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Northington Dahlberg Research, LLC  
Charlotte, NC  
USA

NORTHINGTON DAHLBERG RESEARCH, LLC

## **ENDEAVOR RELATIVE STRENGTH SYSTEM PERFORMANCE**

A statistical performance study of the Endeavor relative strength portfolio system

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# Disclaimer

The risk of loss in trading securities, options, futures and foreign exchange can be substantial. MetaSwing® and Endeavor users and customers are considered as one, herein. Endeavor users and customers must consider all relevant risk factors including their own personal financial situation before trading. Northington Dahlberg Research (NDR), LLC assumes no responsibility for actual trading/investing results based on using Endeavor research. Subscribers to NDR Endeavor must use Endeavor at their own risk.

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# Northington Dahlberg Research, LLC

ND Research is a quantitative technical market research firm that makes [high probability] analytics based on volatility math. Our tools and research give traders and analysts the ability to forecast and improve alpha. ND Research algorithms draw strength from original configurations of volatility mathematics. Each tool and research item is based on responsible quantitative testing.

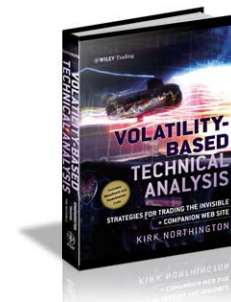
We are the creators of several new concepts in quantitative technical analysis:

**Volatility-Based Support and Resistance** identifies high accuracy points of support and resistance which are remarkably simple to use.

**NDR Relative Strength** designed to capture the benefit of traditional relative strength on the upside but to avoid the weaknesses of it on the downside.

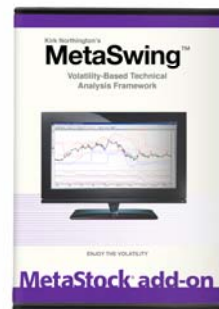
**NDR Synthetic Volatility Index** is a barometer of investor sentiment and near-term market volatility, calculated with our proprietary volatility math. It can be used on any market or security; options premium data not used.

We publish market research for wealth management practices, hedge funds, proprietary trading firms, asset management firms and mutual funds. Our solutions achieve the advantages of profitability, probability, and risk management through the use of quantitative design and statistically valid research methodology. ND Research analytics easily integrate with existing decision processes [work flow] to increase accuracy and profit.



In his book *Volatility-Based Technical Analysis: Strategies for Trading the Invisible* (John Wiley & Sons; Wiley Trading Series), Kirk Northington lays the groundwork for two new volatility-based charting concepts.

Currently our software is available as MetaSwing, a subscription based Add-On to Bloomberg Professional, Thomson Reuters and TradeStation.



# In-Sample Back Testing Methodology

## Test Population

For back-testing each of the Endeavor components the individual stocks of the S&P 500 Index are used. The specific makeup is that of the S&P 500 as defined from October 1, 2001 to September 30, 2009, as the index was rebalanced quarterly. The accurate definition of the index constituents support survivorship bias free testing.

## Data Source

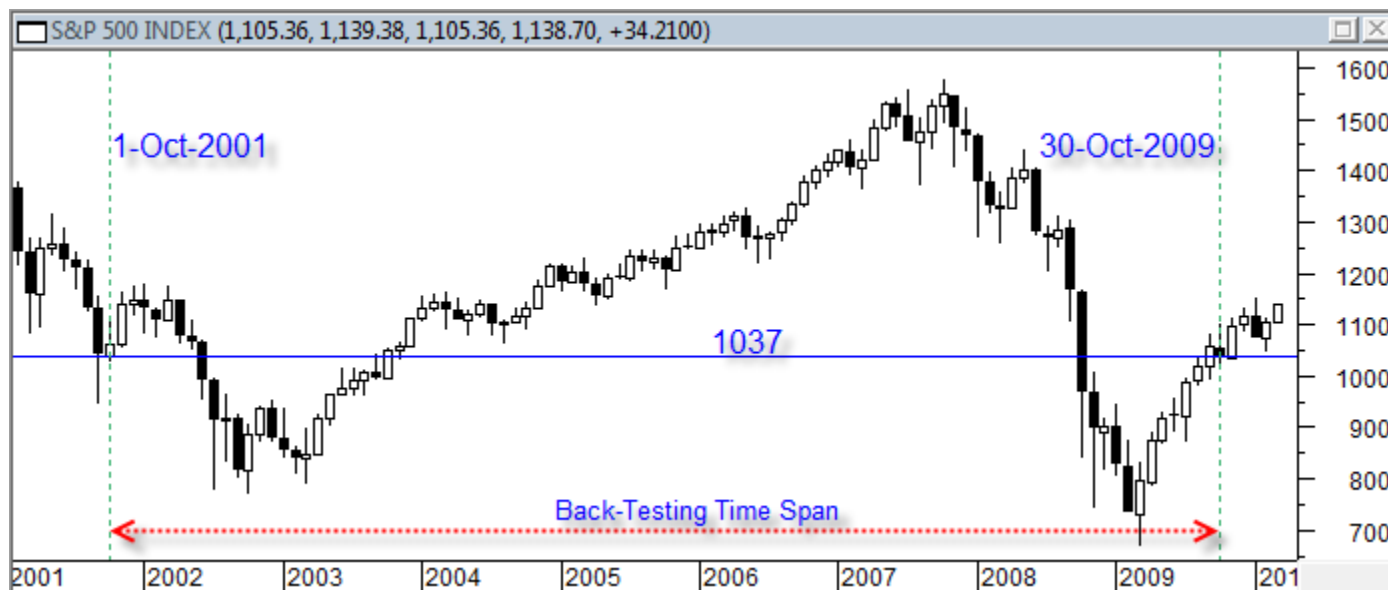
All back-testing is performed using daily time series data from Thomson Reuters. The test signals are only those that occur between October 1, 2001 and October 30, 2009; approximately eight years.

## In-Sample Market Time Span

The test data was chosen to be market neutral. There is only a 2.3 point difference in the S&P 500 Index from the beginning of the test data time span to the end. This creates a more unbiased, de-trended market environment. Doing so creates test results attained throughout an equal effect of bull and bear markets.

Beginning Date: S&P 500 Index 10/1/2001 Close = 1038.55

Ending Date: S&P 500 Index 10/30/2009 Close = 1036.19



## In-Sample Back Testing Methodology

### Performance Test

The testing process simulates a trade for each specific entry and exit signal derived from the system being tested. It is not our recommendation to trade based on a particular component's signal. Simulating a trade is used as a way of testing the component. The signal generation is different for each component. The signal generation logic is given literally and visually with each set of performance data.

### Survivorship Bias Filtering

This phase compensates for testing an Index of stock constituents that does not remain static. There are two means by which survivor bias enters the research universe:

**Type 1 Bias:** The bias of excluding companies from a research universe that met membership criteria historically but did not on the day the universe was defined. These are poor performers eliminated by delisting or acquisition, prior to current index inclusion.

**Type 2 Bias:** The bias of including companies in a research universe that did not meet membership criteria until recently. These are outperformers tested for time spans occurring prior to index qualification.

The purpose of ensuring that performance testing is free of survivorship bias, is to directly simulate the trading of index constituents just as one would have done so over time; just as the makeup of the index changed. This significantly improves the probability that future system performance will track historical system performance.

### Monte Carlo Simulation

Monte Carlo Simulation is used to produce descriptive statistics and distribution analysis. The Monte Carlo Simulation uses a 10,000 iteration, random sampling with replacement.

### Broad Market Comparison

For each instance of a test signal a concurrent trade using the S&P 500 Index is also measured. The performance of the index is then compared to the test statistic.

## In-Sample Back Testing Methodology

### Best Practice Compliance

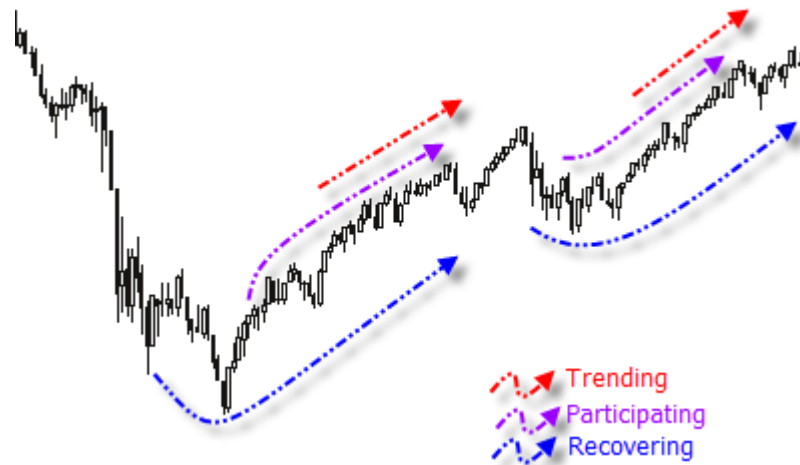
Throughout the back-testing process every effort has been made to adhere to the best practices promoted by the Market Technician's Association. In general these practices are:

- Law of large numbers
- Walk-Forward Portfolio Simulation
- Distribution analysis
- Survivorship Bias Filtering
- De-trended market span
- Monte Carlo Simulation
- Algorithmically generated test results
- Direct comparison to broad market performance

# Endeavor System Methodology

## Phases of Price Behavior

Markets and individual securities experience repetitive sequences of price movement. Following steep bearish moves prices tend to stabilize, then alternate between trending and consolidating.



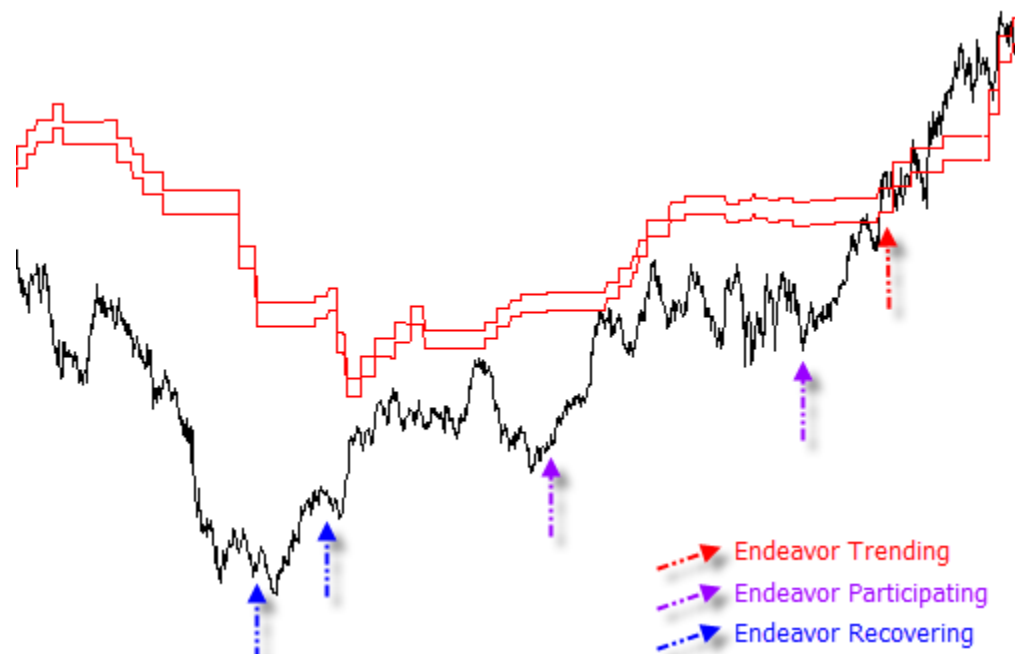
## Endeavor Implements Adaptively

Within the Endeavor algorithmic framework are three types of entry and exit rule sets. These subsystems are designed to produce position decisions which outperform in relative and absolute terms.

Endeavor Trending

Endeavor Participating

Endeavor Recovering





## Endeavor System Methodology: Subsystems

Finding relative strength outperformance within each 'long friendly' market phase means keeping capital productive in smart ways.

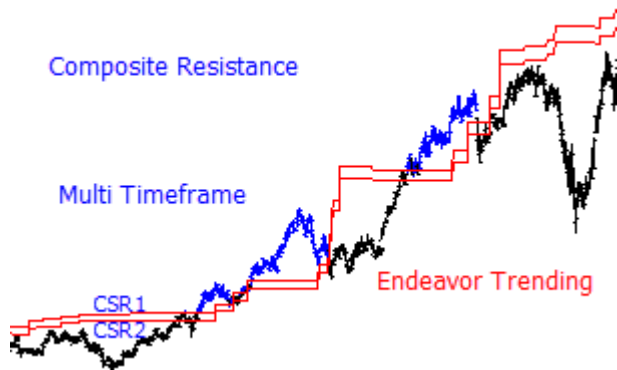
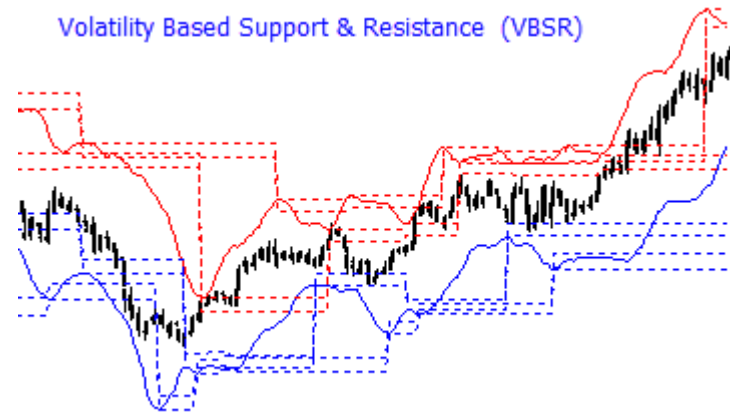
Each Endeavor subsystem focuses on identifying key price movement characteristics with high a correlation to predictive relative strength.

