

SectorSurfer Forward Walk Progressive Tuning, An Introduction

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This document is revised as my understanding improves and when errors are discovered. I appreciate the advice and criticism that Scott Juds and John Nicholas have been providing and I welcome other comments and corrections.

Introduction. My underlying assumption is that trends (momentum) in financial markets are real. The issue is how to exploit them.

SectorSurfer¹ is an algorithm which measures market trends in a special manner. The expectation is that the trends so generated will be more reliable. This article will introduce the investor to SectorSurfer and will suggest how its performance can be evaluated.

Concerning trends, I suggest reading

- "Why Newton was wrong," *The Economist*, January 8, 2011. There is a link to this article at www.sumgrowth.com.
- "Optimal Momentum" at www.optimalmomentum.com is worth reading, as is Antonacci's "Risk Premia Harvesting Through Dual Momentum."
- "Momentum Analysis"

www.macquarieprivatewealth.ca/dafiles/Internet/mgl/ca/en/advice/specialist/darwin/documents/darwin-momentum-analysis.pdf

"Volatility Analysis"

www.macquarieprivatewealth.ca/.../ca/.../darwin-volatility-analysis.pdf

AQR Capital Management provides an *Annotated Bibliography of Selected Momentum Research Papers* at www.aqrindex.com.

Trend Calculation. A "Strategy" is, in SectorSurfer parlance, a portfolio of securities and a set of parameters. SectorSurfer calculates the "trend" for each security and it allocates the portfolio to the best performer. SectorSurfer is not doing anything more special than investing in the security, and in only that security, with the largest trend.

What is special is how SectorSurfer calculates the trend. The trend is the second order exponential average (EMA2) of the daily returns. The calculation

¹ www.sumgrowth.com. For a technical and operational video introduction to SectorSurfer, see Scott Juds' November 2012 "AAll Seminar" on SumGrowth's home page and his May 15, 2013 presentation. The latter is posted at Youtube.com as "SectorSurfer Founder Visits Silicon Valley Users Group."

is explained in the shaded box below. The daily return is the value of the security today less the value of the security yesterday, adjusted for dividends.

The first step is to calculate the exponential moving average (EMA).

$$EMA(n) = 22 * \alpha * DR(n) + (1 - \alpha) * EMA(n-1); n \text{ increasing}$$

where α is the smoothing factor, DR is the daily return at day n, and EMA(n-1) is the smoothed value as of the prior day. The daily change is scaled by 22 market days to approximate the magnitude of a monthly change.

This is algebraically equivalent to defining EMA as the sum of the daily returns.

$$EMA = 22 * \sum W * Daily \text{ Return}$$

where the weights are given by the red line in Chart 1. The process is called "exponential" because the weights approximate the function $e^{-\alpha t}$ where t is the number of market days before the current date and α is the smoothing factor.

The first step is repeated, substituting the exponential moving average EMA for the daily returns DR. Smoothing twice is what makes the process "second order."

$$EMA2(n) = \alpha * EMA(n) + (1 - \alpha) * EMA2(n-1); n \text{ increasing.}$$

Equivalently,

$$EMA2 = \sum W * EMA$$

where the weights are again given by the red line in the chart. Alternatively,

$$EMA2 = \sum W * Daily \text{ Return}$$

where the weights are now given by the blue line in the chart.

The following table illustrates the calculation using the dividend adjusted S&P 500 Composite, represented by VFINX, and $\alpha = 0.02$. (This example uses a factor of 21 rather than 22 for historical reasons.) Both EMA and EMA2 are initialized by setting the oldest values equal to zero. Initialization is not important so long as many, a hundred or more, daily returns are included in the calculation.

DATE	VFINX	21* Daily Return	EMA	EMA2
9/1/1988	14.154		0.000000	0.000000
9/2/1988	14.494	0.50445	0.010089	0.000202
9/6/1988	14.554	0.08693	0.011626	0.000430
6/20/2013	146.335	(0.52225)	0.005413	0.021508
6/21/2013	146.720	0.05525	0.006410	0.021206
6/24/2013	144.940	(0.25477)	0.001187	0.020806

In SectorSurfer parlance, the "trend constant" equals $1/\alpha$.

Second order exponential averaging introduces a "lag" in the trend which is about equal to the trend constant.

This calculation is also referred to as a "double exponential moving average" or DEMA. If the trend constant were 50 days, the calculation might be referred to as DEMA50.

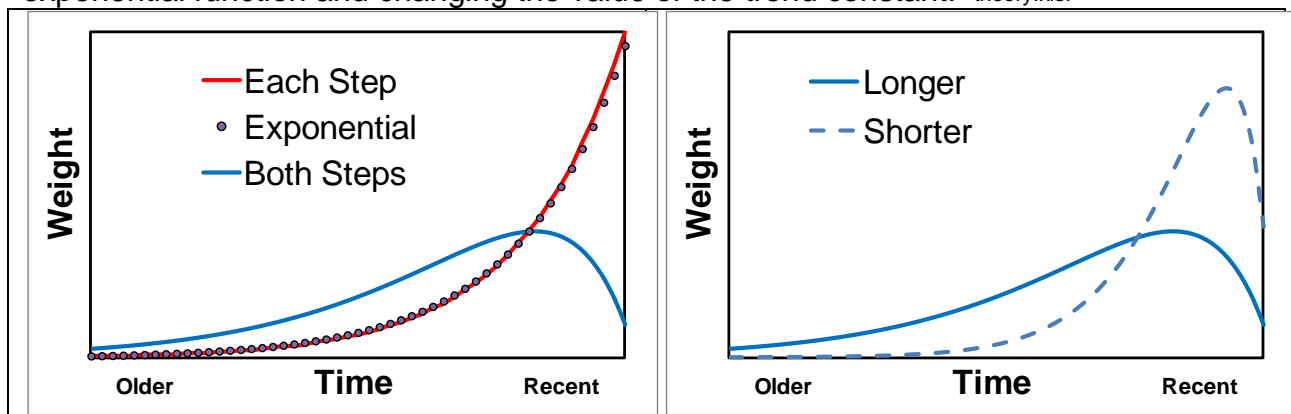
The calculation is algebraically equivalent to computing the trend as the weighted sum of the daily returns

$$Trend = 22 * \sum W * Daily\ Return$$

where the summation is over all prior daily returns. The 22 factor is cosmetic; the purpose is to increase the magnitude of the trend from a daily value to about a monthly value. (There are about 21 market days per month.)

