Market Signals – Examples of Return

The result of the systematic use of market entry and exit signals is discussed with **historical yield examples** based on the American S&P 500 index. Following that, we show the **current yield of different model portfolios** using S&P 500 data (using data of the DAX index in the German version).

1. Historical yield examples

For characteristic time periods between 1964 and 2009, the following diagrams illustrate how the use of market entry and exit signals, applied to the US S&P 500 index, can improve the yield on stock and decrease the stock volatility relative to a buy-and-hold strategy. We show (the logarithm of) the performance of the stock proportion considering both transaction costs (assuming 0.5% for each buy and sell) and a 3% rate of return on assets (in risk-free investments) while the assets are not in stocks. The results are based on historical S&P 500 weekly closing data, since one can show that the use of daily data does not improve the results.

The black curve represents (the natural logarithm of) the S&P 500 index and, thus, is identical to the **buy-and-hold strategy**, i.e. one is always in the market.

The blue curve follows a **conservative strategy**: you are invested in the market whenever the trend (determined by Kalman filtering) lies above a certain threshold. An exit signal occurs when the trend falls below the threshold: then you switch to a risk-free asset with an assumed average rate of 3%.

The red curve follows a **more aggressive strategy**: the exit signal is identical to the conservative strategy, however there is a temporary market entry whenever the trend has fallen below a low-lying negative threshold.

Three results can be highlighted:

- Long duration bear markets (≥ 1 year) can be detected in sufficient time.
- Short-term crashes cannot be avoided because of the inertia of the market signals.
- After the end of a bear market, re-entry in the market is delayed. The more aggressive strategy is faster than the conservative strategy, but carries the risk of intermittent substantial losses if re-entry occurs too early, that is, before the bear market has passed through its absolute minimum.

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Time period 1: Long-term US S&P 500 market index
(January 1964 to August 2009)

A comparison of the three strategies shows how, over a long time period (45 years), the use of market signals improves annual returns and reduces annual volatilities. During this period, there were several bull and bear markets, crashes, and flat markets. The annual return increased in both the conservative and aggressive strategies, because bear markets were avoided and the portfolio was invested in risk-free assets during time periods out of the market.
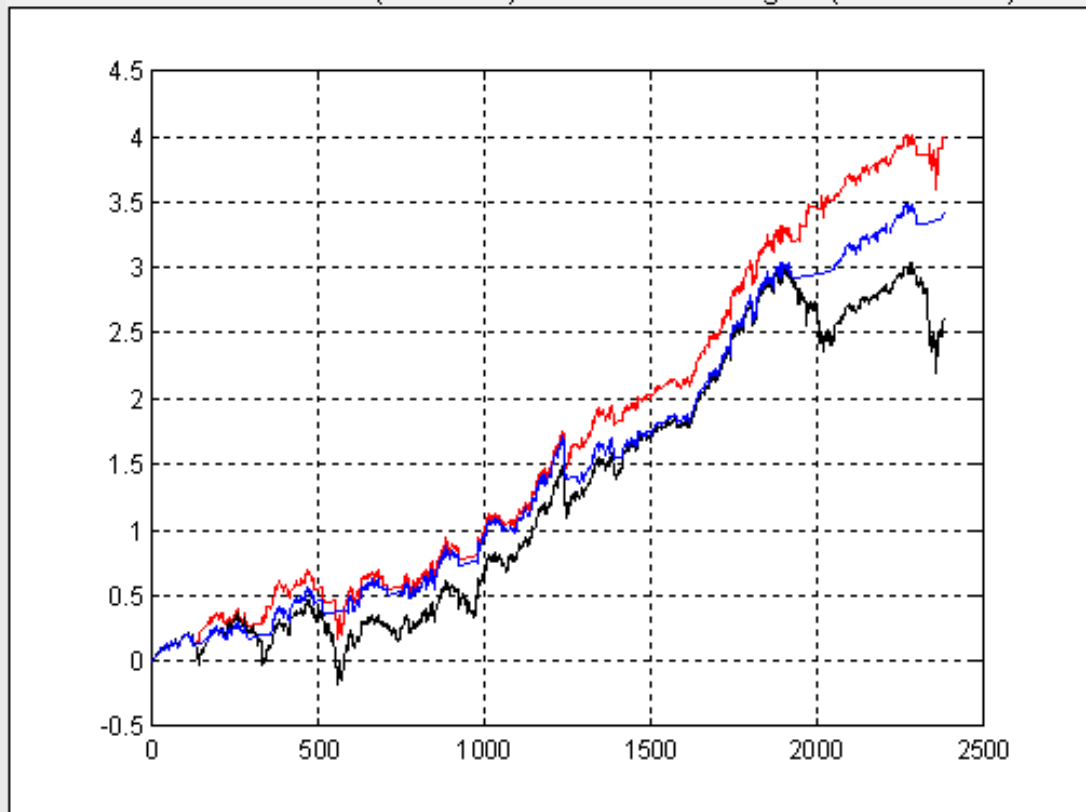
Buy-and-Hold*: 5.8% annual return; 17.1% volatility
Conservative*: 7.7% annual return; 12.5% volatility
Aggressive*: 9.1% annual return; 15.0% volatility