ENDEAVOR			
Phases of Price Behavior	RECOVERING	PARTICIPATING	TRENDING
	<ul style="list-style-type: none"> <li>Relative Strength will turn up</li> <li>trend beginnings</li> <li>early market recovery stocks/ corrections</li> </ul>	<ul style="list-style-type: none"> <li>Relative Strength will continue/turn up</li> <li>initial trend continuations</li> <li>follows corrections/ consolidations</li> </ul>	<ul style="list-style-type: none"> <li>mid trend and higher</li> <li>entry upon resistance break through</li> <li>institutional accumulation</li> </ul>
Characteristics	ENDEAVOR RECOVERING	ENDEAVOR PARTICIPATING	ENDEAVOR TRENDING
	<ul style="list-style-type: none"> <li>NDR Synthetic Volatility Index</li> <li>NDR Relative Strength</li> <li>Alpha Capture</li> </ul>	<ul style="list-style-type: none"> <li>Immediate Volatility Based Resistance</li> <li>Indicating Beginning of Trend</li> <li>Alpha Capture</li> </ul>	<ul style="list-style-type: none"> <li>Multi Timeframed, Projected Volatility-Based Resistance</li> <li>Institutional Participation</li> <li>Alpha Capture</li> </ul>
Endeavor Sub-System			
Technical Strengths	ENDEAVOR RECOVERING	ENDEAVOR PARTICIPATING	ENDEAVOR TRENDING
	<ul style="list-style-type: none"> <li>NDR Synthetic Volatility Index</li> <li>NDR Relative Strength</li> <li>Alpha Capture</li> </ul>	<ul style="list-style-type: none"> <li>Immediate Volatility Based Resistance</li> <li>Indicating Beginning of Trend</li> <li>Alpha Capture</li> </ul>	<ul style="list-style-type: none"> <li>Multi Timeframed, Projected Volatility-Based Resistance</li> <li>Institutional Participation</li> <li>Alpha Capture</li> </ul>

## Endeavor System Methodology

### Innovatively Quantitative

Northington Dahlberg Research pioneered the technical concept of Volatility-Based Support & Resistance (VBSR). VBSR is an advanced and reliable form of technical support and resistance. It is quantitatively proven, and is applicable to any efficiently traded asset class. VBSR is algorithmically generated, and is adaptive based on price volatility.



**Composite VBSR** Endeavor **Trending** outperformance is achieved by identifying stock price performance demonstrating an ability to rise above Composite Resistance. In this way the Endeavor relative strength methodology differs from other technical relative strength systems. It is based on an adaptive support/resistance model, and not on common forms of momentum measurement.

## Endeavor System Methodology: Portfolio Selection Process

**Selection Priorities:** (in order of importance)

### Maintain Full Exposure In Secular Bull Markets

Historically this has proven to reduce portfolio volatility while capturing the potential returns of bull markets.

### Balance Risk Across Multiple Subsystem

**Disciplines** Utilizing a risk-managed ensemble of uncorrelated strategies takes advantage of the different phases of the entire secular bull market.

### Leverage Individual Subsystem Strength to Phase of Market Cycle

Each subsystem discipline will capitalize on a specific phase of a stock's market cycle. Ultimately it enables the entire Endeavor process to react better to sector rotation and market cycle change.

### Reduce Portfolio Volatility With NDR Proprietary

**Analytics** Additional screening with our volatility-based algorithmic tools enables NDR to increase performance and reduce risk.

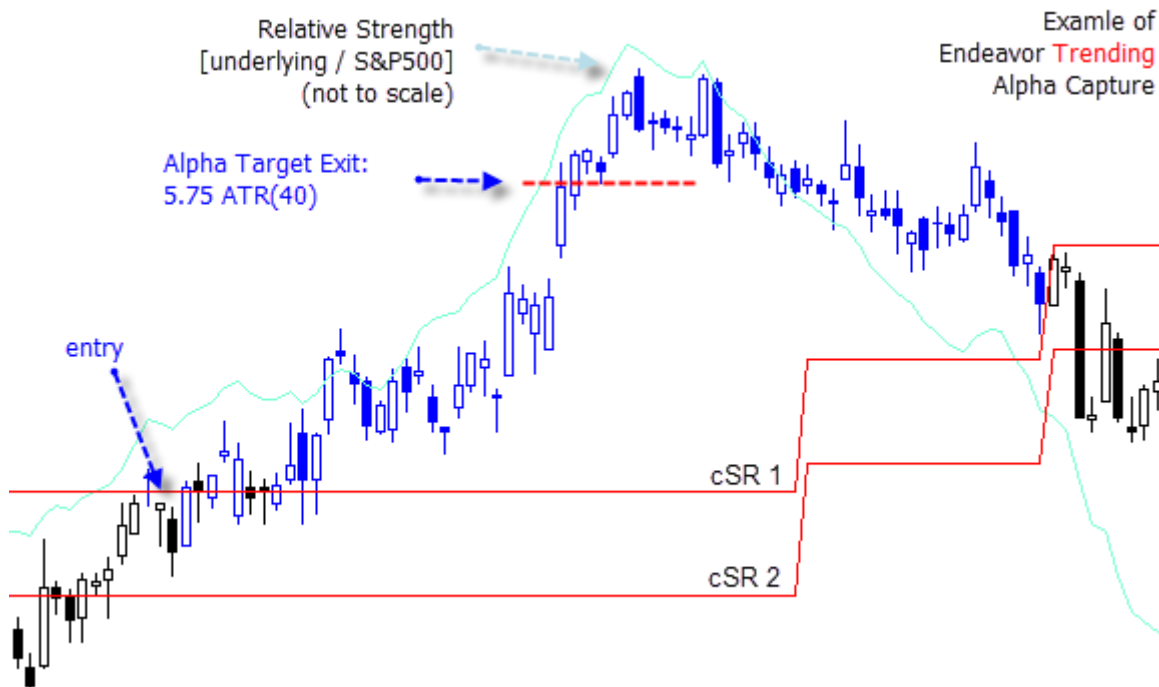
ENDEAVOR	
Early Secular Bull Market Re-Entry to Six Months	Secular Bull Market Six Months Post Re-Entry Forward
$\frac{1}{2}$ RECOVERING $\frac{1}{2}$ PARTICIPATING	$\frac{1}{3}$ RECOVERING $\frac{1}{3}$ PARTICIPATING $\frac{1}{3}$ TRENDING
<ol style="list-style-type: none"><li>1. Maintain <math>\frac{1}{2}</math>   <math>\frac{1}{2}</math> (Recovering   Participating) ratio of 30 subsystem portfolio positions</li><li>2. In the initial six month period of re-entering from cash to market exposure priority is given to Recovery and Participating subsystems</li><li>3. When choosing from entry opportunities of the same subsystem, priority is given to the security with the most favorable NDR analytics</li></ol>	<ol style="list-style-type: none"><li>1. Maintain <math>\frac{1}{3}</math>   <math>\frac{1}{3}</math>   <math>\frac{1}{3}</math> (Recovering   Participating   Trending) ratio of 30 subsystem portfolio positions</li><li>2. If there are insufficient specific subsystem entry opportunities to maintain 33% participation then a different subsystem opportunity will be used</li><li>3. When choosing from entry opportunities of the same subsystem, priority is given to the security with the most favorable NDR analytics</li></ol>

## Endeavor System Methodology: Exiting Discipline 1

### Alpha Capture

Endeavor **Recovering**, **Participating** and **Trending** entries are signaled when price closes above the composite support/resistance 1 - 2 zone (cSR 1-2) in a daily periodicity. This method is designed to identify an existing trend at its earlier or midpoint stage, but only at a point where broad based intuitional participation will persist with probability. As shown below the cSR 1 and 2 lines are automatically adaptive and dynamic based on the price volatility of the underlying security.

When the security closing price is above the cSR 1-2 resistance zone an entry is initiated. The system allots 5 days to build the long position.



The addition of the Alpha Target exit enables better performance by capturing initial relative strength out performance, while freeing up capital to enter more positions which are likely to repeat a similar scenario.

If no Alpha Target is reached will then wait to sell into strength. This enables the position default to a practice of closing into strength and not weakness. See the next page for specifics.

## Endeavor System Methodology: Exiting Discipline 2

### Exits at Strength

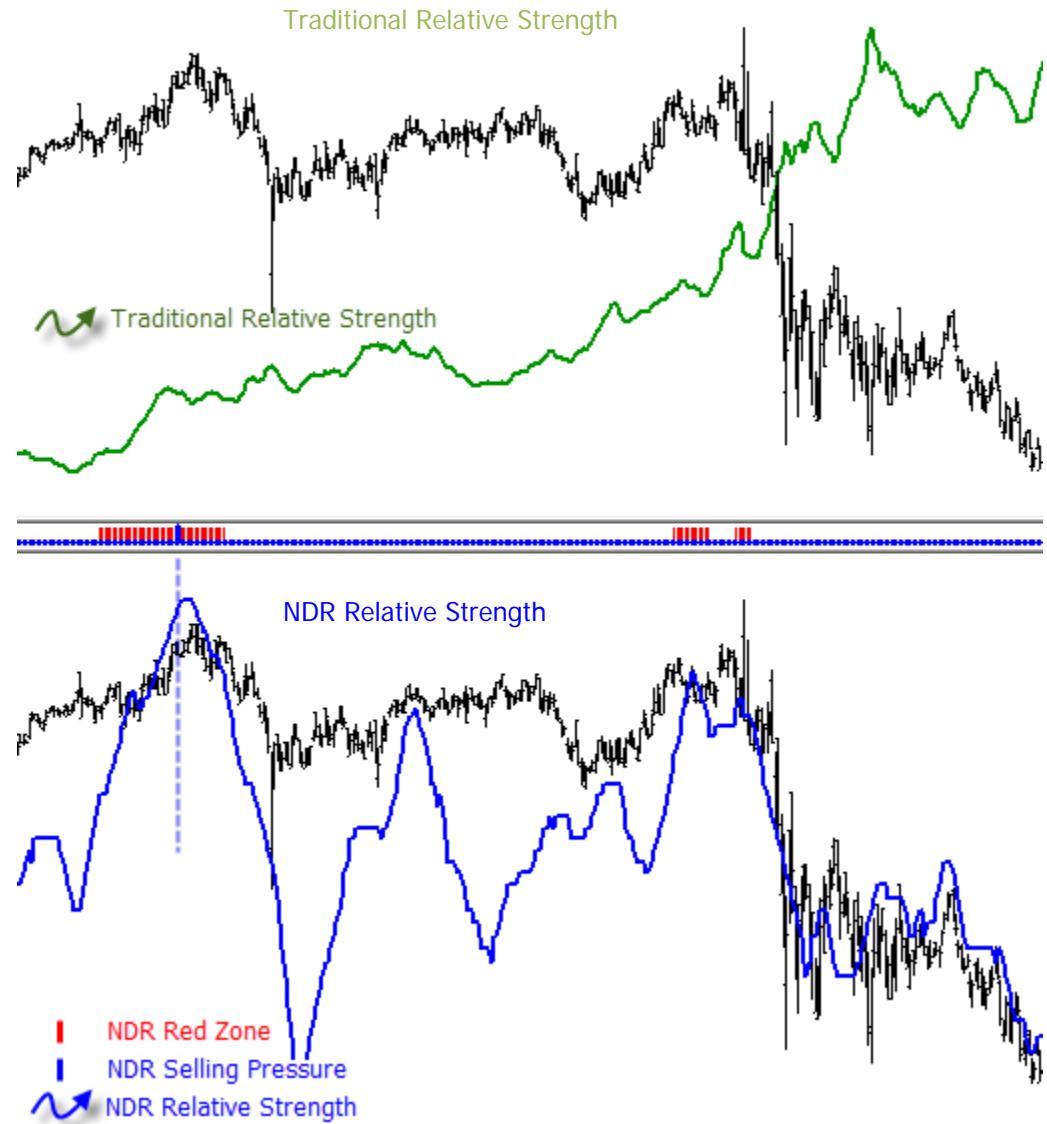
Positions are best ended when they are strong but not likely to continue so. Most portfolios assume strength until weakness forces an exit. ***Quantitatively exiting at a point of strength is superior but requires predictive analytics to do so.***

### NDR Relative Strength

A traditional relative strength ratio measurement will often indicate positive performance even though the position is losing absolute value. NDR Relative Strength is designed to capture the benefit of relative strength on the upside but to avoid the weaknesses of it on the downside. It hones in on the performance the investor desires; outperformance with absolute gains.

### NDR Red Zone

This uses volatility based metrics with NDR Relative Strength to assist in finding zones of susceptibility to weakness in relative strength. Often traditional relative strength can persist though the security exhibits losing on an absolute basis.