The weights assigned to each daily return are shown by the blue curves in Chart 1. There is a low emphasis on the current return, a higher emphasis on the returns from a few weeks ago, a decreasing emphasis on older returns and returns from more than about a year ago are entirely disregarded.

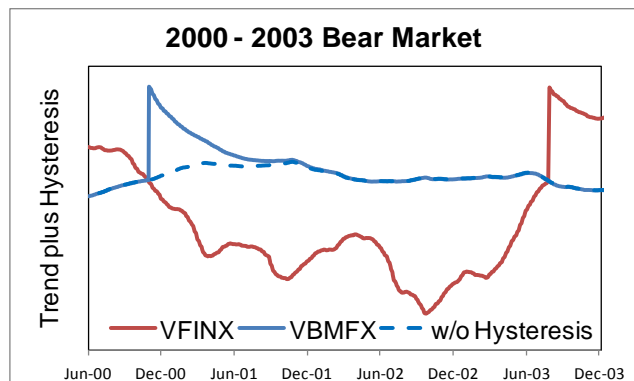
Chart 1. Weighting functions used in exponential averaging, comparison to an exponential function and changing the value of the trend constant. theory.xls.



The relative emphasis placed on the daily returns is affected by the choice of the trend constant. A shorter (smaller) value of the trend constant puts a greater emphasis on near term returns, as is illustrated in the chart on the right. SectorSurfer uses the trend constant as an optimization parameter.

Hysteresis A challenge for any trend following algorithm is to control unnecessary trading caused by temporary price fluctuations. This is commonly addressed by requiring a higher threshold to reverse a trade. Requiring a higher threshold to reverse a trade is called "hysteresis," by analogy with physical processes.

The SectorSurfer implementation of



hysteresis is illustrated in Chart 2². This chart shows the trends of US stocks and bonds during the 2000 - 2003 US bear market. The algorithm trades into bonds when the trend for stocks (red line) falls below the trend for bonds (blue line). Immediately after the trade into bonds, the bond trend is increased. This increase locks in the trade and reduces whipsaw.

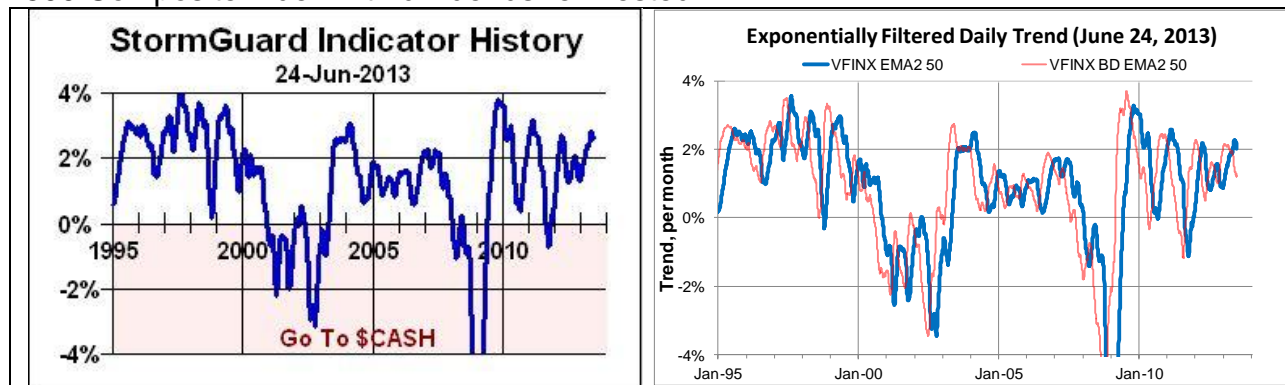
The amount of the increase decays with time. The details are not known but the decay appears to be exponential. The amount of the increase is apparent in the chart by comparing the solid line, which is the sum of the EMA2 for bonds plus the hysteresis, to the dashed blue line, which is the EMA2 alone. Since SectorSurfer trades infrequently, the hysteresis often decays to zero by the time of the next trade signal.

In late 2003, the algorithm trades back to stocks when the stock trend rises above the bond trend. The stock trend is immediately increased. The amount of the increases decays again after the trade date.

StormGuard The purpose of StormGuard is to signal when the market trend is negative and a move to cash (or bonds) might be prudent.

The standard StormGuard Indicator³ is the second order exponential moving average of the daily returns of the S&P 500 Composite without dividends plus a hysteresis (called a "shift" in the SectorSurfer context) of about 0.5%⁴. The amount of the shift can be seen by comparing the chart below left, produced by SectorSurfer, with the EMA2 and bidirectional EMA2 below right.

Chart 3. Comparison of the StormGuard Indicator History and the EMA2 of the S&P 500 Composite Index with dividends reinvested.



SectorSurfer uses the same StormGuard Indicator for all Strategies, with only the variation in the magnitude of the shift to reflect the specific Strategy. In Juds' experience, no index provided better protection than the S&P 500

² This chart was simulated by the author. This information is not available from within SectorSurfer.

