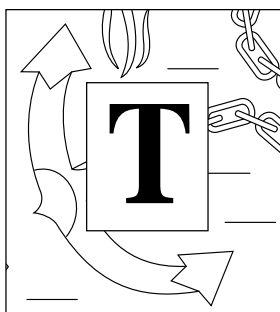


INDICATORS

Anchored Momentum

A centered simple moving average can be used as a reference point when creating technical analysis indicators. Even though a centered simple moving average produces a plot much smoother than its related price plot, the centered moving average technique is generally ignored because it stops short by half of its period. However, some unique and effective momentum indicators can be anchored to a point on a centered simple moving average. Here are the benefits of anchored momentum.

by Rudy Stefenel



Two points on a security price plot can be used to calculate ordinary momentum. A straight line drawn between these points is the momentum line. Figure 1 shows a 27-day centered simple moving average (purple) for the NASDAQ composite index with two different 13-day momentum lines. The ordinary momentum line is green; the anchored momentum line is red. Both end at the closing price on the last day, which is the end of the price plot.

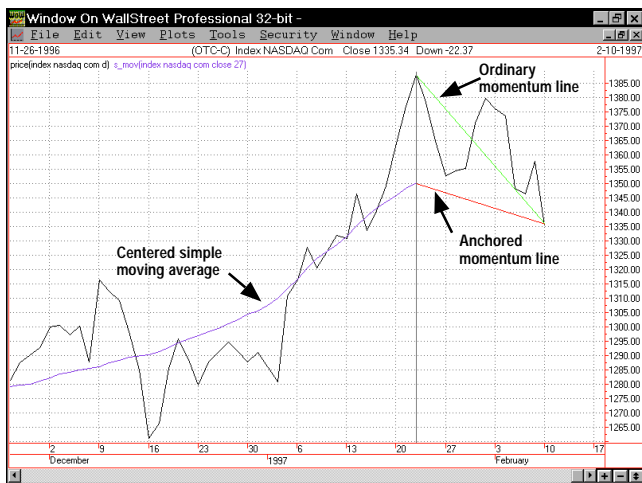


FIGURE 1: MOMENTUM. The ordinary momentum line begins where the composite index price was 13 days earlier, while the anchored momentum line begins where a centered simple moving average ends, which is 13 days earlier than the last day of the price plot. As you can see, anchored momentum is anchored to a centered simple moving average.

The ordinary momentum line begins where the composite index price was 13 days earlier, while the anchored momentum line begins where a centered simple moving average ends, which is 13 days earlier than the last day of the price plot. As you can see, anchored momentum is anchored to a centered simple moving average.

Think of the ends of these momentum lines riding along on the price plot as time passes. The left end of the anchored momentum line is clearly going to have a smoother ride in comparison to the left end of the ordinary momentum line.

ANCHORED MOMENTUM

Compared with the ordinary momentum indicator, the anchored momentum indicator has two important benefits:

- 1 An anchored momentum plot is about half as jagged as the ordinary momentum plot, and more important, the anchored momentum plot does not lag the ordinary momentum plot.
- 2 Anchored momentum represents the action of the security more faithfully than ordinary momentum does.

Figure 2 is an example of these benefits. It shows a chart of the NASDAQ composite index from June 1996 through December 1996. Both the ordinary momentum and the anchored momentum indicators are shown above the price chart. A 10-day, ordinary momentum indicator is green, while a 10-day anchored momentum indicator is red. Seeing the first benefit is easy. Anchored momentum (red) is smoother than ordinary momentum (green), and it is not delayed in relation to the ordinary momentum.

To see the second benefit, look at what happened in mid-August. The ordinary momentum indicator has some large

