re·ality shares™
ADVISORS

This whitepaper details the Reality Shares Guard Indicator and how it can potentially assist in analyzing current market sentiment

GUARD Indicator

Research Paper

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Introduction

Historically the investment returns for equities outperform fixed income over long periods of time, but they are also associated with higher volatility and multiyear bear markets. Investment strategists have tried to improve the risk-adjusted returns of equities by various methods such as hedging, sector rotation, and market timing, which involves avoiding exposure to a market during periods of expected downturn. Reality Shares has built a unique, two-factor market strength assessment, called the Guard methodology, using market price momentum and volatility to identify likely market downturns and upturns. We further apply the Guard methodology to each of the 11 broad market sectors to create the Guard Indicator, a market timing forecasting tool that provides a clear and concise indication of overall market direction.

Momentum as an investment strategy has been well researched in academic literature. Jegadeesh and Titman (1993)[1] showed that buying previous period best-performing stocks and selling underperformers yields profitable strategies in the stock markets. Subsequently, various other studies have confirmed these results across multiple geographies and asset classes.

Similarly, research has been done on the impact of volatility on equity returns. The VIX index, also known as the "fear index," is used by market practitioners as a measure of market sentiment. A study by Cresmont Research[2] links higher volatility to lower expected returns.

Relationship of volatility and market returns[3]
(S&P 500 Index: 1962 – Dec. 31, 2016)
Monthly data: S&P 500 index average daily range

Quartile	Volatility range	% chance up month	% chance down month	If up avg gain	If down avg loss	Expected gain/(loss)
1st	0-1.0%	75%	25%	2.90%	-1.70%	1.70%
2nd	1.0-1.3%	62%	38%	2.90%	-2.00%	1.00%
3rd	1.3-1.7%	56%	44%	3.10%	-3.10%	0.40%
4th	1.7-6.6%	43%	57%	5.10%	-4.90%	-0.60%

Annual data (1962 – 2016): S&P 500 Index average daily range

Quartile	Volatility range	% chance up month	% chance down month	If up avg gain	If down avg loss	Expected gain/(loss)
1st	0-1.1%	92%	8%	15.40%	-1.50%	14.10%
2nd	1.0-1.4%	77%	23%	14.40%	-6.30%	9.60%
3rd	1.4-1.8%	79%	21%	17.90%	-7.70%	12.40%
4th	1.8-2.7%	43%	57%	15.10%	-19.40%	-4.60%

[1] http://www.bauer.uh.edu/rsusmel/phd/jegadeesh-titman93.pdf
[2] http://www.crestmontresearch.com/docs/Stock-Volatility-Return.pdf
[3] http://www.investopedia.com/articles/financial-theory/08/volatility.asp

Guard methodology

Reality Shares created the Guard methodology by combining market price momentum and volatility factors.

In the case of price momentum, the ratio of the Short-Term price levels relative to Long-Term price levels determines the signals that indicate when to enter into the market or when to exit the market. By staying out of the equity markets when the ratio is below the Death Cross, we aim to avoid market downtrends.

Price Indicator ("PI")
= of Short-Term price levels to Long-Term price levels

In the case of volatility, we have used the time series of downside deviation – a measure similar to volatility, but which penalizes only negative returns. The 90-day downside deviation is calculated by the formula:

$$\textit{Downside Deviation}\ (\mathrm{DD}_{t-1}) = \sqrt{1/90 \sum_{i=1, r_{t-i}<0}^{90} r_{t-i}^{2}}$$

Where $r_{(t-i)}$ = Return on day t-i

The ratio of the Long-Term downside deviation levels relative to Short-Term downside deviation levels determines the entry signals. Low levels of this ratio indicate that recent negative volatility is higher than the historical negative volatility.

Vol Indicator ("VI")
= of Long-Term downside deviation levels relative
to Short-Term downside deviation levels

The Guard Score ("GS") is defined as the maximum of the Price Indicator and Vol Indicator.

GS = Maximum(PI,VI)

While using GS as a market-timing indicator, the subject portfolio remains invested in the markets in periods of low downside volatility or high momentum. By staying out of the market when the ratio is below the Threshold Level, the indicator aims to avoid market downtrends. The Threshold Level is defined as the GS value of 1.

Market performance of the Guard methodology

Long-term performance

We used the Guard methodology as a market-timing strategy on the S&P 500 Index for the period 12/31/1956 to 12/31/2016. In this example, we remain fully invested in the S&P 500 Index when the GS is greater than 1, and shift the entire pool of assets into US Government 3-month yields otherwise. The results are as follows:

