SWAN GLOBAL INVESTMENTS

NEW RISK METRICS FOR A NEW WORLD

Marc Odo, CFA®, FRM®, CAIA®, CIPM®, CFP®, Client Portfolio Manager
Chris Hausman, CMT®, Portfolio Manager, Managing Director-Risk

December, 2017

swanglobalinvestments.com

INTRODUCTION

Following the Financial Crisis of 2007-09, there was an explosion of investment products designed to not track the market. Hundreds of hedge funds and liquid alternatives were unveiled post-crisis as investors clamored for investments with low correlations to markets and minimal systematic risk. The release of all these products gave birth to a new problem—performance and risk measurement. If alternative investments were designed to behave differently than the market, does comparing them to the S&P 500 index make any sense? This is especially relevant since the S&P 500 is up over 300% since the market bottom over eight years ago.

In short, how can one tell if an alternative fund is doing its job?

Most of the commonly used performance metrics were designed for traditional, active money managers. Traditional active managers typically seek to add incremental value over a benchmark by making marginal bets on sectors or individual securities. Modern Portfolio Theory (MPT) statistics like alpha, beta, tracking error, and information ratio are well-suited for such managers. However, they aren't as useful for investments that are, by design, going to have return patterns quite different from the market.

Fortunately, there is a new generation of metrics designed for alternative investments. These post-MPT metrics are not yet in widespread use, but they are gaining attention in certain circles. This paper focuses on several new post-MPT statistics that are worth using.

But before we move into the new metrics to use, we should first identify what exactly we should be measuring. So one should ask themselves, "What are alternative investments supposed to do?" I propose investors use alternatives for three primary objectives: to minimize losses; to avoid, or at least minimize, the impact of tail risk, also known as extreme "black swan" events; and to provide consistent, steady returns through most market environments.

In connection to these objectives, I discuss the following new measurements:

1. Minimizing losses: pain index, pain ratio
2. Avoiding tail risk events: omega, upside/downside omega
3. Provide consistent, steady returns: Zephyr K-ratio

Before diving into these new metrics, I preface the discussion by introducing a useful framework for categorizing and understanding the role that various performance metrics play: StatMAP Framework.

THE StatMAP FRAMEWORK

There are dozens upon dozens of risk and return measures available and keeping them straight is a challenge. In a previous role as Director of Research at Zephyr Associates, I developed this framework in order to help people understand all the various measures available. The vast majority of the performance measures can be classified in one of three ways: measures of return; measures of risk; and measures of return-vs-risk trade-off (usually represented as a ratio).

Generally speaking, the higher or larger the measures of return, the better. Conversely, one hopes the values of the various risk measures to be as small as possible. Finally, since return-vs-risk measures are typically expressed as ratios with return in the numerator and risk in the denominator, one would like to see the trade-off ratios like Sharpe ratio and information ratio to be as large as possible.

The other axis on which we can organize our thoughts is risk. There are many different ways to define risk, and focusing on one while ignoring others leaves blind spots in our understanding of it. In order to provide a holistic view of risk, I propose four broad classifications:

1. Risk in terms of volatility
2. Risk relative to a benchmark
3. Risk in terms of capital preservation
4. Risk in terms of tail risk

1. Volatility

This framework reflects the evolution in thinking over the last 50-60 years. When Harry Markowitz and his contemporaries developed the ground-breaking Modern Portfolio Theory, risk was most often described in terms of volatility. Because investment returns were often described using long-term averages, volatility was used as a cross-check on the validity of those long-term averages.

If the long-term average return on an investment was 8% annually, how close was that investment to 8% each and every year? If the investment always posted something in the neighborhood of 8%, it has low volatility, and thus low risk. Conversely, if the range of returns spanned from -32% to +48% on a year-to-year basis, with little predictability as to where the investment would be in any given year, it has high volatility, and thus high risk. Volatility was the original measure of risk and remains a valid concept.

2. Relative to a Benchmark

During the 1980s and 1990s, the most popular performance metrics were measures like alpha, beta, information ratio, and capture ratios. What these metrics have in common is they all use a suitable market index as a benchmark. They are all calculated relative to a standard measuring stick. I believe this was for two reasons.

First, equity markets enjoyed a remarkable bull run between 1982 and 2000. The rising tide lifted all boats. Second, it was during this era that passive investing established itself as a viable approach. Vanguard and then later the ETF providers promised to match market returns very affordably rather than potentially outperform at a hefty price. With the bull market and passive investing as a backdrop, it is no wonder that benchmark-driven metrics became popular. If one was an active manager, one had to “prove” added value over a passive option, and metrics like alpha and information ratio are designed to do just that.

The shortcomings of benchmark-relative metrics were exposed during the first decade of the new millennium. In the span of less than ten years, we experienced the two worst bear markets since World War II. During the dot-com bust of 2000-02, markets lost almost 45%, then during the Financial Crisis of 2007-09, markets fell over 50%. In these kind of environments, it is entirely possible that a manager would have outperformed its benchmark and posted respectable alphas and information ratio but still would have lost 40% of its value.

3. Capital Preservation

When most investors think of risk, they most likely define it as simply "not losing money." The idea of maximizing the excess return-vs-tracking error relationship takes a backseat to not losing 30%, 40%, or 50% of one's wealth. Because this is close to how most investors consider risk, ways of quantifying risk in terms of capital preservation represent the next generation in risk and performance measurements.

4. Tail Risk

Closely related to capital preservation is the risk of extreme, outlier events. Commonly known as "tail risk" or "black swan" events, they are marked by their rarity and severity. The scope and scale of the Financial Crisis of 2007-09 had not been seen since the Great Depression. Quantifying tail risk is difficult, but there have been some innovations on this front.

The StatMAP

The grid below combines these concepts along two axes. At Zephyr, we called this "the StatMAP." Most of the performance and risk metrics fall neatly into this grid.

There are certainly more performance metrics out there, but most of them would fit somewhere within this framework. The ones explored in this paper are highlighted in blue. The two right-most columns, Capital Preservation and Tail Risk, are the focus of the post-MPT discussion, but the first two measures discussed are those of capital preservation.

	Volatility Risk	Benchmark Risk	Capital Preservation Risk	Tail Risk
Return		Excess Return Batting Average Up Capture		Skewness Upside Omega
Risk	Standard Deviation Downside Deviation	Beta R-squared Tracking Error Down Capture	Maximum Drawdown Pain Index	Kurtosis Value at Risk Conditional Value at Risk Downside Omega
Return/Risk Trade-off	Sharpe Ratio Sortino Ratio Zephyr K-ratio	Alpha Information Ratio Treynor Ratio	Calmar Ratio Pain Ratio	Omega

Table 1. Source: Swan Global Investments.

MEASURES OF CAPITAL PRESERVATION: PAIN INDEX & PAIN RATIO

The graph below shows the drawdown of the S&P 500 over the last 20 years. The maximum drawdown can be seen as -50.45% starting in November 2007 and eventually bottoming out by February 2009. But what about the previous bear market, the one from March 2000 to March 2003 when the market lost 44.73%? What about some of the smaller, shorter dips? How long did it take for the market to recover all of its losses? Those questions are not answered by maximum drawdown. They are, however, answered by a metric called the pain index[1].

