



alpha architect

ALPHA ARCHITECT ROBUST ASSET ALLOCATION INDEXES (RAA INDEX)

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We Empower Investors Through Education | Affordable Alpha

IMPORTANT INFORMATION - DISCLOSURES

This document describes the technology behind our Indexes.

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Data is provided by FactSet and Alpha Architect. Attribution results are provided on a best-efforts-basis and are provided for informational purposes only.

We Educate Investors on Systematic Factor Investing



Wesley R. Gray, Ph.D.

PhD/MBA, University of Chicago
BS Economics, Wharton
Captain, Marine Corps

Wesley R. Gray, Ph.D. has been an active participant in financial markets throughout his career. He is the Founder, CEO and Co-CIO for Alpha Architect, an SEC-Registered Investment Advisor. Dr. Gray has published multiple academic articles and books, to include the co-authored books Quantitative Value, DIY Financial Advisor, and Quantitative Momentum.

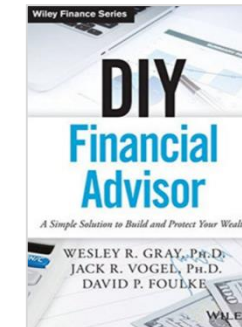
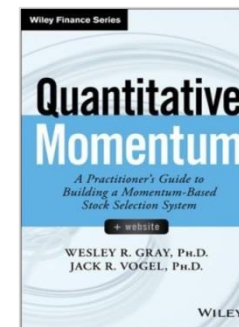


Jack R. Vogel, Ph.D.

PhD, Drexel University
MS Mathematics, Drexel Univ.
BS Mathematics, U. of Scranton

Jack Vogel, Ph.D., conducts research in empirical asset pricing and behavioral finance, and has collaborated with Dr. Gray on multiple projects. He is the CFO and Co-CIO for Alpha Architect, an SEC-Registered Investment Advisor. Dr. Vogel has published multiple academic articles and co-authored the books DIY Financial Advisor, and Quantitative Momentum.

Published multiple **research-focused** finance books



Published in leading, **peer-reviewed** academic journals

- "Why do Enterprise Multiples Predict Expected Stock Returns?" Journal of Portfolio Management (2019)
- "What Motivates Buy-Side Analysts to Share Recommendations Online?" Management Science (2018)
- "Do Fund Managers Identify and Share Profitable Ideas?" Journal of Financial and Quantitative Analysis (2017)
- "Enhancing the Investment Performance of Yield-Based Strategies," Journal of Investing (2014).
- "Analyzing Valuation Measures: A Performance Horse-Race over the Past 40 Years," Journal of Portfolio Management (2012).

Present in **major publications** + editor of academic website

- [Wall Street Journal](#) (multiple articles)
- [CFA Institute](#) (multiple articles)
- [Forbes](#) (multiple articles)
- [Alpha Architect](#) (editor)

Numerous **working papers** (more available upon request)

- "On the Performance of Cyclically Adjusted Valuation Measures"
- "Using Maximum Drawdown to Capture Tail Risk"
- "Does Complexity Imply Value? AAI Value Strategies from 1963 to 2013"
- "Limited Attention and Asset Price Efficiency"
- [Our SSRN working paper website](#)

The Robust Asset Allocation Mission

The Index Seeks Capital Appreciation With Downside Protection¹

Affordable

Risk Managed

Transparent

Liquid

Diversified

Tax Efficient



Our Robust Asset Allocation Index Lineup

Index Name	Index Ticker	Index Inception Date	Factor Exposures	Strategy Overview	Weighting Methodology
Robust Asset Allocation Balanced	RAA BAL INDEX	1/1/1995	Value/Momentum/Trend	Global Tactical Allocation	Dynamic Trend
Robust Asset Allocation Moderate	RAA MOD INDEX	1/1/1995	Value/Momentum/Trend	Global Tactical Allocation	Dynamic Trend
Robust Asset Allocation Aggressive	RAA AGG INDEX	1/1/1995	Value/Momentum/Trend	Global Tactical Allocation	Dynamic Trend