12/31/1956 to 12/31/2016

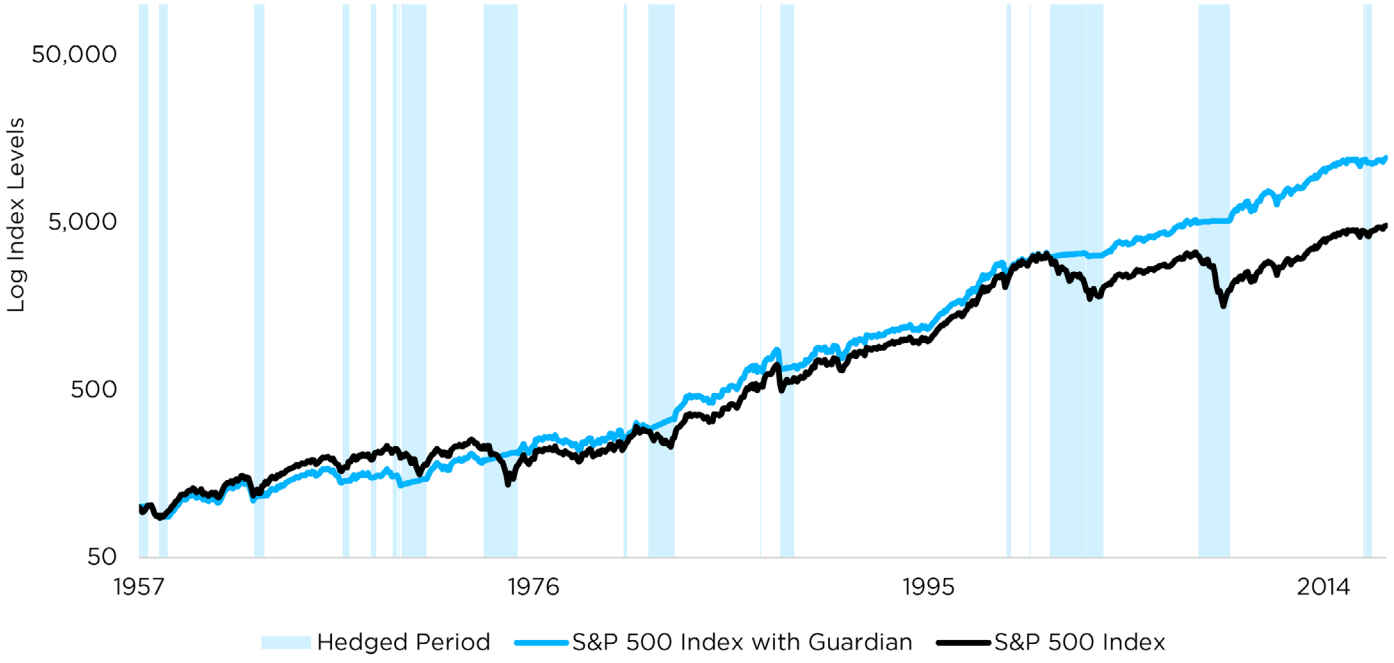
	Guard methodology	S&P 500 Index
% Positive return months	68.1%	59.6%
Average annual return*	8.92%	7.62%
Annualized volatility**	11.7%	14.6%
Sharpe ratio***	0.35	0.19

* Average monthly returns x12

** Monthly standard deviation x √12

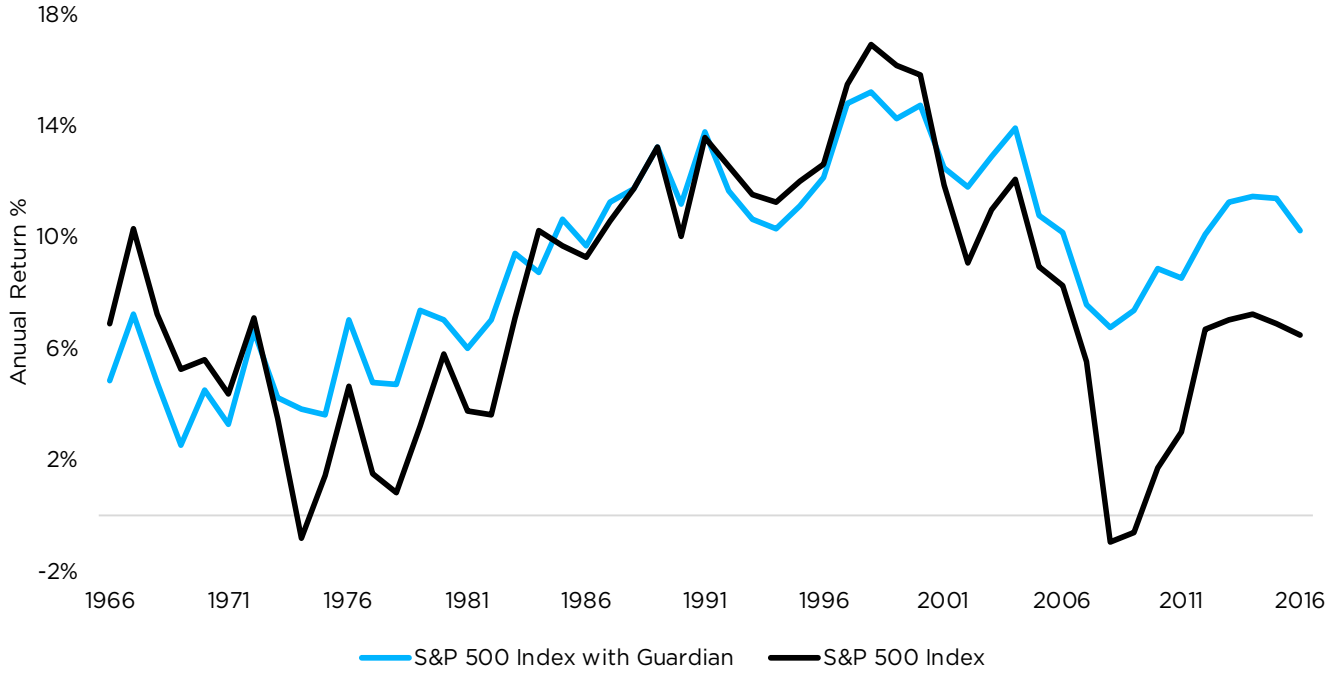
***Sharpe ratio based on monthly excess return over previous end of month 3m yield