*: text colors correspond to graph colors

Logarithm (ln) of stock price with an initial value of 1 as a function of time (in weeks) for various strategies (01.64-08.09)

SigmaDeWe – Risk Management

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**Time period 2: Flat market during several years
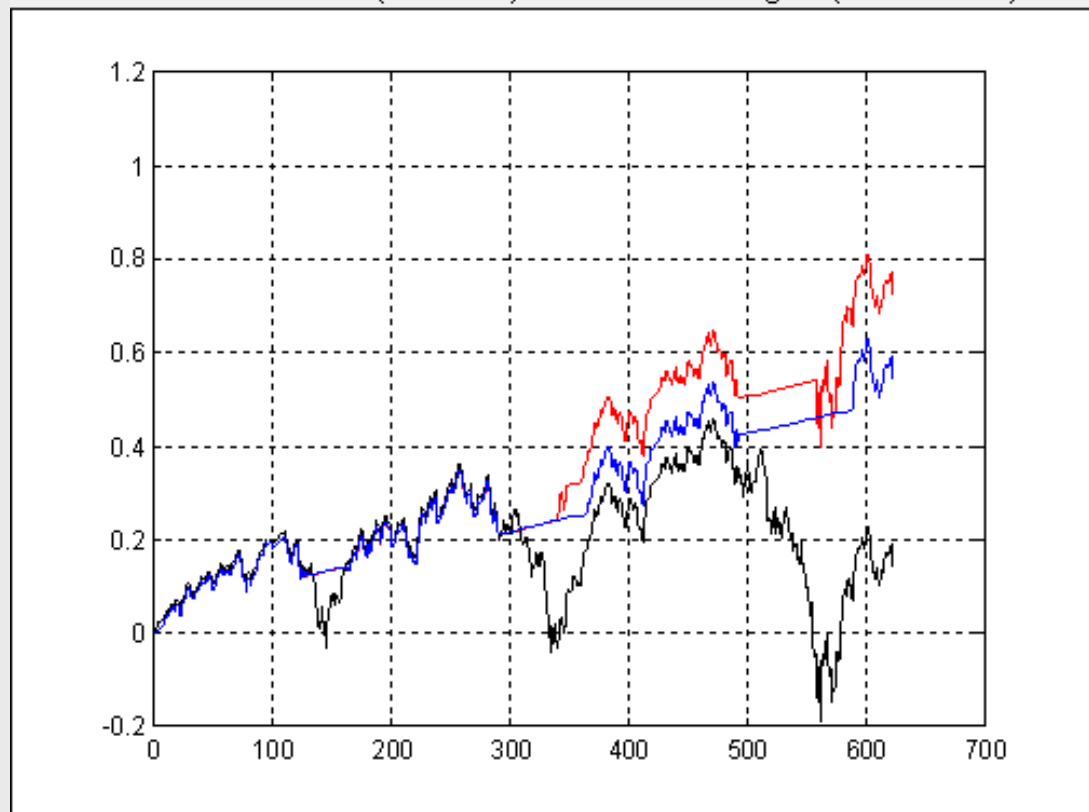(January 1964 to December 1975)**

In an overall flat market, shorter bear markets are also identified in sufficient time.