Balanced

40% Equities

40% Real Assets

20% Bond Assets

Moderate

60% Equities

20% Real Assets

20% Bond Assets

Aggressive

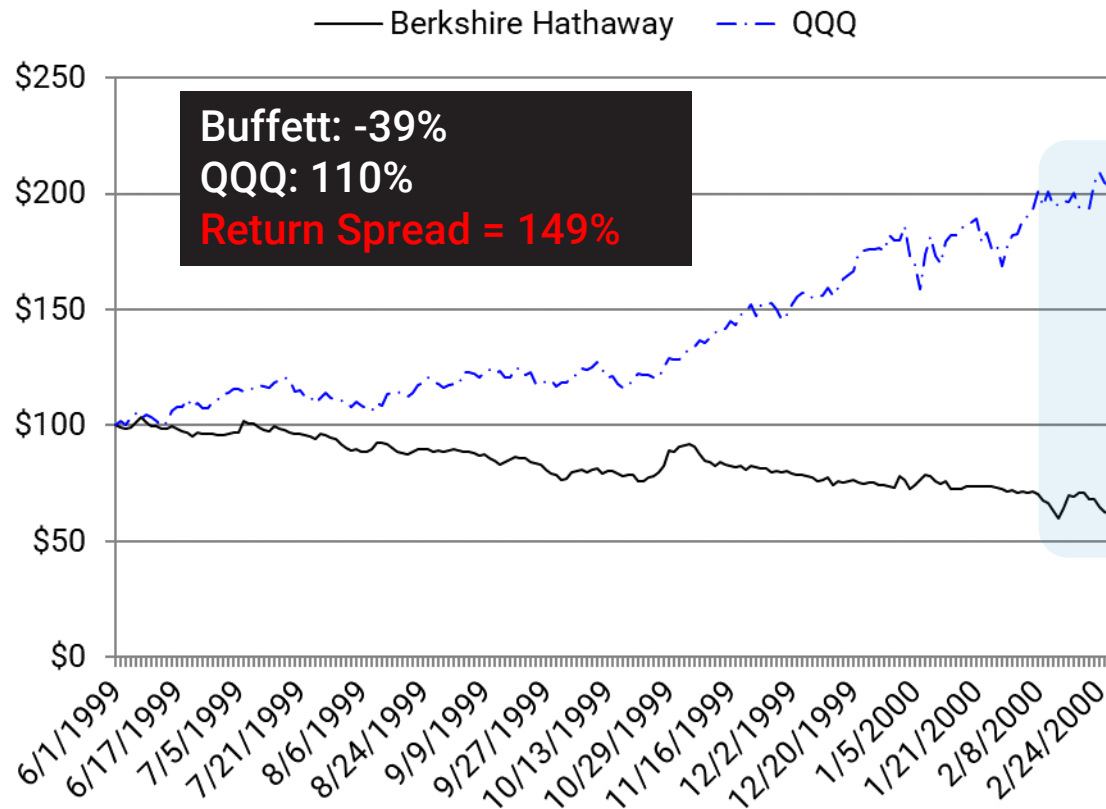
80% Equities

10% Real Assets

10% Bond Assets

Relative Performance: Being Unique, Means Being Different

9-Months of Extreme Relative Performance Pain



Warren Buffett

“Charlie, should we buy tech?”

“Warren Buffett may be losing his magic touch.”