S&P 500 Index with Guard vs S&P 500 Index
(01/01/1957-12/31/2016)



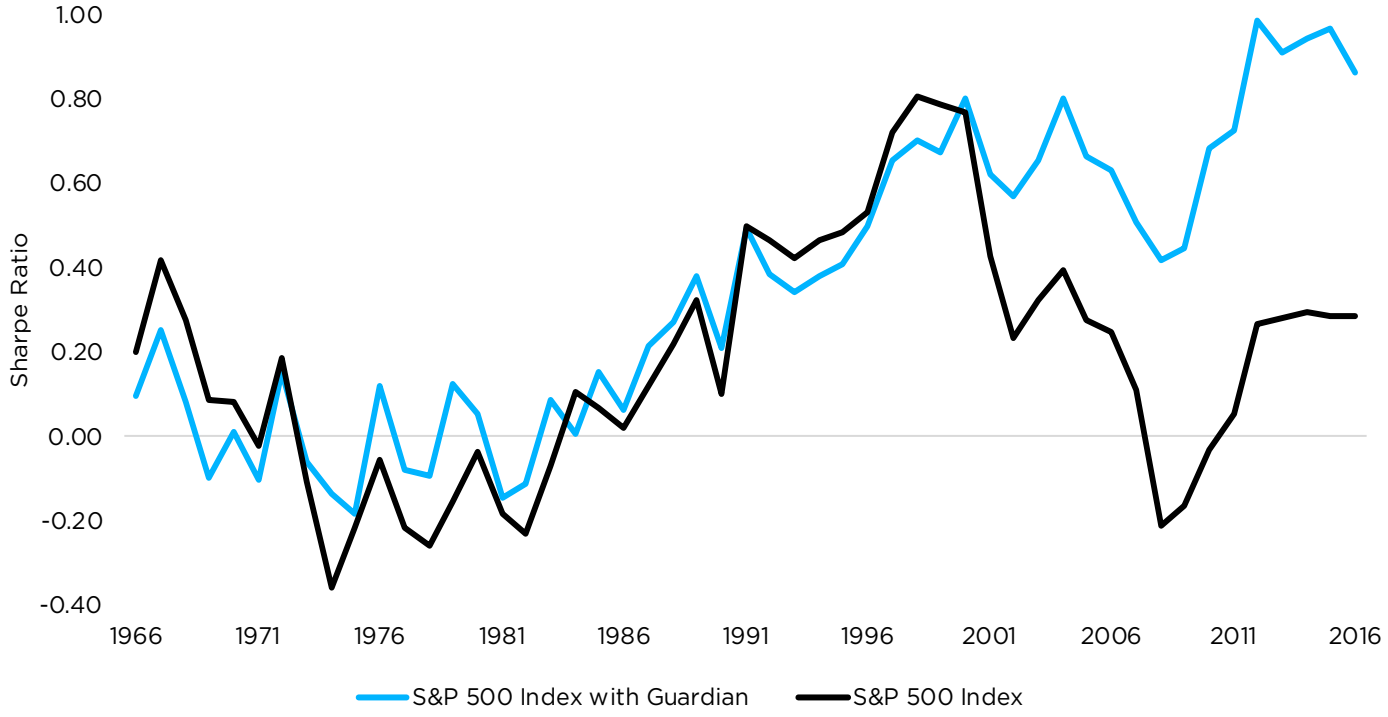
Over the period between 1957 and today, the S&P 500 with Guard triggered a timing event 19 times with an average duration of 7 months.

Rolling ten year average annual return
(01/01/1967-12/31/2016)



Over the period between 1957 and today, the S&P 500 with Guard triggered a timing event 19 times with an average duration of 7 months.

Rolling ten year Sharpe ratio
(01/01/1967-12/31/2016)



The rolling ten year Sharpe ratio comparison shows similar results to the rolling average returns. The Sharpe ratio of the S&P 500 with Guard was higher than the S&P 500 index in 67% of the time.