Buy-and-Hold: 1.2% annual return; 15.1% volatility
Conservative: 4.6% annual return; 9.2% volatility
Aggressive: 6.2% annual return; 12.6% volatility

Logarithm (ln) of stock price with an initial value of 1 as a function of time (in weeks) for various strategies (01.64-12.75)

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Time period 3: Bull market with crash in 1987 and a 18% decline in autumn 1990 (January 1986 to December 1992)
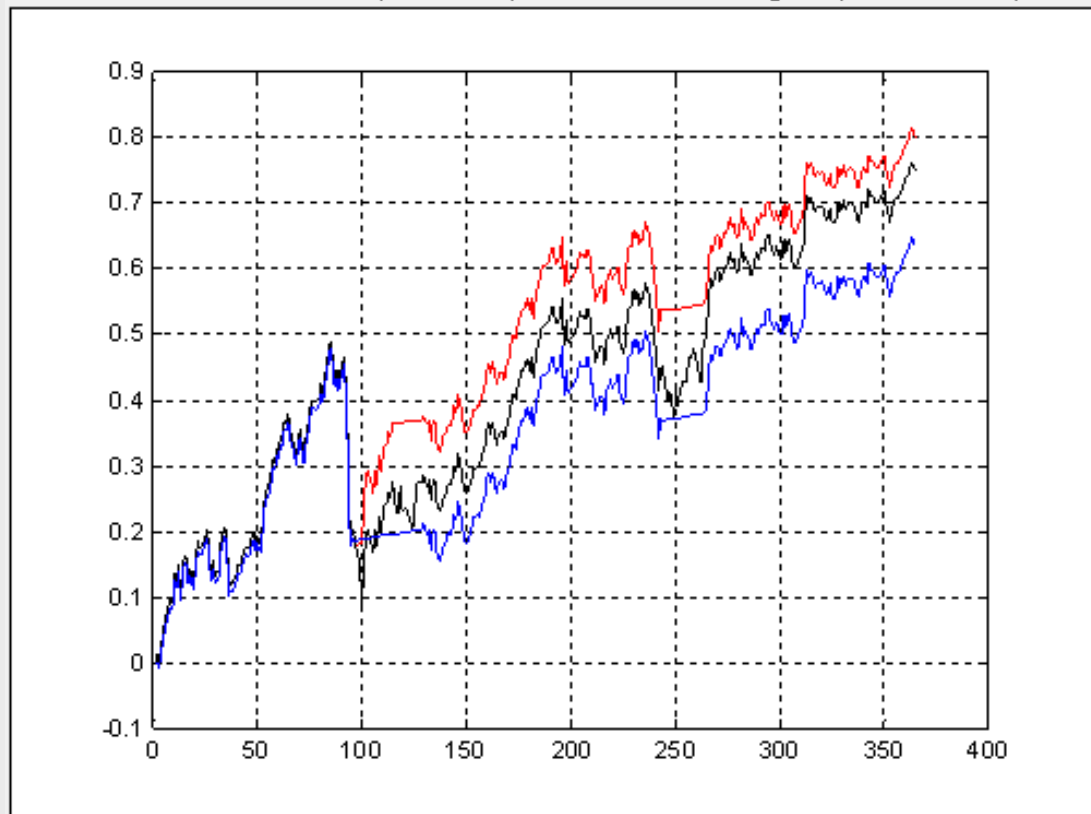
Crashes like the one in October 1987, with a drop of 32% within 2 months, cannot be predicted because of the inertia of the market signals. The conservative strategy is inferior to buy-and-hold because it is slow to predict re-entry into the market.