## Endeavor System Methodology: Risk Management

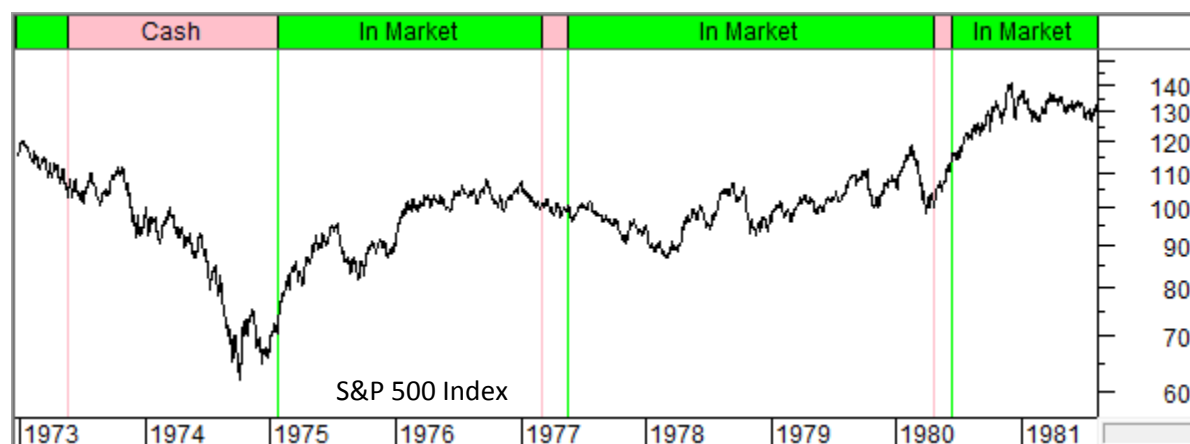
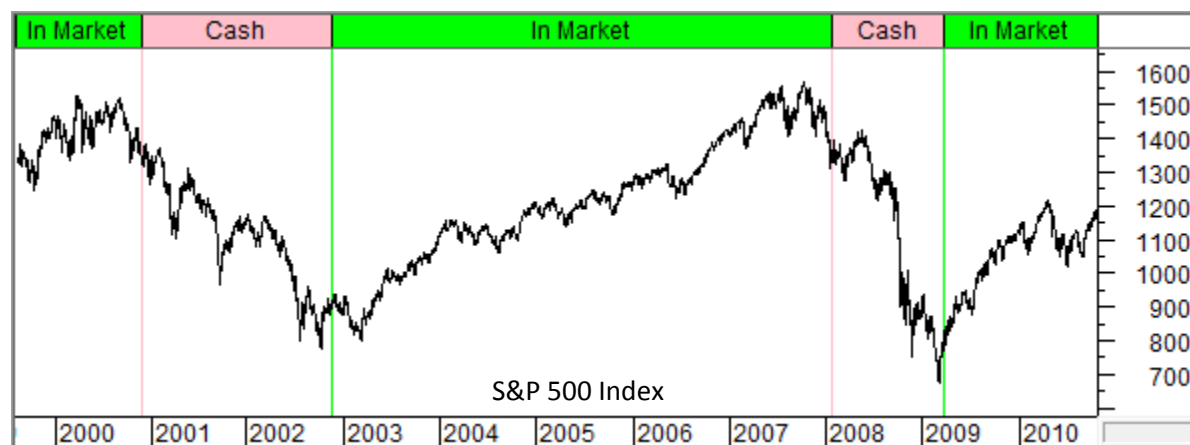
### Cash Hedge

Avoiding the devastating effects of a large bear market draw down is crucial to long preservation of capital. For this reason Endeavor utilizes Composite VBSR and directional volatility-based sensing to detect beginnings of secular bear markets.

When a bear market detection is activated subscribers are notified, and all positions past their minimum hold periods are closed. All remaining positions are closed as they age through, and no new long positions are initiated. The result is that the portfolio migrates to 100% cash.

This type of secular bear market avoidance reduces portfolio volatility at difficult market phases. When a more severe bear market occurs the portfolio can often re-enter at much lower levels.

This function of Endeavor was developed and tested using 62 years of the S&P 500 Index data; from its beginning in 1950. Across this 62 year period Endeavor signals 16 instances of early bear market detection. This equates to once every 4 years on average, which is the average length of a stock market cycle.



## Endeavor System Methodology

### Cash Hedge

The decision to move the Endeavor portfolio to an all cash mode is completely algorithmic. The algorithm is applied to the S&P 500 Index and works as follows:

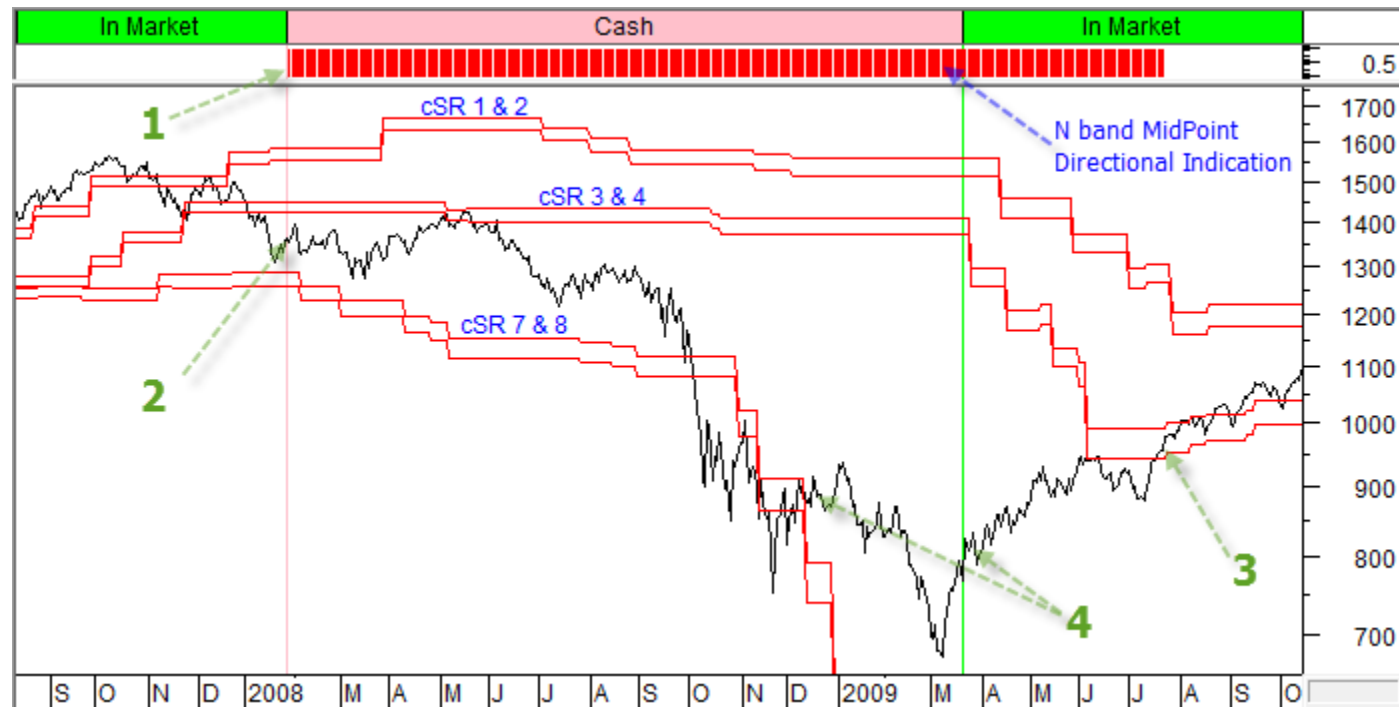
**Step 1** The N band Midpoint Indication detects a probable bear trend beginning.

**Step 2** Concurrently the index price is below composite cSR3.

When step one and two are both positive the portfolio then migrates to an all cash position until re-entry criteria are met.

**Step 3** If the bear market down turn does not produce low enough price levels to fall below cSR8 for 10 sessions, then the portfolio will re-enter the market when price rises above the cSR4 level.

**Step 4** The index price level falls below cSR8 for 10 sessions or longer. It is then able to rise above cSR8 for 10 sessions or longer. This detects the final capitulation phase of a secular bear market. When that occurs, the portfolio waits to re-enter the market for 62 trading sessions; one business quarter. This avoids further volatility associated with capitulation selling.



Portfolio to Cash

Step 1 and Step 2

Portfolio Re-Enter to Market

Step 3 or Step 4

### Rationale

When a market is below the cSR3/4 zone the bullish trend is weak and statistically susceptible to a bear market.

When the market is above the cSR3/4 zone the bullish trend is healthy and is statistically likely to persist.

When the market is below the cSR 7/8 zone most rational selling is finished. What remains is a volatile period of capitulation selling which lasts for approximately one business quarter.

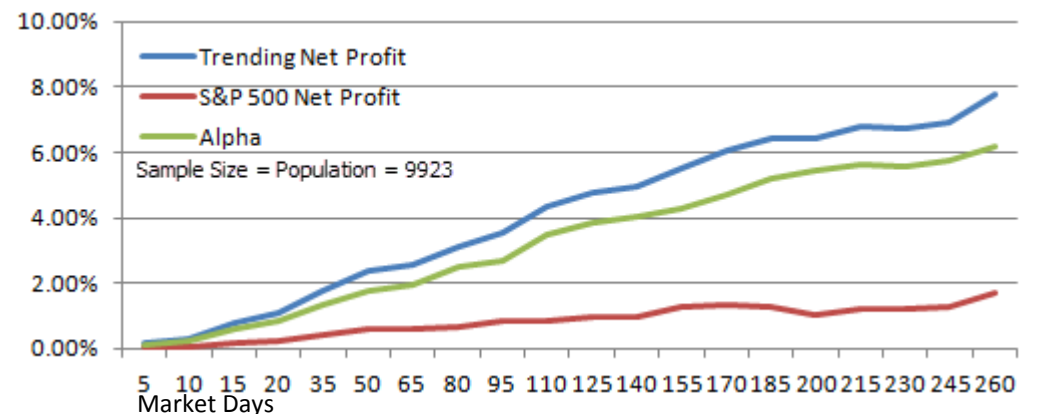
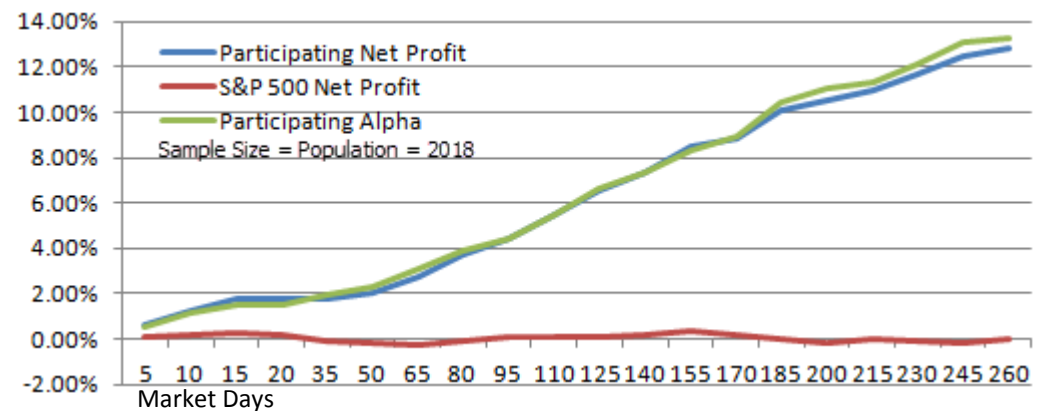
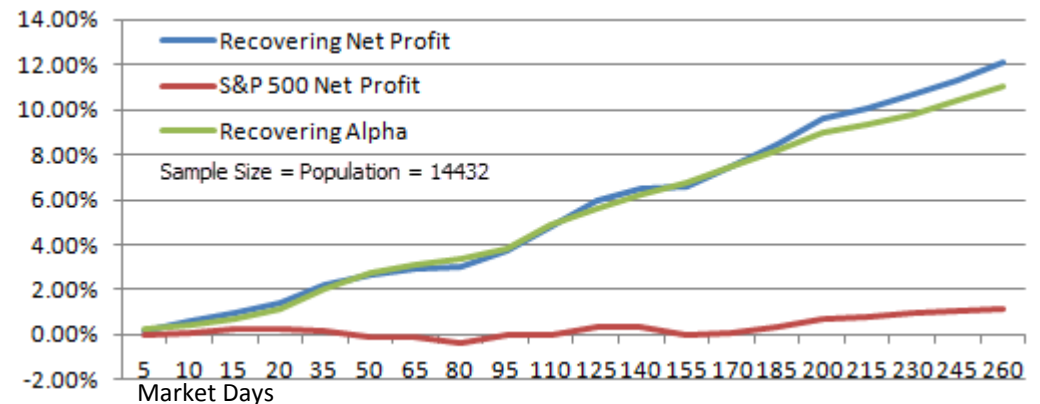
# Endeavor Subsystem Performance

## Entry Signal - *Unmanaged* Performance Characteristics [In-Sample]

The graphs at right show the unmanaged performance of Endeavor subsystems, for a period of one year post position entry.

The sample sizes for each are equal to the whole population of qualified positions during the in-sample test period. This measurement is the mean percentage performance of the position based on closing prices.