*Sharpe ratio based on annual excess return over previous end of year 3m yield

RECENT HISTORICAL PERFORMANCE

1/1/1995 to 12/31/2016

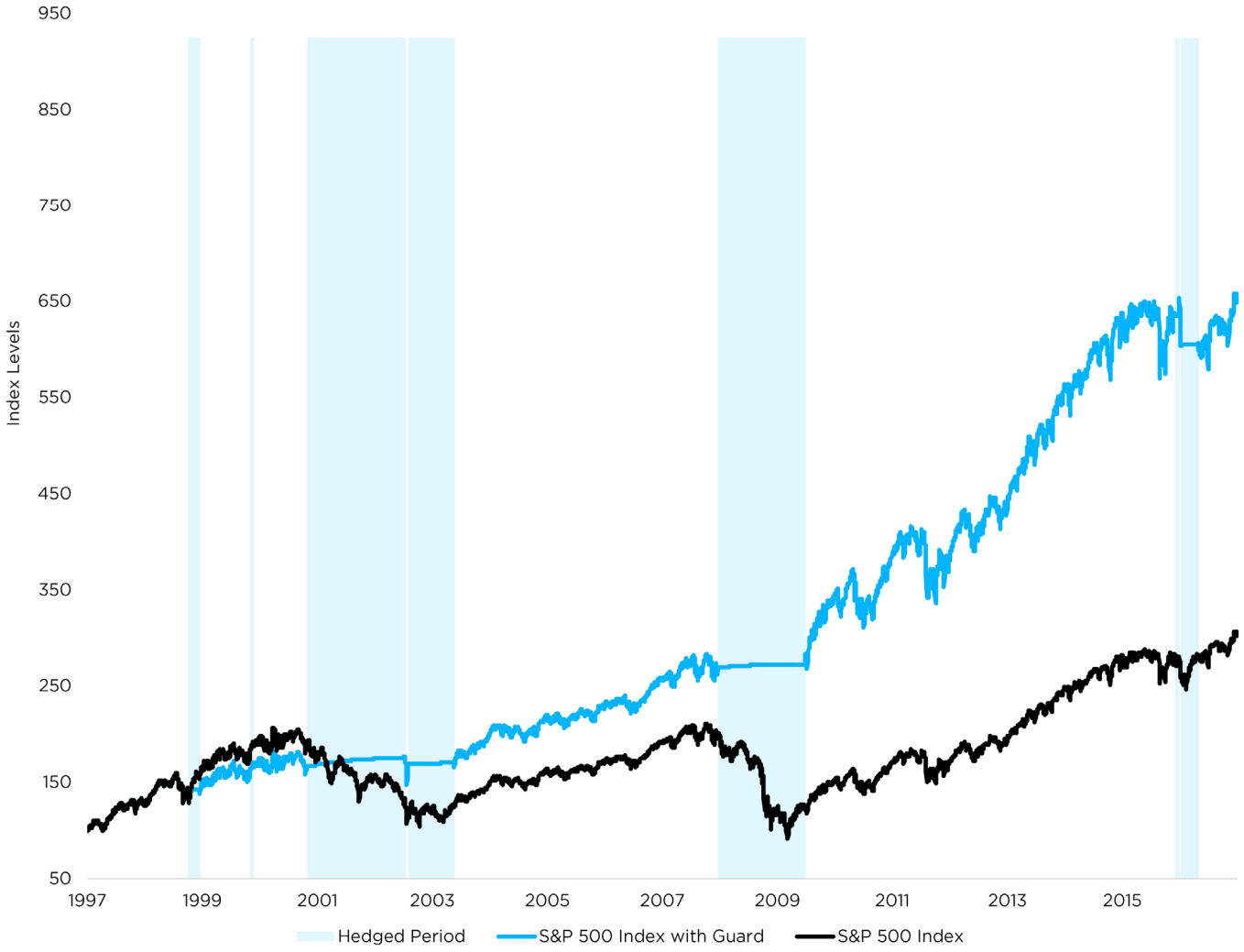
	Guard methodology	S&P 500 Index
% Positive return months	74.3%	63.5%
Average annual return*	12.16%	8.71%
Annualized volatility**	11.0%	15.1%
Sharpe ratio***	0.86	0.40

* Average monthly returns x12

** Monthly standard deviation x √12

***Sharpe ratio based on monthly excess return over previous end of month 3m yield

S&P 500 Index with Guard vs S&P 500 Index
(01/01/1997-12/31/2016)