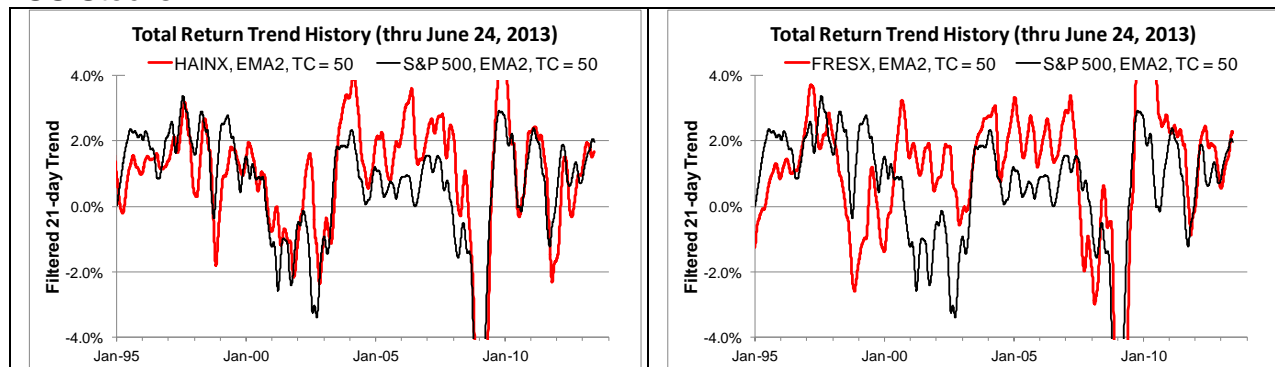
³ StormGuard AQR is designed to react more rapidly to changing market conditions. How StormGuard AQR is defined is not known.

⁴ The standard StormGuard Indicator is the EMA2 of the daily returns of SP-CP (the ticker used by FastTrack for the S&P Composite without dividends) plus a shift. The value of the shift is updated daily on the Strategy Chart. See the appendix for interpreting the parameters on the Strategy Chart.

Composite Index. It seems true that, when the US sneezes, the world catches a cold⁵.

Collaboration for Juds' view is found by superimposing the trend for HAINX (an actively managed foreign stock fund) and the trend for the S&P 500 Composite. As seen below left, the intervals with negative trends tend to line up.

Chart 4. Comparison of the EMA2s for Foreign and US Stocks and for Real Estate and US Stocks.



The S&P Composite is not as good a surrogate for real estate, represented by FRESX and shown in Chart 4 on the right. Negative trends tend to line up during the 2008 bear market but they do not line up during 1999 - 2003 because the bear market in real estate did not coincide with the bear market in US stocks.

SectorSurfer will underperform if a sector is trending positively when the S&P Composite is in decline. StormGuard went to cash in 2002 - 2004 when the better choice would have been to trade into real estate. There is no downside if negative trends do not lineup when US stocks are trending positively since SectorSurfer will allocate to US stocks rather than to the declining sector.

StormGuard uses a 50-day trend constant because, in Juds' experience, this is the value which maximizes performance.

Tuning the Trend Constant. Unlike StormGuard, which always uses a 50-day trend constant, the trends of the funds in the portfolio are tuned to the trend constant which optimizes performance.

The optimization is different in the different versions of SectorSurfer. The original implementation ("standard SectorSurfer" hereafter) chooses the trend constant (and type of filter⁶) based on the performance from the beginning of the dataset⁷ through the date on which the strategy is created. The trend constant is not retuned.

⁵ Paraphrasing Juds' comment on May 15, 2013. See the YouTube video cited in footnote 1, part 3 of 7.

⁶ My hunch is that "type of filter" means one of the three FWPT options.

⁷ More precisely, the earliest date on which there is history for at least two funds.

In the Forward Walk Progressive Tuning (FWPT) version of SectorSurfer, the trend constant is initially tuned from the beginning of the dataset through a "born on date." At approximately half year intervals thereafter⁸, the trend constant is retuned based on the cumulative performance from the beginning of the dataset through the retuning date.

If the born on date were 9/1/1998 and if there were data on at least two funds from 9/1/1988, the initial tuning would be based on the performance over ten years. The first retuning would be based on the performance over about ten and a half years.

The user selects the born on date⁹. I prefer a born on date of December 31, 2002 or 2003 because this provides a full market cycle (1990s bull market followed by the dot-com bear market) for the initial tuning.

I prefer FWPT over the standard version because of the opportunity to evaluate prospective performance. (I apparently am in the minority; Juds reports that less than five percent of SectorSurfer users use FWPT.)

Evaluating SectorSurfer. Prospective performance can be evaluated by examining the effects of composition and SectorSurfer parameters on return, Sharpe Ratio, maximum drawdown and other factors. It can also be evaluated by observing how SectorSurfer chooses the trend constant and by drawing inferences about whether the choices that are made are robust.

The following chart (called "trend chart" hereafter) illustrates the tuning process. A "performance SCORE" is being plotted as a function of the trend constant¹⁰ for two different portfolios.

