adjusting RSI resulted in better returns than the classic approach using the fixed benchmarks of 30 for oversold.

For the short test, I used the bearish period from 9/01/2000 to 10/15/2002 using the NASDAQ 100 stock list. The key statistics from this test are summarized in Table 2 [again, not shown here but can be viewed at the Traders' Tips section at our website, www.Traders.com—*Editor*].

Neither version 1 nor version 2 of the self-adjusting RSI was able to outperform the classic RSI short entry rule. It appears that the constants k and c need to be increased for the short entry rule. We did not perform further tests to optimize the k and c parameters.

The AIQ code for the self-adjusting RSI can be downloaded from AIQ's website at http://www.aiqsystems.com/S&C1.htm.

```
! SELF-ADJUSTING RSI
! Author: David Sepiashvili, TASC February 2006
! Coded by; Richard Denning 12/07/2005

! CLASSIC WELLS WILDER RSI:

! DEFINE THE RSI PARAMETER:
W1 is 14.

! FORMULA TO CONVERT WILDER TYPE RECURSIVE
! AVERAGING TO EXPONENTIAL AVERAGING:
! ExponentialPeriods = 2 * WilderPeriod - 1.
L1 is 2 * W1 - 1.

! RSI FORMULA:
Price is [close].
U  is Price - valresult(Price,1).
D  is valresult(Price,1)-Price.
AvgU  is ExpAvg(Iff(U>0,U,0),L1).
AvgD  is ExpAvg(Iff(D>=0,D,0),L1).
RSI  is 100-(100/(1+(AvgU/AvgD))).

! SELF-ADJUSTING BANDS FOR OVERBOUGHT
! AND OVERSOLD LEVELS:
! VERSION 1:
SD is sqrt(variance(RSI,W1)).
K is 1.8.
OB1 is 50 + K * SD.
OS1 is 50 - K * SD.

! VERSION 2:
C is 2.0.
SMArsi is simpleavg(RSI,W1).
OB2 is 50 + C * simpleavg(abs(RSI - SMArsi),W1).
OS2 is 50 - C * simpleavg(abs(RSI - SMArsi),W1).
```
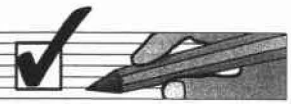
```
! ENTRY RULES FOR TEST OF INDICATORS:
! CLASSIC RSI ENTRY RULES:
LC if RSI < 30.
HC if RSI > 70.
LE if valrule(LC,1) and not LC.
SE if valrule(HC,1) and not HC.

! SELF-ADJUSTING RSI VERSION 1:
LC1 if RSI < OS1.
HC1 if RSI > OB1.
LE1 if valrule(LC1,1) and not LC1.
SE1 if valrule(HC1,1) and not HC1.

! SELF-ADJUSTING RSI VERSION 2:
LC2 if RSI < OS2.
HC2 if RSI > OB2.
LE2 if valrule(LC2,1) and not LC2.
SE2 if valrule(HC2,1) and not HC2.
```

—*Richard Denning, AIQ Systems*
richard.denning@earthlink.net

Trading Solutions

◆ TRADING SOLUTIONS: SELF-ADJUSTING RSI

In his article "The Self-Adjusting RSI," David Sepiashvili provides two methods for adjusting the benchmarks used with the relative strength index: one based on the standard deviation (SD) of recent RSI values, and one based on the smoothed absolute deviation (SAD).

These functions can be entered into TradingSolutions as described below. This is also available as a function file that can be downloaded from the TradingSolutions website (www.tradingsolutions.com) in the Solution Library section. As with many indicators, these functions could make good inputs to neural network predictions. In this case, they would typically be combined with the RSI.