For each subsystem entry a concurrent position is opened for the S&P500 Index. Each graph demonstrates how the subsystem entry algorithm outperforms the benchmark index, without further trade management. Also shown is the pure Alpha generated by the unmanaged position.



### Notes:

Alpha = Excess return - (Beta x Market excess return)

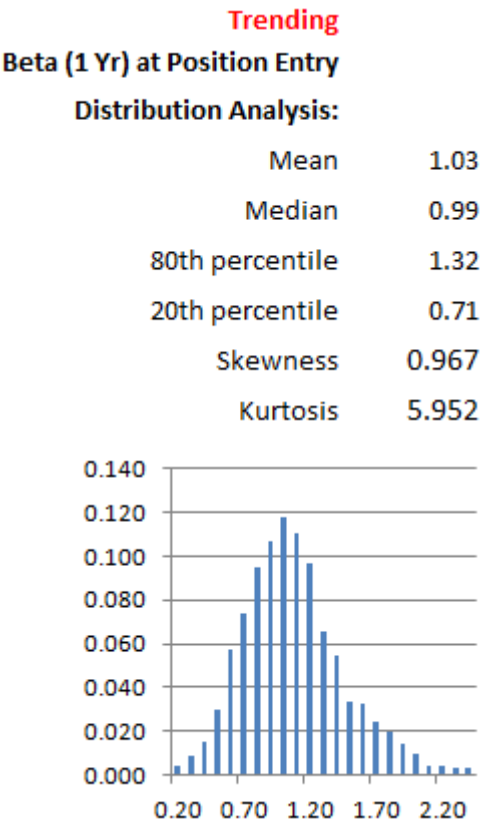
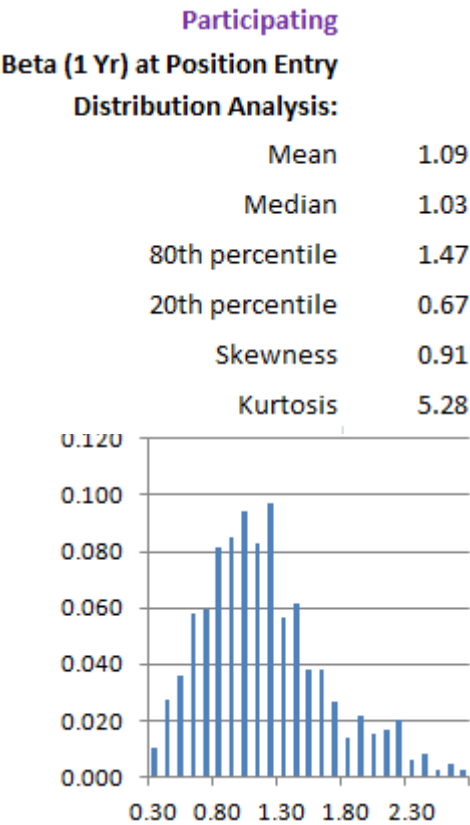
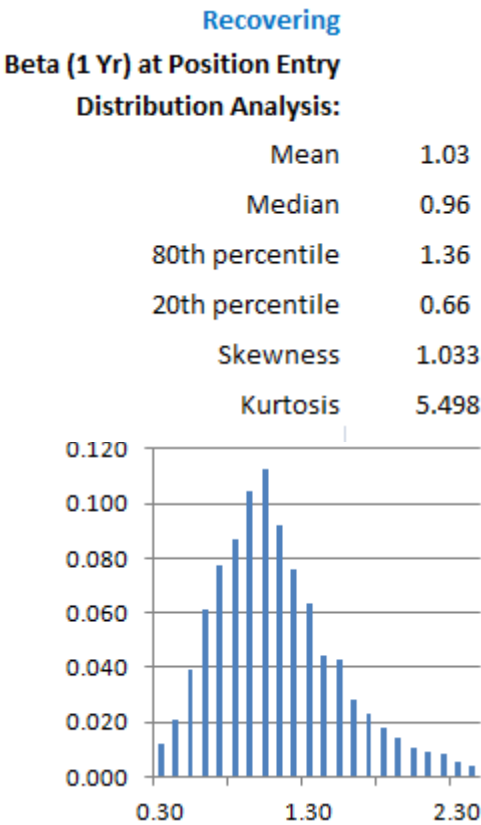
Alpha calculations use a 4% annual risk-free rate of return



Endeavor Subsystem Performance

Entry Signal - Beta Characteristics [In-Sample]

For each subsystem an examination of one year beta measurements are shown below. This gives evidence of one way which Endeavor manages risk. Monte Carlo analysis of the subsystem entry beta show that each population beta is very nearly equal to that of the benchmark S&P 500 Index; which is 1.00. The distributions show tight groupings around the respective mean and median.



# Endeavor System Performance

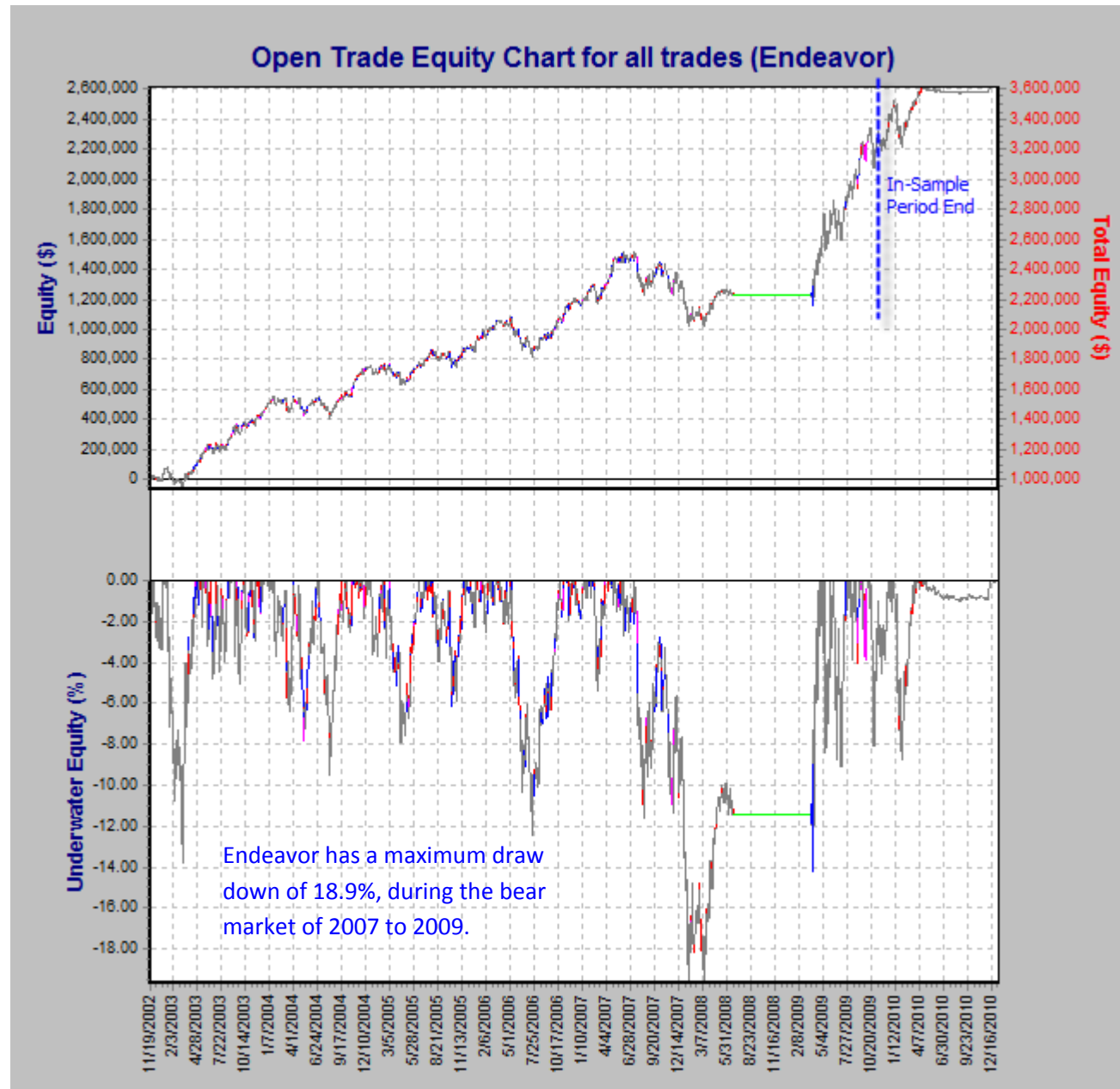
## Portfolio Performance [In-Sample]

### Trade Parameters:

Initial Capital	\$ 1,000,000
Max Portfolio Positions	30
Max Portfolio Capital Per Trade	3.33%
Portfolio Test Start Date	October 1, 2001
Portfolio Test End Date	October 30, 2009
Margin Use	None
Survivorship-Bias Filtered	Yes
System Direction	Long
Positions Executed	412

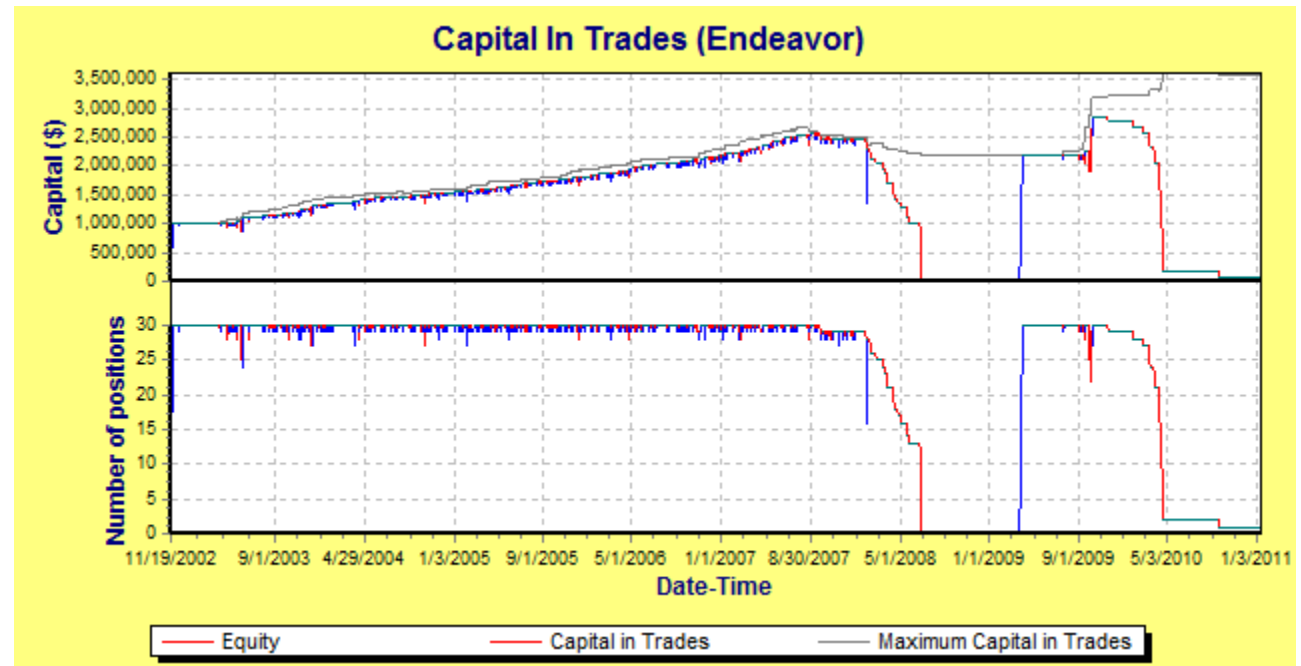
### Performance Results:

Finishing Capital	\$ 3,075,057
Sharpe Ratio	0.88
CAGR	15.08%
Profit Factor	3.44
Buy and Hold Return (S&P 500)	0.00%
[S&P500 Index declined by 2.3 points during this period]	
Maximum Drawdown	18.90%
[July-2007 to March-2008]	
Maximum Trough to Peak	207%
[Oct-2001 to Oct-2009]	
Win %	70.91%
Loss %	29.09%
Average Trade Duration (days)	175
Max Consecutive Winning	20
Max Consecutive Losing	7
Average Winning Trade \$	\$ 12,335.00
Average Losing Trade \$	\$ (9,180.00)

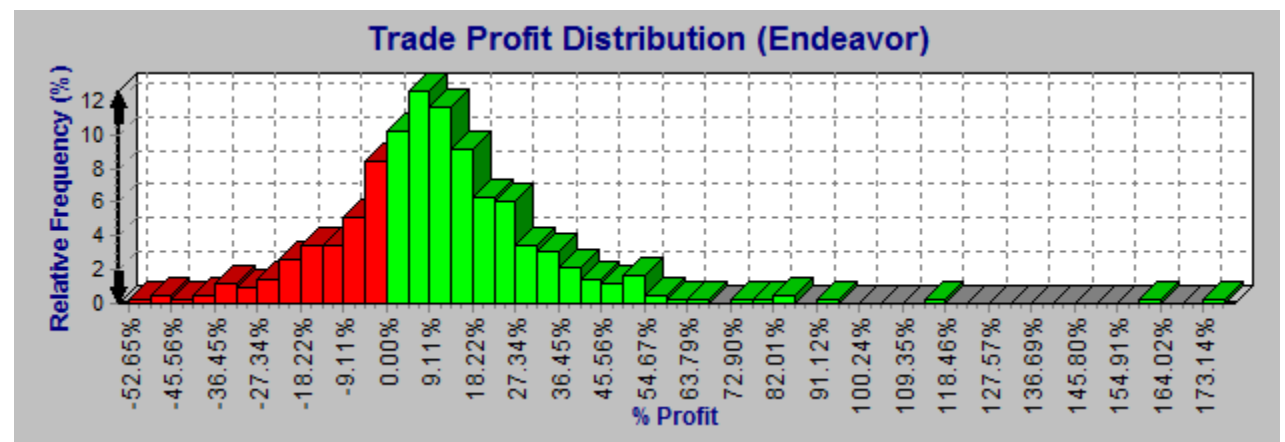


## Portfolio Performance [In-Sample]

Endeavor maintains a high priority for being 100% invested when the S&P500 is signaling a secular bull market. At right it can be seen that utilizing the strength of each subsystem enables full exposure. Also clear is the timely move to cash at the beginning of the 2007-2009 bear market.