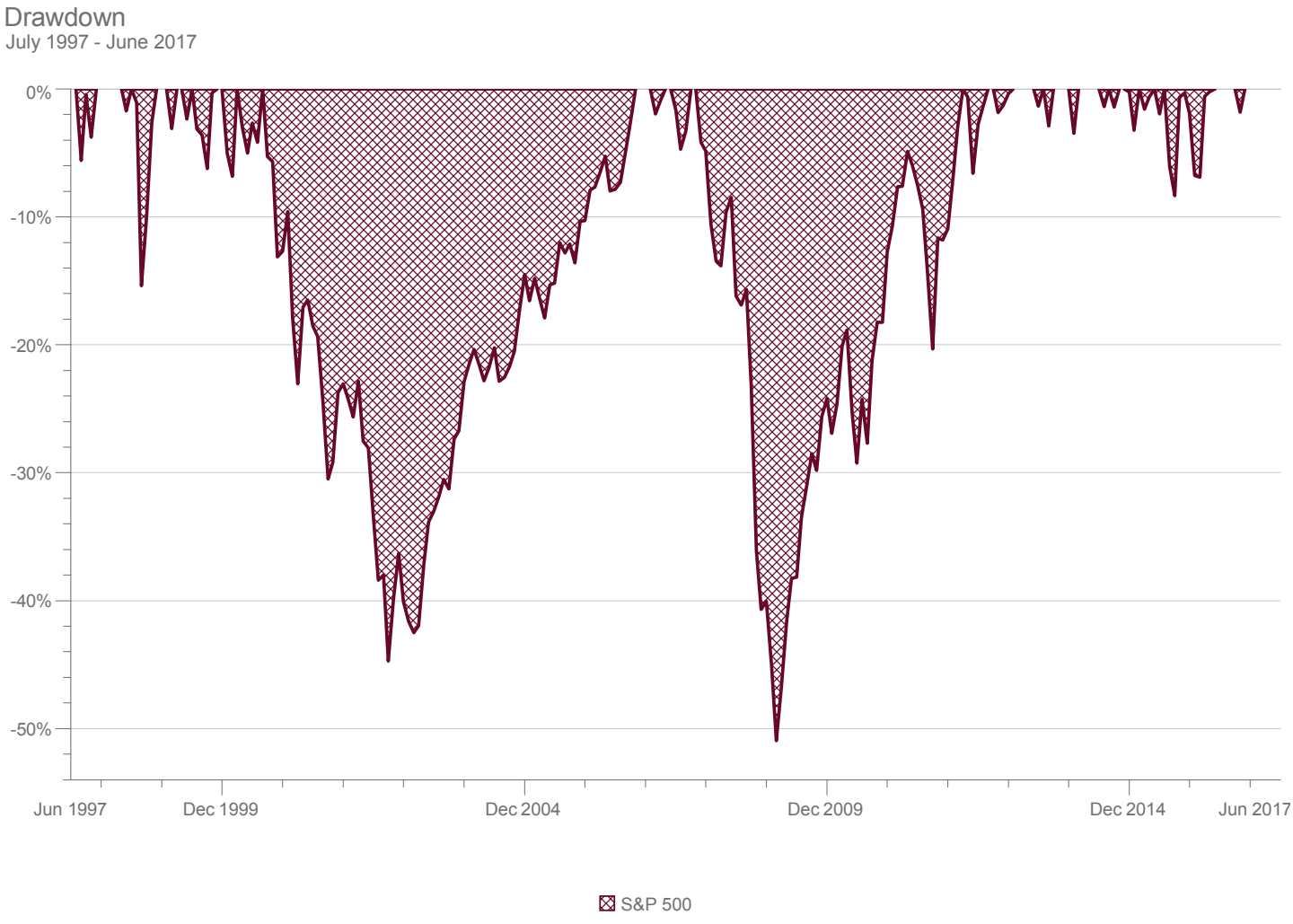


Chart 1. Source: Zephyr StyleADVISOR

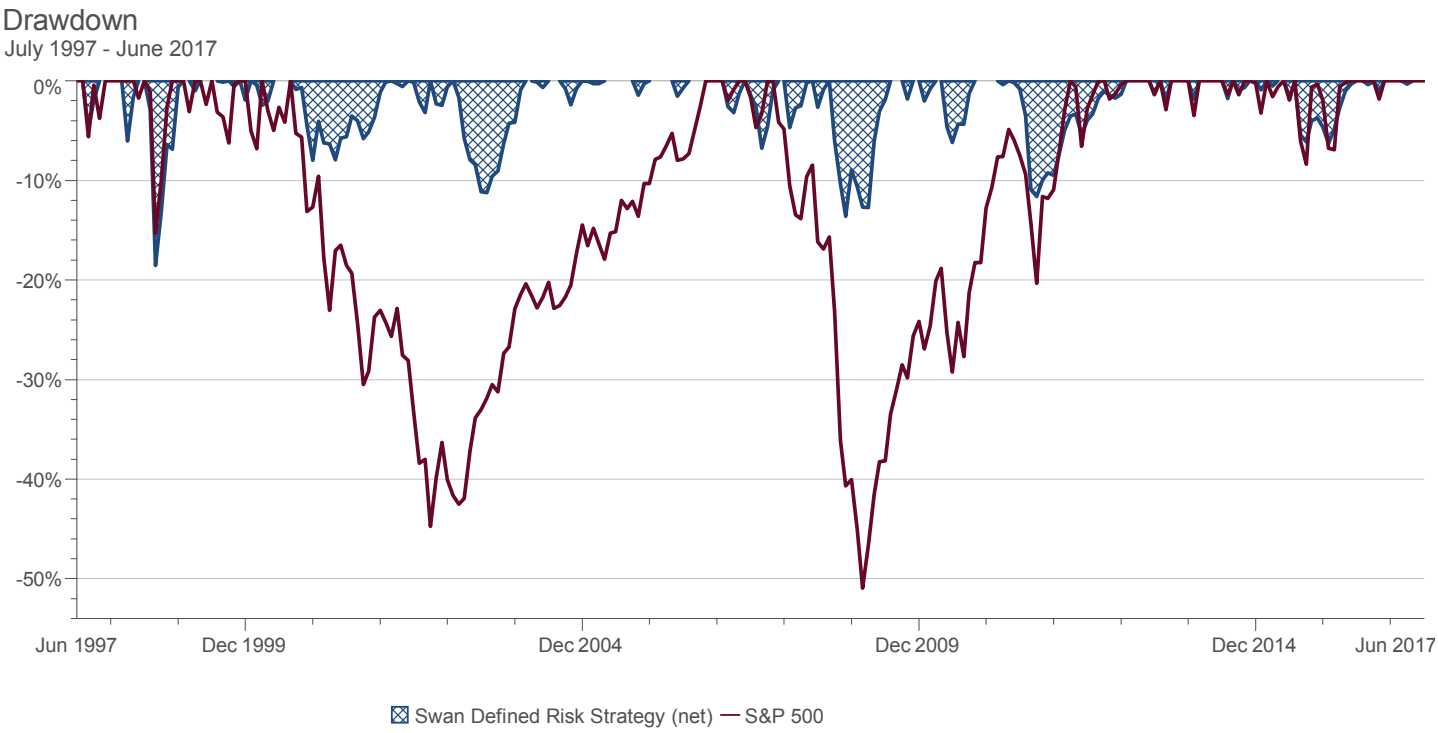
[1] The pain index and the pain ratio were developed by Dr. Thomas Becker and Aaron Moore of Zephyr Associates in 2006. http://www.styleadvisor.com/sites/default/files/article/zephyr_concepts_pain_ratio_and_pain_index_pdf_18774.pdf

The Pain Index

If one were to fill in the entire area between the drawdown line and the break-even line, it would encapsulate three things: the depth of losses, the duration of losses, and the frequency of losses[2]. These three results are exactly what the pain index measures.

From a practical standpoint, one should ask: "What is good? What should I be looking for when I look at the pain index?" Like all other risk measures, the smaller the value the better. The best possible pain index would be 0.00, which would indicate that an investment had never lost a penny over the time period in question. In order to understand whether a pain index is "good" or "bad," it should be compared to some alternatives, like an asset class index or competitors.

In the graph below, we see the same S&P 500 graph, but with the Swan DRS Select Composite included. If one were to look at the drawdown, "pain" area encompassed by the DRS and compare it to the S&P 500, a ballpark estimate might be the S&P 500's "pain" is five times as large. As it turns out, the DRS's pain index of 2.26 is roughly one-



	Maximum Drawdown	Max Drawdown Begin Date	Max Drawdown End Date	Max Drawdown Length	Max Drawdown Recovery Date	Pain Index
Swan Defined Risk Strategy (net)	-18.56%	Jul 1998	Aug 1998	2	Jan 1999	2.26%
S&P 500	-50.95%	Nov 2007	Feb 2009	16	Mar 2012	11.73%

Chart 2. Source: Zephyr StyleADVISOR

[2] Mathematically speaking the pain index in an integral. It is a calculus term measuring the area between a line and a curve. For the pain index the break-even axis is the line and the drawdown is the curve.

fifth the size of the S&P 500's pain index of 11.73. The depth, duration, and frequency of losses of the DRS has been about one-fifth that of the S&P 500 over the last 20 years.

If there is one drawback to the pain index, it is that it only measures risk, not reward. The safest investments with the lowest pain indexes are likely to be those investments with scarcely any upside, like savings accounts, certificates of deposit, or money markets. Investing is all about optimizing returns against risks, so ideally we would be able to balance the pain index against a measure of return. This is where the pain ratio comes in.