BARRON'S

Sustainable Investing
Requires Perspective

Robust Asset Allocation Index Methodology

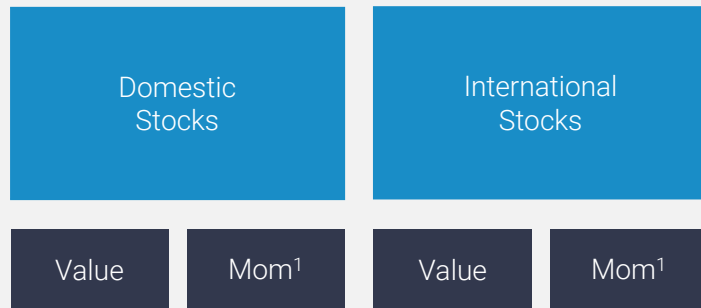


The Robust Asset Allocation Process

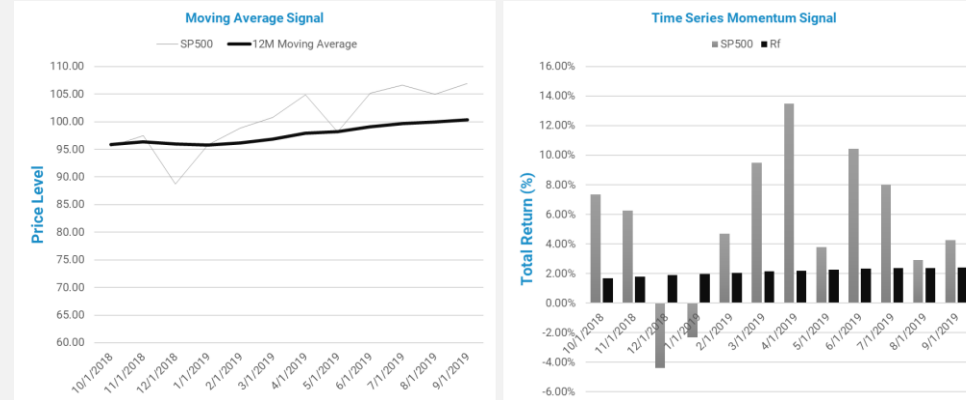
1 Create **diversified exposures** across asset classes; adjust weights depending on risk tolerance



2 Deploy high-conviction value and momentum strategies



3 Deploy Downside Protection Model on all asset classes

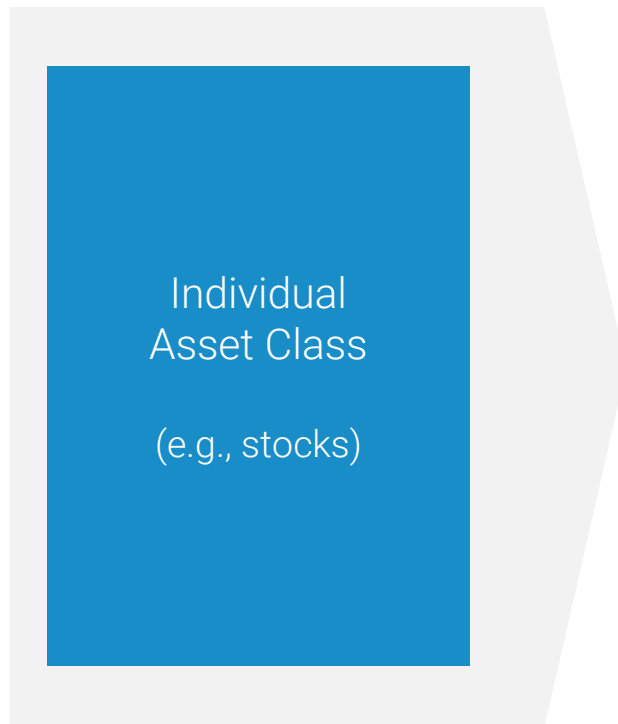


¹Mom=Momentum.

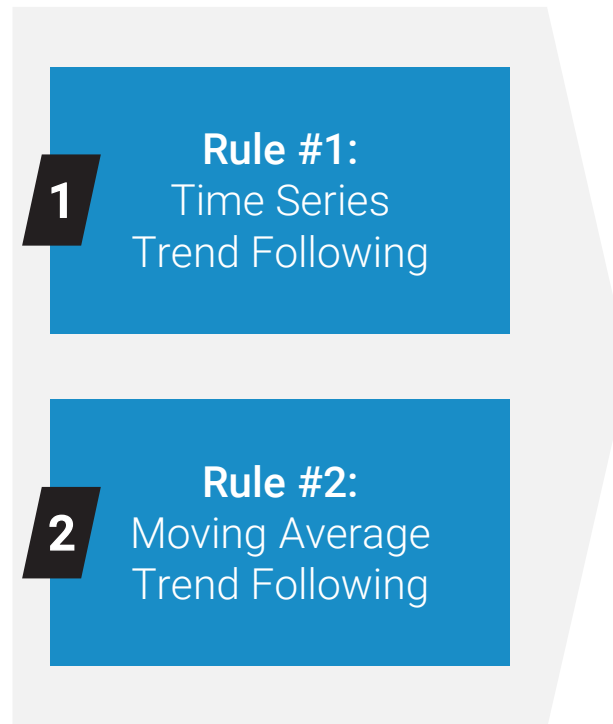
The results are hypothetical results and are NOT an indicator of future results and do NOT represent returns that any investor actually attained. Please see disclosures for additional information. Additional information regarding the construction of these results is available upon request. Indexes are unmanaged, do not reflect management or trading fees, and one cannot invest directly in an index.