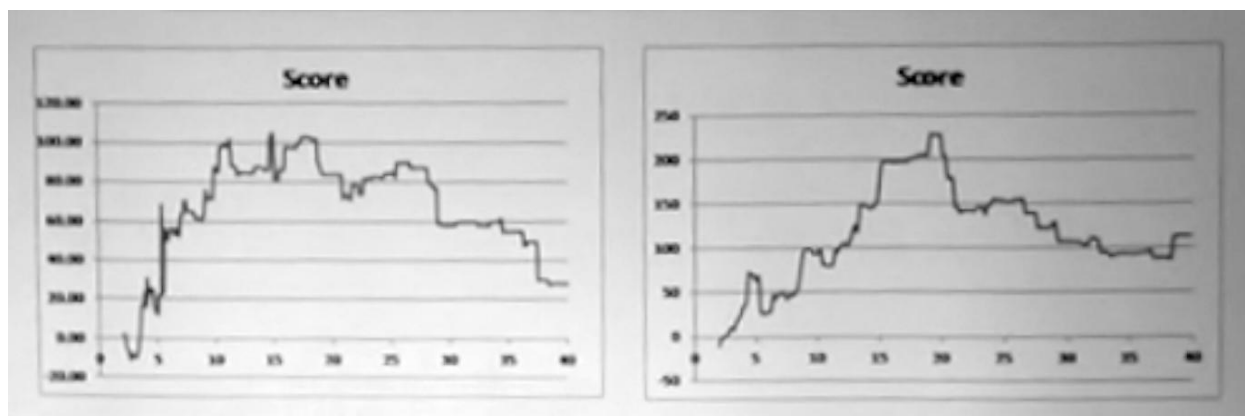
⁸ Nominally 125 market days. However, tuning is only conducted on a potential trade date (daily, month end, week end; see holding period parameter). Tuning is deferred if changes to the time constant would precipitate a trade or violate a fund's short term trading policy. In my experience, setting the minimum hold time parameter to "Month-End" provides a more regular retuning schedule.

⁹ SectorSurfer will move the date forward if necessary to ensure that at least one fund in the strategy has five years of data prior to the initial tuning.

¹⁰ These charts are from Juds' May 15, 2013 presentation; see footnote 1.

Juds has not identified the "performance SCORE" other than to say that it is dominated by cumulative return with an overweighting of recent returns. Recent returns have more influence of the trend constant when retuning than at initialization (Juds, e-mail to the author, October 19, 2013.)

Chart 5. Trend Charts for Two Unidentified Portfolios.

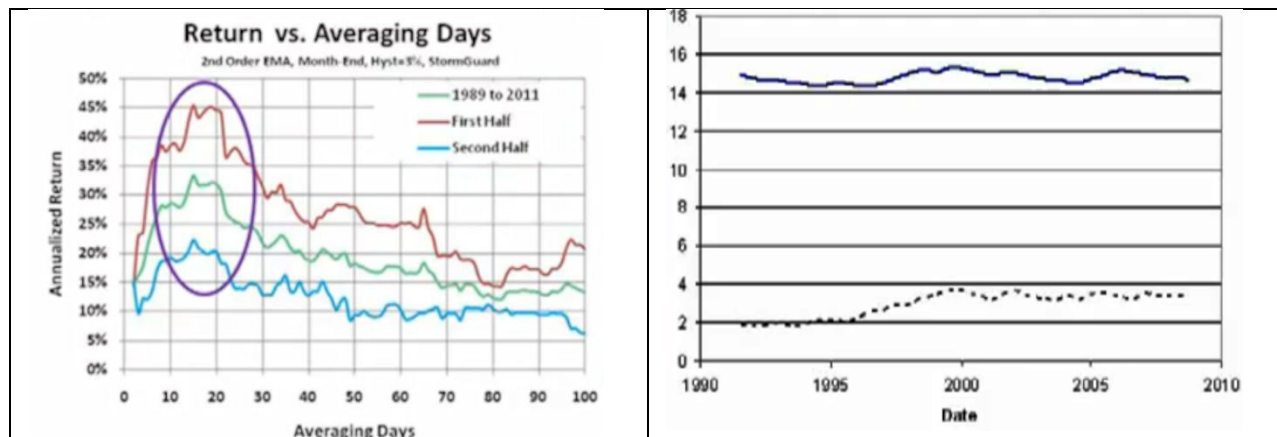


SectorSurfer is better able to optimize the performance of the portfolio on the right because the maximum on the right is better defined.

The trend chart is available in tabular form in the downloadable file. Thus it is possible to review the trend chart for your strategy and to infer something about the quality of the optimization process.

Chart 6 left illustrates "split sample stationarity." The maximum in the trend chart occurs near seventeen days irrespective of whether the trend constant is tuned to the first half of the interval, to the second half of the interval or to the whole interval.

Chart 6. Tests for Stationarity; taken from the May 15 video described in footnote 1. The trend constant is called "Averaging Days" in the diagram on the left.



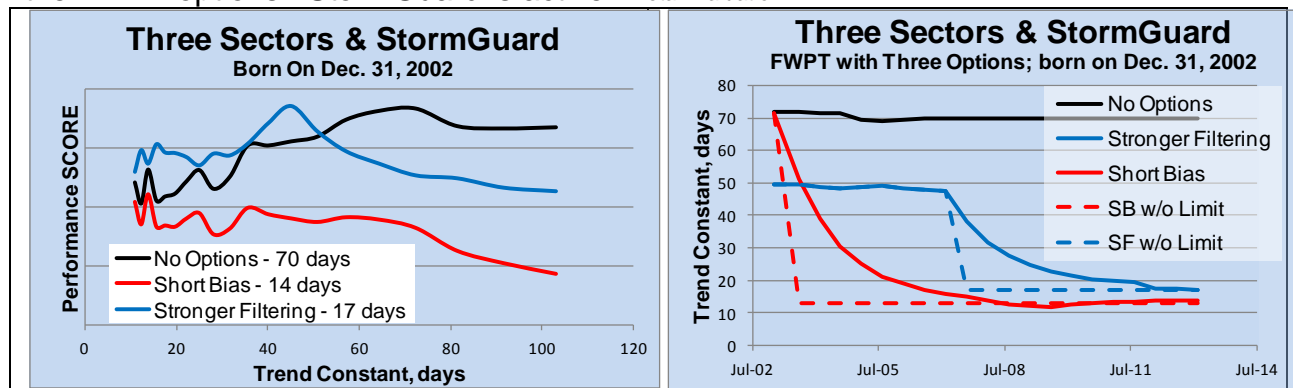
The chart on the right illustrates the more rigorous "progressive tune stationarity" test." The trend constant is retuned every 125 days based on the performance during the prior 250 days. (A reminder, FWPT retunes based on the entire prior history.) The solid line is the tuned value of the trend constant over time. I call the chart on the right the "stationarity chart."

