



Improving on Buy and Hold: Asset Allocation using Economic Indicators

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Most long-term stock market investors follow a buy-and-hold strategy, one that makes big losses unavoidable when major downturns strike the stock market. This strategy assumes that an investor cannot know when to switch from one asset to another and that if one avoids the bad days of the market, one is also likely to miss the best days.

Buy-and-hold may have been a successful strategy during the bull market from 1980 to 2000, but it has been a disaster over the last 10 years. A \$10,000 investment in the Vanguard S&P 500 Index Fund made 10 years ago (in August 2000) would now be worth only about \$8,600.

Another standard piece of advice is to diversify one's investments. A recent article in Advisor Perspectives by David B. Loeper, [Fake Diversification Exposed: Does Asset Allocation Work?](#), concludes that apart from a diversification into intermediate-term Treasury bonds, other "diversifiers" do little to protect one's investments. Investors should sell or significantly reduce their stock holdings in anticipation of a recession or slowdown of the economy and switch into a Treasury bond fund, and then reverse the process ahead of a recovery.

The problem investors face is determining the timing of the switch.

I present a way to resolve this dilemma. My model is based on various economic indicators that provide timely buy and sell signals for the S&P 500 index. Trading signals are generated when certain patterns of the decision variables occur that have historically always preceded a particular major change in market direction. It is reasonable to assume that similar patterns will occur in advance of future similar changes in market direction.

My model typically provides sell signals before contractions of the economy and buy signals when economic recovery is imminent, with all signals occurring well before the market has responded much to the perceived economic changes. Acting on the model's signals is instrumental to avoiding major market downturns while still being invested in the market at all other times. This timing approach, with funds placed into a money market account when they are not invested in the market, achieves excellent returns over long periods of time, as shown by the "Value" graphs in figure 1. Even better returns result if the investment is switched into a fund that invests in Government National Mortgage



Association (GNMA) pass-through certificates, such as the Vanguard GNMA Fund, instead of a money market fund. The model is described in Appendix A.

There has recently been much speculation in the financial media whether the Economic Cycle Research Institute's (ECRI) U.S. Weekly Leading Index (WLI) and the index's annualized growth rate are currently suggesting an upcoming recession. It is naive to suggest that just because the WLI growth rate has declined to a certain level that a recession is imminent. The present steepness of the yield curve — the forward rate ratio between the 2- and 10-year yields is at a record high of almost 1.20, an unprecedented level — does not support a recession prediction. As can be seen in figure 1, the yield curve has been inverted prior to the last seven recessions (indicated by the forward rate ratio between the 2- and 10-year yields being less than 1.00), but currently it is extremely steep. The growth rate of ECRI WLI has at the same time declined to a negative, recession-predicting level. That has not happened in the last 45 years, and presumably that decline is why there is so much discussion about this in the financial media. The negative value of the WLI growth rate suggests that growth will be miserably slow. For a description of the forward rate ratio see Appendix A and B.

The more important question facing investors now, however, is to what extent one should be invested in the market. My model suggests that one should have significantly reduced one's market exposure at the beginning of April 2010. The model, which also relies largely on the WLI, provides the mathematically derived signals to reduce or sell one's stock market investments well before recessions and economic slow-downs occur, generating sell signals near market tops and buy signals near market bottoms.

Appendix C lists all the trading signals from 1966 onwards that this model provided including a *type C sell signal* at the end of March 2010 and a *type A sell signal* near the end of April 2010. The model provided a sell signal before the 1987 stock market crash, and also near the 2000 and 2007 market tops. It also generated buy signals in March 2003 and March 2009, near the market's lows.

Figure 1 depicts the S&P 500 Index with the sorted trading signals from the model superimposed. The "Value" graphs on this chart show the value over time of an initial investment based on the model's trading signals. The investment, when out of the market (on the "Value" graphs, the smooth lines between sell and buy intervals) is assumed to earn interest at the prevailing Federal Funds Rate. The end value on 3/30/2010 for an investment made in 1966 is more than 15 times higher (a 13.31 % average annual return), and similarly an investment made in 1980 would be about seven times higher (a 15.38 % average annual return) than what the same investments would have grown to if left permanently in the market. Dividend income is not included in the analysis.

An investment made on 7/3/80 in the Vanguard 500 Index Fund with dividends reinvested would have provided a 16.51 % average annual return if the trading model was followed, versus 9.81 % if the initial investment was left permanently in the fund. If the funds, when



out of the market, were invested in the Vanguard GNMA Fund instead of a money market account, the investment would have provided a 17.58 % average annual return.