Our Robust Trend-Following Methodology

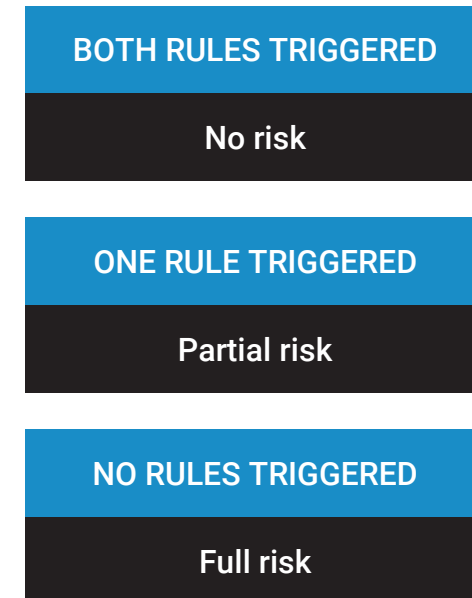
Identify Asset Class



Assess Trend - Following Rules

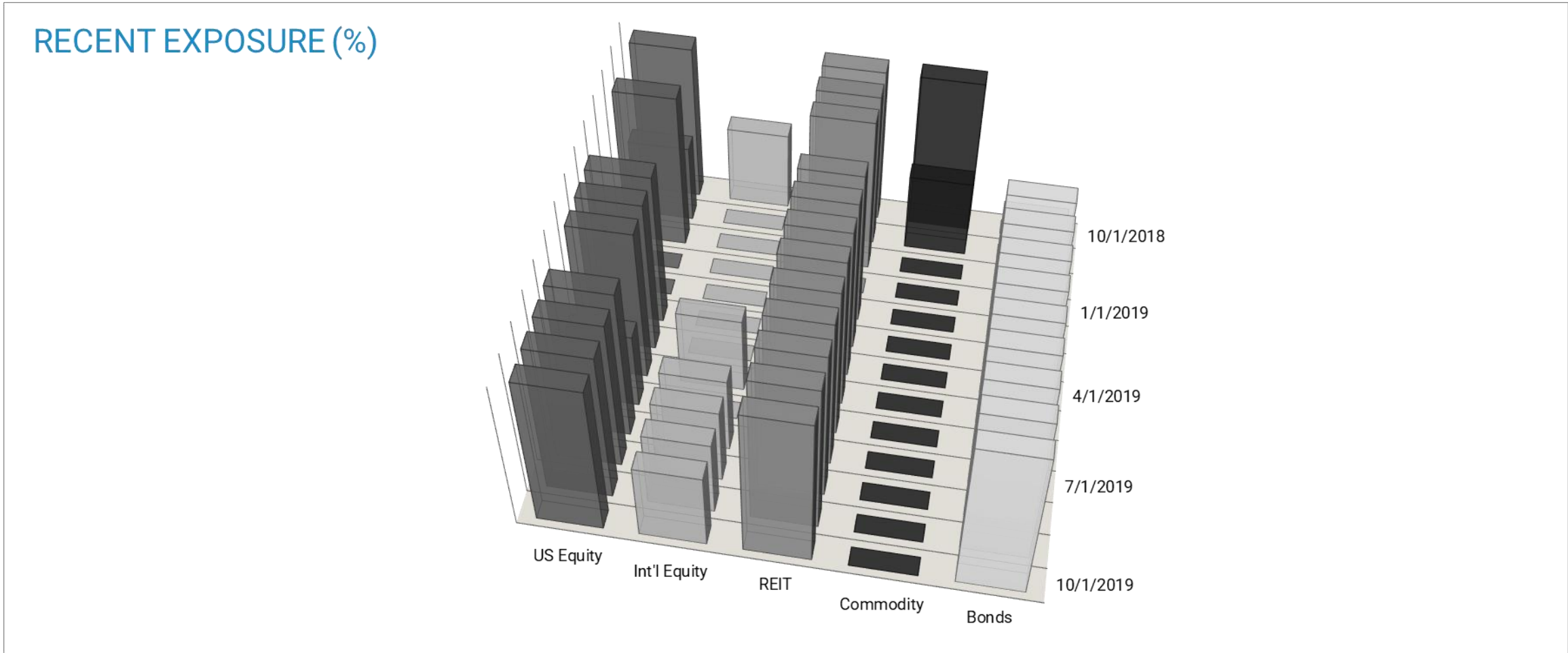


Determine Portfolio Hedging Posture



*Our Trend-Following Models may not work in all situations and could fail to achieve their objectives.