Function Name: Self-Adjusting RSI Overbought Benchmark (SD)
Short Name: SARSI+SD
Inputs: Data, Period, Multiplier (1.8)
Add (50, Mult (Multiplier, StDev (RSI (Data, Period), Period)))

Function Name: Self-Adjusting RSI Oversold Benchmark (SD)
Short Name: SARSI-SD
Inputs: Data, Period, Multiplier (1.8)
Subtract (50, Mult (Multiplier, StDev (RSI (Data, Period), Period)))

Function Name: Self-Adjusting RSI Overbought Benchmark (SAD)
Short Name: SARSI+SAD
Inputs: Data, Period, Multiplier (2.0)
Add (50, Mult (Multiplier, MA (Abs (Sub (RSI (Data, Period), MA (RSI (Data, Period), Period))), Period)))

Function Name: Self-Adjusting RSI Oversold Benchmark (SAD)
Short Name: SARSI-SAD
Inputs: Data, Period, Multiplier (2.0)
Subtract (50, Mult (Multiplier, MA (Abs (Sub (RSI (Data, Period), MA (RSI (Data, Period), Period))), Period)))

—*Gary Geniesse, NeuroDimension, Inc.*
800 634-3327, 352 377-5144
www.tradingsolutions.com

◆ TRADE NAVIGATOR:
SELF-ADJUSTING RSI IN TRADESENSE

In Trade Navigator Gold and Platinum versions, you can create custom functions to display on the chart as indicators. In this way, you can add your own indicators to the indicators already provided in Trade Navigator or you can add indicators from traders who have provided formulas for their indicators in books or magazines.

The TradeSense formula to create the self-adjusting RSI indicator as described by David Sepiashvili requires you to create four functions. We will call the indicators "self adjusting RSI k oversold"; "self adjusting RSI k overbought"; "self adjusting RSI c oversold"; and "self adjusting RSI c overbought." The number of days to use can be edited for each of these indicators by simply changing the "bars in average" on the Chart Settings window. To add the self-adjusting RSI indicators to the list of indicators in Trade Navigator, follow these steps [*Editor's note:* Not printed here. Readers can find the enumerated steps in the Traders' Tips section at our website, www.Traders.com].

For your convenience, we have created a special file that you can download through Trade Navigator, which will add these four indicators to Trade Navigator for you. Simply download the free file "**SCFEB06**" using your Trade Navigator and follow the upgrade prompts.

—*Michael Herman*
Genesis Financial Technologies
*http://www.GenesisFT.com*

BRIGHTSPARK
◆ TECHNIFILTER PLUS: SELF-ADJUSTING RSI

Here are the TechniFilter Plus formulas for the self-adjusted RSI, as described in David Sepiashvili's article in this issue, "The Self-Adjusting RSI."

```
1. NAME: SelfAdjustingRSI_STD
SWITCHES: multiline
PARAMETERS: 1.8,14
FORMULA:
[1]: 50+ &1* CG&2I&2 {c}{nc} {Upper}{rgb#16711680}
[2]: 50- &1* CG&2I&2 {c}    {Lower}{rgb#16711680}
[3]: CG&2 {c}    {rgb#255}
[4]: 70 {c}   {rgb#0}
[5]: 30 {c}   {rgb#0}
[6]: 50 {c}   {rgb#8421504}
COMMENT: Standard deviation method

2. NAME: SelfAdjustingRSI_SAD
SWITCHES: multiline
PARAMETERS: 1.8,2,14
FORMULA:
[1]: 50+&2*(CG&3-Cg&3A&3)U0A&3 {c}{nc} {Upper}{rgb#16711680}
[2]: 50- &2*(CG&3-Cg&3A&3)U0A&3 {c}    {Lower}{rgb#16711680}
[3]: CG&3 {c}   {rgb#255}
[4]: 70 {c}   {rgb#0}
[5]: 30 {c}   {rgb#0}
[6]: 50 {c}   {rgb#8421504}
COMMENT:  Smoothed absolute deviation method
```
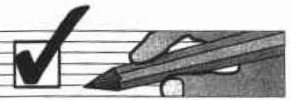
Visit TechniFilter Plus's website to download these formulas.
—Benzie Pikoos, Brightspark
+61 8 9375-1178, sales@technifilter.com
www.technifilter.com