Figure 2 shows the buy and sell signals obtained from the model for the time period 2002 to 2010 and also some of the decision variables used to generate the signals.

The model is not suitable for short-term investments, but it is beneficial for longer-term stock market investments, such as retirement accounts. While I acknowledge the mantra that “past performance is not an indicator of future results,” for more than 40 years (including seven recessions) my model has, without exception, provided much better results than what would have been achieved by neglecting the opportunities of market timing.

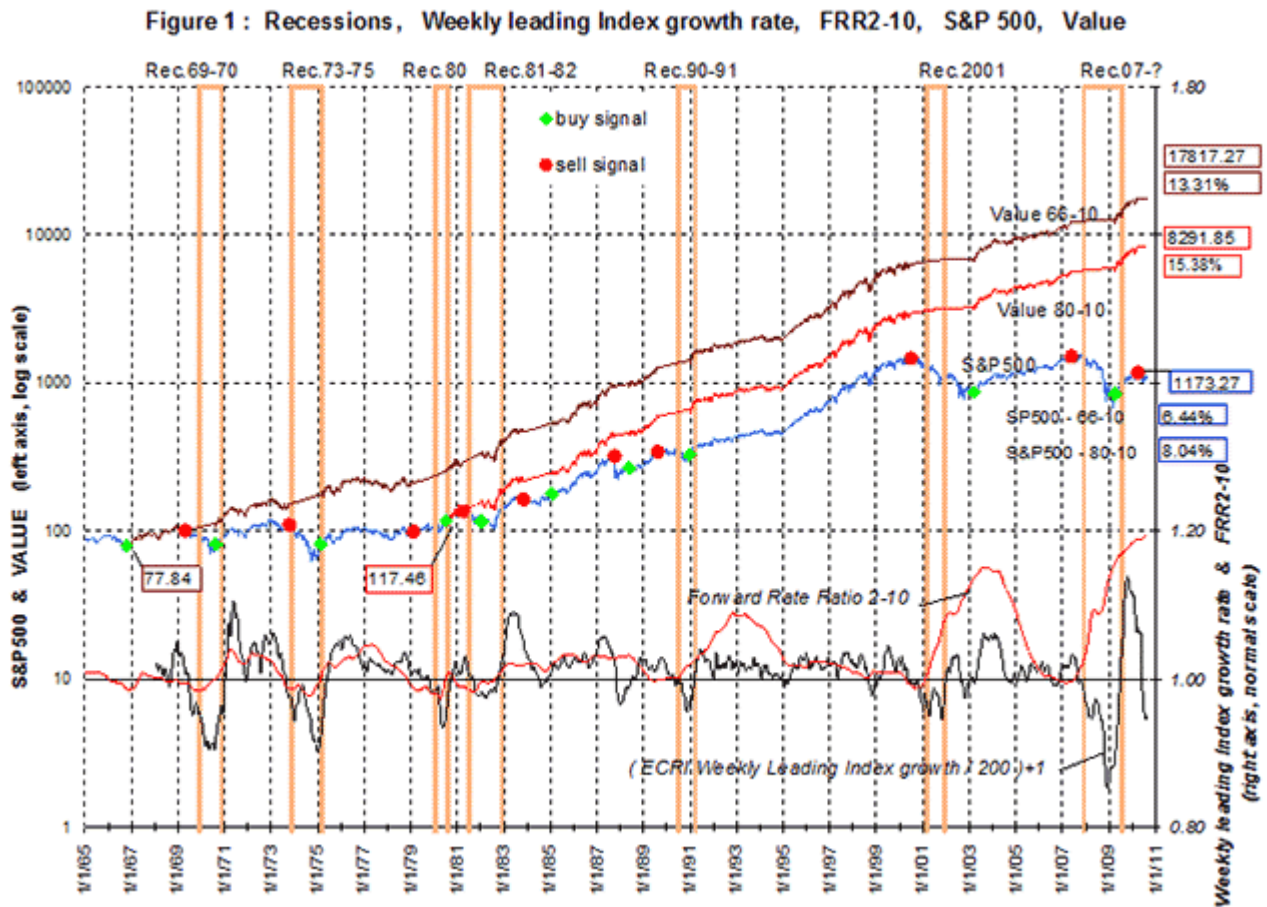
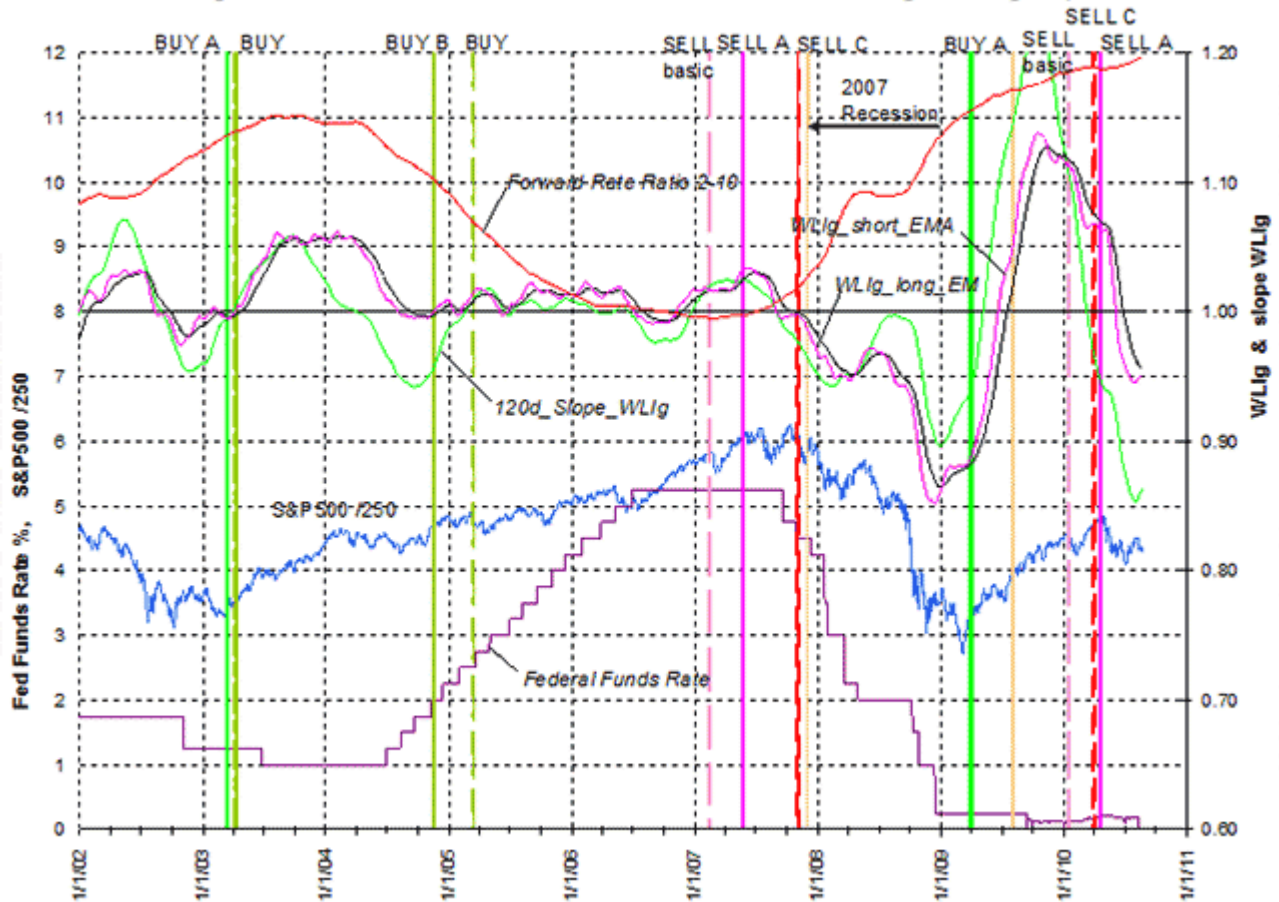