The Pain Ratio

The pain ratio is a risk/return measurement that uses the pain index within the calculation. It defines risk in terms of capital preservation. This measurement should look somewhat familiar as it uses the Sharpe ratio as a template.

The Sharpe ratio is one of the most well-known and widely used performance measures. William Sharpe developed it over half a century ago to quantify the return-vs-risk trade-off, essentially answering how much "bang for the buck" an investment delivered.

$$Sharpe\ ratio = \frac{R_{investment} - R_{risk\ free}}{\sigma}$$

The numerator of the Sharpe ratio is an investment's excess return over the risk-free rate. The rationale behind the Sharpe ratio is that if someone invests in a risky investment, then they should be compensated with a return above and beyond the risk-free rate.

The denominator of the Sharpe ratio is the standard deviation of the investment, a measure of volatility. As mentioned previously, volatility was the primary measure of risk when academia first started getting serious about measuring and quantifying risk and return. In short, the Sharpe ratio measures how much reward is obtained per unit of risk, with risk defined in terms of standard deviation.

There have been many variations on Sharpe's premise. The basic framework is the same, but standard deviation is swapped out for different risk metrics to get different perspectives on risk. Probably the two most famous examples are the Treynor ratio and the Sortino ratio, where the new risk metrics used are beta and downside deviation, respectively.

$$Treynor\ ratio = \frac{R_{investment} - R_{risk\ free}}{\beta}$$

$$Sortino\ ratio = \frac{R_{investment} - R_{risk\ free}}{\sigma_{downside}}$$

$$Pain\ ratio = \frac{R_{investment} - R_{risk\ free}}{Pain\ index}$$

The pain ratio follows in this tradition. The numerator is the same as the others (i.e., the excess return over the risk-free investment). The denominator is the pain index introduced a moment ago. It is still the amount of return per unit of risk, but risk in defined in terms of capital preservation rather than volatility. Like all ratios, the higher the pain ratio the better, since return is in the numerator and risk in the denominator. In order to ascertain what a "good" number is, one must compare against the pain ratios of peers or asset class indices.

Both the pain index and the pain ratio deliver measurements that are related to an investor's objective to minimize losses. They are both also easier for investors to understand as they are connected to what they care about in a more concrete way.

MEASURES OF TAIL RISK: OMEGA & UPSIDE/DOWNSIDE OMEGA

Omega

Omega is useful to illustrate the impact that outlier events have on a distribution. Like the pain index, the best way to understand omega is through the use of a visual. In the graph below, we see a distribution of the 12 monthly returns on the S&P 500 in 2016, sorted from worst to first. The worst return in 2016 was -4.96%, the best was 6.78%. Three months were negative, one was very close to zero, and eight months were positive.

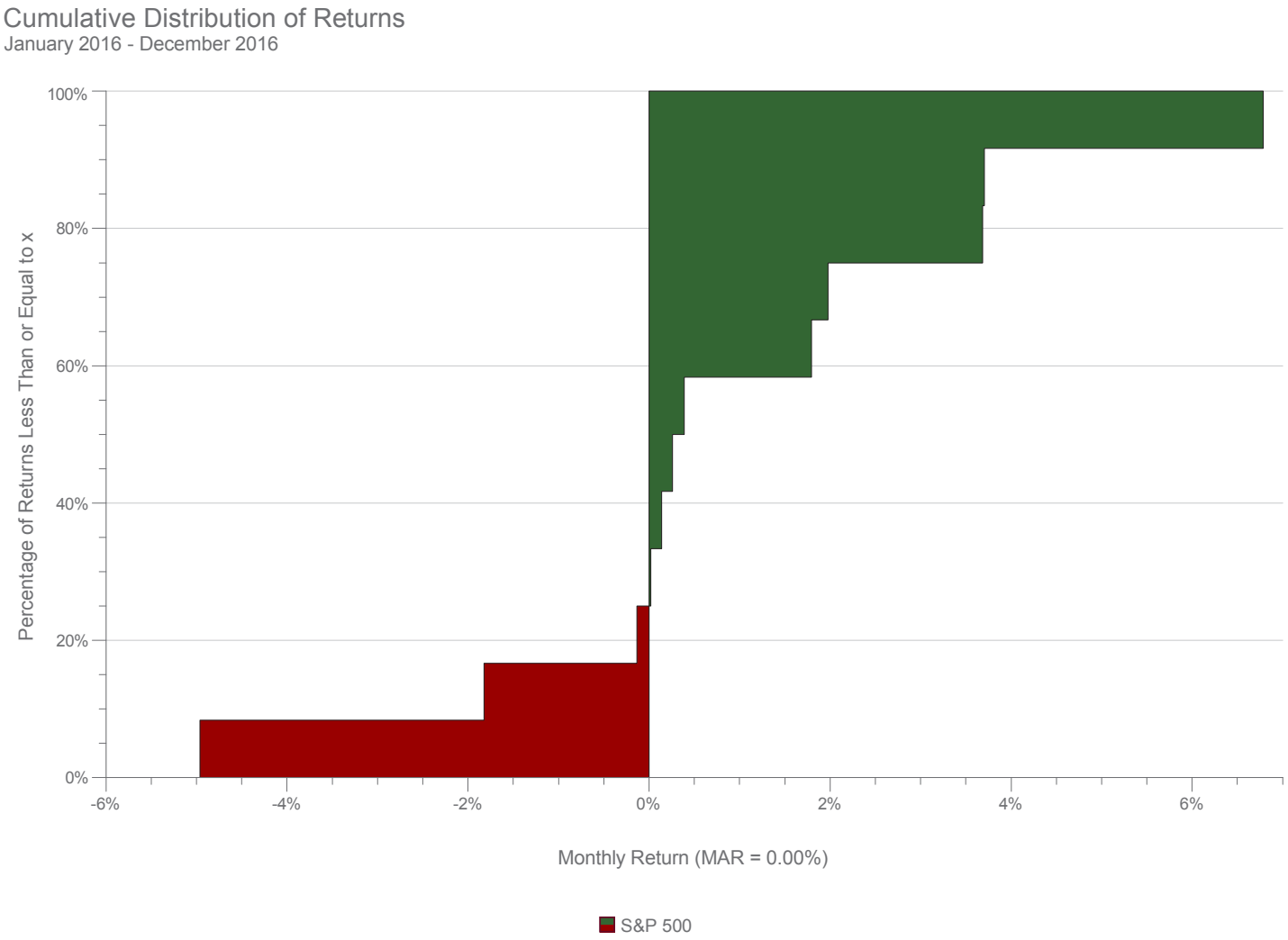


Chart 3. Source: Zephyr StyleADVISOR

This graph might not be too interesting if one only looks at a single year. It's chunky and doesn't seem to tell you too much. However, if you were to expand the time horizon to something larger like 20 years, the picture becomes much more informative.