The dotted line is the "hysteresis." I do not know whether hysteresis refers to the shift associated with StormGuard or to the shift applied to the security which led at the last market signal.

Juds has emphasized that the trend constant should exhibit "trend signal stationarity"¹¹. The user can test for stationarity since the value of the trend constant at each retuning is reported in the downloadable file.

Chart 7 displays the trend and stationarity charts for a portfolio of large capitalization US stocks, actively managed large foreign stocks and actively managed US real estate. All funds have histories back to September 1, 1988.

Chart 7. Trend and Stationarity Charts for VFINX, HAINX and FRESX as a function of the FWPT options. StormGuard is active. Beta Evaluation R1.



The black curves correspond to FWPT with no options. The trend chart on the left exhibits a broad maximum in the vicinity of 70 days and the algorithm chooses this maximum. The chart on the right illustrates that the algorithm chooses a value near 70 days at each retuning.

FWPT with no options exhibits stationarity *in the context of this portfolio*.

The red curves correspond to FWPT with "a bias towards short trends" - "short bias" or "ST" hereafter. The stationarity chart on the right indicates that the algorithm chose a trend constant of 70 days on initial tuning. The maximum at about 70 days apparently decayed with time, leaving only the residual evident in the chart on the left. As a consequence, the algorithm shifted to the maximum at about 14 days.

Although the red curve on the right suggests a gradual change, the shift from one maximum to the other occurred at the first retuning. The reason that the stationarity chart shows a gradual change is that the trend constant is only allowed to change by one third of the distance between the old and new values. If the one third limit had not been imposed, the trend constant would have changed as indicated by the dashed red line.

If the trend constant is about seventy at the initial tuning and about 14 (absent the one third rule) six months later, it might appear that the trend constant should be about 14 if the BOD were advanced to December 2003. However,

¹¹ The trend constant might not be constant if the funds in the portfolio have histories of different length and if the optimum value of the trend constant is different for a portfolio of the older funds as compared to a portfolio of the older and younger funds.

retuning gives significantly more emphasis to recent performance than does the initial tuning. The result is that the stationarity chart is little effected if the BOD is advanced to December 2003, other than a 1-year shift to the right.

FWPT/ST does not exhibit stationarity.

The blue lines correspond to FWPT with "Stronger Filtering" - "SF" hereafter. My hunch is that "stronger filtering" means a bias towards longer trend constants but it is not known how this is achieved.

The trend chart shows a maximum at about 40 days and the stationarity chart indicates that the algorithm chose this maximum for several retunings. The algorithm shifted to a maximum with a smaller trend constant in mid 2007. The shape of the blue curve is consistent with the abrupt change illustrated by the dashed blue line.

FSPT/SF does not exhibit stationarity.

Evaluating SectorSurfer on Return

Table 1 summarizes the performance statistics¹² for the portfolio of US and foreign stocks and real estate.

Table 1. Three Equity Sectors (VFINX, HAINX and FRESX) and Standard StormGuard, December 31, 2002 - December 31, 2012. There is additional information in Table 2.

	FWPT No Options	FWPT Short Bias	FWPT Stronger Filtering	Standard SectorSurfer
Return	20.2%	14.7%	17.4%	21.0%
Std. Dev.	18%	15%	19%	16%
Sharpe Ratio	1.1	0.9	0.9	1.3
2008 Loss	14%	14%	14%	5%
Stationarity ¹³	70 ± 1	21 ± 15	34 ± 14	not available

¹² Annual returns are determined from the portfolio values downloaded from SectorSurfer (/d option) for the specific interval of interest, ten calendar years in this instance. The annualized return, standard deviation and Sharpe Ratio are calculated from the annual returns over the specific interval.

The Sharpe Ratio is the arithmetic average of the reduced annual returns divided by the standard deviation of the reduced returns. The reduced annual return is the annual return in a specific year less the T-bill return for that year (Ibbotson data).

SectorSurfer calculates the Sharpe Ratio as the arithmetic average of the reduced annual returns divided by the standard deviation of the portfolio. The reduced return is the return over the entire interval less the return of a Fidelity money market fund over the entire interval. (Or, equivalently, the average return less the average return of the money market fund.)

SectorSurfer calculates the standard deviation as the square root of the average variance, measured at 1-year rolling intervals over the entire dataset.

The differences in standard deviation and Sharpe Ratios are probably not material so long as the values quoted here are not directly compared to the values from SectorSurfer.

FWPT/No provides a better return than the other FWPT options. FWPT/No was the best choice from a tuning perspective.

Better returns are usually associated with better tuning.

Performance can be affected by the StormGuard options.

1. Active or standard StormGuard trades to or from cash at month's end. It honors holding period limitations when the minimum hold parameter is set to "Automatic;"
2. Disabled; and
3. AQR (Asymmetric Quick Response). AQR is more aggressive in that it usually trades to/from cash as soon as the StormGuard Indicator turns negative/positive rather than waiting until the end of the month and it never honors holding period limitations.

AQR StormGuard boosts the return of this portfolio slightly, see Table 2, but AQR is not acceptable *with this portfolio* since there is no stationarity.

The performance of this portfolio is affected by the Minimum Hold parameter, discussed next.

