Improving on Buy and Hold: Updated Model Description

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In my August 2010 article I advocated a market timing strategy, to sell or significantly reduce one's stock holdings in anticipation of a recession or slowdown of the economy and switch into cash or a low beta Treasury bond fund, and then reverse the process ahead of a recovery. I presented a model to determine the timing of the switch.

A description of some changes to improve the model was presented in my December 2011 article together with a buy recommendation for the S&P 500. I have since then made further improvements to the model which affect the sell signals.

The model description is given below. Appendix A lists the criteria to generate buy and sell signals. Appendix B is a description of RecessionAlert's recession warning system, a new addition to the model. Appendix C lists dates of historic buy and sell signals from the model, and returns flowing from investments made according to the model - also shown graphically in figure 1. Appendix D lists calculation details for the Forward Rate Ratio, Exponential Moving Average, and Commodity Channel Index.

Note that all references to days refer to trading days not calendar days; there are about 252 trading days per year. Also refer to the original August 2010 article for a complete overview of the model.

Model Description

Basic economic data

The input data is the daily S&P 500 Index from 1965 to 2012 and the following economic indicators:

- The 3-month T-Bill, 2-year and 10-year U.S. Treasury Note yields.
- The year on year percentage change of the Consumer Price Index.
- The Federal Funds Rate.
- The ECRI's U.S. Weekly Leading Index (WLI).
- The smoothed 6-month annualized growth rate of the WLI (WLIg).
- The RecessionAlert RFE level. (see Appendix B)

The ECRI's U.S. Weekly Leading Index and the index's growth were modified by constants:

WLI used = *WLI* = (WLI – 50) / 10

WLIg used = *WLIg* = (WLIg/200 + 1)

A value of *WLIg* greater than 1 and less than 1 would represent positive and negative growth, respectively.

Decision variables

Moving Averages (MA):

- MA of S&P500 over 15 days (15-d MA)
- MA of S&P500 over 35 days (35-d MA)

Exponential Moving Averages (EMA):

- EMA of the Forward Rate Ratio with a smoothing factor of 0.015
- EMA of S&P500, with a smoothing factor of 0.050
- long EMA of *WLI* with a smoothing factor of 0.010
- short EMA of *WLI* with a smoothing factor of 0.100
- long EMA of *WLIg* with a smoothing factor of 0.050
- short EMA of *WLIg* with a smoothing factor of 0.400

Slopes (slope = change over a specific number of stock market days):

1. 35 day slope of the [EMA of S&P500]
2. 20 day slope of the [long EMA of WLI]
3. 20 day slope of the [long EMA of WLI +1]
4. 5 day slope of the [long EMA of WLIg +1]
5. 20 day slope of the [long EMA of WLIg +1]
6. 120 day slope of the [long EMA of WLIg +1]

In 3 to 6 above, a slope greater than 1 or less than 1 signifies a positive or negative slope, respectively.

Other:

- Commodity Channel Index

Sell signals

The model provides three types of sell signals. Detailed requirements for the sell signals to be generated are listed in Appendix A.

The initial *basic sell signal* which usually leads to a *type A sell signal* occurs when economic conditions deteriorate, which is mainly indicated by the short EMA of the U.S. Weekly Leading Index's growth rate moving below its long EMA.

At the same time the yield curve must be inverted, or, to provide for conditions of prolonged economic weakness, real interest rates must be negative.

After a basic sell signal has been issued economic conditions may worsen, which is indicated by the 5-day slope of long EMA of the U.S. Weekly Leading Index's growth rate falling below its 20-day slope, which then causes a *type B sell signal* to be generated.

To include conditions when a *basic sell signal* did not occur before a major market decline, such as the 1987 crash, parameters for a *type C sell signal* have been devised, the signal providing an exit from the market before such declines. Additionally, a *type C sell signal* will also be generated when the RecessionAlert RFE level moves above 2 (indicating a high possibility of an approaching recession), irrespective of whether a *basic sell signal* has been generated before.

Buy signals

The model provides three types of buy signals. Detailed requirements for the buy signals to be generated are listed in Appendix A.