Most Recent Asset Allocation Exposures



Historical Simulation

The image is a composite graphic. The left side is a dark, semi-transparent overlay containing faint, light-colored technical sketches of mechanical parts. The right side shows a close-up, high-angle view of a technical drawing on a grid-lined paper. A clear plastic ruler with three large circular cutouts is placed over the drawing. A black pen lies diagonally across the ruler. The overall aesthetic is professional and technical, suggesting a focus on engineering or design.

Simulated Strategy Background

- Simulated Historical Performance: 1/1/1995 to 12/31/2018. All returns are total returns and include the reinvestment of distributions (e.g., dividends).
- ROBUST Trend rules trigger index related trading for the hedge and components and are rebalanced monthly. 50% 12-month time series momentum rule and 50% 12-month simple moving average rule. For a given asset class, the rules are calculated based on the underlying passive index. i.e., S&P 500 Total Return Index is used for domestic equity; MSCI EAFE Total Return Index for international equity.
 - RAA_BAL_INDEX_NET = 40% global value momentum and trend equity (GVMT_INDEX_NET), annually rebalanced; 20% REIT; 20% COMM; 20% Bonds. Net 0.75% in costs.
 - RAA_MOD_INDEX_NET = 60% global value momentum and trend equity (GVMT_INDEX_NET), annually rebalanced; 10% REIT; 10% COMM; 20% Bonds. Net 0.85% in costs.
 - RAA_AGG_INDEX_NET = 80% global value momentum and trend equity (GVMT_INDEX_NET), annually rebalanced; 5% REIT; 5% COMM; 10% Bonds. Net 0.95% in costs.
- GVMT_INDEX_NET = Please note that there was an Index change that went into effect on 6/1/2018. Annual rebalance (First Week of May) across QV INDEX NET, QM INDEX NET, IQV INDEX NET, and IQM INDEX NET. Alpha Architect calculations through 12/31/2015; Solactive calculations thereafter. ROBUST Trend manages a dynamic 0-100% hedge component. Trend rules trigger index related trading for the hedge and components and are rebalanced monthly. Interest earned is assumed to be T-Bill minus 0.5%; Interest paid is assumed to be T-Bill plus 0.5%. Hedging can create exposures that drift from the model weights. We manage this risk by trading back to model weights when there is a trigger or there is no longer a hedge position. Upside Rebalance: 10.00%. Downside Rebalance: 10.00%. Net 1.0% in costs.
 - US Stocks = SP500 Total Return Index
 - Int'l Stocks = MSCI EAFE Total Return Index
 - REIT = FTSE Nareit / All Equity REITs -INV
 - Comm. = PDBC ETF; prior to 12/1/2014, Goldman Sachs Commodity Index
 - Bonds = Bloomberg Barclays US Aggregate Government - Treasury (7-10 Y)
- RAA_Simple_MOD = 30% US Stocks, 30% Int'l Stocks, 10% REIT, 10% Comm, 20% Bonds. Gross returns.
- Hypothetical performance results have many inherent limitations, some of which, but not all, are described in the disclosures at the end of this document. No representation is being made that any fund or account will or is likely to achieve profits or losses similar to those shown herein. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently realized by any particular trading program.
- Indexes are unmanaged, do not reflect management or trading fees, and one cannot invest directly in an index.
- Please see the disclosures at the end of this document for additional information.