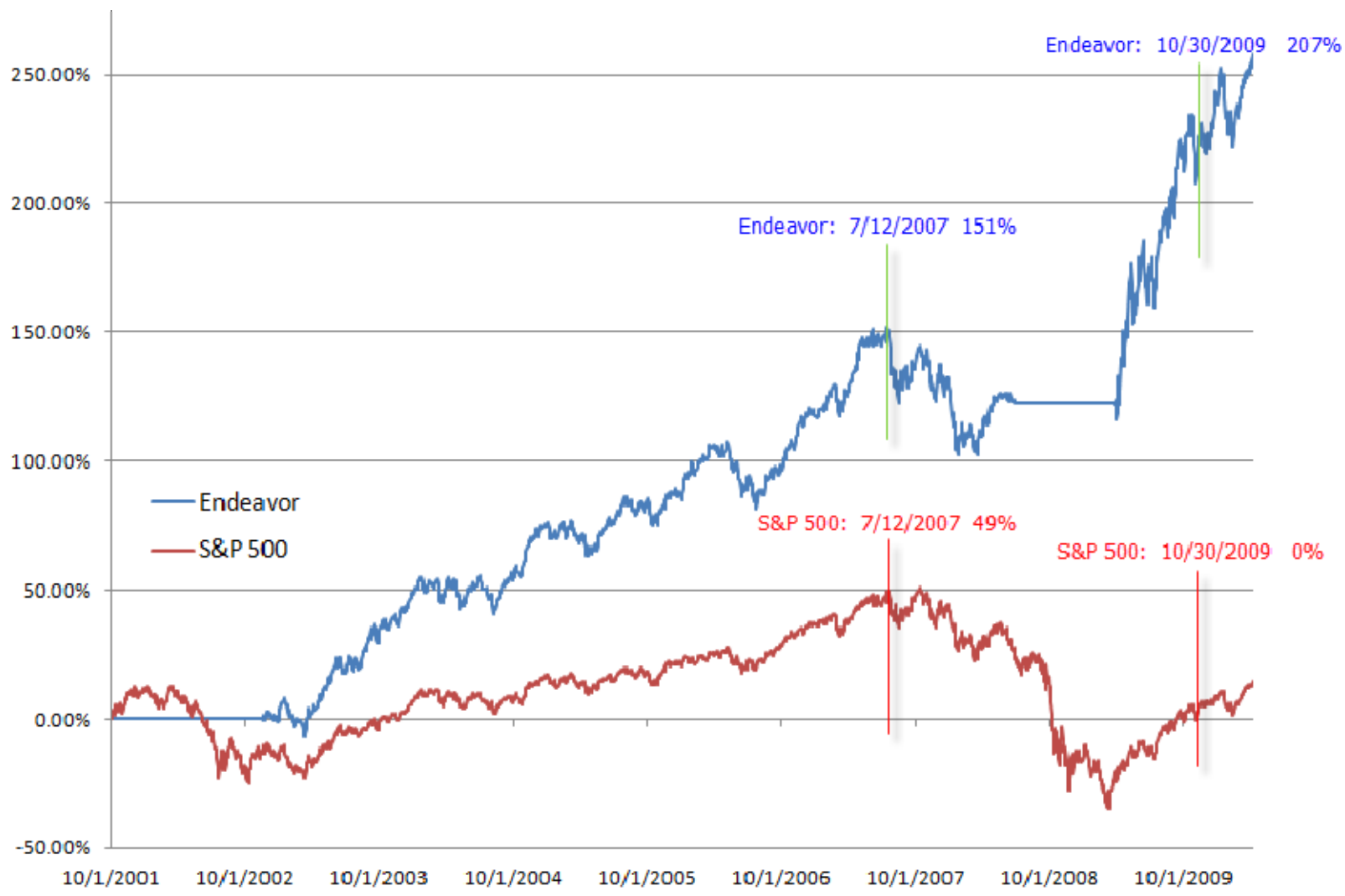


The trade profit distribution graph indicates a positive skew with respect to winning versus losing positions.



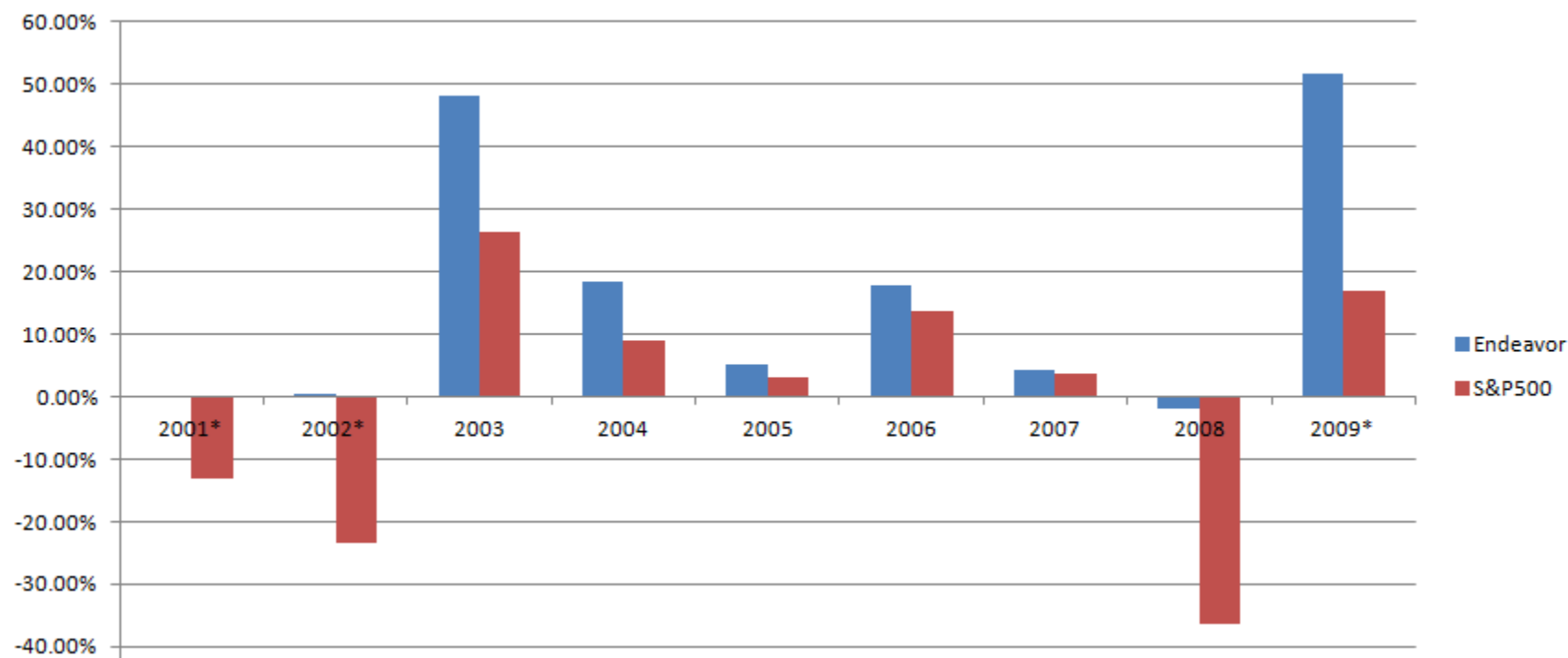
Portfolio Performance [In-Sample]

Equity Percentage Change



Portfolio Performance

Annual Returns: Endeavor and S&P 500 [In-Sample]

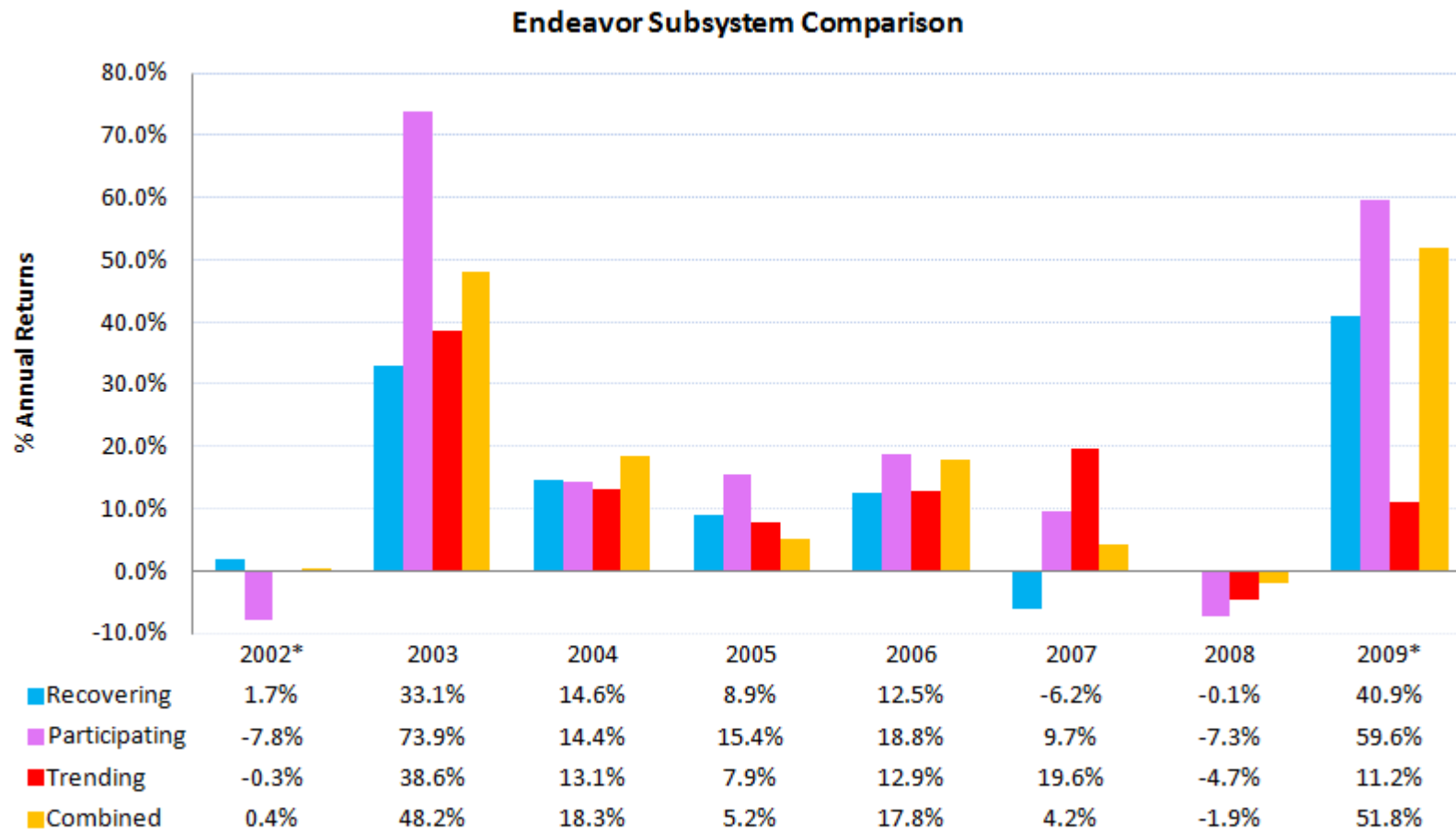


	2001*	2002	2003	2004	2005	2006	2007	2008	2009*
Endeavor	0.00%	0.38%	48.19%	18.32%	5.16%	17.78%	4.19%	-1.90%	51.82%
S&P500	-13.03%	-23.37%	26.38%	8.99%	3.00%	13.62%	3.53%	-36.31%	17.03%