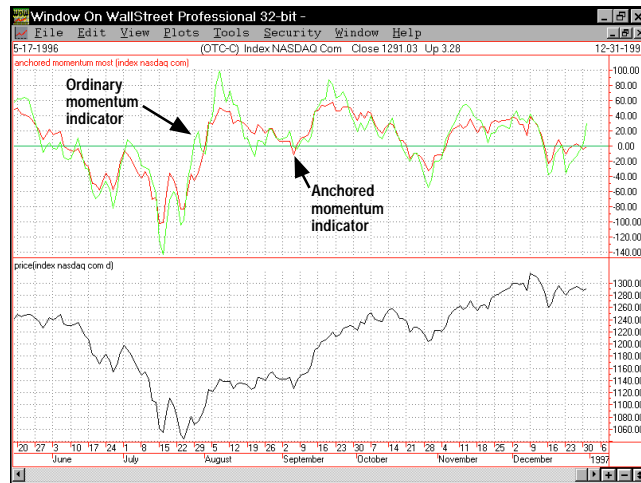
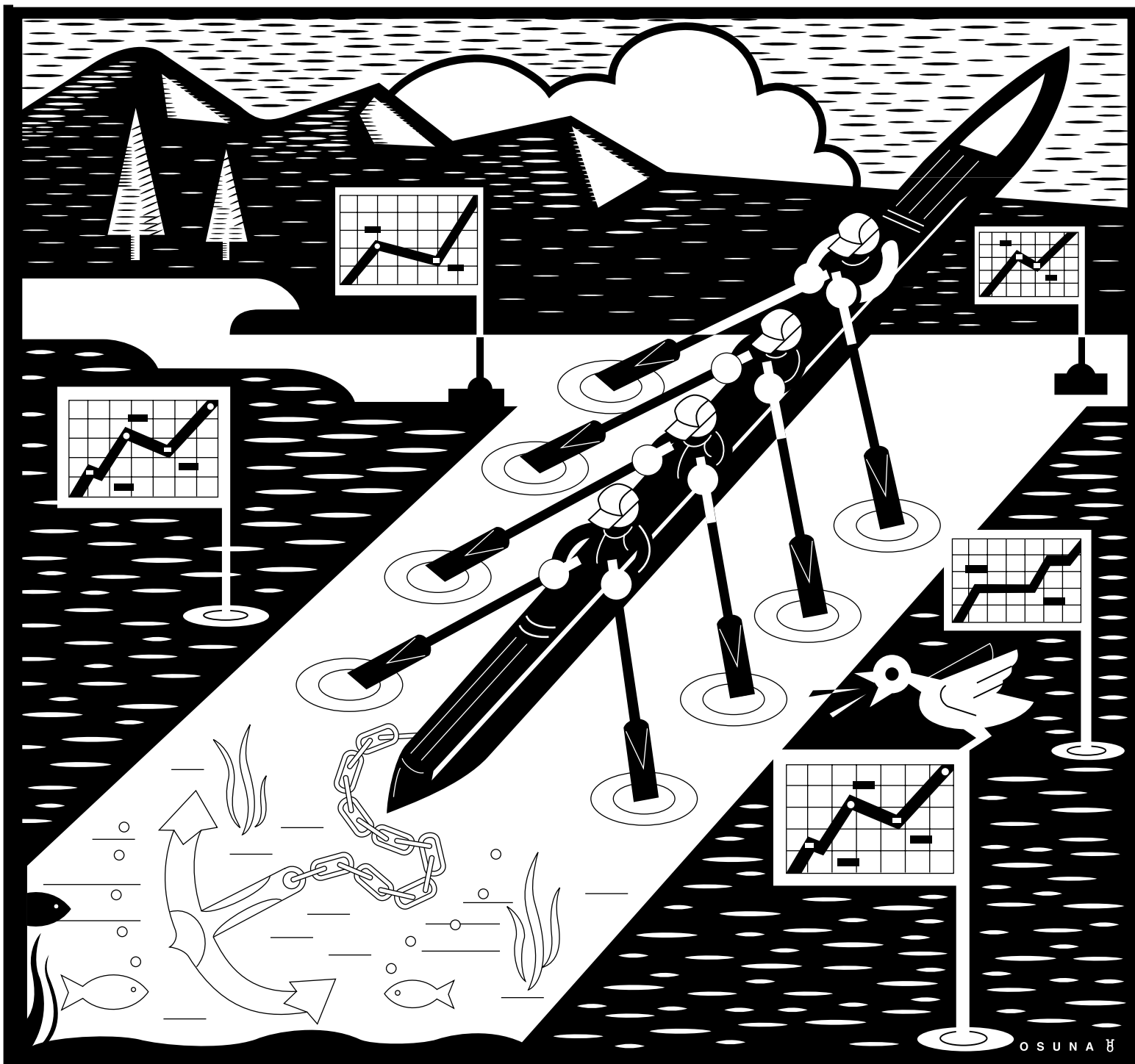


FIGURE 2: NASDAQ COMPOSITE INDEX. A 10-day ordinary momentum indicator is green, and a 10-day anchored momentum indicator is red. Anchored momentum (red) is smoother than ordinary momentum (green), and it is not delayed in relation to the ordinary momentum. The ordinary momentum indicator has some large peaks that were the result of big dips earlier in July. Those dips in July distorted what the ordinary momentum indicator showed later. In contrast, the anchored momentum indicator is hardly influenced by the dips in July, giving a more faithful representation of what the NASDAQ composite index was doing in August.

WINDOW ON WALLSTREET PROFESSIONAL



HANK ASUNA

peaks that were the result of big dips earlier in July. Those dips in July distorted what the ordinary momentum indicator showed later. In contrast, the anchored momentum indicator is hardly influenced by the dips in July, giving a more faithful representation of what the NASDAQ composite index was doing in August.

Let us compare the ordinary momentum indicator with the NASDAQ price plot over the whole period. There is some correlation, but the ordinary momentum indicator plots spikes, while the market is simply leveling off. Not only are recent trading ranges reflected in the indicator, the inverses of past trading ranges are represented in it as well. However, you can clearly see a strong correlation between the fluctuations of the NASDAQ index price and the anchored momentum indicator. There are virtually no artifacts from past trading ranges.

ORDINARY MOMENTUM

Before we discuss calculating anchored momentum, we need to review how ordinary momentum is calculated. Ordinary momentum is simply the difference between the latest price and the older price. The period between these prices is the momentum period.

$$\text{Ordinary momentum} = \text{Latest price} - \text{Older price}$$

Momentum expressed as a percent change is more useful than expressed as a price change. Expressed as percent change, the actions of different securities can be fairly compared and ranked. It is essential to use the same momentum period for each security when their actions are compared.

To express how much the price has changed as a percentage, divide ordinary momentum by the older price and multiply the whole thing by 100. Here is the expression for percent change of ordinary momentum:

$$\text{Percent change ordinary momentum} = 100(\text{Latest price} - \text{Older price}) / \text{Older price}$$

Simplifying this algebraically, we get

$$\text{Percent change ordinary momentum} = 100((\text{Latest price} / \text{Older price}) - 1)$$

CENTERING A SIMPLE MOVING AVERAGE

Before we can develop the anchored counterpart to ordinary momentum, we need to know how much to shift a simple moving average (SMA) in order to center it. First, let us take a simple case, a three-day SMA. The second day is halfway between the first and third days. It is the *middle* day. In this case, we need to shift this SMA one day to the left to center it over the price plot. You can visualize this by identifying the middle day of the moving average period as the day with the same number of days before it as after it in the moving average period.

Mathematically, you would subtract one from the number of days in the moving average period and divide the result by two. To avoid a fractional day shift, you must pick an odd number (of days in this example) for the period of the centered SMA.