A *type A buy* signal is generated when economic conditions improve which is mainly indicated by the short EMA of the U.S. Weekly Leading Index's growth rate, after having formed a bottom, moving from negative growth to reduced negative growth and above its long EMA. Other parameters, including a significant decline of the Federal Funds Rate, are also required for a *type A buy signal*.

In order to not unduly restrict buying opportunities additional buy signals were devised. A *type B buy signal* excludes the Federal Funds Rate parameter and a *type C buy signal* relies only on the long and short EMAs of the U.S. Weekly Leading Index's growth rate.

Appendix A – Requirements for signals to be generated

Sell Signals

Basic sell signal and *sell signal type A*

A *basic sell signal* is generated when the following simultaneously applies:

- The [short EMA of *WLIg+1*] moves below the [long EMA of *WLIg+1*] while the [long EMA of *WLIg+1*] still shows positive growth but which is steadily declining, and
- the EMA of the Forward Rate Ratio FRR2-10 is at or below 1.00 (indicating an inversion of the yield curve), or if the average of the 3-month T-Bill, 2-

year and 10-year T-Note yields minus the annual inflation rate is less than -1.00%, and

- when X is greater than the maximum of X over the preceding 130 days – 0.5%, where
  X = the maximum Federal Funds Rate (FFR) over the preceding 130 days minus the minimum FFR over the preceding 650 days.

A *Type A sell signal* is generated after a *basic sell signal* :

- when for the first time after a basic sell signal, the day after the oscillator level derived from a 30-day Commodity Channel Index (CCI) calculation for the S&P500, scaled with an inverse factor of 0.015, exceeded 100 for 3 days in succession, but not later than 65 days.

A sell signal will not be generated if a new buy signal appears after a *basic sell signal* before the *Type A sell signal* occurs.

Sell signal type B

A *type B sell signal* is generated when a *basic sell signal* has previously been generated and the 5-day slope of the [long EMA of *WLIg* **+**1] falls below the 20-day slope of the [long EMA of *WLIg* **+**1].

Sell signal type C

A *type C sell signa*l is generated when the 120-day slope of the [long EMA of *WLIg* **+**1] slopes downward and initially passes through 1.015. The sell signal is generated if within a 1-year period this slope subsequently passes through 0.980. Just before the signal date the market must still be in a modestly rising trend, which requires the 35 day slope of the [EMA of S&P500] to be greater than 0.005 x [EMA of S&P500].

A *type C sell signa*l is also generated when the RecessionAlert RFE level rises above 2.

Buy signals

Buy signal type A

A *type A buy signal* is generated when the [short EMA of *WLIg*], after having formed a bottom, moves from negative growth to positive growth and moves above the [long EMA of *WLIg*]. The [short EMA of *WLIg*] must be less than 1.000 and the 20-day slope of the [long EMA of *WLIg* **+**1] must be greater than 1.000. Further, the 20-day slope of the [long EMA of *WLI*] must still be negative or flat and the [short EMA of *WLI*], after having bottomed out, moves upwards again. Also the Federal Funds Rate must have fallen at least 2.50% from a previous high, the previous high being considered over the preceding 5 year period. (Later *type A buy*

signals are eliminated if they appear within 100 days of an initial *type A buy* signal.)

Buy signal type B

A *type B buy signal* is generated when the conditions for a *type A buy* signal have been met, but with the Federal Funds Rate condition omitted and the EMA of the Forward Rate Ratio is greater than 1.050. Also the 20-day slope of the [long EMA of *WLI* +1] must be greater than 1.000.

Buy signal type C

A *type C buy signal* is generated when the 120-day slope of the [long EMA of *WLIg* **+**1] is greater than the [long EMA of *WLIg*] and is between 1.010 and 0.975. Also the [short EMA of *WLIg*] minus the [long EMA of *WLIg*] must be greater than -0.005.