\* Partial year: 3 months in 2001 and 9 months in 2009

## Portfolio Performance

### Annual Returns: Endeavor Sub-systems [In-Sample]



\* Partial year: 1 month in 2002 and 9 months in 2009

# Endeavor System Performance

## Portfolio Performance [Out-Of-Sample]

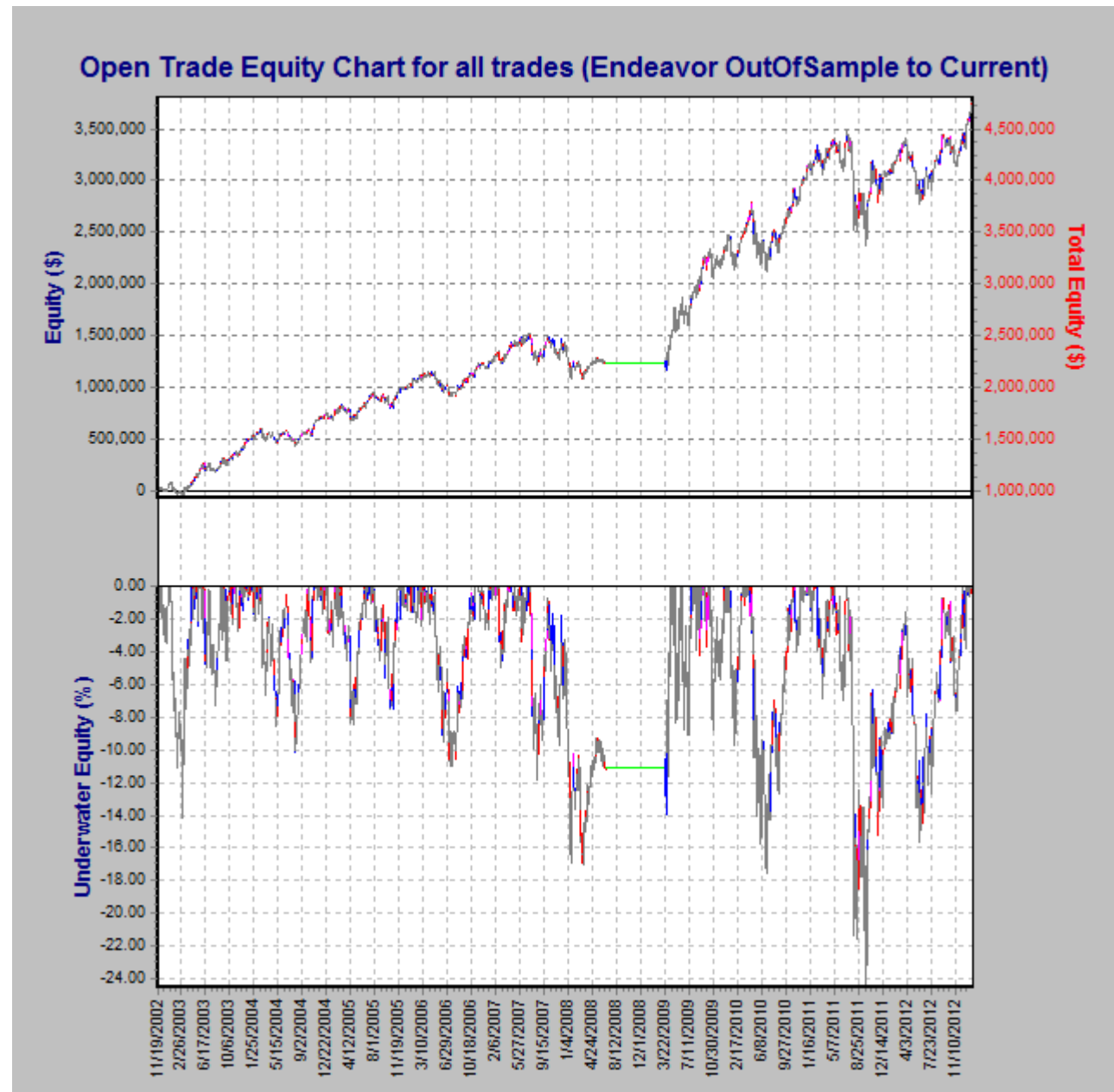
### Trade Parameters:

Initial Capital	\$ 1,000,000
Max Portfolio Positions	30
Max Portfolio Capital Per Trade	3.33%
Portfolio Test Start Date	October 1, 2001
Portfolio Test End Date	January 31, 2013
Margin Use	None
Survivorship-Bias Filtered	Yes
System Direction	Long
Positions Executed	614

### Performance Results:

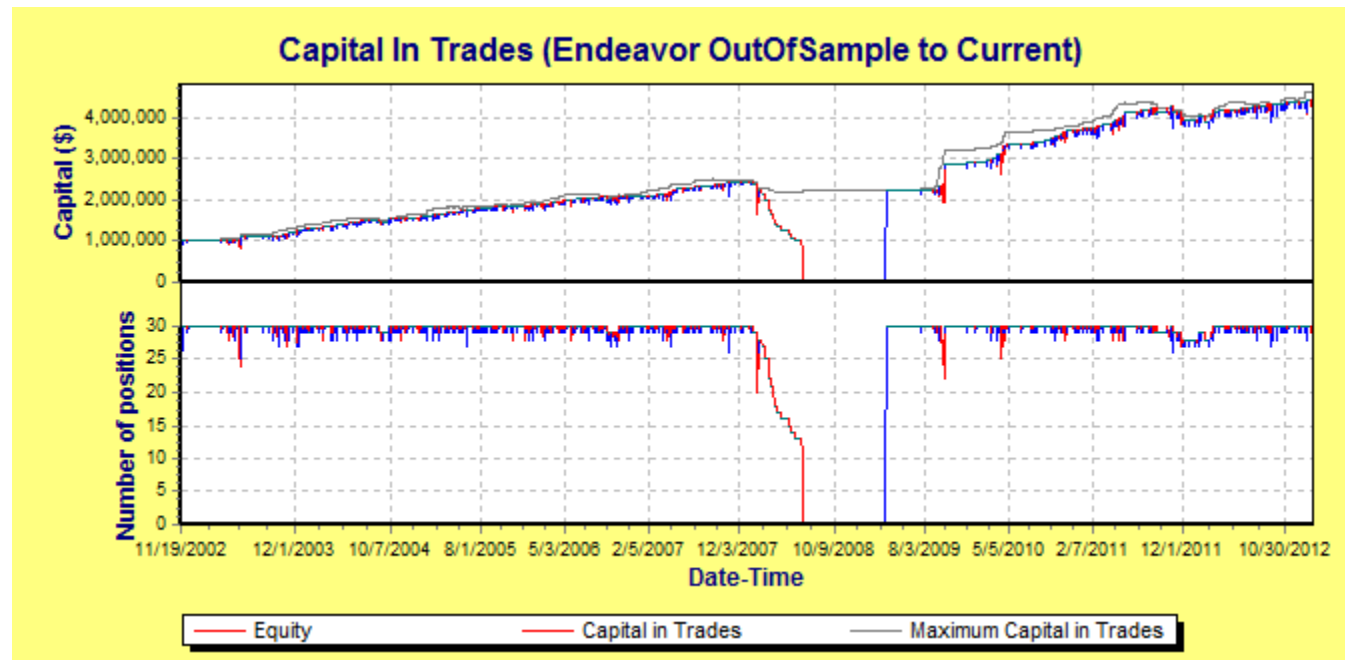
Finishing Capital	\$ 4,809,515
Sharpe Ratio	0.76
CAGR	16.62%
Profit Factor	2.85
Buy and Hold Return (S&P 500)	44%
Endeavor System Return	381%
Maximum Drawdown	21.4%
Win %	67.10%
Loss %	32.74%
Average Trade Duration (days)	166
Max Consecutive Winning	28
Max Consecutive Losing	10
Average Winning Trade \$	\$ 14,228.00
Average Losing Trade \$	\$ (10,212.00)

\* S&P 500 component stocks only

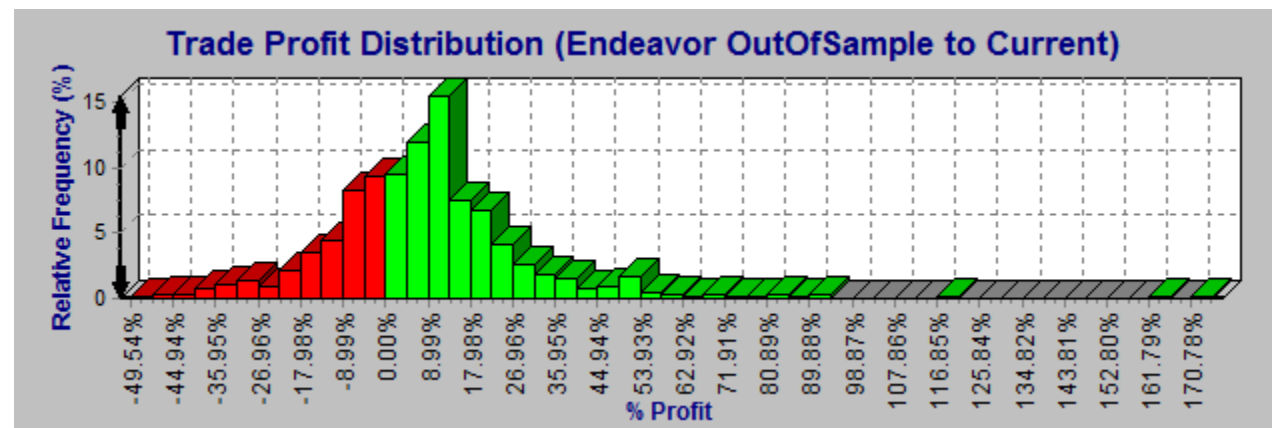


## Portfolio Performance [Out-Of-Sample]

At right Endeavor exits positions when it detects the beginning of a potential secular bear market.



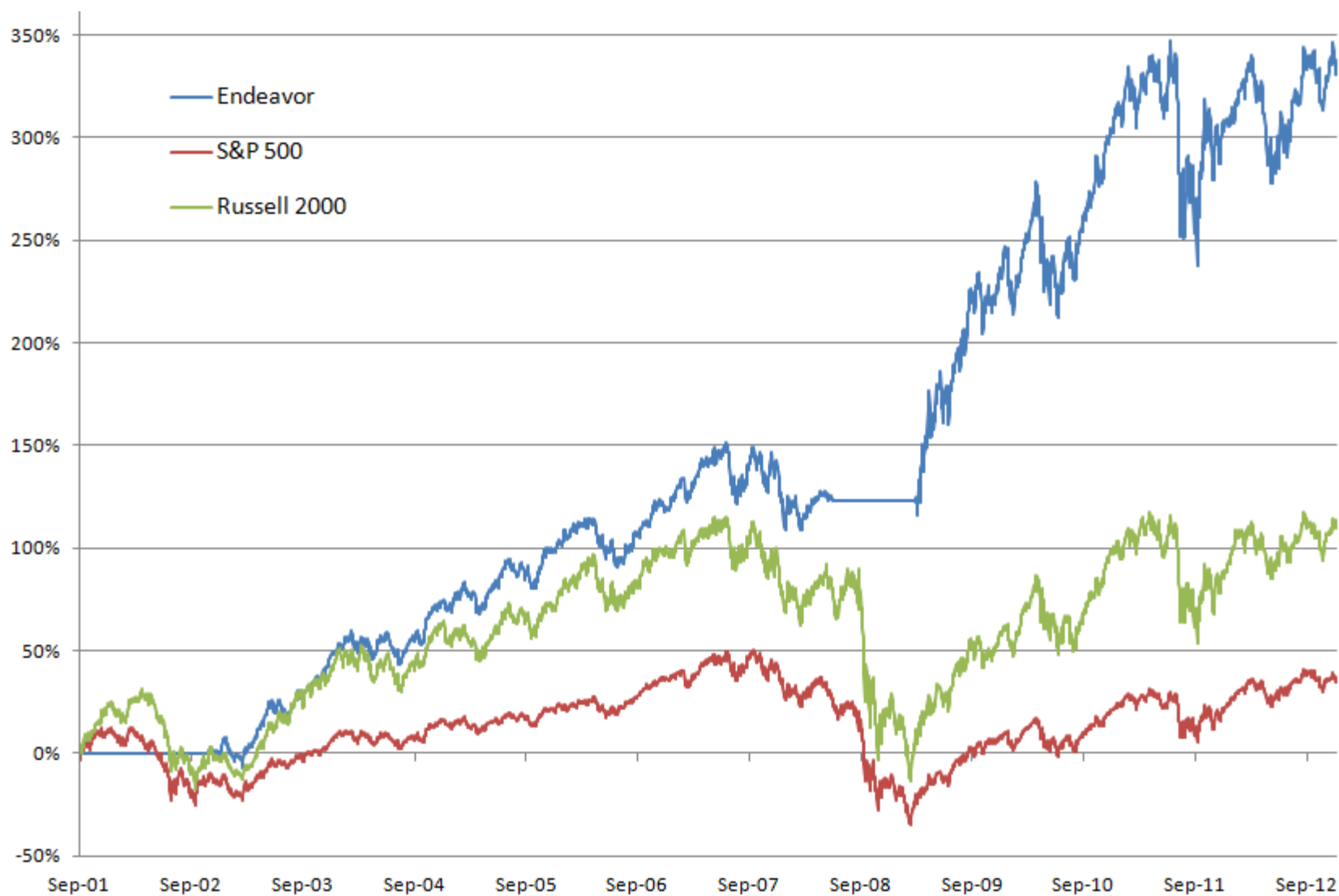
The trade profit distribution graph indicates a positive skew with respect to winning versus losing positions.