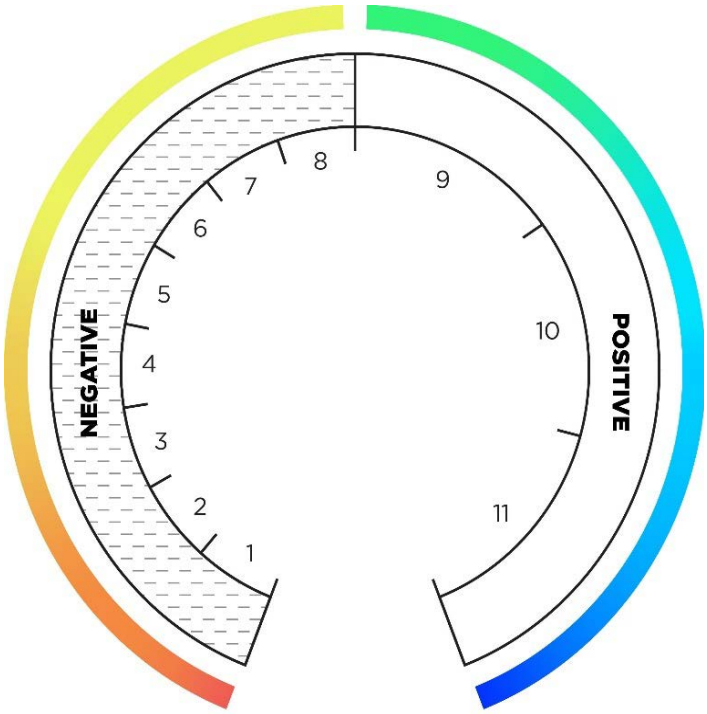
Potential drawbacks

Situations under which the Guard methodology may underperform

- Long periods of range-bound price movement
  - The PI is a trend-following indicator. It may generate buy or sell signals during prolonged range-bound markets which may result in underperformance.
- Bull markets and price bubbles accompanied by high volatility
  - The VI generates buy signals if the recent volatility is lower than long-term volatility. During periods of market price bubbles, the volatility is high and the index might not capture some parts of a bull market.

Guard: sector applications

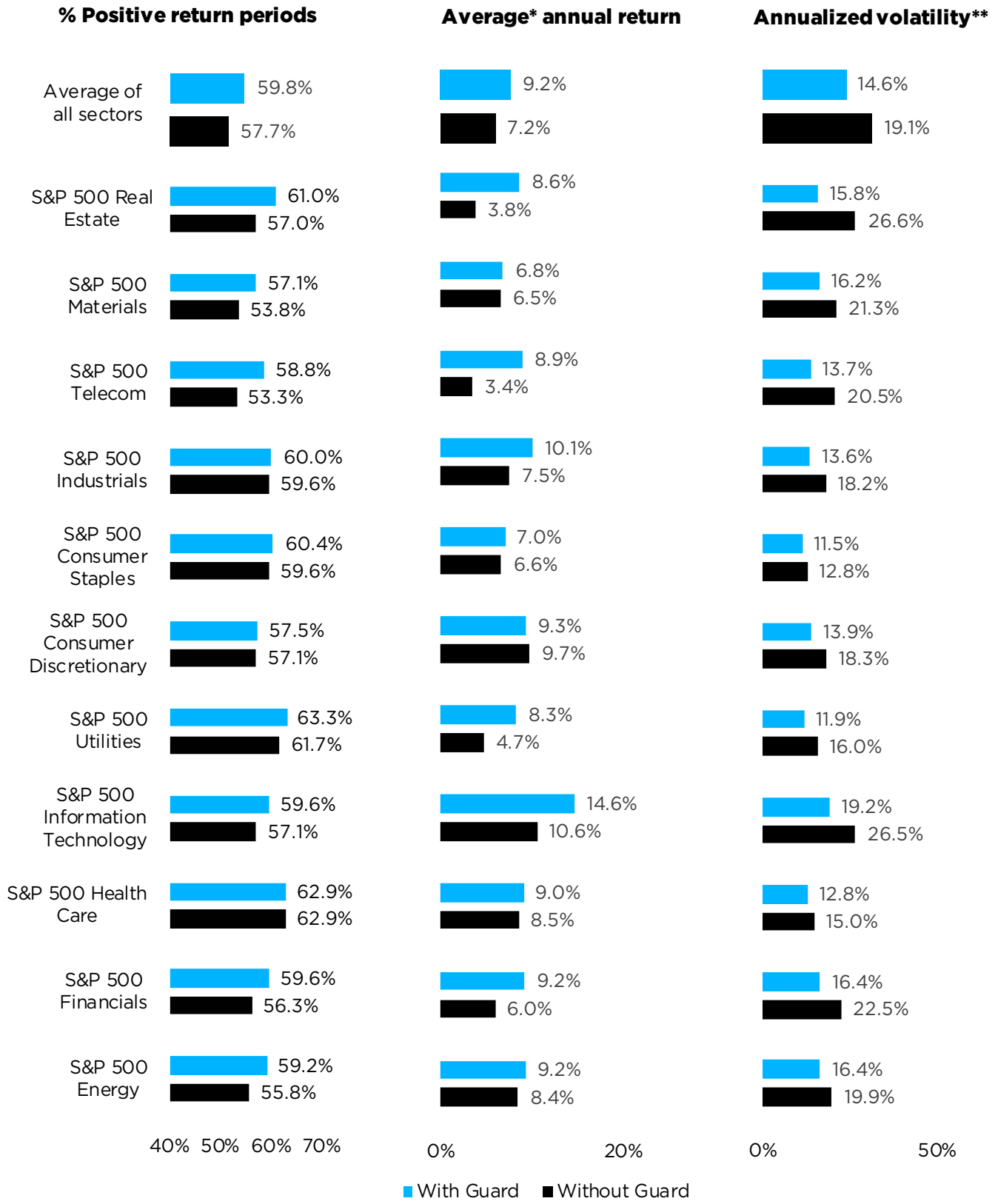
After determining that using the Guard methodology as an overlay on the S&P 500 was a successful market timing strategy, producing higher returns compared to the index alone, we applied the methodology at the sector level and discovered it is equally effective at predicting sector-level performance. For the twenty year period ending 12/31/2016* the Guard methodology improved the risk-return profile of the majority of the 11 broad market sectors as seen in the table below. The Guard methodology produced higher average annual returns in ten out of 11 sectors, lowered price volatility in all 11 sectors and increased the percentage of months with positive returns in ten of the 11 sectors. The below results show the performance of investing in the sector indices when the GS is greater than 1, and shifting to the Barclays US Aggregate Bond Index otherwise.