✦ BIOCOMP DAKOTA: SELF-ADJUSTING RSI

David Sepiashvili's self-adjusting RSI is easily implemented in BioComp Dakota, which is our new Swarm Technology walk-forward trading software. Dakota users merely need to create three adaptable parameters: the RSI period and the buy and sell thresholds, such as:

```
ParameterName(1) = "RSI Period"
ParameterMin(1) = 5
ParameterMax(1) = 20

ParameterName(2) = "Buy Threshold"
ParameterMin(2) = 10
ParameterMax(2) = 40

ParameterName(3) = "Sell Threshold"
ParameterMin(3) = 60
ParameterMax(3) = 90
```

Then in the CreateSignal function, use the built-in RSI function and create a conditional evaluation against the thresholds, looking for the transition across them:

```
RSI = Dakota.RSI(PriceHistory,ParameterValue(1))

if PriorRSI < ParameterValue(2) and RSI > ParameterValue(2) then
  Signal = -1
elseif PriorRSI > ParameterValue(3) and RSI < ParameterValue(3) then
  Signal = 1
else
  Signal = PriorSignal
end if

PriorSignal = Signal
```

Automatically, Dakota will create a swarm of RSI trader bots that adapt their periods and thresholds to flock toward current equity gains.

Dakota users can download the full scriptbot script from the private Dakota site at http://www.biocompsystems.com/Dakota.

—Carl Cook, BioComp Systems, Inc.
www.biocompsystems.com/profit
952 746-5761

TICKQUEST
NEOTICKER®

✦ NEOTICKER: SELF-ADJUSTING RSI

In his article "The Self-Adjusting RSI," David Sepiashvili presents an indicator called the adjustable benchmark. This indicator can be implemented as a formula indicator in NeoTicker. The indicator has three parameters:

• RSI period (an integer)
• SMA period (an integer), and
• c (constant multiplier).

The indicator we named the "TASC adjusted benchmark 2" will plot two lines on a chart that correspond to overbought and oversold lines.

TASC adjusted benchmark 2
```
$c := param3;
$n := param1;
$m := param2;
myRSI := rsindex(data1, $n);
plot1 := 50+$c*average(abs(myRSI-average(myRSI,$n)),$m);
plot2 := 50-$c*average(abs(myRSI-average(myRSI,$n)),$m);
```

When adding adjusted benchmarks to a chart, it will be plotted in a different pane than the RSI. In order to put adjusted benchmarks *into* the RSI pane, select the adjusted benchmarks indicator by clicking on the label at the left-hand corner of the pane, hold down the left mouse button, and drag it into the pane where RSI is plotted. The resulting chart will have the benchmarks and RSI plotted in the same pane.

A downloadable version of this indicator and a sample chart group will be available at NeoTicker's Yahoo! User Group website.

—Kenneth Yuen, TickQuest Inc.
www.tickquest.com

✦ TRADECISION: SELF-ADJUSTING RSI

After reading David Sepiashvili's article, "The Self-Adjusting RSI," we gained a new perspective on using RSI and its levels. Based on Sepiashvili's ideas, it's easy to create a trading strategy in Tradecision to generate buy/sell signals based on the RSI with self-adjusted overbought–oversold benchmarks.

First, in the Function Builder, we need to write a new function that returns a "1" in the case where RSI is above the overbought benchmark; "-1" if RSI is under the oversold benchmark; and zero in all other cases.

When we use the standard deviation method, we'll name the new function RSISelfAdjusted:

```
function (price:numeric,length:Numeric):Numeric;
var
  rsiVal:= RSI(price,length);
  stdVal:=StdDev(rsiVal,length);
  scaledVal := 1.8 * stdVal;
end_var

if (rsiVal > 50 + scaledVal ) then return 1;
if (rsiVal < 50- scaledVal ) then return -1;
return 0;
```

When we use the smoothed absolute deviation method, we'll name it RSISelfAdjusted2:

```
function (price:numeric,length:Numeric):Numeric;
var
  rsiVal:= RSI(price,length);
  absVal:= abs( rsiVal - sma(rsiVal,length) );
  scaledVal := 2.0 * sma(absVal, length);
end_var

if (rsiVal > 50 + scaledVal ) then return 1;
if (rsiVal < 50- scaledVal ) then return -1;
return 0;
```