Simulated Summary Statistics

The potential for reduced downside risk and modestly higher returns

Summary Statistics	RAA_BAL_INDEX_NET	RAA_MOD_INDEX_NET	RAA_AGG_INDEX_NET	RAA_SIMPLE_MOD
CAGR	9.61%	10.77%	12.11%	7.05%
Sharpe Ratio (RF=T-Bills)	0.90	0.94	0.90	0.47
Worst Drawdown	-14.30%	-14.80%	-18.49%	-44.53%
1-Year Annualized Return	-9.03%	-11.26%	-14.01%	-6.73%
3-Year Annualized Return	0.52%	0.80%	0.98%	4.90%
5-Year Annualized Return	0.07%	-0.39%	-0.91%	3.21%
10-Year Annualized Return	3.38%	3.91%	4.42%	7.66%
Since Inception (1/1995)	9.61%	10.77%	12.11%	7.05%

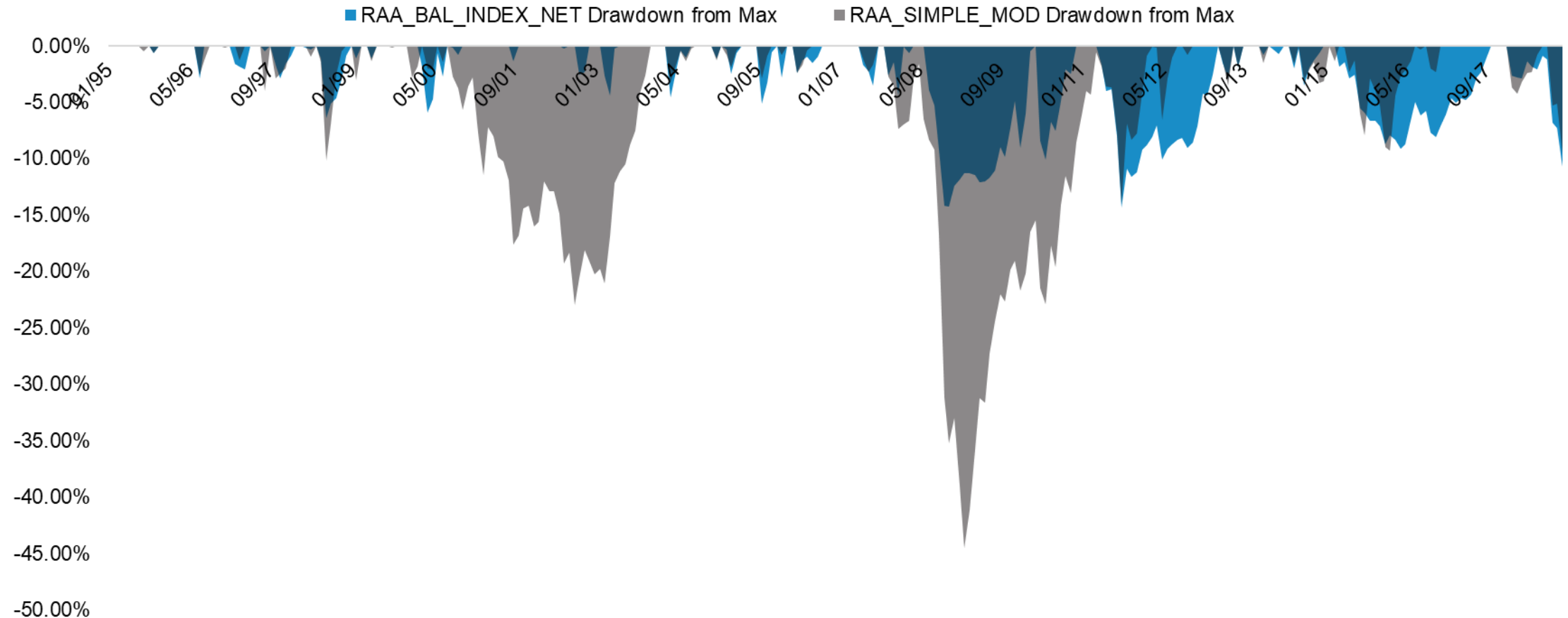
Correlation Matrix	RAA_BAL_INDEX_NET	RAA_MOD_INDEX_NET	RAA_AGG_INDEX_NET	RAA_SIMPLE_MOD
RAA_BAL_INDEX_NET	100.00%	96.51%	91.98%	62.04%
RAA_MOD_INDEX_NET	96.51%	100.00%	98.88%	60.66%
RAA_AGG_INDEX_NET	91.98%	98.88%	100.00%	59.14%
RAA_SIMPLE_MOD	62.04%	60.66%	59.14%	100.00%

**Bold denotes values less than |.5|

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Simulated Drawdown Analysis (RAA MOD Index Shown)