* 2/28/2007 to 12/31/2016 data period for Real Estate sector

Performance statistics of the 11 broad market sectors with & without Guard methodology
(12/31/1994 to 12/31/2016)

* Average monthly returns x12
** Monthly standard deviation x √12



Guard Indicator

After showing positive predictive results for the Guard methodology at both the market- and sector-level, we conducted additional analysis to optimize the market-timing model for the S&P 500. Our results show the best forecasts resulted from assessing each sector individually using the Guard methodology and combining the scores to determine whether the market trend was broad-based and not skewed by any particular sector(s). The total combined Guard score of the sectors is calculated to produce the Guard Indicator ("GI"), our proprietary market strength indicator. When nine or more sectors have a positive GS the GI is positive, forecasting a rising market. When three or more sectors turn negative, the GI forecasts a market decline.

We determine the GI based on the number of sectors out of the 11 broad market sectors which have a Buy signal based on the GS.

GI = Count of 11 GICS Level 1 sectors with GS > 1

The GI value can vary from 0 to 11. Progressively higher values in multiple sectors indicate a growing probability for a potential future broad-based market rally. By investing in the stock market when the GI value is greater than 8, the index seeks to capture the expected market uptrend.

Market performance of the Guard Indicator

The Guard Indicator has been successful in identifying major long-term market declines in back-testing. Over the past 15 years, it correctly forecast both of the major bear markets in the U.S., signaling to reduce market exposure for all but three trading days from 9/15/1999 until 5/22/2003 and avoiding a decline of 20.87 percent in the S&P 500 Total Return Index. It also signaled to exit the equity markets from 1/10/2008 until 7/14/2009, when the S&P 500 Total Return Index fell 33.78 percent.

In back-tested results, the Guard Indicator has been shown to enhance returns and reduce

Note: Effective the close of trading on Sep. 16, 2016, the Guard Indicator tracked 11 broad market sectors due to the addition of the Real Estate sector.

volatility through a wide range of market conditions. In the 20 years from 1997 through 2016, investing in the S&P 500 Total Return Index (SPXT) during positive Guard Indicator signals and shifting assets to the Barclays US Aggregate Bond Index during negative signals would have generated average annual returns of 11.6 percent, about 35 percent greater than the 8.6 percent return for the S&P 500 alone. Over the same period, the Guard Indicator strategy had 10.5 percent average annual volatility, nearly one-third less than the 15.3 percent volatility for the S&P 500.