Buy-and-Hold: 11.3% annual return; 17.8% volatility
Conservative: 9.5% annual return; 15.4% volatility
Aggressive: 12.1% annual return; 16.6% volatility

Logarithm (ln) of stock price with an initial value of 1 as a function of time (in weeks) for various strategies (01.86-12.92)

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Time period 4: The last two bear markets with market entry in 2000
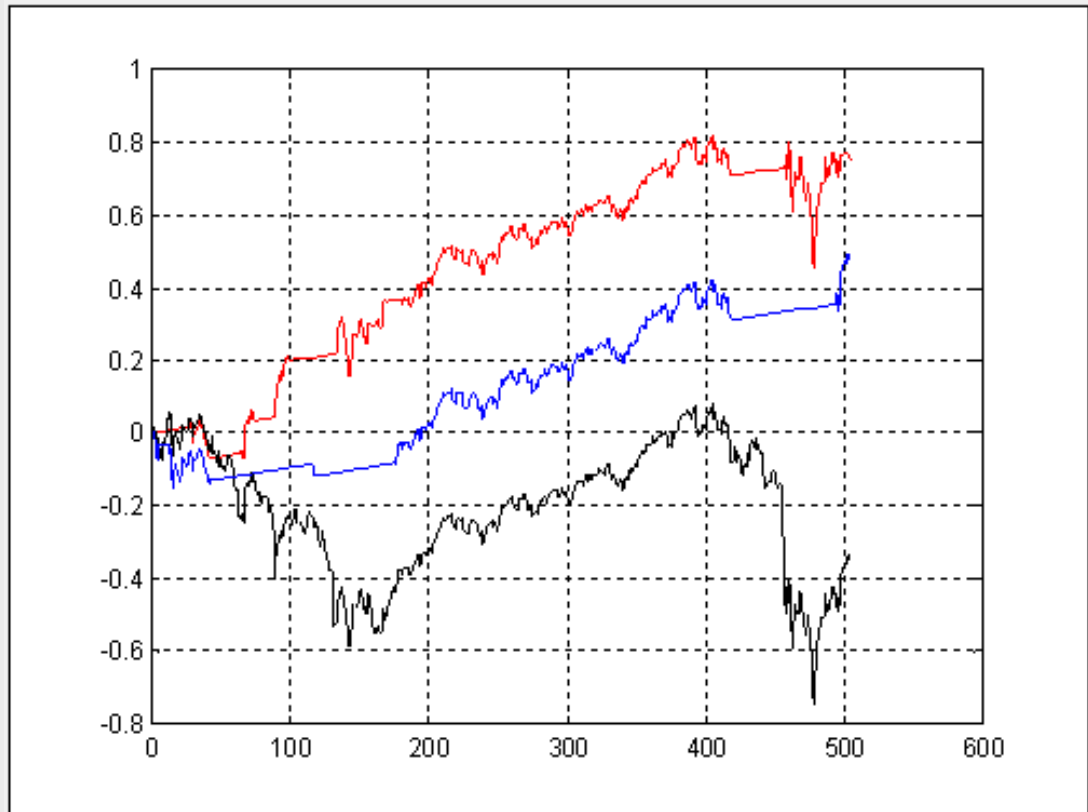**(January 2000 to August 2009)**

Long-lasting bear markets are identified in sufficient time. Market re-entry occurs relatively late with the conservative strategy, but the interim risk of loss is lower.

Buy-and-Hold: -3.5% annual return; 19.9% volatility
Conservative: 5.1% annual return; 11.0% volatility
Aggressive: 8.1% annual return; 16.3% volatility