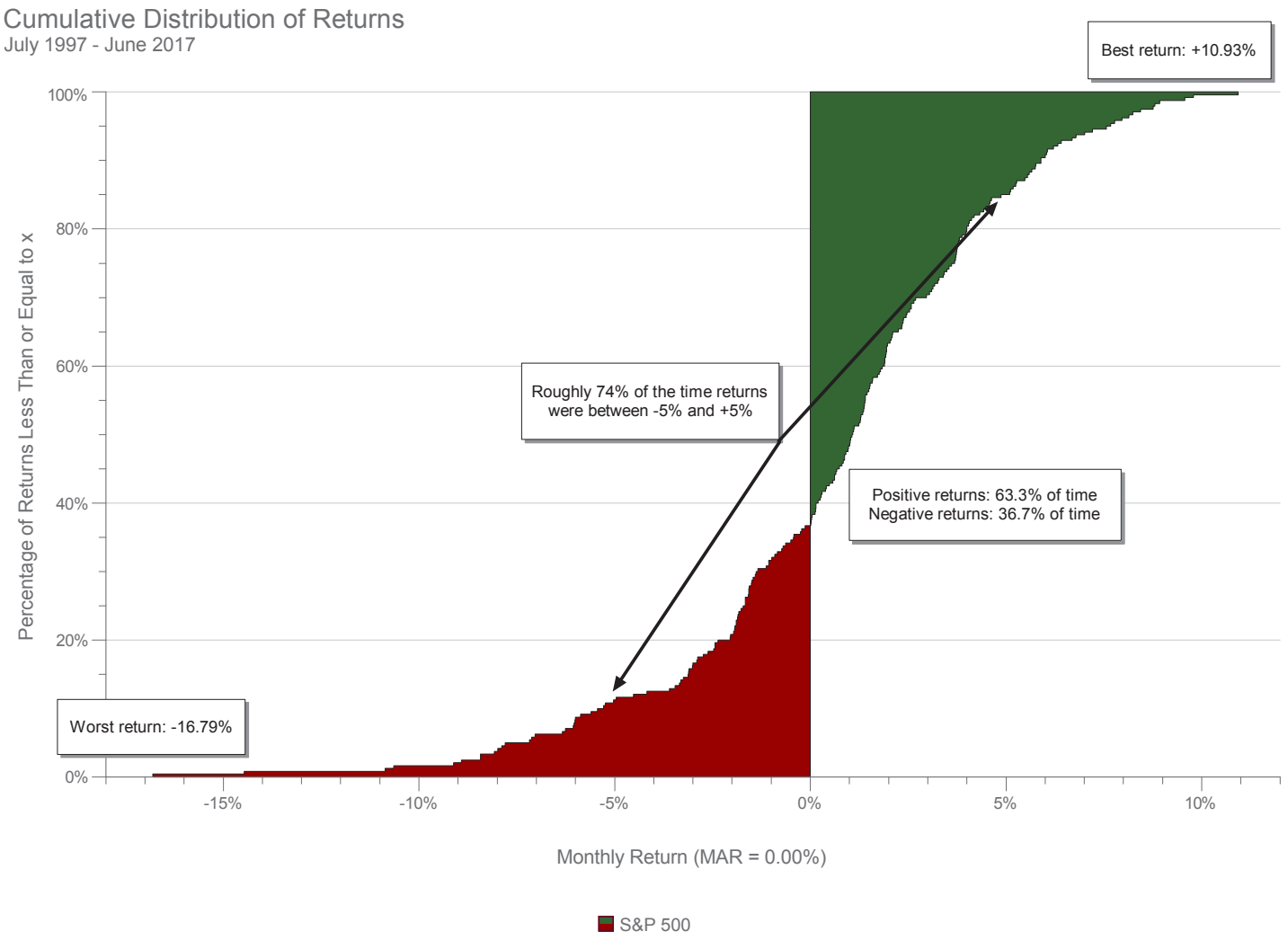


Chart 4. Source: Zephyr StyleADVISOR

The worst one-month return over the last 20 years was -16.79% and the best was 10.93%. Returns were positive (green area) 63.3% of the time whereas returns were negative (red area) 36.7% of the time. Roughly 74% of the returns fell somewhere between -5% and +5%. This graph gives us an excellent idea of what the overall distribution of returns looks like.

Omega is derived from this graph. The green area represents the count and scale of monthly returns that fall above a minimum accepted return (MAR), in this case set to 0%. Ideally, this green area would be quite large. The red area, on the other hand, represents the count and scale of observations that fall below the MAR. One would hope this area to be as small as possible. Omega is calculated by dividing the good green area by the bad red area[3].

What should be apparent by looking at the omega graph is the impact of outlier events on the calculation of omega. If there are numerous observations well below (or above) the MAR, they will equate to large amounts of real estate. Conversely, if most of the monthly observations fall somewhere close to the MAR, they won't generate a lot of area to be measured. Therefore, omega is an excellent metric for determining the impact of tail risk, or "black swan," events.

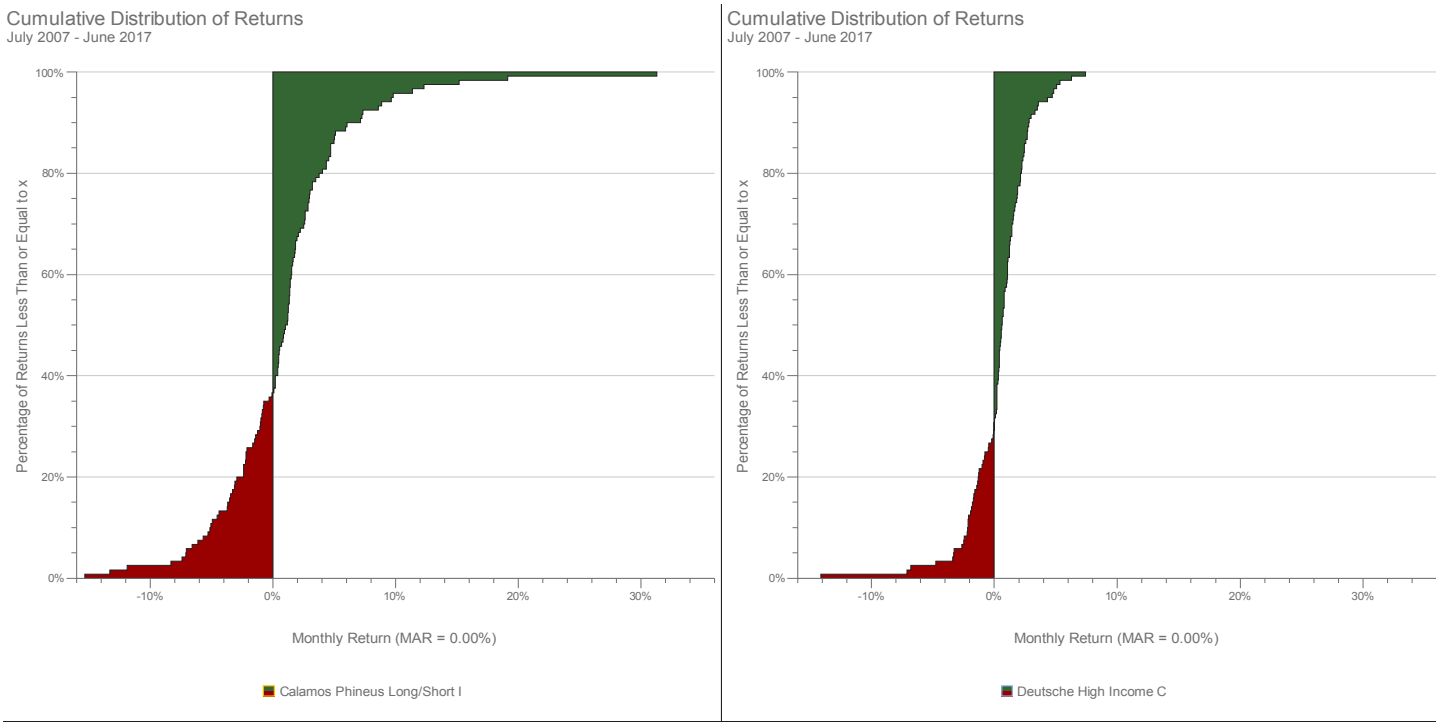
Since omega is a ratio with a "good" number

[3] Omega was developed by Con Keating and William Shadwick in 2002. http://www.isda.org/c_and_a/pdf/GammaPub.pdf

in the numerator and a "bad" measure in the denominator, an analyst would hope to see large omega numbers. And just like the pain index or pain ratio, there is not an absolute value that one can use as a reference point to determine whether an omega is good or bad. The omega would need to be compared against that of a benchmark or a group of peers.

Upside Omega and Downside Omega

If there is one drawback to omega, it is that it rolls the "good" (the green area) together with the "bad" (the red area) to form a single number. But what if one only wants to analyze the downside risk or upside potential in isolation? Omega doesn't account for that. After all, it's possible that Manager A has a very small green area and a very



Custom Table
July 2007 - June 2017: Summary Statistics

	Omega (MAR = 0.00%)	Upside Omega (MAR= 0.00%)	Downside Omega (MAR= 0.00%)
Calamos Phineus Long/Short I	1.67	2.41%	1.44%
Deutsche High Income C	1.67	1.15%	0.69%

Chart 5. Source: Zephyr StyleADVISOR

small red area and Manager X has very large green and red areas and at the end of the day the omegas are roughly the same. This situation is displayed in the chart above.

One refinement to the concept of omega is to simply look at the two halves independently and not roll them up into a single ratio[4]. This is called upside omega and downside omega. Obviously one hopes upside omega is large, signifying 1) many observations above the MAR, 2) extreme observations above the MAR or 3) both. Conversely, one hopes downside omega is small, for the same reasons.

[4] Breaking out omega into its separate components was not part of the original Keating and Shadwick paper. It was an enhancement brought about by Zephyr Associates.