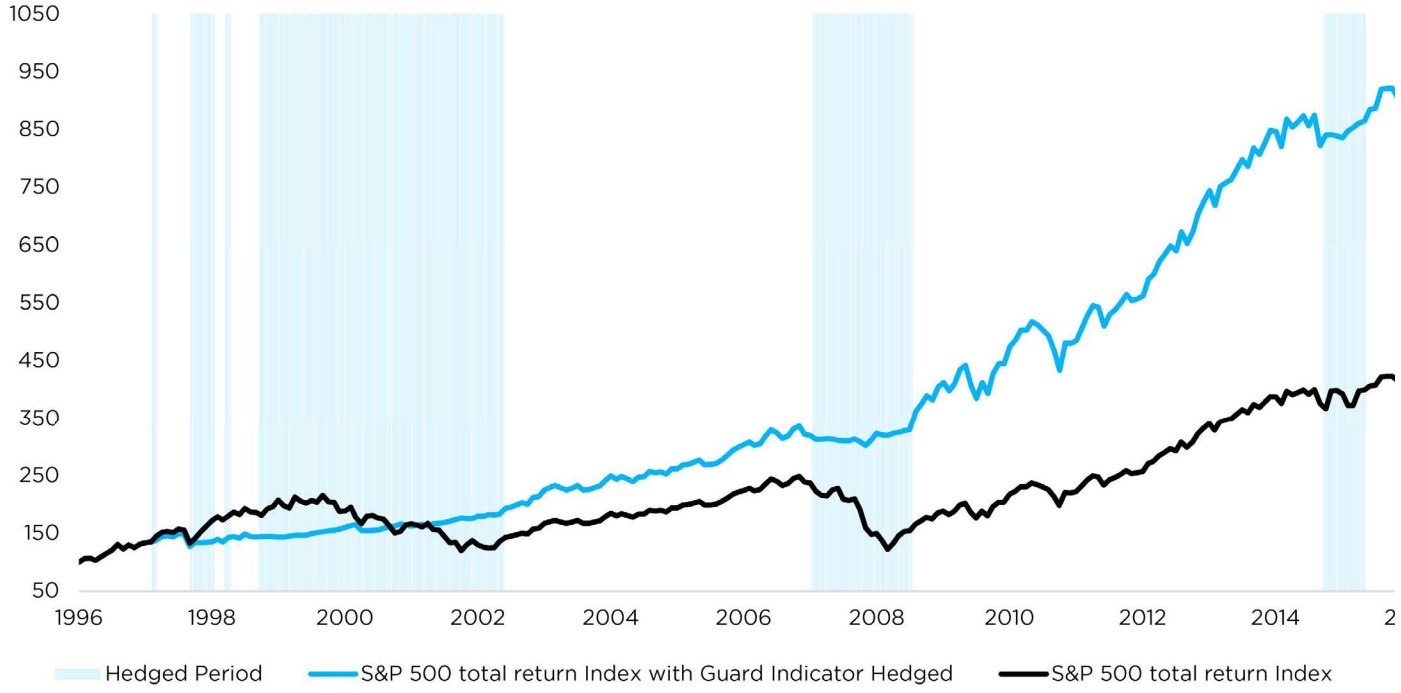
The below results show the performance of being invested in the S&P 500 Total Return Index when the GI is greater than 8 and shifting to the Barclays US Aggregate Bond Index otherwise, during the period 12/31/1996 - 12/31/2016.

12/31/1994 - 12/31/2016

	Guard Indicator	S&P 500 total return index
% Positive return months	70.4%	65.4%
Average annual return*	13.9%	10.6%
Annualized volatility**	10.6%	15.1%
Sharpe ratio***	1.06	0.52

* Average monthly returns x12
** Monthly standard deviation x √12
***Sharpe ratio based on monthly excess return over previous end of month 3m yield

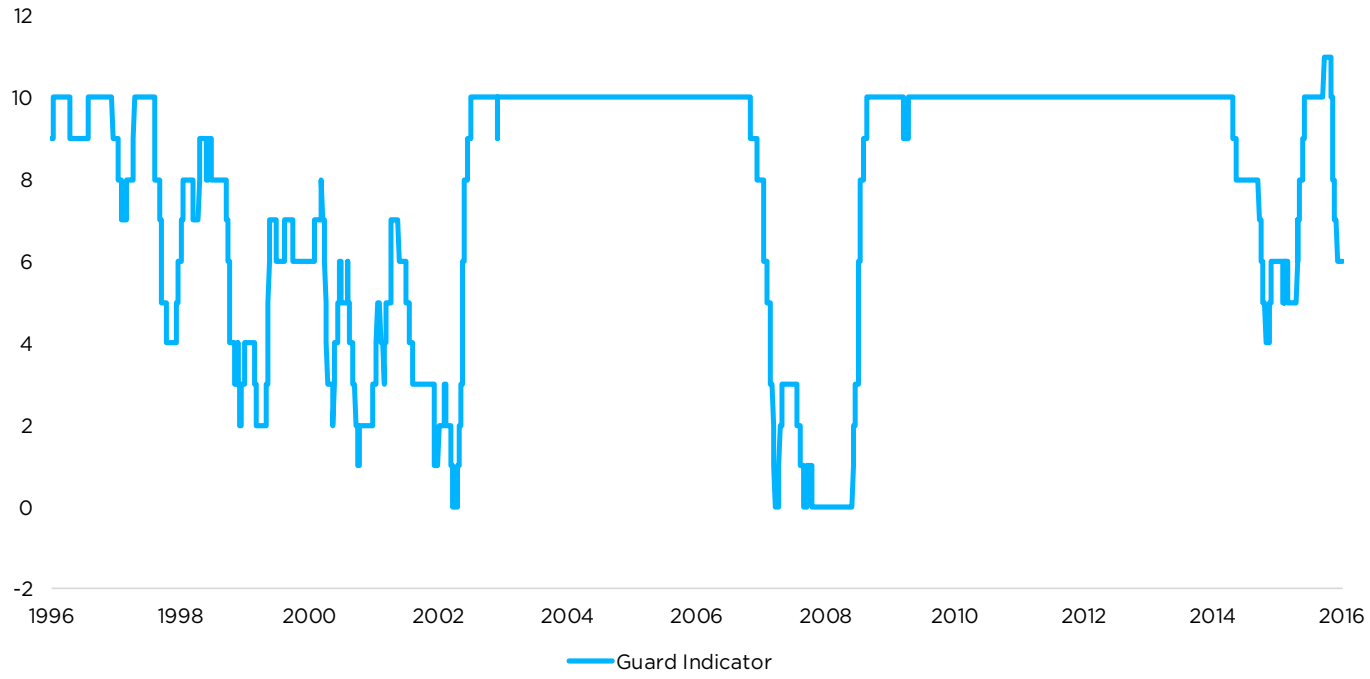
S&P 500 TR Index with Guard Indicator hedged vs S&P 500 TR index
(1997-2016)



The Guard Indicator signaled downturns in the market eight times in the last 20 years, which generated an outperformance of more than 2.4 times the S&P 500 Total Return. The Guard Indicator improves its accuracy when it includes sectors in the score calculation.