Logarithm (ln) of stock price with an initial value of 1 as a function of time (in weeks) for various strategies (01.00-08.09)
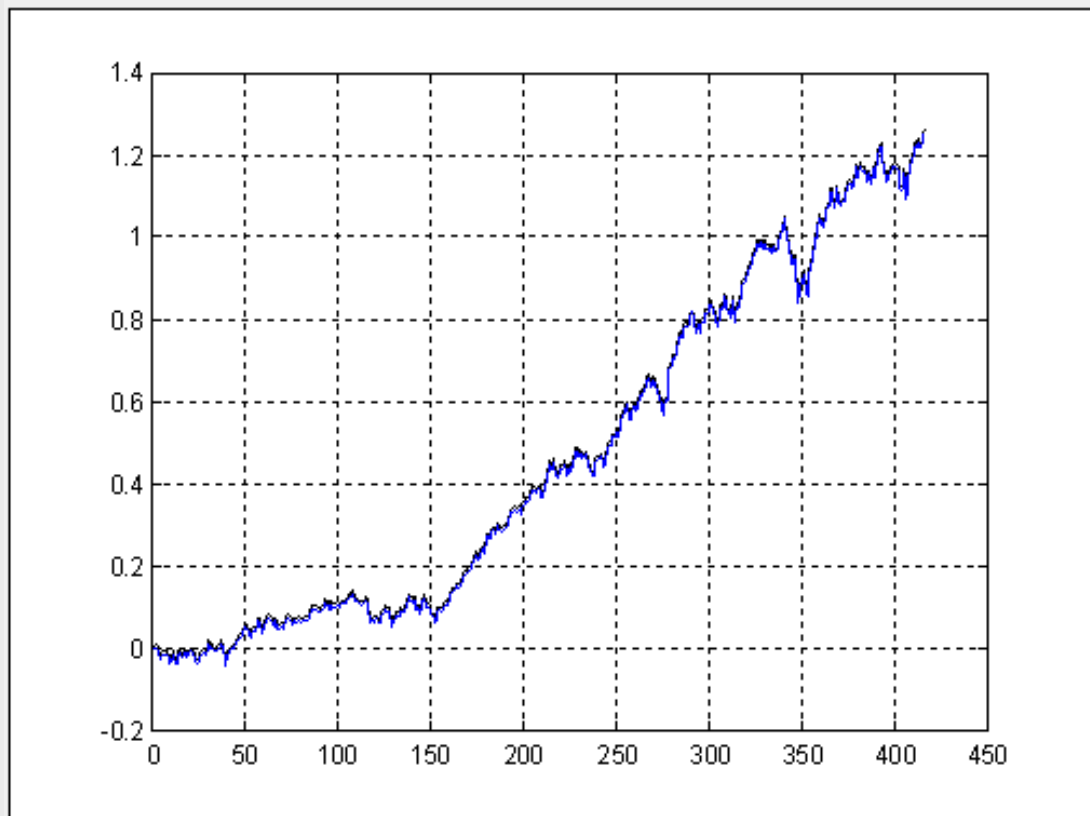
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Time period 5: Long-lasting bull market (January 1992 to December 1999)

Both the conservative and the more aggressive strategy yield no exit or entry signals, not even for interim correction phases, like the short-term decline with fast recovery in 1998. Return rates and volatilities are identical to buy-and-hold.

Buy-and-Hold: 17.1% annual return; 15.4% volatility

Logarithm (ln) of stock price with an initial value of 1 as a function of time (in weeks) for the optimal buy-and-hold strategy (01.92-12.99)

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2. Current yield of different model portfolios

For the period 2006 to the present day we consider four model portfolios based on the S&P 500 index (based on the DAX index in the German version) and compare the performance with and without the use of market signals. Each model portfolio has a starting value of 100 on 1/1/2006:

Portfolio 1: 100% risk-free investment in the form of fixed-term deposits with interest rates given by the valid monthly Federal Funds Effective Rate (https://www.federalreserve.gov/datadownload/Build.aspx?rel=H15).

Portfolio 2: 100% investment in the S&P 500 Total Return index (e.g. an ETF that tracks the S&P 500 Total Return index) and application of a buy-and-hold strategy. Here the monthly data of the S&P 500 Total Return index are approximated by using monthly data of the S&P 500 index and adding an average monthly dividend yield based on the expected annual S&P 500 dividend yield.

Portfolio 3: 20% invested in the S&P 500 Total Return index, 80% in risk-free fixed-term deposits, and following the market signals (conservative strategy). With this stock proportion, even risk-averse investors can achieve a good long-term return because the loss probability for the total portfolio is very small. Details on how to determine your personal stock proportion as a function of loss and return probabilities are described in the article **Portfolio Management**.

Portfolio 3a: 20% invested in the S&P 500 Total Return index, 80% in risk-free fixed-term deposits without following the market signals and with no control of the stock proportion.