MEASURES OF VOLATILITY: ZEPHYR K-RATIO

Zephyr K-ratio

The Zephyr K-ratio is a variation on an obscure but intriguing measure known as the Kestner ratio[5]. In a nutshell, the K-ratio measures the consistency of wealth creation. Most investors really want just two things:

1. They want their wealth to appreciate at a rapid rate.
2. They want their wealth to appreciate along a consistent path.

This is what the K-ratio measures. Again, we turn to an illustration to help understand this new metric.

Below we see a cumulative return graph for the S&P 500 over the last 20 years[6]. Superimposed over the actual data is a straight, best-fit line. The steeper the slope of that line, the better. A steeper slope indicates a more rapid pace of wealth appreciation. It is the slope of that line that is the return measure, the numerator of the K-ratio.

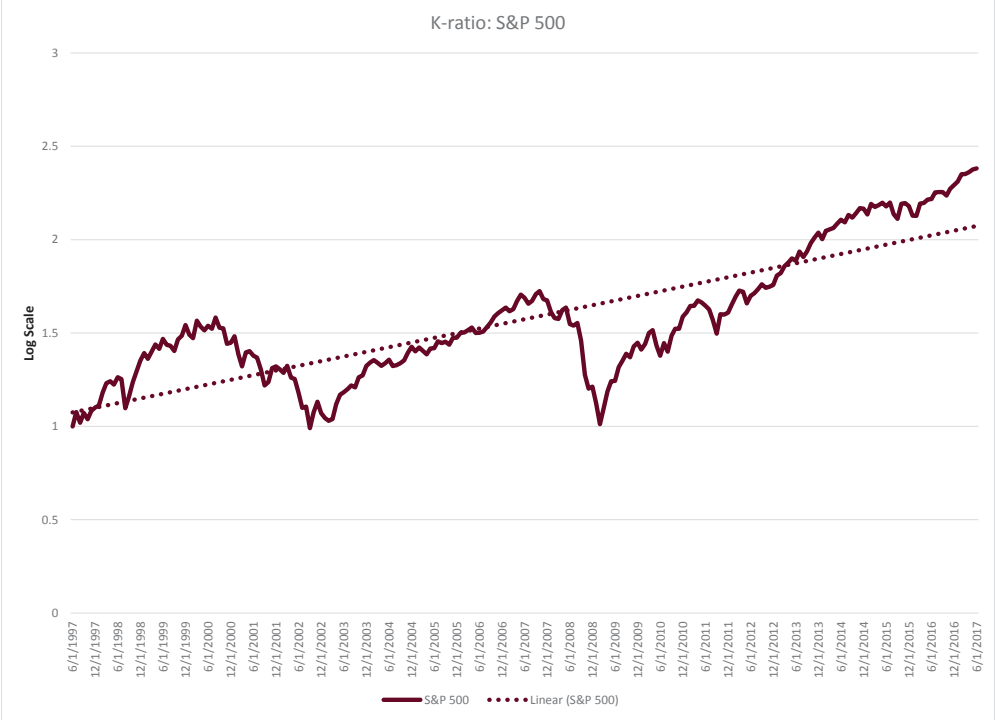


Chart 6. Source: Zephyr StyleADVISOR, Swan Global Investments

[5] The K-ratio was first proposed by Lars Kestner in 1996. The Zephyr K-ratio is a variation of the K-ratio that removes an element of the formula that incorporates the number of data points used in the calculation. http://www.styleadvisor.com/sites/default/files/article/zephyr_concepts_zephyr_k_ratio_pdf_41672.pdf

[6] Because this is a cumulative return graph, it takes into account the compounding of wealth. In order to superimpose a best-fit line over a compounding series, the graph must first be converted to a log scale.

In order to calculate this new metric, the K-ratio uses the standard error of the mean as its measure of risk. The standard error of the mean is subtly but importantly different than the standard deviation used in most performance and risk statistics. Standard deviation measures how much individual observations of data tend to be dispersed from the mean value. Standard error of the mean is a test of the mean itself—it is a way to indicate how precise or accurate a mean value is.

For the practical purposes of the K-ratio, using the standard error of the mean as a measure of risk allows us to see just how closely an actual return pattern matches that idealized straight line. The smaller the standard error of the mean, the closer the actual return series is to the idealized straight line. Conversely, a large standard error of the mean indicates that the actual path the investment takes meanders far and wide off the straight line. The standard error of the mean is the denominator of the K-ratio.

As an added benefit, the K-ratio addresses one of the long-standing complaints regarding the use of standard deviation as a risk measure: It does not and cannot take into account the timing of bad returns. If there are a dozen very bad monthly returns over the span of ten years, standard deviation cannot tell whether those bad months were randomly scattered throughout a decade or if they were all clustered in a small period of time. Anyone who remembers the dark days of late 2008/early 2009 knows that when it rains, it pours, and that some of the worst months in memory were tightly clustered within a few quarters.

The standard error of the mean and the K-ratio remedy this. We can see how the financial crisis pushes the investment off of the idealized straight line because when you add up month after month after month of bad returns, you discover that the market has lost 50%.

So, the K-ratio is the slope of the best-fit line, measuring capital appreciation, divided by the standard error of the mean, which is a measure of consistency. Like all the ratios discussed in this paper, the larger the number the better, and a comparison to peers is necessary to determine whether a number is “good” or “bad.”

The path of wealth appreciation is not a straight line; there are many ups and downs along the way. However, a straight line of wealth appreciation can be thought of as an ideal. If an investment offered a consistent rate of wealth appreciation with no deviations on a month-to-month or year-to-year basis, it would likely find an enthusiastic pool of investors.

APPLYING POST-MPT METRICS TO THE DEFINED RISK STRATEGY

Swan Global Investments developed the Defined Risk Strategy (DRS) over 20 years ago with many of the post-MPT goals in mind. Founder and CEO Randy Swan sought to preserve capital through bear markets and minimize the impact of extreme events. Randy was seeking a solution that provided consistent wealth creation with little deviation. This was back in 1997, before any of these new risk metrics were devised and when benchmark-relative investing was the dominant approach. Now that our tool kit has been improved to quantify capital preservation, tail risk, and consistency of returns, let’s see how these metrics apply to the DRS and a number of different benchmarks.

Capital Preservation: Pain Index and Pain Ratio

With its emphasis on not losing money, it should be no surprise that the pain index for the DRS has been quite low over the last 20 years, at 2.26. Also, the last 20 years have featured the two largest bear markets since World War II, so it should also make sense that the pain index for the S&P 500 would be large at 11.73. The pain index for the DRS is roughly one-fifth of that of the S&P 500, and just over one-half that of a blended 60% S&P 500/40% Barclays Aggregate mix, and slightly less than that of the HFRI Fund Weighted Composite Index.