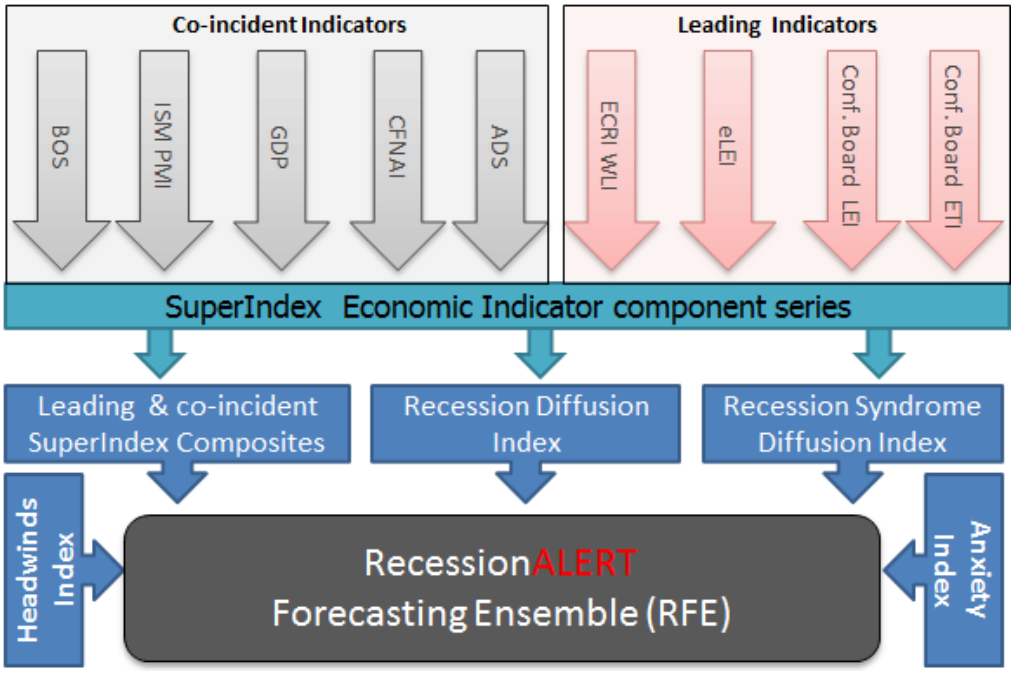
Appendix B

Recession warning signals from RecessionAlert.com

The RFE level is available from the web site's members page of recessionalert.com. The recession dating model for the 6 indices of the Recession Forecasting Ensemble (RFE) is shown below.

The RFE level is the number of models (0 to 6) that are in recession territory. The models are:

1. Leading SuperIndex
2. Coincident SuperIndex
3. Recession Diffusion Index
4. Recession Syndrome Diffusion Index
5. Headwinds Index
6. Anxiety Index



(source: RecessionAlert.com)

Improving on Buy and Hold: Better Investment Returns with Signals from Economic Indicators and RFE				
Returns to Jun-22-12 from	10/20/66	7/3/80	12/20/90	3/12/03
Returns without RFE	12.60%	14.28%	12.99%	13.55%
Returns with RFE > 5	12.77%	14.53%	12.99%	13.55%
Returns with RFE > 4	12.77%	14.53%	12.99%	13.55%
Returns with RFE > 3	12.77%	14.53%	12.99%	13.55%
Returns with RFE > 2	12.79%	14.55%	13.02%	13.62%
Returns with RFE > 1	12.75%	14.50%	12.94%	13.43%
Returns with RFE > 2 minus Returns without RFE	0.19%	0.28%	0.03%	0.07%

Appendix C

Buy / Sell signals sorted by date

The initial 1966 buy signal was obtained from a trend following model. Obsolete signals were omitted, i.e. buy signals not preceded by a sell signal and occurring after a previous buy signal, or sell signals not preceded by a buy signal and occurring after a previous sell signal were removed. Out of sample signals from October 2010 onwards are shaded yellow. The model was invested 71% of the

total time from October 1966 to February 2013 and provided about 18 times the return of a permanent investment in the S&P500 over this period.