For example, using a nine-day simple moving average, subtract one from nine, which leaves eight. Divide eight by two and get four. So we need to shift a nine-day simple moving average four days to the left to center it over the price plot. This is illustrated in Figure 3, which is a plot of the Dow Jones Industrial Average (DJIA) with a nine-day moving average shifted four days to the left. As you can see, the centered SMA is smoother than the price plot; it is not delayed, and it ends four days before the last day of the price plot. It is smoother than the price plot to anchor the left end of a momentum line. To help clarify this, the last nine days of the plot are marked with vertical lines. The vertical line in the center (c) marks the end of the centered SMA.

CALCULATING ANCHORED MOMENTUM

Now we are ready to start calculating anchored momentum. We will use our nine-day centered simple moving average shown in Figure 3. Use the latest price as the right-hand end of the anchored momentum line and anchor the left-hand end of the anchored momentum line to the end of the centered SMA plot. The momentum period is the length of the anchored momentum line and is four days, which is the same as the shift needed to center the simple moving average. The top of Figure 3 shows another comparison of anchored momentum, and the ordinary momentum is presented as well. The momentum period is four days for both.

Here are two forms of anchored momentum, one called *most*

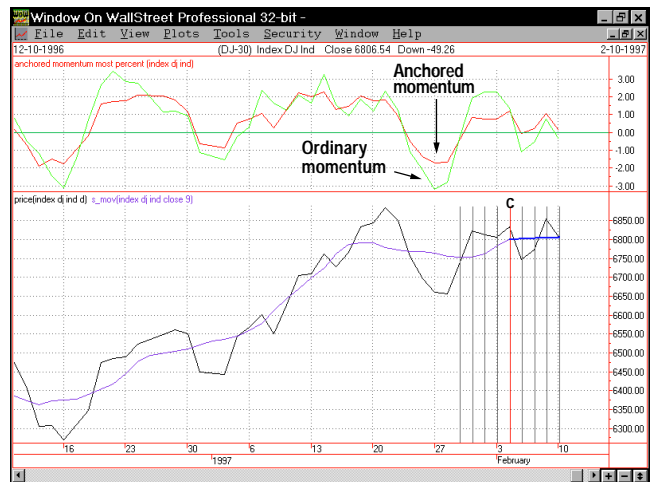


FIGURE 3: DOW JONES INDUSTRIAL AVERAGE. Here, a nine-day moving average is shifted four days to the left. The centered simple moving average is smoother than the price plot; it is not delayed, and it ends four days before the last day of the price plot. It is smoother than the price plot to anchor the left end of a momentum line. The last nine days of the plot are marked with vertical lines. The vertical line (c) in the center marks the end of the centered simple moving average.

anchored momentum and the second called general anchored momentum. Most anchored momentum is the simplest. In addition, the final step to calculating anchored momentum is to present the indicator as a percentage change basis.

Knowing that the number of days to shift a moving average to the left, in order to center it, is the same as its equivalent momentum period after it is centered, we can write an expression for anchored momentum. We will specify the SMA period and then subtract the moving average from the latest price:

$$\text{Most anchored momentum} = \text{Latest price} - \text{Simple moving average}$$

Specifying the SMA period in terms of momentum is going to take some algebraic manipulation. Recall that the momentum is specified by subtracting one from the moving average period and dividing that result by two:

$$\text{Momentum period} = (\text{Simple moving average period} - 1) / 2$$

Solving this equation for the SMA period, we get

$$\text{Simple moving average period} = (2 * \text{Momentum period}) + 1$$

Using this formula, you always get an odd number for the SMA period for any momentum period. So most anchored momentum is always consistent with the requirement of using an odd number of days for the centered SMA period. More will be said about using odd numbers when general anchored momentum is covered.

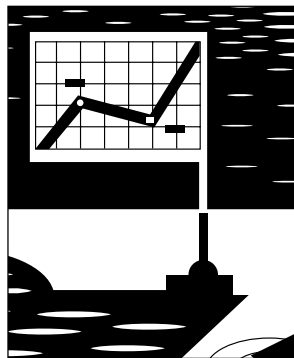
Now that we have a formula for most anchored momentum and a formula for how to specify the period of the related centered SMA period related to it, put those two formulas next

to each other for a complete definition of most anchored momentum:

$$\text{Most anchored momentum} = \text{Latest price} - \text{Simple moving average}$$

where

$$\text{Simple moving average period} = (2 * \text{Momentum period}) + 1$$



ANCHORED MOMENTUM AS A PERCENTAGE

The next step is to make anchored momentum into a percentage. What will anchored momentum be a percentage of? Ordinary momentum is a percent change of the latest price and the older price. Take percent change

ordinary momentum and find an anchored momentum equivalent to it. The right end of an ordinary momentum line is attached to the latest price, and so is the right end of an anchored momentum line. The difference between ordinary momentum and anchored momentum is where the left end of the momentum line is tied.

Anchored momentum uses a point on a centered moving average instead of the older price, so anchored momentum is the percent difference between the latest price and a point on a centered moving average. Even though this percentage is not a percent change of price, it is analogous to a percent change of price. Recall that the expression for ordinary momentum as a percent change of price is:

$$\text{Percent change ordinary momentum} = 100((\text{Latest price} / \text{Older price}) - 1)$$

To make an anchored momentum equivalent, all we need to do is replace the older price with its anchored momentum equivalent, a simple moving average with a period of $(2 * \text{Momentum} - \text{Period}) + 1$. After doing this, we get most anchored momentum as:

$$100((\text{Latest price} / \text{Simple moving average}) - 1)$$

where the SMA period is $(2 * \text{Momentum} - \text{Period}) + 1$.

The word *most* preceded anchored momentum in *most anchored momentum* because by picking the end of the centered SMA to start our momentum line, we chose the limiting case of anchored momentum, thus, *most anchored momentum*. Nothing stops us from picking a point farther to the left, along the centered SMA plot to anchor a momentum line.