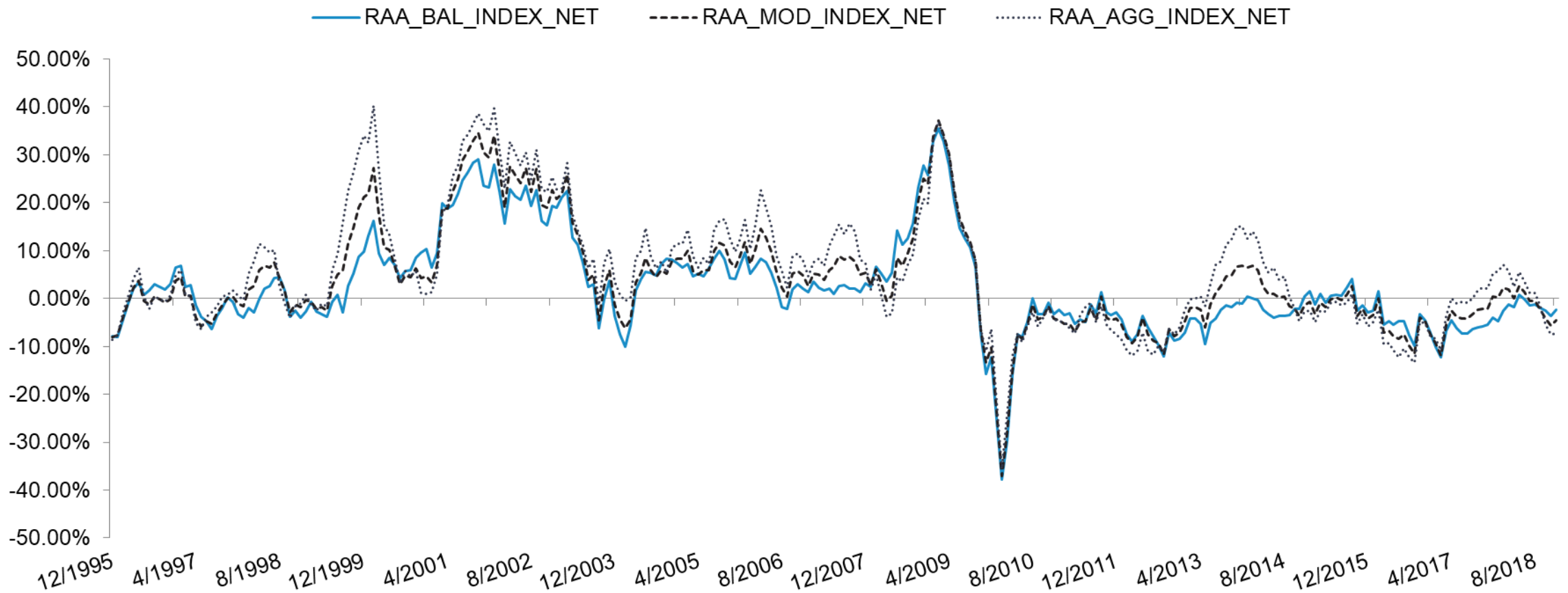
Potential to minimize large losses, but the strategy cannot eliminate volatility



Simulated Relative Performance

Trend-following creates the potential for large deviations from buy and hold benchmarks

1-Year Rolling CAGR Relative to RAA_SIMPLE_MOD



Portfolio Applications

The image is a composite graphic. The left side is a dark, semi-transparent overlay containing the text 'Portfolio Applications' in a bold, white, sans-serif font. The right side shows a technical drawing on a grid background. The drawing includes a series of concentric circles and smaller circles arranged in a pattern, possibly representing a mechanical part or a design element. A ruler is visible at the bottom right of the drawing area. The overall aesthetic is professional and technical.

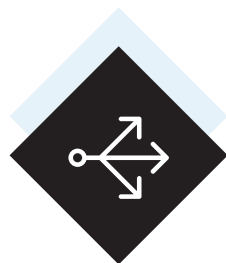
How to Use Our Indexes: Deployment Options



Core Satellite

Combine an aggressive factor portfolio alongside a core low-cost market beta portfolio.

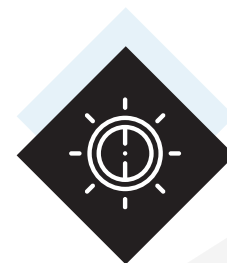
-
- +Potential for higher returns
 - Potential for tracking error



Factor Diversification

Deploy a focused factor allocation alongside a low-tracking error factor exposure.