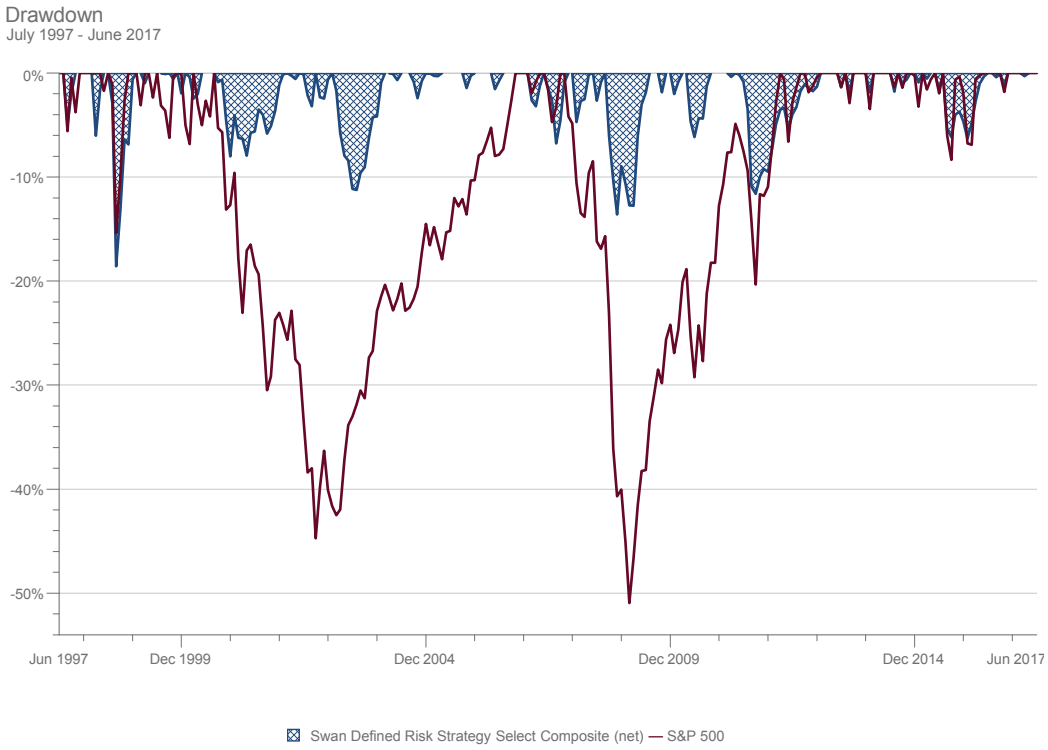
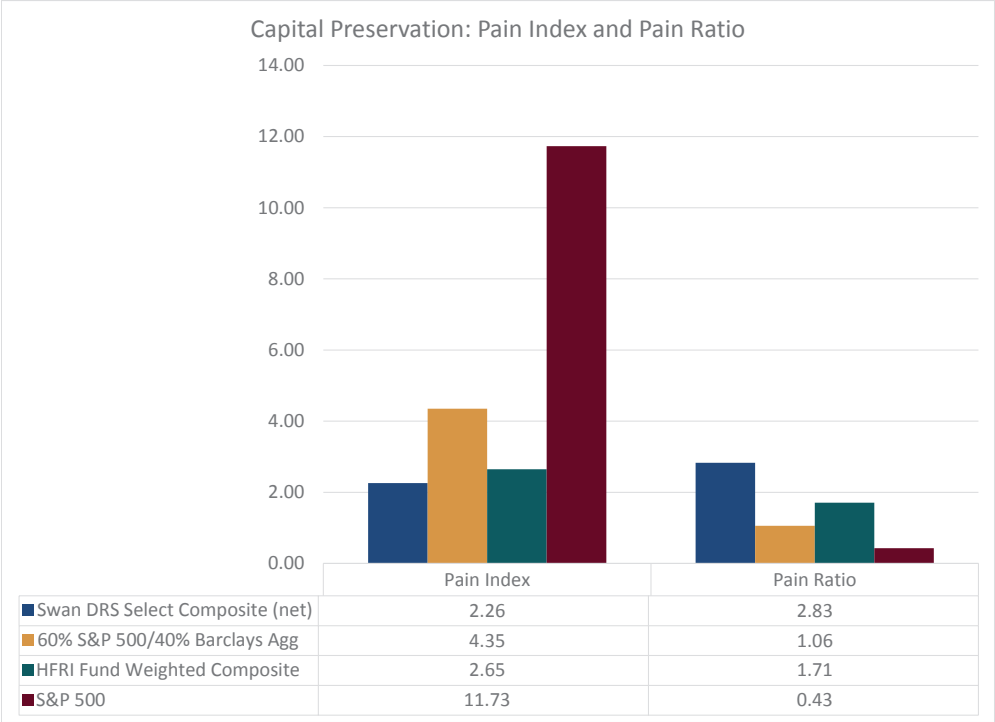


Chart 7. Source: Zephyr StyleADVISOR



	Pain Index	Pain Ratio
Swan DRS Select Composite (net)	2.26	2.83
60% S&P 500/40% Barclays Agg	4.35	1.06
HFRI Fund Weighted Composite	2.65	1.71
S&P 500	11.73	0.43

Chart 8. Source: Zephyr StyleADVISOR, Swan Global Investments

While the DRS is prepared for bear markets, it is important to note that the DRS is not solely a bear market strategy. There are some strategies that are inversely correlated to the market and only do well when the market is down. The DRS, in contrast, is designed to be a full market solution, one that participates in up markets but also offers downside protection. The evidence of this can be seen in the pain ratio. With return as the numerator and the pain index as the denominator, one will want to see a large pain ratio number. With a pain ratio of 2.83, the DRS bests all three benchmarks.

Tail risk: Omega

While the pain index illustrates how well the DRS has historically mitigated losses, one cannot deny that there is a cost to that. The price of protecting on the downside is to give up some of the returns on the upside. The graph below illustrates this trade-off. The S-graph for the DRS is narrower than the S-graph for the S&P 500. The area encapsulated by the count and scale of returns less than 0% (i.e., the downside omega) is smaller than that of the S&P 500—a good thing. However, the trade-off is the upside omega area, representing the count and scale of returns greater than 0% is less than that of the S&P 500.

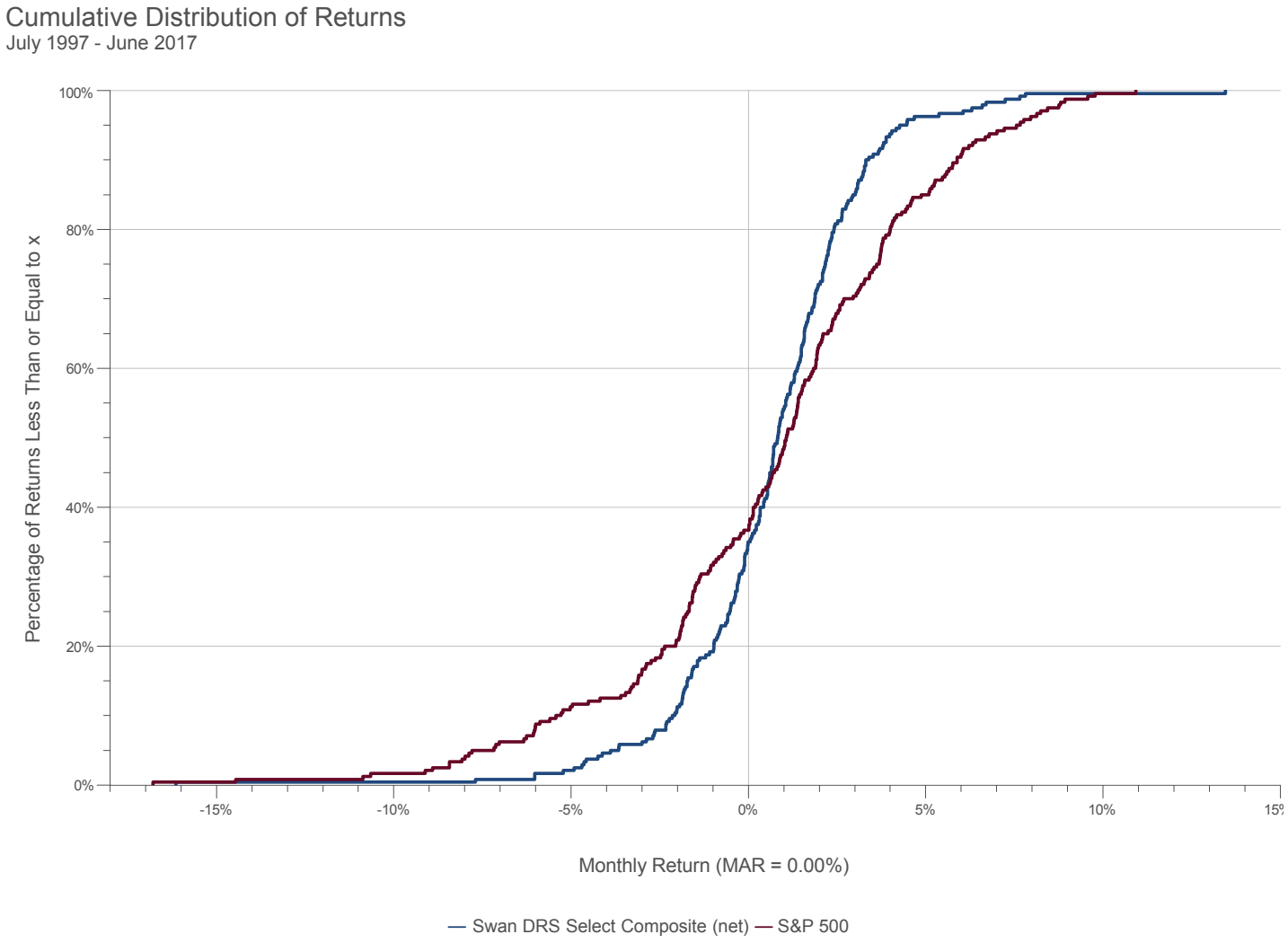
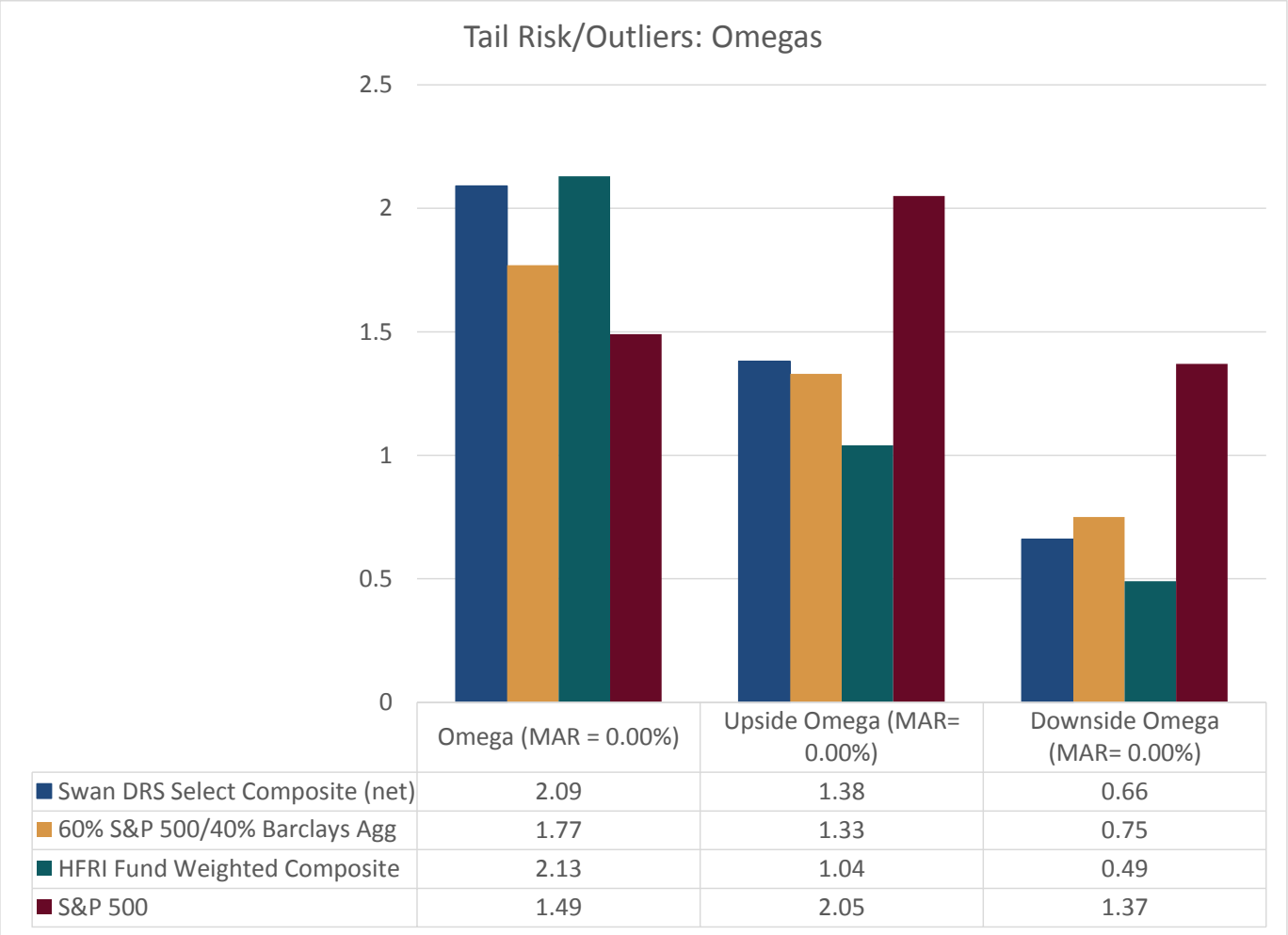