GENERAL ANCHORED MOMENTUM

The momentum line on Figure 4 is an example of anchoring

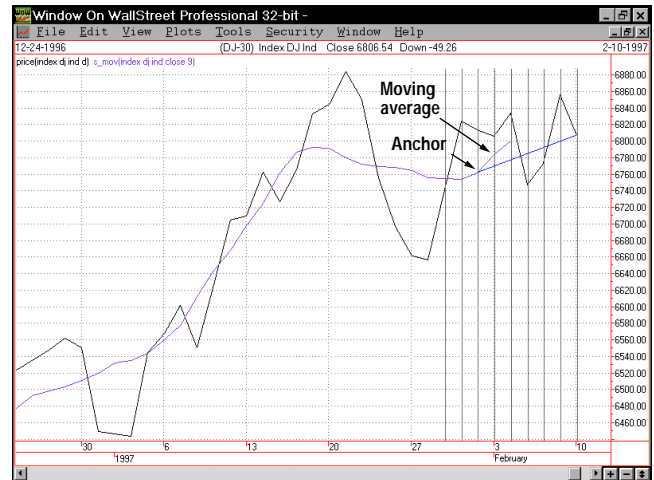


FIGURE 4: DOW JONES INDUSTRIAL AVERAGE. The momentum line here is an example of anchoring a momentum line onto a point to the left of the end of a centered simple moving average plot. Instead of anchoring the momentum line four days back, at the end of the centered simple moving average plot, it is anchored six days back, two days before the end. This line, covering six days, is a general anchored momentum line.

a momentum line onto a point to the left of the end of a centered simple moving average plot. Instead of anchoring the momentum line four days back, at the end of the centered simple moving average plot, it is anchored six days back, two days before the end. This line, covering six days, is a general anchored momentum line.

The momentum period for general anchored momentum is longer than the expression $(\text{Simple moving average period} - 1) / 2$, by an added momentum length. This added length is the total length less the expression $(\text{simple moving average period} - 1) / 2$. In other words:

$$\text{Added momentum length} = (\text{Total momentum period}) - (\text{Simple moving average period} - 1) / 2$$

Suppose we want to use a 31-day centered moving average. This would represent a momentum length of $(\text{Simple moving average period} - 1) / 2$. This is $(31 - 1) / 2$, which will account for 15 days of momentum by itself. If we want the momentum period to be 20 days, then the added length is five days. The significance of this is that we need to reference a point five days earlier than the end of the centered SMA line.

In contrast, if we had made the momentum period 15 days, then there would be no added momentum length. This is the *most anchored case*. It is the limiting case because it uses the largest possible period for the centered moving average for a given moving momentum period, hence *most anchored momentum*.

When visualizing this, the period between the end of the centered SMA and the latest price represents a momentum period of $(\text{SMA period} - 1) / 2$ by itself. We need an expression that can reference this point (the end of the centered SMA) or any point to the left of this point along the centered SMA plot to represent the general case of anchored momentum.

With this information, we have what we need to write an expression for the general case of anchored momentum:

$$\text{General anchored momentum} = \text{Latest price} - A \text{ value at a point along a centered SMA}$$

where

$$(\text{Simple moving average period} - 1)/2$$

accounts for some of the momentum and

$$(\text{Momentum period}) - (\text{Simple moving average period} - 1)/2$$

accounts for the balance with the condition that

$$\text{Momentum period} \geq (\text{Simple moving average period} - 1)/2$$

This condition is necessary to prevent us from attempting to refer to a point past the right end of the centered SMA plot to anchor the left end of the anchored momentum line. If the momentum period is equal to the SMA period minus one divided by 2, then this is the limiting case, most anchored momentum.

Now, we need to make this into the percentage of the difference between the latest price and a point on a centered simple moving average. Again, it is helpful to start with percent change ordinary momentum:

$$\text{Percent change ordinary momentum} = 100 * ((\text{Latest price} / \text{Older price}) - 1)$$

To make this into the general case of anchored momentum, just replace the older price with a value on a centered simple moving average:

$$\text{General anchored momentum} = 100 * ((\text{Latest price} / \text{value of a point on a centered SMA}) - 1)$$

where

$$(\text{SMA period} - 1)/2$$

accounts for a portion of the momentum and

$$(\text{Momentum period}) - (\text{SMA period} - 1)/2$$

accounts for the balance, with the condition that

$$\text{Momentum period} \geq (\text{SMA period} - 1)/2$$

Let us consider using even numbers for the SMA period used in the expression for general anchored momentum. The expression $(\text{SMA period} - 1)/2$ is only representing part of the momentum period. If the SMA period is an even number, $(\text{SMA period} - 1) / 2$ will include a half of a day. As an example, if 10 is chosen for the SMA period,

$$(\text{SMA period} - 1)/2 = (10 - 1)/2 = 4.5$$

To represent the balance of the momentum period, we refer to a distance of

$$(\text{Momentum period}) - (\text{SMA period} - 1)/2$$

to the left of the end of the centered moving average plot. There may not be a technical analysis software package available that will reference back by a fractional amount. What this means is that

$$(\text{Momentum period}) - (\text{SMA period} - 1)/2$$

should be a whole number.

If you use an even number for $(\text{SMA period} - 1)/2$, then you should use an amount that includes a half day for the momentum period so that the total of these two is a whole number. If you do *not* do this, then

$$(\text{Momentum period}) - (\text{SMA period} - 1)/2$$

will get rounded off to a whole number by the technical analysis software you use and you may not get what you intended. Software from different manufacturers may use different round-off rules. The easiest way out is to always use an odd number for the SMA period when working with general anchored momentum.