Portfolio Performance [Out-Of-Sample]

Equity Percent Change



## Appendix A: Cash Hedge Performance

Below are the historical Endeavor performance data from 1950 to 2012.

The S&P 500 was first created by Standard and Poors in 1950.

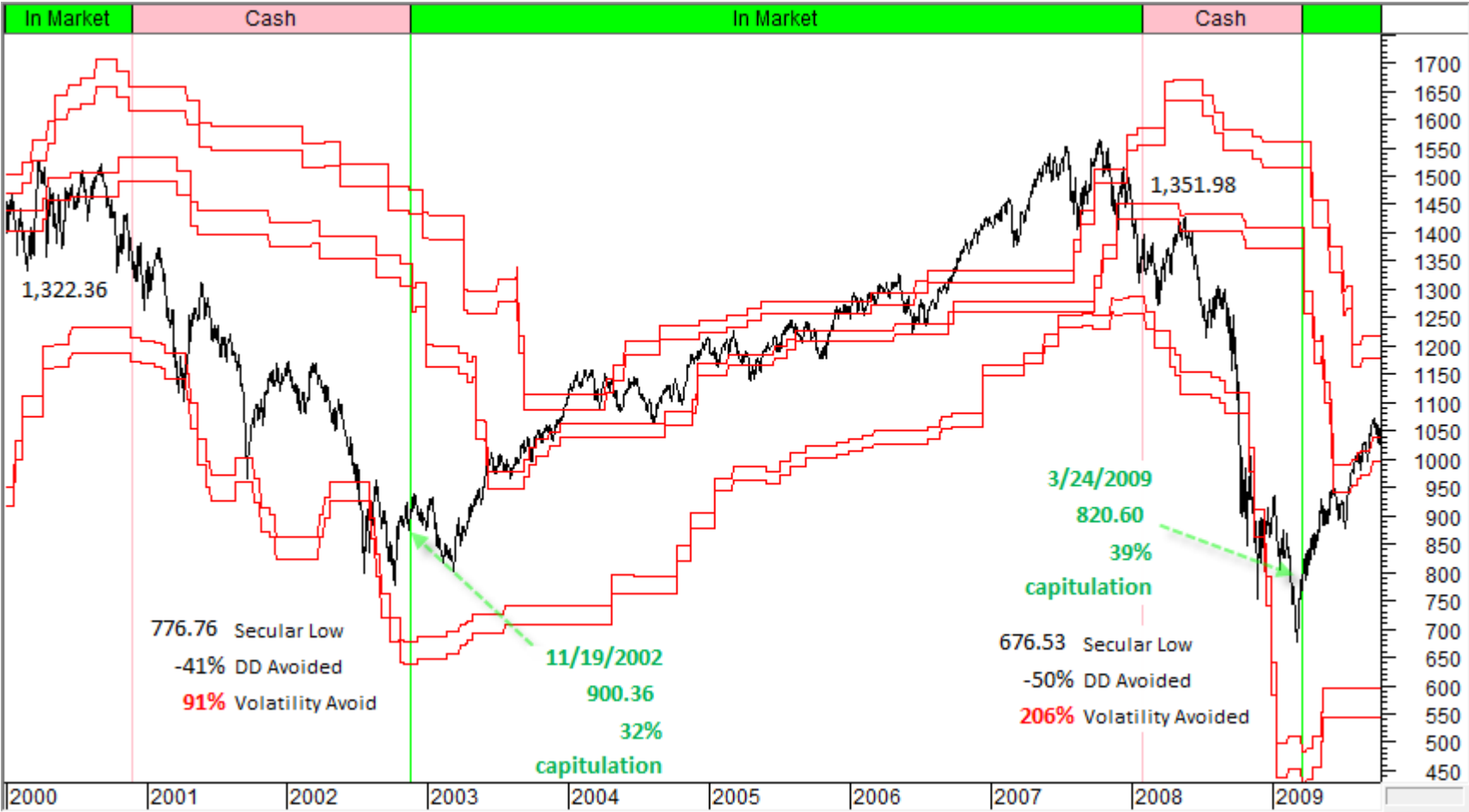
Hedging Stats 1980 - 2012	9	10	11	12	13	14	15	16
Cash Hedge Initiation Date	4/21/1980	9/17/1981	5/9/1984	11/20/1987	9/4/1990	12/20/1994	11/24/2000	1/31/2008
Cash Hedge Index Level	100.55	118.87	160.52	240.04	322.56	458.08	1,322.36	1,351.98
System Re-Entries (best of Capitulation or Conservative)								
Re-Entry Date	6/16/1980	9/21/1982	5/16/1984	7/14/1988	2/19/1991	2/16/1995	11/19/2002	3/24/2009
Re-Entry Index Level	115.81	122.51	158.00	269.33	369.06	484.56	900.36	820.60
Better Entry (%)	-15%	-3%	2%	-12%	-14%	-6%	32%	39%
Entry Discipline	conservative	conservative	conservative	conservative	conservative	conservative	capitulation	capitulation
Conservative Approach Only								
Conservative Entry Date	6/16/1980	9/21/1982	5/16/1984	7/14/1988	2/19/1991	2/16/1995	6/16/2003	8/17/2009
Conservative Entry Level	115.81	122.51	158.00	269.33	369.06	484.56	988.61	998.18
Better Entry (%)	-15%	-3%	2%	-12%	-14%	-6%	25%	26%
	No	No	No	No	No	No		
Risk Considerations								
Secular Low	99.80	102.42	157.50	225.21	295.46	457.10	776.76	676.53
DD Avoided (%)	-1%	-14%	-2%	-6%	-8%	0%	-41%	-50%
Volatility Avoided (100dHV)	7%	23%	1%	8%	21%	-9%	91%	206%
positive % indicates that the portfolio avoids high volatility								

## Appendix A: Cash Hedge Performance

Hedging Stats 1950 - 1979	1	2	3	4	5	6	7	8
Cash Hedge Initiation Date	6/17/1953	2/15/1957	9/13/1957	5/24/1962	7/29/1966	7/9/1969	5/23/1973	3/4/1977
Cash Hedge Index Level	23.55	43.51	44.80	61.11	83.77	97.63	103.58	100.88
System Re-Entries (best of Capitulation or Conservative)								
Re-Entry Date	12/24/1953	5/29/1957	3/13/1958	10/23/1962	11/23/1966	9/28/1970	1/24/1975	5/18/1977
Re-Entry Index Level	24.80	47.11	42.46	54.96	79.67	82.83	72.07	99.60
Better Entry (%)	-5%	-8%	5%	10%	5%	15%	30%	1%
Entry Discipline	conservative	conservative	capitulation	capitulation	conservative	capitulation	capitulation	conservative
Conservative Approach Only								
Conservative Entry Date	12/24/1953	5/29/1957	5/23/1958	12/27/1962	11/23/1966	10/26/1970	2/28/1975	5/18/1977
Conservative Entry Level	24.80	47.11	43.85	63.02	79.67	83.77	80.77	99.60
Better Entry (%)	-5%	-8%	2%	-3%	5%	14%	22%	1%
Risk Considerations								
Secular Low	22.71	42.99	38.98	52.32	73.20	69.29	62.34	97.11
DD Avoided (%)	-4%	-1%	-13%	-14%	-13%	-29%	-40%	-4%
Volatility Avoided (100dHV)	-20%	-33%	73%	116%	57%	125%	100%	-10%
positive % indicates that the portfolio avoids high volatility								