Portfolio 4: 40% invested in the S&P 500 Total Return index, 60% in risk-free fixed-term deposits, and following the market signals (conservative strategy). With this stock proportion the long-term return is significantly higher, the loss probability is still low compared to a buy-and-hold strategy.
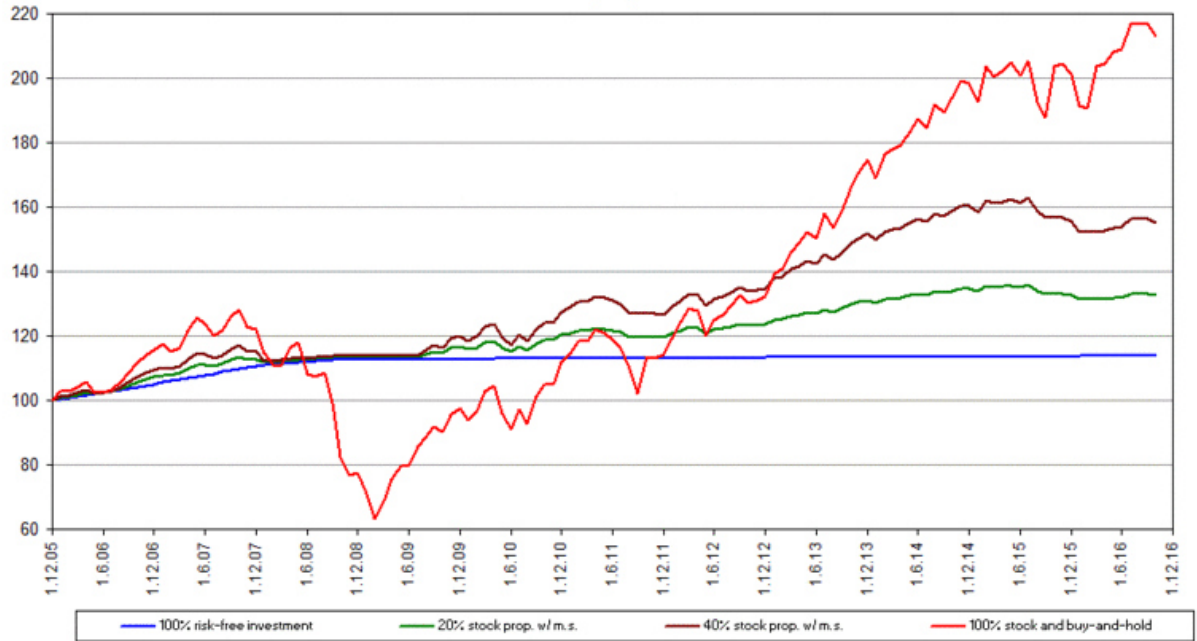
Portfolio 4a: 40% invested in the S&P 500 Total Return index, 60% in risk-free fixed-term deposits without following the market signals and with no control of the stock proportion.