buy date *sell date*	S&P500		cal. days in market	cal. days buy & hold
10/20/66	77.84	buy		
2/14/69	*103.61*	*sell A*	848	
8/18/70	76.20	buy A		
7/25/73	*109.64*	*sell A*	1072	
2/12/75	79.92	buy A		
12/8/78	*96.63*	*sell A*	1395	
7/3/80	117.46	buy A		
3/17/81	*133.92*	*sell A*	257	
1/15/82	116.33	buy A		
11/1/83	*163.66*	*sell C*	655	
9/21/84	165.67	buy A		
10/2/87	*328.07*	*sell C*	1106	
3/1/88	267.23	buy A		
6/5/89	*322.03*	*sell A*	461	
12/20/90	330.12	buy A		
6/29/00	*1442.39*	*sell C*	3479	
3/12/03	804.19	buy A		
11/2/07	*1509.65*	*sell C*	1696	
3/30/09	787.53	buy A		
3/8/10	*1138.50*	*sell A*	343	
10/15/10	1176.19	buy A		
7/7/11	*1353.22*	*sell A*	265	
12/8/11	1234.35	buy A		
7/5/12	*1367.58*	*sell A*	210	
8/1/12	1375.32	buy A		
2/22/13	1515.12	invested	205	
-	- Period	- invested	11992 71%	16927 100%

Average annual returns

Average annual returns from 1966, 1980, 1990, and 2003 are listed below and compared to returns achieved from a permanent investment in the S&P 500. Dividends, fees, taxes, etc. were not taken into account, but interest earned (at the Federal Funds Rate) when not in the market was included in the returns.

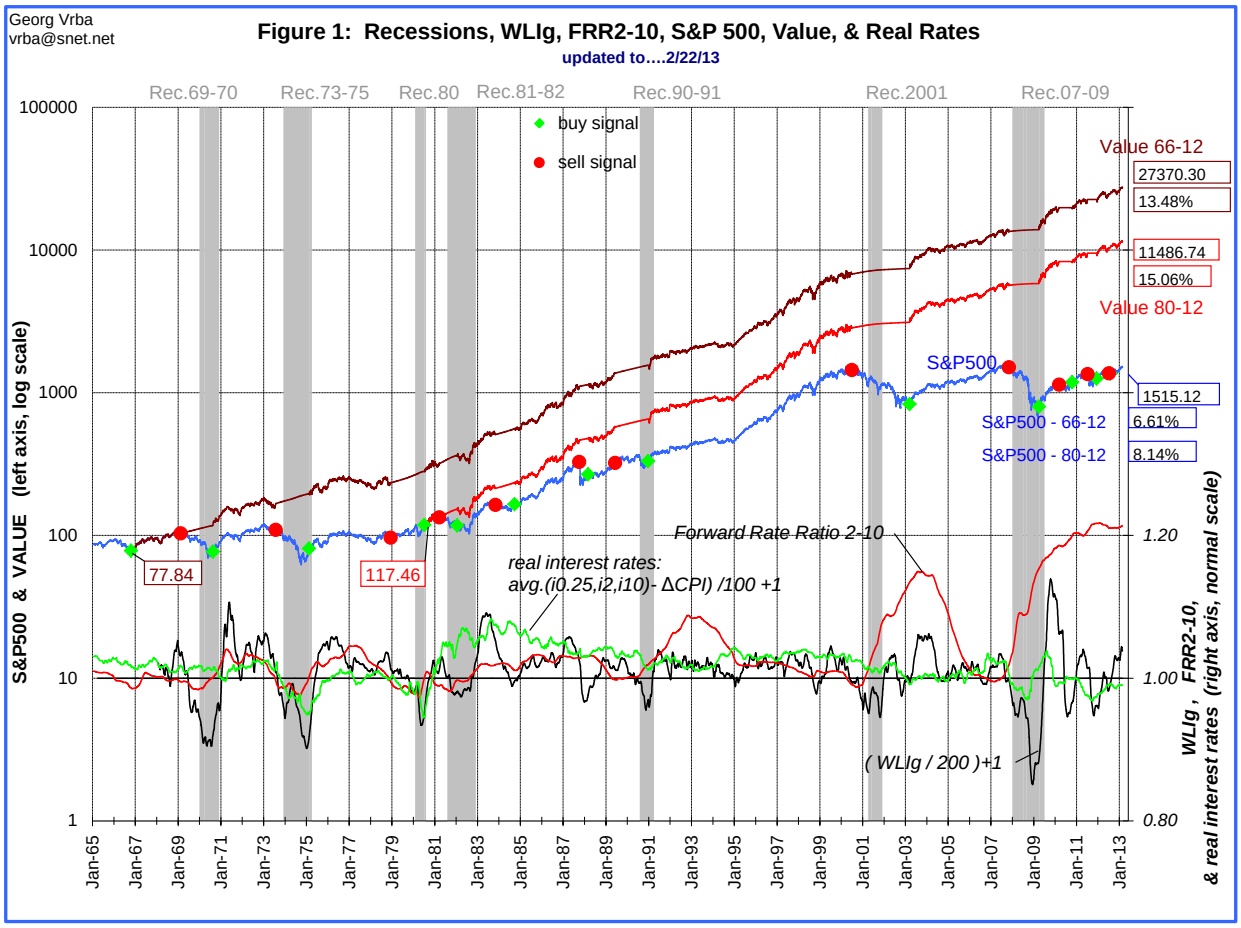
		S&P	model	model/S&P
buy	10/20/1966	77.84	77.84	1
	2/22/2013	1515.12	27370.30	18.06
	avg. annual return	6.61%	13.48%	2.04