COMPARISONS

Most anchored momentum has some advantages over general anchored momentum. For one, it is easier to calculate. If it is used in a trading system, then there is one fewer variable providing less opportunity of overfitting the data, and optimization of variables goes faster. In addition, most anchored

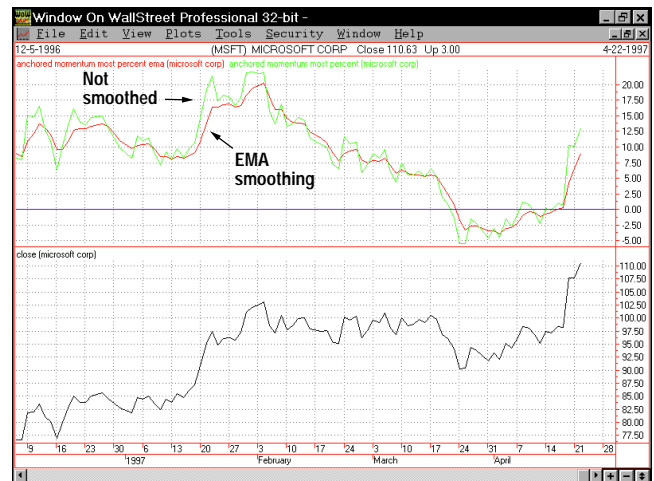


FIGURE 5: MICROSOFT. A 27-day anchored momentum is plotted two ways at the top half of Figure 5. The smoother plot is with four-day exponential smoothing of recent price, and the jagged plot is without exponential smoothing. The improvement gained with exponential smoothing is significant, because before this extra smoothing is added, most of the jaggedness was related to the right end (recent price) of the anchored momentum line bumping along as time passes.

momentum provides the most filtering to remove the influence of past price bumps in its plot.

General anchored momentum has its advantage too. Often, there is predictive value in the influence of past price bumps that most anchored momentum filters out. Often, there will be a significant dip in a stock price just as its price skyrockets. General anchored momentum allows you to reduce the period of the centered SMA in comparison to the momentum period, giving you control of how much influence past price ranges have on a general anchored momentum plot. You can choose a SMA period small enough to keep some influence of large past price ranges, but large enough to filter out past price noise.

The user will need to use some judgment to determine what the best ratio of SMA period and momentum period to use. The ratio will be related to specific markets and the personality of specific securities. I tend to use most anchored momentum because it works well with mutual funds that I have experimented with, and with one fewer variable, I reduce the possibility of overfitting the data when backtesting a trading system.

A SMOOTHER INDICATOR

Now that you have the basics of anchored momentum, there is an obvious refinement. If we will tolerate an increase in delay in this indicator, its plot can be made even smoother by replacing the latest price in its expression with a second moving average. I will be using an exponential moving average (EMA).

Look at the stock price plot for Microsoft (Figure 5). It shows a 27-day most anchored momentum plotted two ways at the top half. The smoothed plot is with four-day exponential smoothing of recent price, and the jagged plot is without exponential smoothing. The improvement gained with exponential smoothing is significant because before this extra smoothing is added, most of the jaggedness was related to the right end (recent price) of the anchored momentum line. The expressions for anchored momentum with exponential smoothing of the latest price are shown below. Most anchored momentum with exponential smoothing of price:

$$100*((EMA/ SMA) -1)$$

where the SMA period is $(2 * \text{Momentum} - \text{period}) + 1$. General anchored momentum with exponential smoothing of the price is:

$$100((EMA/Value \text{ of a point on centered moving average}) - 1)$$

where $(SMA \text{ period} - 1)/2$ accounts for a portion of the momentum and $(\text{Momentum period}) - (SMA \text{ period} - 1)/2$ accounts for the balance with the condition that $\text{Momentum period} \geq (SMA \text{ period} - 1)/2$.

IN-SAMPLE PERIOD BACK TEST RESULTS

AnMomMstEmaFBI0X-S&C Fidelity S. Biotech-Daily 03/01/93 - 08/29/97

PERFORMANCE SUMMARY: ALL TRADES

Total net profit	\$9,179.57	Open position P/L	\$0.00
Gross profit	\$9,808.25	Gross loss	\$-628.68
Total # of trades	10	Percent profitable	70%
Number winning trades	7	Number losing trades	3
Largest winning trade	\$2,900.67	Largest losing trade	\$-526.85
Average winning trade	\$1,401.18	Average losing trade	\$-209.56
Ratio avg win/avg loss	6.69	Avg trade(win & loss)	\$917.96
Max consec. winners	3	Max consec. losers	2
Avg # bars in winners	82	Avg # bars in losers	31
Max intraday drawdown	\$ -591.02		
Profit factor	15.60	Max # contracts held	465
Account size required	\$591.02		

FIGURE 6: IN-SAMPLE RESULTS, 3/1/93 to 8/29/97. After running the SuperCharts trading system variable optimizer using the in-sample time span, the variables arrived at for best total net profit are MomPer = 10, EmaPer = 7 and Hyst = 1.1.

CONDITIONS

As the period of the exponential smoothing is increased, becoming large in comparison to the centered moving average period, the anchored momentum switches into reverse, moving in a direction opposite to the one that it normally moves. (If you wish to explore this condition, put a minus sign in front of the expression so that it moves in the proper direction.)

Now you have enough information to create indicators for both general anchored momentum and most anchored momentum indicators. (See sidebar, "Expressions.")

A TRADING SYSTEM

Anchored momentum adapts to mechanical trading systems quite well. Here's a trading system for a mutual fund, Fidelity Select Biotechnology, using most anchored momentum with exponential smoothing.

To check the trading system in an out-of-sample period, the Net Asset Value (NAV) data was divided into two periods. The NAV data that I used came from FastTrack. It was changed to MetaStock format with the FastTrack Exporter. Since this data is available from September 1, 1988, to present, a little more than nine years, I decided to divide it into two-year, four-year and one-half year periods. The first period is from September 1, 1988, to March 1, 1993; the second period is from March 1, 1991, to August 29, 1997.

SuperCharts was used because it has a trading system variable optimizer. Optimization was done for best total net profit over the second period, March 1, 1991, to September 1, 1997, making this the in-sample period. The earlier period, September 1, 1988, to March 1, 1993, is the out-of-sample period, used to see if this trading system did well during a period outside the in-sample.