Market entry and exit times are determined by the SigmaDeWe market signals. At times when the market signals give an exit signal, the stock proportion is sold and invested in the form of fixed-term deposits with the then valid interest rates. When in the market, the stock proportion is kept within a bandwidth of ±10% of its initial value. Whenever the stock proportion moves out of this band, stocks are bought or sold to adjust back to the original proportion. Transaction costs are assumed to be 0.7% for each transaction.
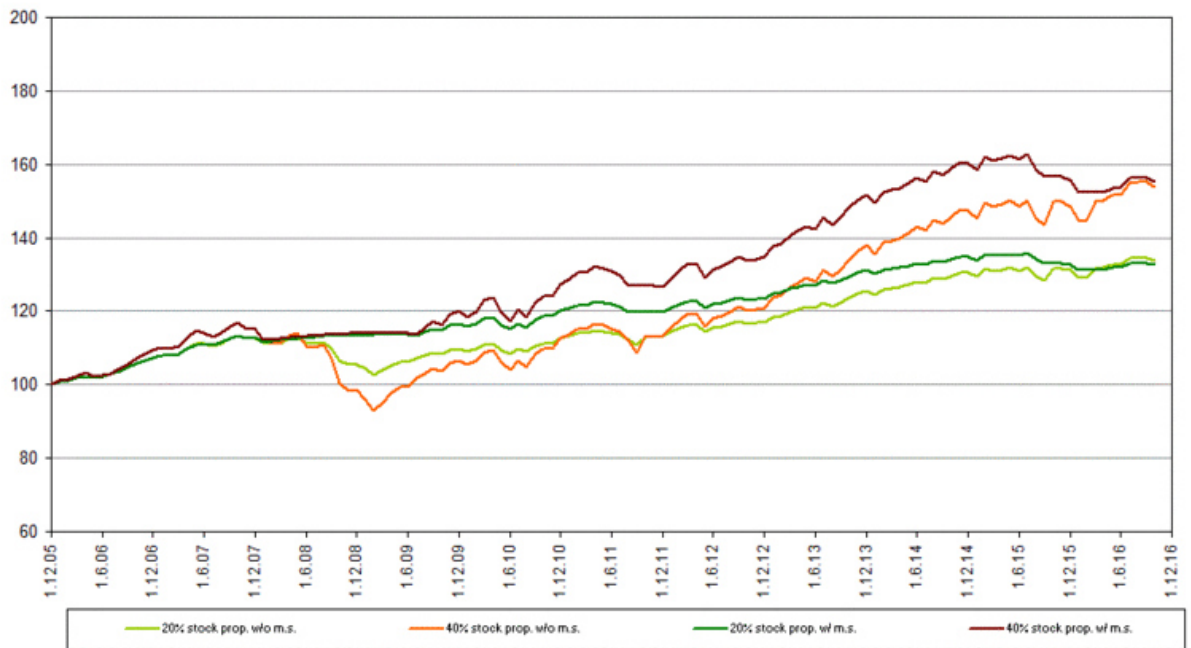
The performance of the model portfolios and the current values of the model portfolios are shown in the following graphs and table.

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Monthly performance since Janary 1, 2006 of 4 model portfolios with an initial value of 100 (based on the S&P 500 index); with market signals (conservative strategy) and with stock proportion control

— 100% risk-free investment   — 20% stock prop. w/ m.s.   — 40% stock prop. w/ m.s.   — 100% stock and buy-and-hold

Monthly performance since Janary 1, 2006 of 4 model portfolios with an initial value of 100 (based on the S&P 500 index); with and without market signals and stock proportion control

— 20% stock prop. w/o m.s.   — 40% stock prop. w/o m.s.   — 20% stock prop. w/ m.s.   — 40% stock prop. w/ m.s.

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Model portfolios based on the S&P 500 index since 2006

Oct. 31, 2016	Interest rates for risk-free investment **	Δ abs.	Market presence *	Δ abs.	Portfolio value	Δ in %
Portfolio 1 100% risk-free	0,40%	0,00%	0	0	114,0	0,0%
Portfolio 2 100% stock with buy-and-hold strategy	0,40%	0,00%	1	0	213,1	-1,8%
Portfolio 3 80% risk-free, 20% stock with market signals and with stock proportion	0,40%	0,00%	1	0	132,7	-0,3%
Portfolio 3a 80% risk-free, 20% stock without market signals and no stock proportion	0,40%	0,00%	1	0	133,8	-0,5%
Portfolio 4 60% risk-free, 40% stock with market signals and with stock proportion	0,40%	0,00%	1	0	155,3	-0,7%
Portfolio 4a 60% risk-free, 40% stock without market signals and no stock proportion	0,40%	0,00%	1	0	153,6	-1,0%

*: 1 means "in the market"; 0 means "out of the market"

**: valid monthly Federal Funds Effective Rate

Δ: changes since 4 weeks

Remark: Another market entry signal in March for the portfolios 3 and 4. The current situation shows the problem with a trend following strategy: even for very long trends too many signals can occur which reduce the performance of the portfolios (market exit signal in Sept. 2015, market entry signal in October, market exit in January 2016 and now re-entry in March 2016).