Chart 9. Source: Zephyr StyleADVISOR



	Omega (MAR = 0.00%)	Upside Omega (MAR= 0.00%)	Downside Omega (MAR= 0.00%)
Swan DRS Select Composite (net)	2.09	1.38	0.66
60% S&P 500/40% Barclays Agg	1.77	1.33	0.75
HFRI Fund Weighted Composite	2.13	1.04	0.49
S&P 500	1.49	2.05	1.37

Chart 10. Source: Zephyr StyleADVISOR, Swan Global Investments

It has always been Swan's philosophy that protecting against losses is more important than capturing all of the upside gains. The graphs above illustrate how the DRS's history reflects this bias. If we were to quantify this trade-off by dividing the upside omega by the downside omega, one simply gets the ratio between the two: the omega measure as originally described by Keating and Shadwick. For the DRS, the omega is 2.09, whereas the omega for the S&P 500 is 1.49. This means the ratio between the good and bad areas of the distribution is skewed more to the positive with the DRS.

The omega ratio for the DRS is slightly less than that of the hedge fund index, 2.09 versus 2.13. The DRS has more upside omega (1.38 vs 1.04) but also more downside area (0.66 vs 0.49). At the end of the day, the trade-off between upside and downside is roughly equal between the two.

Consistency of Wealth Creation: The Zephyr K-ratio

The DRS looks particularly strong when analyzed in terms of consistency of wealth creation. First of all the slope of the best-fit line is steeper than that of the S&P 500, meaning the DRS does a better job of creating wealth. But more importantly, the actual data line tends to hug the idealized best-fit line much more closely than the S&P 500 fits

its ideal line. This is the consistency part of the equation. A strong return metric divided by a smaller risk metric will likely lead to better overall ratios. That is what we see with the K-ratio metric—the DRS winning on both the wealth creation and the consistency fronts.