Figure 2 : Recession, Fed Funds Rate, S&P 500, FRR, WLIg & WLIg slope



Appendix A – Model Description

Basic economic data

The input data is the daily S&P 500 Index from 1965 to 2010 and the following basic economic indicators:

- 2-year and 10-year U.S. Treasury Note yields
- Federal Funds Rate
- ECRI's U.S. Weekly Leading Index (WLI)
- ECRI's U.S. Weekly Leading Index growth rate (WLIg)

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

$$\text{WLI used} = \text{WLI} = (\text{WLI} - 50) / 10$$

WLIg used = $\text{WLIg} = (\text{WLIg}/200 + 1)$ A value of WLIg greater than 1 and less than 1 would represent positive and negative growth, respectively.



Yield curve

A fairly reliable indicator for an upcoming recession is the difference between short- and long-term interest rates (known as the “yield curve”). An upward-sloping yield curve, in which long-term interest rates are higher than short-term rates, is normal. An “inverted” yield curve, with short-term rates above long ones usually heralds a recession. The model uses the 2-year and 10-year U.S. Treasury yields as measures of short-term and long-term rates, respectively, and calculates the Forward Rate Ratio (FRR2-10) between the two rates. The FRR is described in an article by Howard L. Simons in *Stocks, Futures and Option Magazine*, March 2007 and can be calculated for any two rates on the yield curve. (See Appendix B for the formula to calculate FRR2-10.)