When trading Fidelity Selects, there is a 0.75% fee charged if the fund is held 29 days or less. To avoid this surcharge, a condition was added to the exit-long rule that the fund must

EXPRESSIONS

Here are expressions for SuperCharts and TradeStation, Window on WallStreet, and Technical Analysis Scanner: SuperCharts and TradeStation often give a "Divide by zero" error message in cases where other technical analysis software will not give this error message. For this reason, I built a check into the expressions for SuperCharts and TradeStation to ensure that there is no potential to divide by zero. Having gone this far, I built in a check to be sure that momentum period \geq (simple moving average period - 1) / 2 for the general anchored momentum case. If variables and data that you use for anchored momentum are intercepted by either of these two checks, then the expressions for SuperCharts and TradeStation will return zero.

Window on WallStreet will not work with a conditional statement unless it relates to data. I could not include a check that momentum period \geq (simple moving average period - 1) / 2 for the general anchored momentum expressions.

TAS and Window on WallStreet rarely gave a divide by zero message, but when it occurred, TAS returned a zero, and Window on WallStreet responded with an error message. I like to keep things simple, so I did not include a check for divide by zero or a check to see that momentum period \geq (simple moving average period - 1) / 2 for either Window on WallStreet or TAS.

TAS returns zero if you try to reference a point back by a zero amount. As an example, REF(Close, - 1) represents the closing price one day ago. Windows on WallStreet will accept REF(Close, 0) as the closing price for today, but TAS will return zero if you use REF(Close, 0). This means that when using general anchored momentum with TAS, you cannot let momentum period = (simple moving average period - 1) / 2 to represent the most anchored case. So remember when using TAS, you cannot use a limiting case of general anchored momentum to represent most anchored momentum using the expressions presented here.

Variables used in all of the following expressions:

MomPer = Momentum period

SmaPer = Simple moving average period

EmaPer = Exponential moving average period

GENERAL ANCHORED MOMENTUM**SuperCharts/TradeStation**

IFF(Average(Close, SmaPer)[MomPer - ((SmaPer - 1) / 2)] > 0
AND

MomPer \geq ((SmaPer - 1) / 2),
100 * ((Close / Average(Close, SmaPer)[MomPer - ((SmaPer - 1) / 2)]) - 1), 0)

Window on WallStreet

100 * ((Close / REF(MOV(Close, SmaPer, S), ((SmaPer - 1) / 2) - MomPer)) - 1)

Technical Analysis Scanner

100 * ((Close / REF(MOV(Close, SmaPer, 'S'), ((SmaPer - 1) / 2) - MomPer)) - 1)

MOST ANCHORED MOMENTUM**SuperCharts/TradeStation**

IFF(Average(Close, (2 * MomPer) + 1) > 0,
100 * ((Close / Average(Close, (2 * MomPer) + 1)) - 1), 0)

Window on WallStreet

100 * ((Close / MOV(Close, (2 * MomPer) + 1, S)) - 1)

Technical Analysis Scanner

100 * ((Close / MOV(Close, (2 * MomPer) + 1, 'S')) - 1)

GENERAL ANCHORED MOMENTUM WITH EXPONENTIAL SMOOTHING**SuperCharts/TradeStation**

IFF(Average(Close, SmaPer)[MomPer - ((SmaPer - 1) / 2)] > 0
AND
MomPer \geq ((SmaPer - 1) / 2), 100 * ((XAverage(Close, EmaPer) / Average(Close, SmaPer)[MomPer - ((SmaPer - 1) / 2)]) - 1), 0)

Window on WallStreet

100 * ((MOV(Close, EmaPer, E) / REF(MOV(Close, SmaPer, S), ((SmaPer - 1) / 2) - MomPer)) - 1)

Technical Analysis Scanner

100 * ((MOV(Close, EmaPer, 'E') / REF(MOV(Close, SmaPer, 'S'), ((SmaPer - 1) / 2) - MomPer)) - 1)

MOST ANCHORED MOMENTUM WITH EXPONENTIAL SMOOTHING**SuperCharts/TradeStation**

IFF(Average(Close, (2 * MomPer) + 1) > 0,
100 * ((XAverage(Close, EmaPer) / Average(Close, (2 * MomPer) + 1)) - 1), 0)

Window on WallStreet

100 * ((MOV(Close, EmaPer, E) / MOV(Close, (2 * MomPer) + 1, S)) - 1)

Technical Analysis Scanner

100 * ((MOV(Close, EmaPer, 'E') / MOV(Close, (2 * MomPer) + 1, 'S')) - 1)

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be held more than 29 days.

A simple trading system could be to enter long when a most anchored momentum plot crosses a zero line up from below and exit long when it crosses the zero line down from above. The problem with this sort of trading system is that it can

produce whipsaw trades when the market is not trending, the way a moving average crossover trading system will. To reduce the number of whipsaw trades, I put in a hysteresis region defined by two lines with the zero line centered between them. An enter-long trade occurs when the most

anchored momentum plot crosses the upper hysteresis line moving up from below and an exit-long trade occurs when the most anchored momentum plot crosses the lower hysteresis line moving down from above.

Here are trading rules for the QuickEditor in SuperCharts and TradeStation:

Enter-long:

$$\text{IFF}(\text{Average}(\text{Close}, (2 * \text{MomPer}) + 1) > 0, 100 * ((\text{XAverage}(\text{Close}, \text{EmaPer}) / \text{Average}(\text{Close}, (2 * \text{MomPer}) + 1)) - 1), 0) > \text{Hyst} / 2$$

Exit-long:

$$\text{IFF}(\text{Average}(\text{Close}, (2 * \text{MomPer}) + 1) > 0, 100 * ((\text{XAverage}(\text{Close}, \text{EmaPer}) / \text{Average}(\text{Close}, (2 * \text{MomPer}) + 1)) - 1), 0) < -\text{Hyst} / 2$$

$\text{AND}(\text{DateToJulian}(\text{Date}) - \text{DateToJulian}(\text{EntryDate})) > 29$

MomPer is the momentum period, EmaPer is the exponential moving average period and Hyst is the hysteresis amount. Slippage was set to zero. Commission was set to zero because it is only \$7.50 if you trade using Fidelity Fox software or a Touch-Tone telephone. This is such a small amount that I prefer to neglect it. "Max number bars back system will reference" was set at 90. The starting equity was \$10,000. Enter-long and exit-long trades were at the next bar at the market.