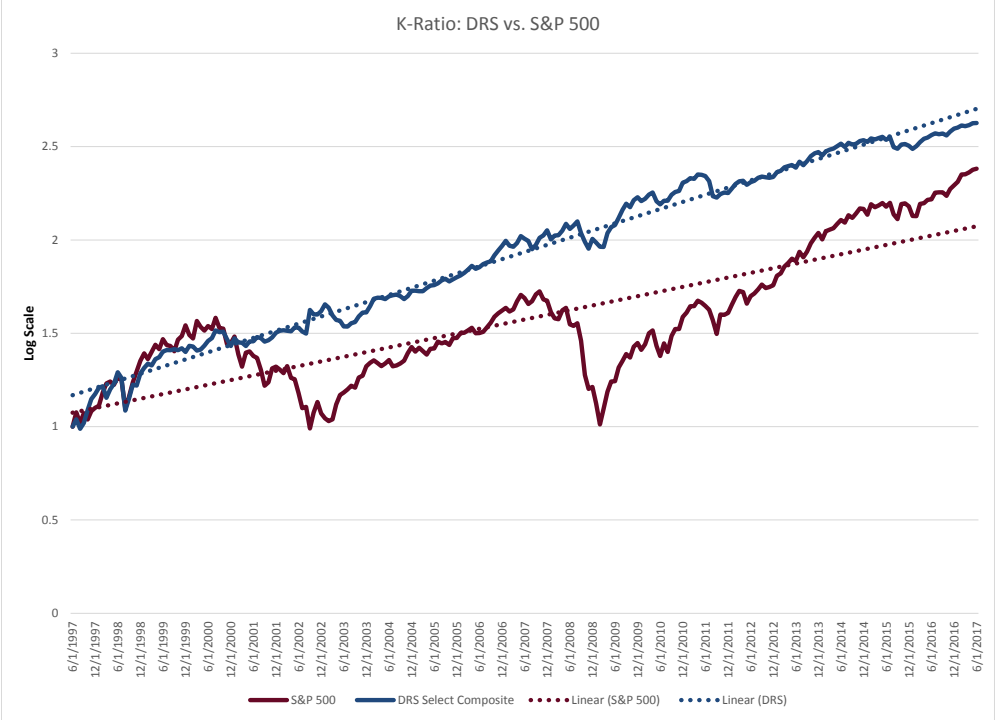


Chart 11. Source: Zephyr StyleADVISOR, Swan Global Investments

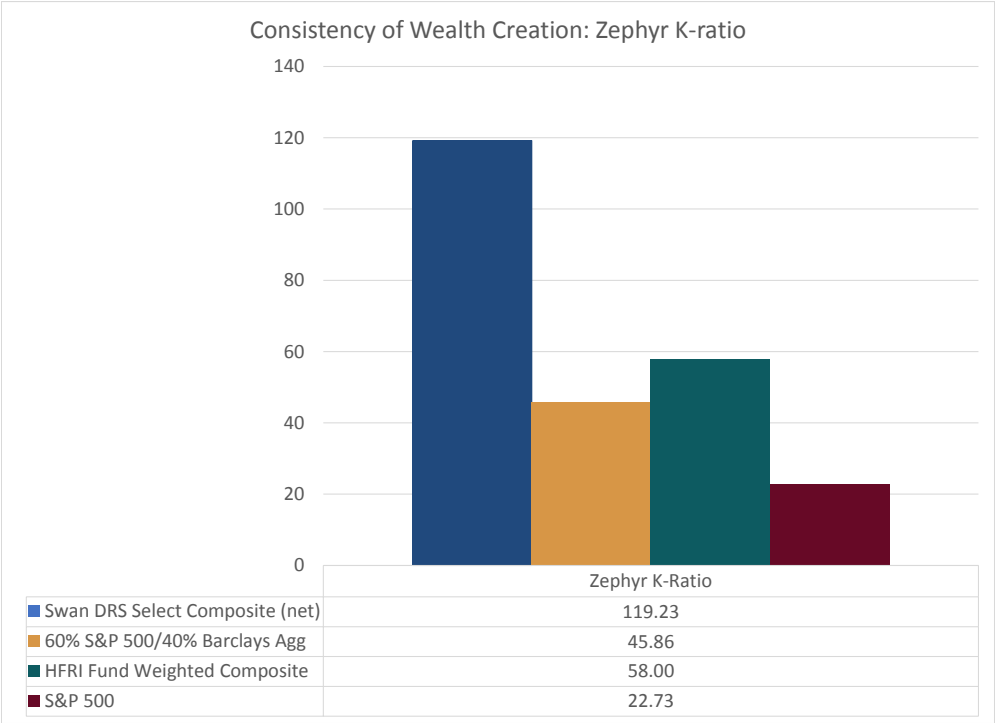


Chart 12. Source: Zephyr StyleADVISOR, Swan Global Investments

The DRS's K-ratio is 119.23, much better than the S&P 500's 22.73. In practical terms, this means those two big bear markets in 2000-02 and 2007-09 had a big impact on an investor's path of wealth creation. An investment made solely in a S&P 500 product would have been knocked severely off course by those crises. Of course anyone who had been through those periods remembers those events, but the K-ratio allows us to quantify it. The balanced 60/40 mix and the hedge fund index did better than the S&P 500 with K-ratios of 45.86 and 58.00, respectively, but they are well short of the DRS's K-ratio of 119.23.

CONCLUSION

It's funny how an investor's perception of risk changes throughout a market cycle. During a bull market, greed is the driver and the reference point is the market. In many investors' eyes the goal is to outperform the market, in which case the definitions of risk are those seen in the second column of the StatMAP.

	Volatility Risk	Benchmark Risk	Capital Preservation Risk	Tail Risk
Return		Excess Return Batting Average Up Capture		Skewness Upside Omega
Risk	Standard Deviation Downside Deviation	Beta R-squared Tracking Error Down Capture	Maximum Drawdown Pain Index	Kurtosis Value at Risk Conditional Value at Risk Downside Omega
Return/Risk Trade-off	Sharpe Ratio Sortino Ratio Zephyr K-ratio	Alpha Information Ratio Treynor Ratio	Calmar Ratio Pain Ratio	Omega

Table 1: Swan Global Investments.

However, when the market reverses and enters bear territory, fear takes over and the definition of risk often becomes capital preservation and avoiding tail events. By incorporating these new post-MPT statistics into the performance review process, one is able to get a much more holistic, big-picture view of risk.

FOOTNOTES

Important Disclosures:

This communication is informational only and is not a solicitation or investment advice. Nothing in this presentation constitutes financial, legal, or tax advice. All information is subject to change or correction without notice. The charts and graphs contained herein should not serve as the sole determining factor for making investment decisions. To the extent that you have any questions regarding the applicability of any specific issue discussed to your individual situation, you are encouraged to consult with Swan. All information, including that used to compile charts, is obtained from sources believed to be reliable, but Swan does not guarantee its reliability. Swan's investments may consist of securities which vary significantly from those in the benchmark indexes listed above and performance calculation methods may not be entirely comparable. Accordingly, comparing results shown to those of such indexes may be of limited use. All Swan performance results have been compiled solely by Swan Global Investments and are unaudited. Other performance return figures indicated in this material are derived from what Swan believes to be reliable sources, but Swan does not guarantee its reliability. There is no guarantee the DRS structured portfolio investment will meet its objectives. This is not a guarantee or indication of future performance. References to the S&P 500 and other indices herein are for informational and general comparative purposes only. Indexes are unmanaged and have no fees or expenses. An investment cannot be made directly in an index. Investment strategies with other securities may vary significantly from those in the benchmark indexes listed. All investments involve the risk of potential investment losses as well as the potential for investment gains. Prior performance is no guarantee of future results and there can be no assurance that future performance will be comparable to past performance.

Swan Global Investments, LLC ("Swan") is an independent Investment Advisory headquartered in Durango, Colo. registered with the U.S. Securities and Exchange Commission under the Investment Advisers Act or 1940. Being an SEC-registered advisor implies no special qualification or training. Swan offers and manages its Defined Risk Strategy to individuals, institutions and other advisory firms. All Swan products utilize the Defined Risk Strategy ("DRS"), but may vary by asset class, regulatory offering type, etc. Accordingly, all Swan DRS product offerings will have different performance results due to offering differences and comparing results among the Swan products and composites may be of limited use. There are eight DRS Composites offered: 1) The DRS Select Composite which includes non-qualified accounts; 2) The DRS IRA Composite which includes qualified accounts; 3) The DRS Composite which combines the DRS Select and DRS IRA Composites; 4) The DRS Institutional Composite which includes high net-worth, non-qualified accounts that utilize cash-settled, index-based options held at custodians that allow participation in Clearing Member Trade Agreement (CMTA) trades; 5) The Defined Risk Fund Composite which includes mutual fund accounts invested in the S&P 500; 6) The DRS Emerging Markets Composite which includes mutual fund accounts invested in emerging markets; 7) The DRS Foreign Developed Composite which includes all research and development account(s), and mutual fund accounts invested in foreign developed markets; 8) The DRS U.S. Small Cap Composite which includes all research and development account(s), and mutual fund accounts invested in U.S. small cap issues.

Additional information regarding Swan's policies and procedures for calculating and reporting performance returns is available upon request. Swan claims compliance with the Global Investment Performance Standards (GIPS) and has prepared and presented this report in compliance with GIPS standard. Swan's compliance with GIPS has been independently verified from its inception on July 1, 1997 through December 31, 2016. A copy of the verification report is available upon request. To receive copies of the report please call 970.382.8901 or email operations@ swanglobalinvestments.com. Verification assesses whether (1) the firm has complied with all the composite construction requirements of the GIPS standards on a firm-wide basis and (2) the firm's policies and procedures are designed to calculate and performance in compliance with the GIPS standards. Verification does not ensure the accuracy of any specific composite presentation. The Defined Risk Strategy Select Composite demonstrates the performance of all non-qualified assets managed by Swan Global Investments, LLC since inception. It includes discretionary individual accounts whose account holders seek the upside potential of owing stock, and the desire to eliminate most of the risk associated with owning stock. The composite relies on LEAPS and other options to manage this risk. Individual accounts own S&P 500 exchange-traded funds, LEAPS associated with the ETFs, as well as option strategies based on other widely traded indices. The Defined Risk Strategy Select Composite includes all nonqualified discretionary accounts which are solely invested in the Defined Risk Strategy. The Defined Risk Strategy was designed to protect investors from substantial market declines, provide income in flat or choppy markets, and to benefit from market appreciation. Stock and options are the primary components of the strategy. The performance benchmark used for the Defined Risk Strategy is the S&P 500 Index comprised of 500 large-capitalization stocks, and which does not charge fees. 336-SGI-121217

ABOUT SWAN GLOBAL INVESTMENTS

Investing Redefined

Since 1997, our hedging and options strategies have been redefining investing to directly address the biggest threat long-term investors face: market risk.

Market risk is too big a threat to investors to be dealt with passively. So we hedge it.

Our simple, yet innovative investment philosophy is the foundation of our Defined Risk Strategy, a rules-based, multi-asset hedged equity strategy, with a track record of generating consistent returns while defining, or limiting, downside risk to improve investment outcomes and protect irreplaceable capital through full market cycles.

SWAN GLOBAL INVESTMENTS

1099 Main Ave., Suite 206
Durango, CO 81301