Minimum Hold Parameter. When the minimum hold time parameter is set to "Month-End," trade decisions are made on the last day of the month and executed at the close on the first day of the following month. (The trade date can be identified by comparing the daily change in the value of the portfolio to the daily returns of the securities involved in the trade.)

When the minimum hold time parameter is set to "Automatic," trade decisions are made on the last day of the month so long as a trade on the first day of the following month would not violate holding period requirements imposed by the funds. For example, if a fund were to impose a ninety day minimum holding period and if the trade date would be sixty days after purchase, the trade would be deferred and re-evaluated at the end of the following month.

The holding period restrictions that apply to the funds used in these examples are:

- Fidelity Real Estate assesses a 0.75% fee if a purchase (other than dividend reinvestment) is sold in less than ninety days.

Fidelity also has an informal rule prohibiting "round trips," the purchase and sale of the same fund within thirty days (or the sale and repurchase of the same fund within thirty days.) I say "informal" because Fidelity appears to enforce this rule only if round tripping becomes habitual.

¹³ The mean and standard deviation of the trend constant over time as it is burdensome to prepare the stationarity chart. It would speed analysis if SectorSurfer were to generate trend and stationarity charts.

- Harbor International limits round trips to four per year. This limitation may not be enforceable unless shares are not purchased directly from Harbor International.
- Vanguard prohibits on-line and telephone repurchases of the same fund within the same account for sixty days after a sale.

Vanguard has short term redemption fees on some of its funds. There are no short term redemption fees for VFINX or VBMFX.

Incorporating these rules into trade recommendations is a yeoman task and errors are inevitable. SectorSurfer prohibits the sale of HAINX within sixty days even though the fund imposes no such limitation.

Table 2. Three Equity Sectors (VFINX, HAINX and FRESX), 2003 - 2012. The data are incomplete for simulations which predated the archival system described at www.lingane.com/sectorsurfer. Returns during the 10-year interval, determined using FWPT, are not affected by the Data Date (the final date of the FastTrack data base when the simulation was performed.) Returns using the standard version are affected because the trend constant is slightly different when tuned over the longer interval.

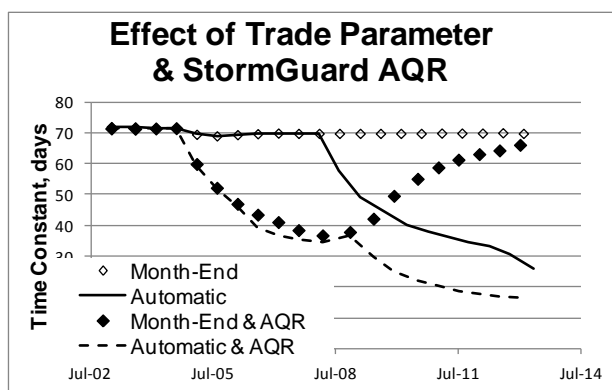
SectorSurfer	FWPT/No	FWPT/No	FWPT/No	FWPT/No	FWPT/ST	FWPT/SF	Std
Version No.	5.0.69				5.0.69		5.0.69
StormGuard	Std	Std	ARQ	AQR	Std	Std	Std
Trade Hold	Monthly	Auto	Auto	Monthly	Monthly	Monthly	Monthly
Born on Date	12/31/02	12/31/02	12/31/02	12/31/02	12/31/02	12/31/02	10/17/13
Data Date	10/17/13	6/28/13	6/28/13	6/28/13	10/17/13	6/28/13	10/17/13
2003	36%	36%	38%	38%	32%	36%	34%
2004	19%	19%	19%	19%	29%	19%	19%
2005	19%	19%	14%	14%	9%	15%	19%
2006	28%	28%	32%	32%	23%	26%	28%
2007	16%	16%	16%	16%	6%	11%	16%
2008	-14%	-19%	-20%	-20%	-14%	-14%	-5%
2009	53%	53%	60%	68%	27%	53%	53%
2010	30%	32%	32%	30%	31%	32%	30%
2011	10%	-11%	0%	19%	3%	-1%	10%
2012	18%	9%	24%	16%	11%	11%	16%
10-yr Return	20.2%	16.2%	19.8%	21.4%	14.7%	17.4%	21.0%
Std. Dev.	18%	22%	22%	22%	15%	19%	16%
Sharpe	1.1	0.8	0.9	1.0	0.9	0.9	1.3
Stationarity	70 ± 1	55 ± 17	40 ± 20	55 ± 12	21 ± 15	34 ± 14	n/a
BOD Constant	72	72	71	71	71	50	68
Cur. Constant	68	26	17	66	14	17	n/a
Sauce 1	1				5		2
Sauce 2	3				3		5
Min. Hold	3				3		3
StormGuard	SG0				SG0		SG0
SG Shift	-0.6				-0.6		-0.3
Chart Option	CH1				CH1		CH1
Sauce 7	OP1				OP5		OP0
Decision Shift	DS0				DS0		DS0
Sauce 9	co				co		co
Sauce 10	ReOp				ReOp		LI-0
Beta Evaluation R1	SI:NA	SI:AA	SI:BA	SI:CA	SI:OA	SI:EA	SI:FA

Table 3. Effects of Holding Period and AQR. Three Equity Sectors (VFINX, HAINX and FRESX), December 31, 2002 - December 31, 2012. See also Table 2.

	FWPT No Options Month-End	FWPT No Options Automatic	FWPT No Options Month-End	FWPT No Options Automatic
StormGuard	Standard	Standard	AQR	AQR
Return	20.2%	16.2%	21.4	19.8%
Std. Dev.	18%	22%	22%	22%
Sharpe Ratio	1.1	0.8	1.0	0.9
2008 Loss	14%	19%	20%	20%
Stationarity	70 ± 1	55 ± 17	55 ± 12	40 ± 20

Performance was the identical through June 2008 independent of whether the Minimum Hold Parameter was set to "Month-End" or to "Automatic" in conjunction with standard StormGuard. As shown in Chart 8, the trend constants were also identical.