After running the SuperCharts trading system variable optimizer using the in-sample time span, March 1, 1993, to September 1, 1997, the variables arrived at for best total net profit are MomPer = 10, EmaPer = 7 and Hyst = 1.1. Figure 6 shows the in-sample results.

In order to achieve this, 465 contracts (shares) were required, so \$10,000 starting capital was used. We start with \$10,000, so divide 10,000 by the fund's NAV on the date of the first long trade. The NAV was 21.491 on August 24, 1991. The number of contracts is $10,000 / 21.491 = 465.3$. SuperCharts rounds this off to 465.

See Figure 7 for a plot of the last two years of this period. Most anchored momentum with exponential smoothing is shown at the top of the chart. The hysteresis lines that I mentioned earlier are shown plotted parallel to the zero line. The upper line is used for entering long and the lower line is for exiting long. The NAV plot of Fidelity Select Biotechnology is shown in the middle. Long trades are shown as up-arrows and exits are shown as down-arrows. The equity graph is shown at the bottom of the chart.

Even though 70% profitable trades with a 6.69 win/average loss ratio is quite respectable, we should reserve judgment until we can examine the results for the out-of-sample period.

DISCUSSION

Some discussion about using SuperCharts for backtesting mutual fund trading systems is in order; this also applies to TradeStation. SuperCharts was apparently developed for trading contracts and not for mutual funds, but it is useful for mutual funds. When trading mutual funds, as when managing an individual retirement account (IRA) or 401K account,

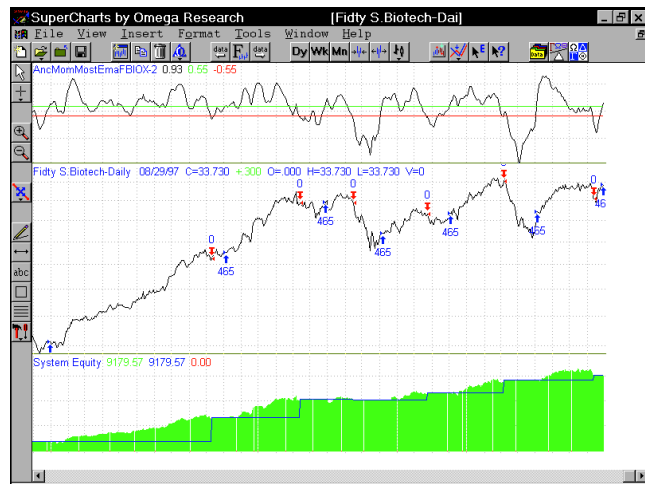


FIGURE 7: FIDELITY SELECT BIOTECHNOLOGY. Here's a plot of the last two years of this period. Most anchored momentum with exponential smoothing is shown at the top of the chart. The hysteresis lines mentioned earlier are shown plotted parallel to the zero line. The upper line is used for entering long and the lower line is for exiting long. The NAV plot of Fidelity Select Biotechnology is shown at the middle of the chart. Long trades are shown as up-arrows and exits are shown as down-arrows. The equity graph is shown at the bottom.

generally the whole profit and equity from the last trade are reinvested into the next trade (compounding).

In contrast, SuperCharts uses the same number of contracts (shares in the case of stocks and mutual funds) for each trade. Even so, SuperCharts provides good trading signals for trading mutual funds. You just need to remember:

- 1 If you want to start with a given dollar amount, you must divide the starting dollar amount by the NAV of the first trade, a long trade, to determine the number of contracts to start with. You must run the trading system twice to do this. The first run is to get the NAV of the first long trade. After you use this to determine the number of contracts (shares), then you need to run it again to get the results.
- 2 SuperCharts invests the same number of contracts (shares) each trade; it does not account for compounding. A nice positive equity line would be even more positive if SuperCharts could represent compounding when backtesting trading systems.
- 3 You must choose the position basis setting in the stops menu.
- 4 SuperCharts will only display a maximum of two years using daily data.

Now that the trading system, with the values of the variables determined for the in-sample period, is tested for the out-of-sample period, September 1, 1988, to September 3, 1993, shown in Figure 8. In this case, the first long trade was on January 12, 1989, and the NAV on that date was 6.751. The number of contracts is $10,000 / 6.751 = 1,481.26$, which rounds to 1,481. Figure 9 shows the whole period. Figure 10 shows

the last two years of the out-of-sample period. The number of contracts held is 1,481.

Is this better than buy and hold? To check, a trading system was created with the SuperCharts QuickEditor that has a single rule to enter-long, Date >= 890111. The Fidelity fund was purchased on January 12, 1989, which is the same day it was purchased, using the most anchored momentum trading system. There is no expression of exiting, because the total open position profit can be used as total net profit. The number of contracts used was 1,481. Total open position profit is \$39,955.90. The most anchored momentum trading system beat buy and hold by \$18,007.93, which is 45% better.

The reason that the percent profitable trades is smaller than it was for either the in-sample or out-of-sample periods is related to a parameter that I chose in a SuperCharts menu, "Max number bars back system will reference." I had made this 90 days. When the trading system was tested over the whole period, September 1, 1988, to September 1, 1997, the 90 days following March 1, 1993, is included in the test. These 90 days were excluded when backtesting the in-sample period, March 1, 1993, to September 1, 1997, earlier. The 90 days following March 1, 1993, was less profitable than the entire period in general.