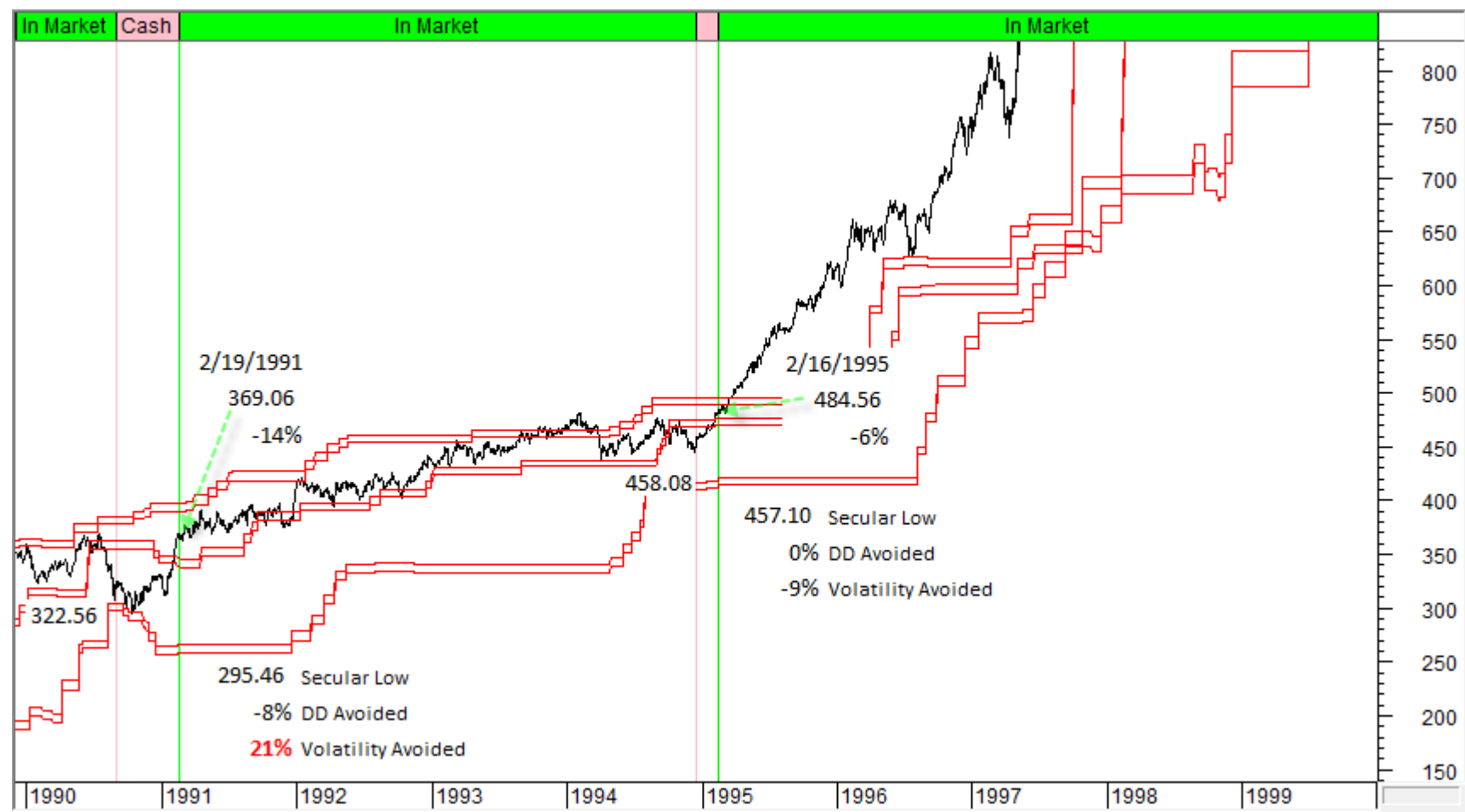
Appendix A: Cash Hedge

Historical 2000 - 2012



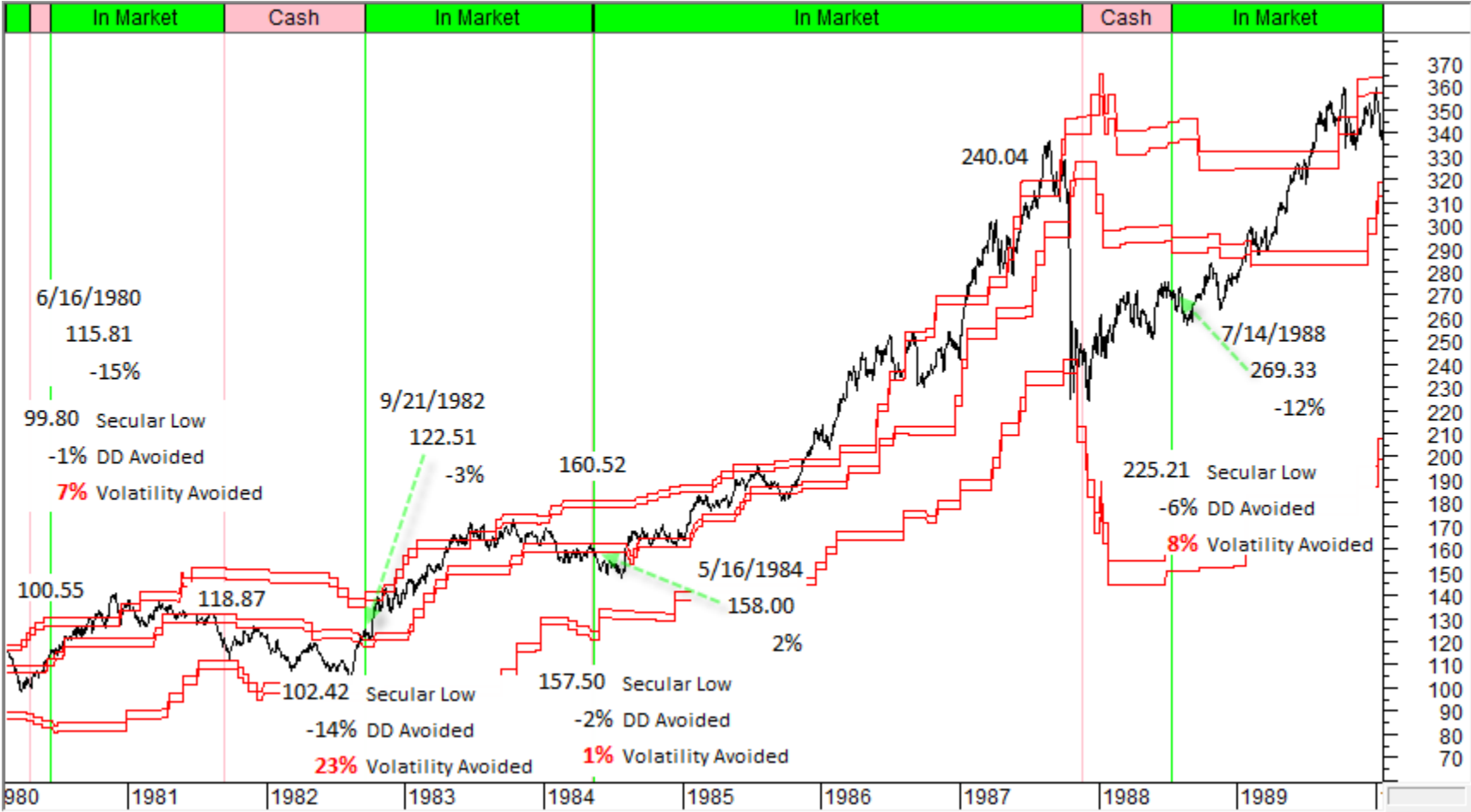
Appendix A: Cash Hedge

Historical 1990 - 1999



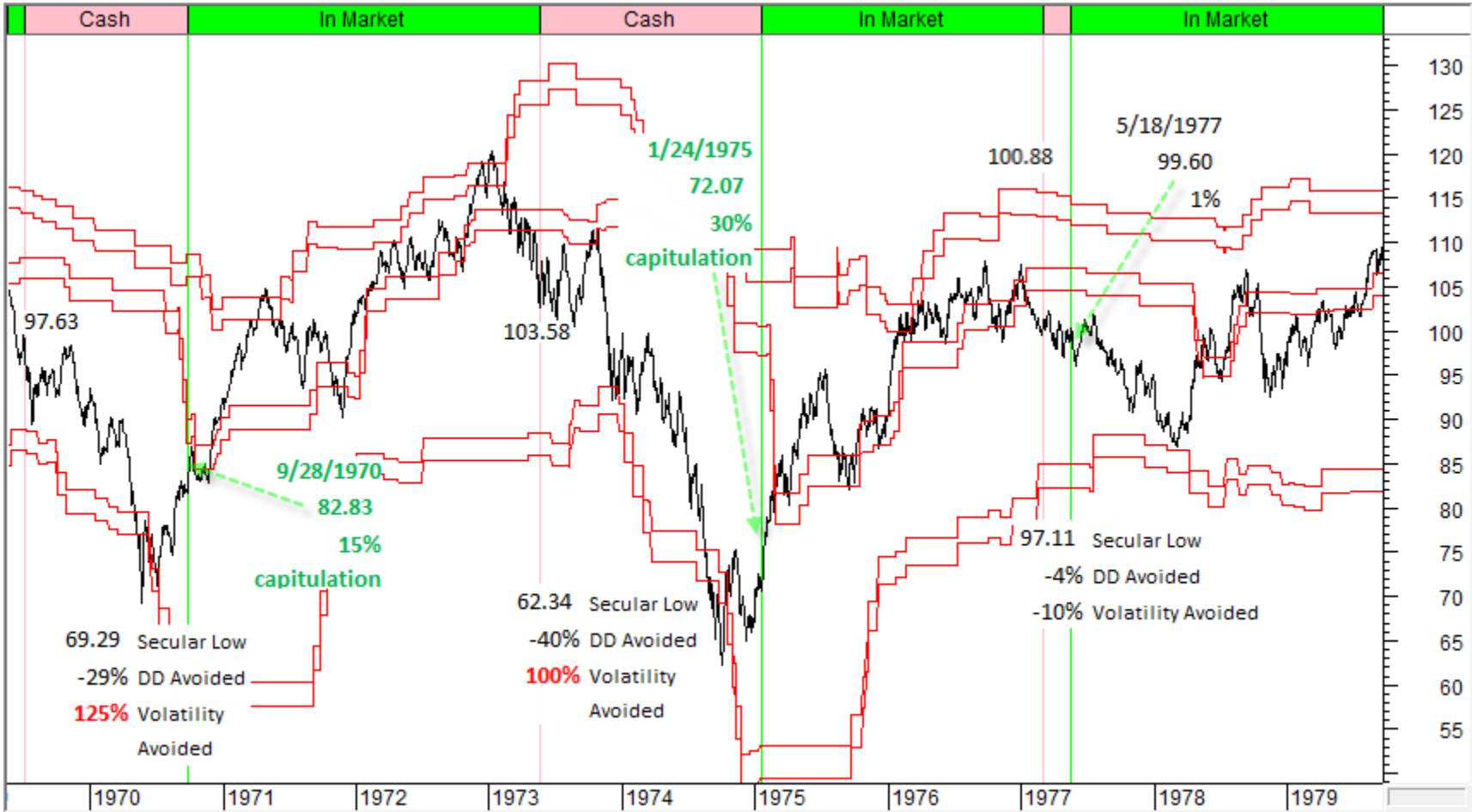
Appendix A: Cash Hedge

Historical 1980 - 1989



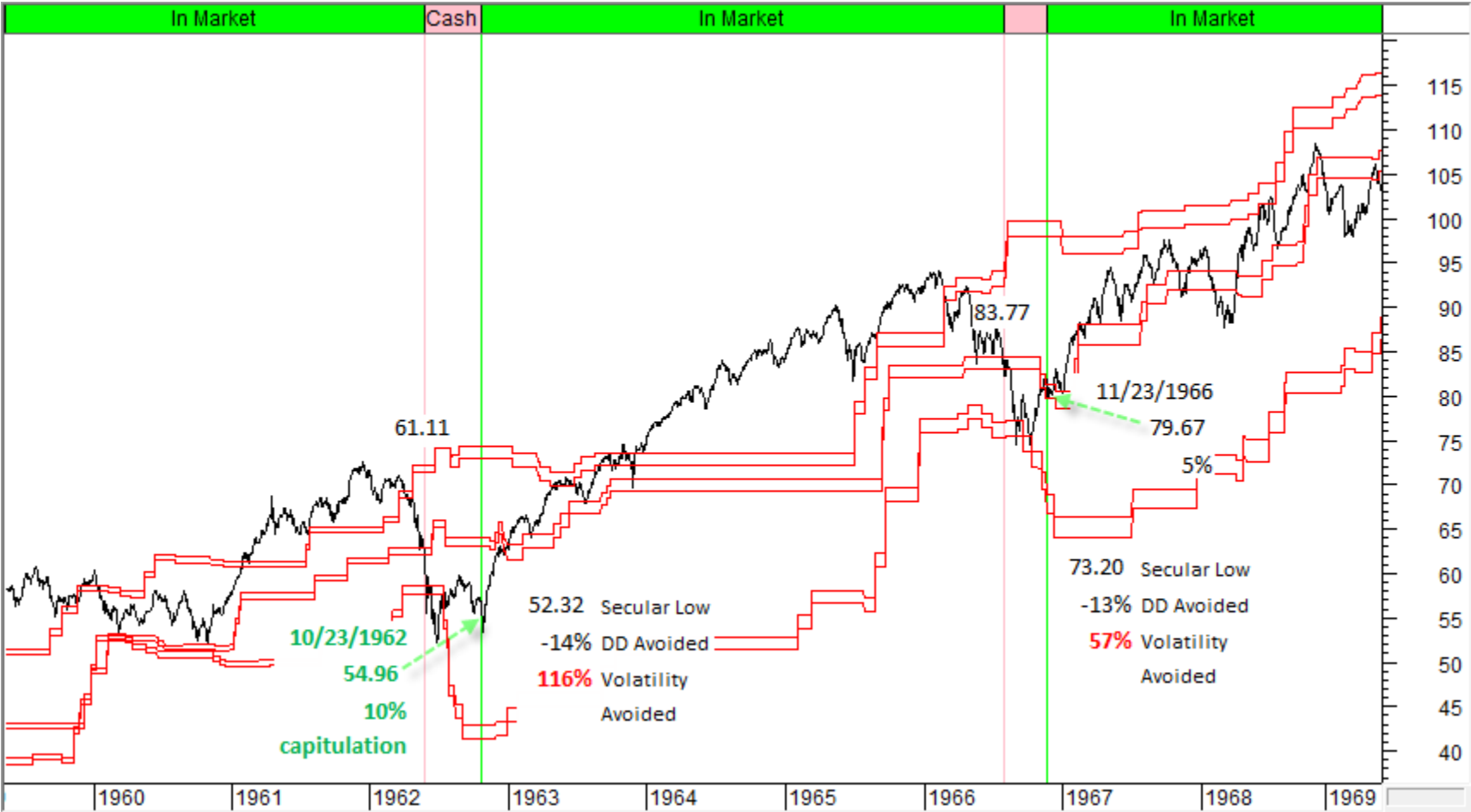
Appendix A: Cash Hedge

Historical 1970 - 1979



Appendix A: Cash Hedge

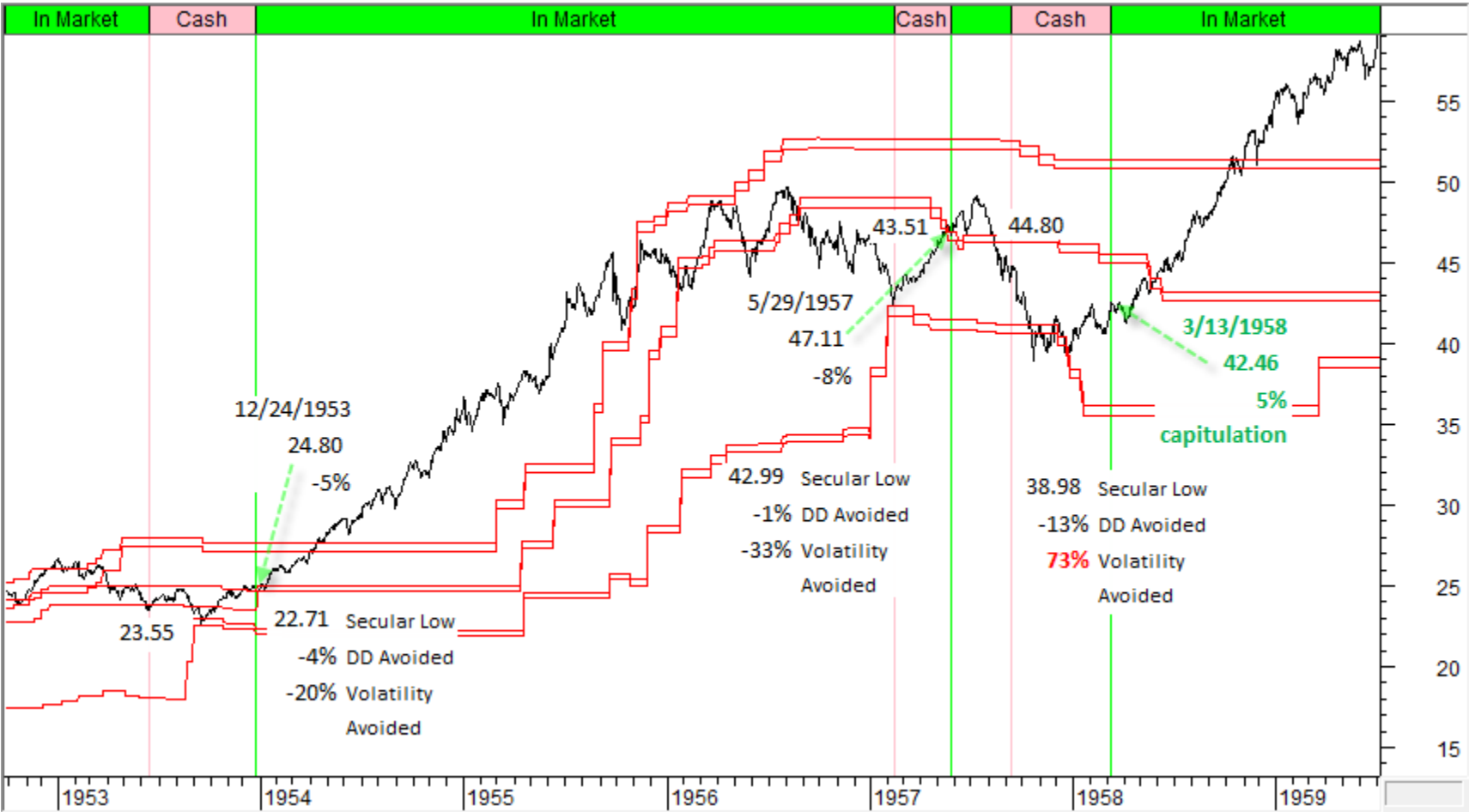
Historical 1960 - 1969





Appendix A: Cash Hedge

Historical 1950 - 1959



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