Chart 8. Stationarity Charts for a Portfolio of VFINX, HAINX and FRESX as a function of the Minimum Hold and StormGuard options. Beta Evaluation R1.



The difficulty arose at the end of June 2008. StormGuard advised trading out of HAINX into cash. The trade was executed at the closing price on July 1 when the Minimum Hold was set to "Month-End" but the trade was deferred to August when the Minimum Hold was set to "Automatic."

HAINX lost 3.4% during the month's delay.

The trend constant was retuned at the beginning of August. The trend constant did not change when the Minimum Hold was set to "Month-End."

The trend constant tried to change to about 35 when the Minimum Hold was set to "Automatic" but the actual decline, shown in Chart 8, was limited by the one third rule. The tuned trend constant remained low for the rest of the simulation. All because the portfolio was a month late trading to cash!

I do not recommend the "Automatic" setting when backtesting because you would probably implement the strategy using ETFs and these have no trade restrictions.

SectorSurfer posts a yellow warning on the Strategy Chart when there is a trading restriction associated with one of the funds. This warning is annoying because it obscures much of the chart.

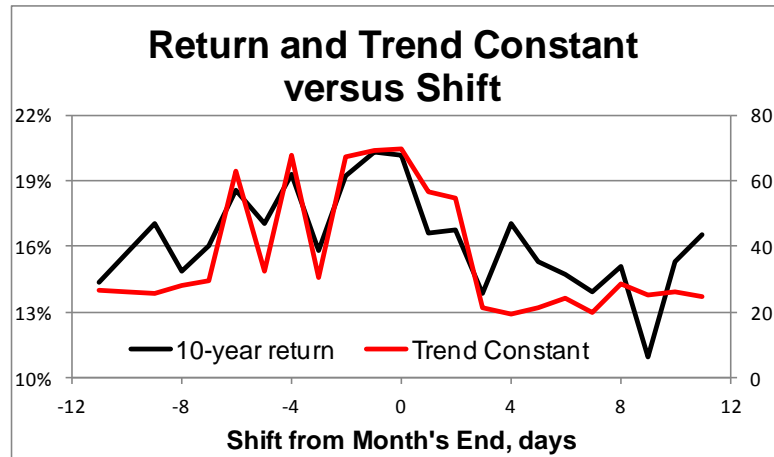
Warning: "Week-End" and "Daily" provide different results from "Month-End."

Stationarity for this Strategy was inferior using StormGuard AQR. See Chart 8.

Effect of Decision Date. The FWPT version includes the option to move the decision date forward or back by eleven market days.

The effects of changing the decision date on the trend constant and on the return over the ten years 2003-2012 are shown in adjacent chart.

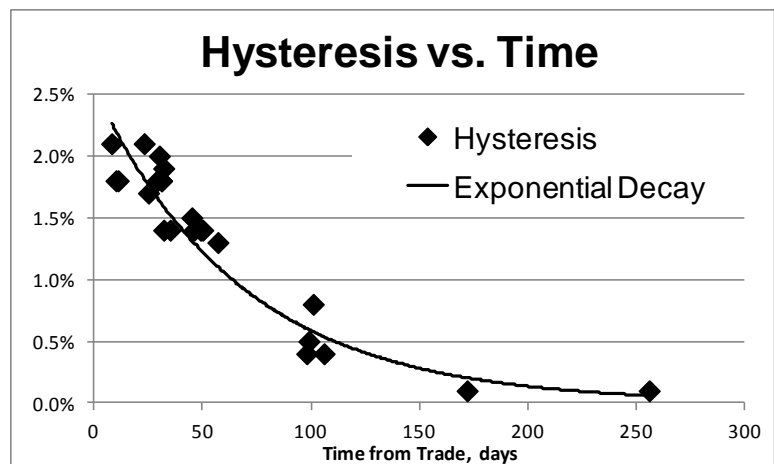
Chart 9. Effects of Shifting the Decision Day from Month-End. Large capitalization US stocks (VFINX), actively managed foreign stocks (HAINX) and actively managed US real estate (FRESX). FWPT with no options, standard StormGuard. decision day.xls



A shift in the decision day changes the value of the trend constant. A different trend constant means that the trends of each fund are changed, that trade signals are changed and ultimately that the return is changed.

Juds recommends a zero shift. A zero shift provided the largest return and best stationarity for this Strategy. The explanation is unknown and results may be different with other portfolios/Strategies.

The value of the hysteresis associated with each fund was estimated by adjusting the individual trends for the value of EMA2 calculated from the reported trend constant. Uncertainty is on the order of 0.2% per month since the value of the trend is estimated from a small graph.



The hysteresis for funds not in the lead is generally zero within the measurement uncertainty. The hysteresis for the fund in the lead decays exponentially with the time from the last trade as shown in the chart.

Alternative Portfolio Strategies. Performance is compared in Table 4.

- A static portfolio containing 24% VFINX, 24% HAINX, 12% FRESX and 40% VBMFX. The static portfolio was rebalanced on the last day of the month¹⁴;
- A portfolio in which the AAI Model Stock Portfolio¹⁵ was rebalanced annually with bonds in a 60:40 ratio;
- A SectorSurfer portfolio of three equity sectors, FWPT/No and standard StormGuard (Table 1);
- A portfolio in which allocation among US and foreign stocks, real estate and bonds was controlled using FastTrack's one month momentum model¹⁶; and
- A portfolio in which the AQR US Large Cap Momentum Index¹⁷ was rebalanced annually with bonds in a 60:40 ratio.