Decision variables

The following Exponential Moving Averages (EMAs) are calculated:
(see Appendix B for descriptions of EMA, smoothing factor and “long” and “short” 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

The following slopes are calculated: (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 : Federal Funds Rate

Sell signals

The model provides three types of sell signals. Detailed requirements for the sell signals to be generated are listed in Appendix B. The initial *basic sell signal* which automatically leads to a *type A sell signal* 13 weeks later 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. However, this signal will also be generated when the yield curve is abnormally steep, which provides for conditions of prolonged economic weakness with concurrent very low short-term interest rates. 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 dropping 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.

Buy signals

The model provides three types of buy signals. Detailed requirements for the buy signals to be generated are listed in Appendix B. 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 buying 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 B – Calculation Details

Forward Rate Ratio

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 used for calculating FRR2-10 is

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

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. For a detailed description see http://en.wikipedia.org/wiki/Moving_average

The formula used for calculating the EMA is

$$\text{EMA}_{\text{today}} = \text{EMA}_{\text{yesterday}} + \alpha \times (\text{value}_{\text{today}} - \text{EMA}_{\text{yesterday}})$$

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.

Sell Signals

Sell signal type A

An initial *basic sell signal* is generated when the [short EMA of $WLIg$] moves below the [long EMA of $WLIg$] while the [long EMA of $WLIg$] still shows positive growth but which is steadily declining and the EMA of the FRR2-10 is at or below 1.00 (indicating an inversion of the yield curve), or is above 1.175. Also the Federal Funds Rate must be greater than the previous maximum rate minus 0.50%, the previous maximum rate being considered over the preceding six months period. (Later basic sell signals are eliminated if they appear within 100 days of an initial basic sell signal.)

A *Type A sell signal* is generated 13 weeks after a basic sell signal occurs, because it was found by inspection that this selling delay achieved on average the highest selling values.

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 $WLIg + 1$] drops below the 20-day slope of the [long EMA of $WLIg + 1$].

Sell signal type C

A *type C sell signal* 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 $0.005 \times$ [EMA of S&P500].

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 dropped at least 2.50% from a previous high, the previous high being considered over the preceding 20 months 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 [long EMA of *WLIg*] minus the [short EMA of *WLIg*] must be greater than 0.005.

Appendix C - Signal Dates and S&P 500 values

<i>Buy Signal Type A</i>		<i>Buy Signal Type B</i>		<i>Buy Signal Type C</i>	
08/18/70	76.20	04/10/03	871.58	03/26/82	111.94
02/12/75	79.92	11/18/04	1183.55	01/23/85	177.30
07/03/80	117.46			05/25/88	253.77
01/15/82	116.33			03/24/99	1268.59
12/20/90	330.12			04/03/03	876.45
03/12/03	804.19			03/14/05	1206.83
03/30/09	787.53				

<i>Sell Signal Type A</i>		<i>Sell Signal Type B</i>		<i>Sell Signal Type C</i>	
04/17/69	100.78	10/03/69	93.19	06/10/69	100.42
09/23/69	95.63	02/07/74	93.30	11/01/83	163.66
10/16/73	110.19	03/13/79	99.84	10/02/87	328.07
02/09/79	97.87	09/19/79	108.28	04/09/90	341.37
07/17/79	101.83	02/14/80	116.72	06/29/00	1442.39
01/09/80	109.05	04/01/81	136.57	11/05/07	1502.17
03/31/81	136.00	08/10/89	348.25	03/30/10	1173.27
08/28/89	352.09	09/27/00	1426.57		
08/07/00	1479.32				
05/22/07	1524.12				
04/20/10	1207.17				

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.

10/20/66 77.84 buy
 04/17/69 100.78 sell A



08/18/70	76.20	buy A
10/16/73	110.19	sell A
02/12/75	79.92	buy A
02/09/79	97.87	sell A
07/03/80	117.46	buy A
03/31/81	136.00	sell A
01/15/82	116.33	buy A
11/01/83	163.66	sell C
01/23/85	177.30	buy C
10/02/87	328.07	sell C
05/25/88	253.77	buy C
08/10/89	348.25	sell B
12/20/90	330.12	buy A
06/29/00	1442.39	sell C
03/12/03	804.19	buy A
05/22/07	1524.12	sell A
03/30/09	787.53	buy A
03/30/10	1173.27	sell C

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