The results would have been better if certain factors could have been taken into consideration. If compounding was used, the profits would have been considerably larger, making the equity curve rise steeper. In addition, money market profits for the periods that the trading system was not invested in the Fidelity fund were not included in the total net profit.

CONCLUSION

Of course, it should be noted that only one way to use anchored momentum in a trading system was presented here. Anchored momentum is useful for ranking mutual funds, industry groups and sectors. I use TAS (Technical Analysis Scanner) for this. Compared with ranking with percent change ordinary momentum, each security changes in rank more gently over time when anchored momentum is used. If a trading system is built around ranking mutual funds, there will be fewer false trades because a mutual fund's rank is less likely to jump back and forth through buy or sell trigger points due to past price bumps.

Anchored momentum has two advantages over ordinary momentum. It is smoother, and it better represents what the security is doing. It is presented as a percentage change to make it more useful for ranking mutual funds, sectors and industry groups.

I presented two forms of anchored momentum; the first was general anchored momentum, which is the most flexible and general. This form of anchored momentum has two

OUT-OF-SAMPLE PERIOD RESULTS

AnMomMstEmaFBIOX-S&C Fidelity S.
BIOTECH-Daily 09/01/88 - 03/01/93

PERFORMANCE SUMMARY: ALL TRADES

Total net profit	\$ 27,522.90	Open position P/L	\$0.00
Gross profit	\$ 31,266.87	Gross loss	\$ -3,743.97
Total # of trades	16	Percent profitable	69%
Number winning trades	11	Number losing trades	5
Largest winning trade	\$7,490.90	Largest losing trade	\$ -1,386.22
Average winning trade	\$2,842.44	Average losing trade	\$ -748.79
Ratio avg win/avg loss	3.80	Avg trade(win & loss)	\$ 1,720.18
Max consec. winners	4	Max consec. losers	2
Avg # bars in winners	57	Avg # bars in losers	24
Max intraday drawdown	\$ -2,784.28	Max # contracts held	1,481
Profit factor	8.35		
Account size required	\$ 2,784.28		

FIGURE 8: OUT-OF-SAMPLE PERIOD RESULTS. In this case, the first long trade was on January 12, 1989, and the NAV on that date was 6.751. The number of contracts rounds to 1,481.

WHOLE TEST PERIOD RESULTS

AnMomMstEmaFBIOX-S&C Fidelity S.
BIOTECH-Daily 09/01/88 - 08/29/97

PERFORMANCE SUMMARY: ALL TRADES

Total net profit	\$ 57,693.83	Open position P/L	\$ 0.00
Gross profit	\$ 65,183.25	Gross loss	\$ -7,489.42
Total # of trades	29	Percent profitable	66%
Number winning trade	19	Number losing trades	10
Largest winning trade	\$ 9,238.48	Largest losing trade	\$ -1,677.97
Average winning trade	\$ 3,430.70	Average losing trade	\$ -748.94
Ratio avg win/avg loss	4.58	Ave trade(win & loss)	\$ 1,989.44
Max consec. winners	4	Max consec. losers	2
Avg # bars in winners	65	Avg # bars in losers	25
Max intraday drawdown	\$ -2,784.28	Max # contracts held	1,481
Profit factor	8.70		
Account size required	\$ 2,784.28		

FIGURE 9: WHOLE TEST PERIOD. The trading system, with the values of the variables determined for the in-sample period, is tested for the total period. In this case, the first long trade was on January 12, 1989, and the NAV on that date was 6.751. The number of contracts is $10,000/6.751 = 1481.26$, which rounds to 1,481.

variables, the momentum period and the centered simple moving average period. The other form explained was the most anchored momentum. This uses the largest possible period for the centered moving average and has only one variable: the momentum period.

Either can have an additional variable if you use an EMA of the latest price for extra smoothing. Most anchored momentum, with one less variable than general anchored momentum, has advantages. It is easier to calculate. If it is used in a trading system, one less variable providing less opportunity of overfitting the data and optimization of variables goes faster.

General anchored momentum has its advantage as well. It lets you keep and control the influence of past price bumps when you determine that there is predictive value.

Although anchored momentum is smoother than ordinary momentum, smoothing the latest price with a moving average does wonders, because nearly all the jaggedness that was not taken care of by anchoring was related to the bumpiness of the latest price. This extra smoothing comes at the cost of a little delay in this indicator. The example that I presented of a trading system for Fidelity Select Biotechnology using most anchored momentum should give a clue as to its effectiveness. In the final analysis, it beat buy and hold by 45%.

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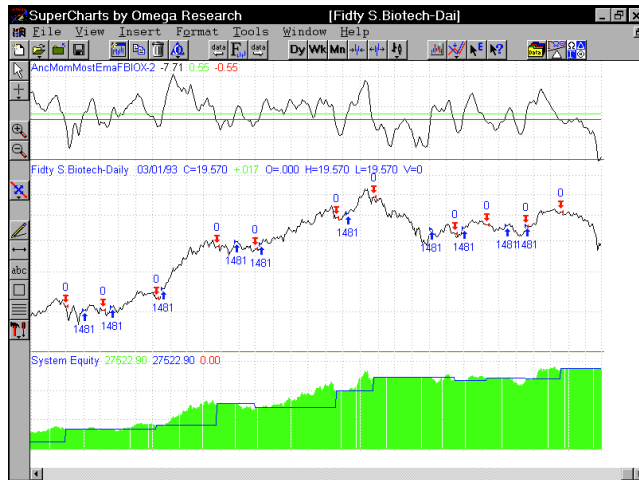


FIGURE 10: FIDELITY SELECT BIOTECHNOLOGY. Here are the last two years of the out-of-sample period. The contracts held number 1,481.

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†See *Traders' Glossary* for definition