Table 4. Three Equity Sectors and Bonds, 2003 - 2012. Beta Evaluation R1

	Static 24:24:12:40	60:40 AAI Shadow Portfolio	SectorSurfer	Investors FastTrack	60:40 AQR Large Cap Momentum Index
Return	8.6%	16.1%	20.2%	12.6%	6.6%
Std. Dev.	13%	22%	18%	16%	18%
Sharpe Ratio	0.6	0.7	1.1	0.8	0.4
2008 Loss	23%	28%	14%	23%	37%

SectorSurfer doubles the return and Sharpe Ratio and reduces the 2008 loss as compared to the 24:24:12:40 static portfolio.

The AAI Shadow portfolio also doubles the return but the Sharpe ratio is little changed since the volatility increases. The loss in 2008 increases.

FastTrack significantly increases the return, although not as much as the increase with the AAI Shadow Portfolio or SectorSurfer. There is little effect on the standard deviation and no effect on the 2008 loss.

The AQR US Large Cap Momentum Index does not show promise.

¹⁴ The median return of the BNY Mellon Master Trust Universe was 7.8% for the ten years ending December 2012. The BNY Mellon database includes nearly 700 corporate, foundation, endowment, Taft-Hartley and health care plans. This 24:24:12:40 static portfolio has exceeded the median return of these professional managers for each 10-year interval since 2002.

¹⁵ The AAI Model Shadow Stock Portfolio provides recommendations in the micro-cap value sector of the US market. See <http://www.aai.com/model-portfolios/getting-started>. The statistics shown here were calculated from the annual returns reported for this portfolio blended with VBMFX in a 60:40 ratio.

¹⁶ The FastTrack one month momentum model examines the return over the prior month for each fund and shifts 25% of the portfolio from the funds with the lowest 1-month return to the fund with the highest 1-month return. www.fasttrack.net/Trading_sector_Fidelity_funds.asp.

¹⁷ Statistics were calculated from annual returns downloaded from aqindex.com on June 27, 2013.

A portfolio containing 60% AQR US Large Cap Momentum Index and 40% bonds rebalanced annually provided a 6.4% annualized return, 11% standard deviation, 0.5 Sharpe Ratio and 20% 2008 loss.

SectorSurfer also stands out because it trades infrequently, typically only two or four transactions per year.

Effects of Portfolio Composition Gold stocks, real estate, smaller US stocks, emerging markets and bonds are useful in some portfolios, hurtful in others and without effect in still others. See "Designing a SectorSurfer Portfolio" at www.lingane.com/sectorsurfer.

Approach portfolio design without prejudice. Test, test and retest.

SectorSurfer is Not for Dilettantes Do not underestimate the time and effort that will be required to build your confidence in your Strategy.

Since the SectorSurfer software is under development, the user must be alert to difficulties and occasional data upsets. Both SectorSurfer and Investors FastTrack are very good at correcting errors which are brought to their attention.

Preserving the Results It is not possible to reproduce results as of a prior date¹⁸. Thus it is necessary to have a method for preserving the results. I save the downloadable file, the Strategy Chart and the last trade into a spreadsheet. My spreadsheet is available at www.lingane.com/sectorsurfer.

Summary Observations

SectorSurfer has the potential to increase return and reduce risk as compared to a static 60:40 portfolio with few trades.

FWPT is preferred over the standard version because it allows users to evaluate of both tuning quality and prospective return.

Test all options; the defaults are not always the best choices. Avoid the "Automatic" Minimum Hold parameter.

Both tuning quality and return are dependent on the portfolio composition.

Wish List My suggestions for improvements to SectorSurfer are posted at www.lingane.com/sectorsurefer.

Caveat. *The portfolios investigated herein may not perform in the same manner as other portfolios. Nothing herein should be construed as investment advice. Reach your own conclusions and recognize that techniques which provided good performance in the past may not work as well in the future.*

¹⁸ A useful change to SectorSurfer would be the ability to define the end date for a simulation. Currently, the end date is always the last date in the FastTrack dataset.

Appendix. The "Strategy Secret Sauce Ingredients"

The values of the secret sauce parameters are reported on the Strategy Chart at the middle of the right hand margin.

"ReOptimize" and "LI-0" disappear on resaving the strategy.

Parameter	FWPT Version	Standard Version
Software version	For example, V 5.0.43	Same
User.Strategy	For example, EC3.0A (hexadecimal) EC3 equates to user 3779 0A equates to strategy 10	Same
Unknown1	L6	L2
Trend Constant at Born on Date	For example, 103.1 (days)	Same
Order of Filter	Same as the n in OPn, below	EMAn; n = 2 or 3
Hysteresis	3 (percent)	3 - 7 (percent)
Minimum Hold	0 = trade automatic 1 = trade any day 2 = trade weekends 3 = trade month's end	Same
SGn	StormGuard n = 0; Standard n = 1; Disabled n = 2; AQR	Same
StormGuard Shift	For example, -0.5 (% per month)	Same
CHn	Chart Options n = 0; reference is automatic or AGG n = 1; reference is S&P500 or Average If "less spaghetti," add 4 (i.e., n = 4 or 5).	Same
OPn	FWPT Options n = 0, standard, without FWPT n = 1; without options n = 3, stronger filtering n = 5, bias towards short trends n = 7; stronger filtering & short bias	n = 0 always
DSn	Decision Day Shift = n	n = 0 always
Unknown8	co	Same
Note:	<ul style="list-style-type: none"> • ReOptimize (SG-std or SG AQR if changing from SG-std) • Inverse (SG disabled) • NoInverse (SG AQR) 	LI-0; meaning unknown