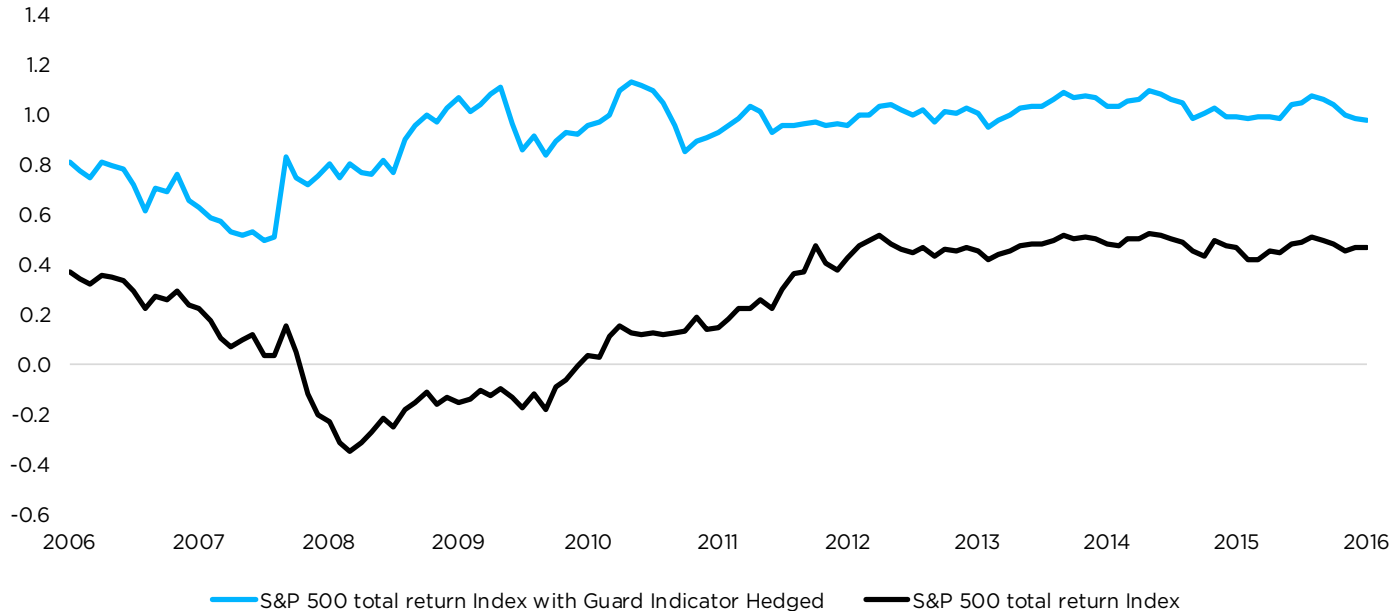
Note: Effective the close of trading on Sep. 16, 2016, the Guard Indicator tracked 11 broad market sectors due to the addition of the Real Estate sector.

Guard Indicator value over time for S&P 500 Index
(01/01/1997 to 12/31/2016)



The Guard Indicator is triggered when the Guard Score falls below 9 (8 prior to 19th Sep 2016). The Guard Indicator is more reactive to dramatic moments in the market when it incorporates sectors.

10 Year rolling Sharpe ratio***
(1997-2016)



The 10-year rolling Sharpe ratio shows an inverse relationship against the S&P Sharpe ratio starting in mid-2007. The backtest of the Guard Indicator demonstrates that using the recommended methodology will improve the portfolio's risk-adjusted return even in down markets.

***Sharpe ratio based on monthly excess return over previous end of month 3m yield
Note: Effective the close of trading on Sep. 16, 2016, the Guard Indicator tracked 11 broad market sectors due to the addition of the Real Estate sector.

Potential drawbacks

Situations under which the Guard Indicator may underperform

- Bull markets with participation from only a few sectors
    - The GI is designed to capture a broad based rally rather than one concentrated in a few sectors. For example, we can note from the performance charts that GI underperformed during period of internet bubble 1998-2000.
- There is a potential lag effect that may take place on the GI because certain sector indicators may take time to reach sufficient levels to create a trigger event
- The GI may not capture extremely sharp drops in the market because the indicator might need more time data to trigger an event

Click here to learn about the Reality Shares index utilizing the Guard Indicator to time market hedges