buy	7/3/1980	117.46	117.46	1
	2/22/2013	1515.12	11486.74	7.58
	avg. annual return	8.14%	15.06%	1.85

buy	12/20/1990	330.12	330.12	1
	2/22/2013	1515.12	5795.66	3.83
	avg. annual return	7.11%	13.78%	1.94

buy	3/12/2003	804.19	804.19	1
	2/22/2013	1515.12	2964.60	1.96
	avg. annual return	6.57%	14.00%	2.13

Last update Feb-25-13



Appendix D

Forward Rate Ratio FRR2-10

FRR2-10 is the rate at which one can lock in borrowing for the eight year period starting two years from now, divided by the ten-year rate itself. The FRR2-10 is indicative of the slope of the yield curve between the two-year and the ten-year note yields; a FRR2-10 greater than 1.00 indicates a positively sloped yield curve (ten-year note yields are higher than two-year note yields); a FRR2-10 less than 1.00 indicates an inversion of the yield curve (two-year note yields are higher than ten-year note yields).

The formula for calculating FRR2-10 is

$$FRR2\text{-}10 = \{ [(1 + i_{10})^{10} / (1 + i_2)^2]^{1/8} - 1 \} / i_{10}$$

or a simpler formula which works better at low yields is

$$FRR2\text{-}10 = (5 * i_{10} - i_2) / (4 * i_{10})$$

where i_{10} and i_2 are the 10 year and 2 year U.S. Treasury Note yields, respectively.

Exponential Moving Average

The exponential moving average (EMA) is a type of filter that applies weighting factors to the observed data values. The weighting for each older data point decreases exponentially, never reaching zero. The formula used for calculating the EMA is :

$$EMA_{today} = EMA_{yesterday} + \alpha \times (value_{today} - EMA_{yesterday})$$

The coefficient α represents the degree of weighting decrease, a constant smoothing factor between 0 and 1. A higher α discounts older observations faster. Alternatively, α may be expressed in terms of *N* time periods, where $\alpha = 2/(N+1)$. For example, *N* = 199 for the long EMA of *WLI* with a smoothing factor of 0.01, and *N* = 19 for the short EMA of *WLI* with a smoothing factor of 0.10. The “long” and “short” refers to the N time periods used in the calculation of the smoothing factor for the EMA.

Commodity Channel Index

An oscillator used in technical analysis to help determine when an investment vehicle has been overbought and oversold. The Commodity Channel Index quantifies the relationship between the asset's price, a moving average (MA) of the asset's price, and normal deviations (D) from that average. It is computed with the following formula :

$$CCI = \frac{Price - MA}{0.015 \times D}$$

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