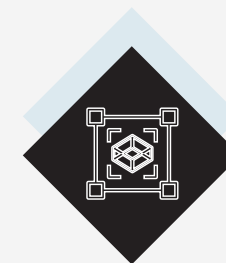
-
- +Potential factor diversification
 - Potential for tracking error



Alternative Exposure

Deploy the exposure in an alternative sleeve, where tracking error expectations are high.

-
- +Potential to diversify portfolio
 - Potential for tracking error



AA Model*

Deploy the exposures in accordance with custom Alpha Architect allocation models.

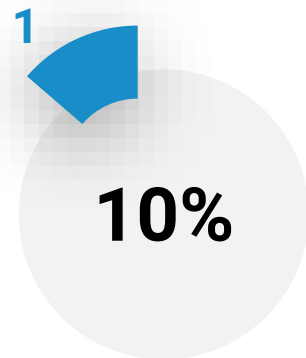
-
- +Max leverage on AA research efforts
 - Potential for tracking error

*Contact us for additional information.

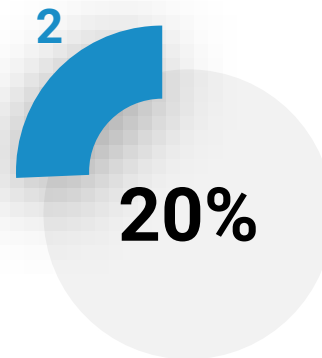
Core-Satellite Allocation: 3 variations for different objectives

Contact us for customized model solutions to minimize behavioral issues.

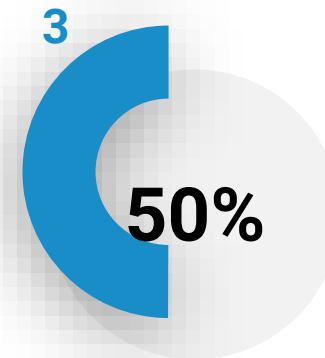
Examples below with different global (i.e., RAA_MOD_INDEX_NET) diversification exposure



Benchmark
Constrained



Benchmark
Aware



Focused
Factors

Simulated Strategy Background

- Simulated Historical Performance: 1/1/1995 to 12/31/2018
- All returns are total returns and include the reinvestment of distributions (e.g., dividends).
- Data sources include Alpha Architect and Bloomberg.
- Legend
 - World 70/30 = Monthly rebalance across 70% MSCI World Total Return Index and 30% 90-Day Treasury Bills
 - World 70/30 + 10% RAA_MOD = 90% in World 70/30 and 10% in RAA_MOD_INDEX_NET, monthly rebalanced
 - World 70/30 + 20% RAA_MOD = 80% in World 70/30 and 20% in RAA_MOD_INDEX_NET, monthly rebalanced
 - World 70/30 + 50% RAA_MOD = 50% in World 70/30 and 50% in RAA_MOD_INDEX_NET, monthly rebalanced
- Performance figures contained herein are hypothetical, unaudited and prepared by Alpha Architect, LLC; hypothetical results are intended for illustrative purposes only. Past performance is not indicative of future results, which may vary. Index returns are for illustrative purposes only and do not represent actual fund performance. Index performance returns do not reflect any management fees, transaction costs, or expenses, which would reduce returns. Indexes are unmanaged and one cannot invest directly in an index.
- Please see the disclosures at the end of this document for additional information.

Simulated Summary Statistics

Potential for higher risk-adjusted returns

Summary Statistics	World 70/30	World 70/30 + 10% RAA_MOD	World 70/30 + 20% RAA_MOD	World 70/30 + 50% RAA_MOD
CAGR	5.58%	6.13%	6.67%	8.26%
Sharpe Ratio (RF=T-Bills)	0.35	0.42	0.49	0.70
Worst Drawdown	-40.76%	-37.93%	-34.99%	-25.48%
1-Year Annualized Return	-5.47%	-6.05%	-6.64%	-8.38%
3-Year Annualized Return	4.82%	4.42%	4.03%	2.82%
5-Year Annualized Return	3.50%	3.12%	2.73%	1.58%
10-Year Annualized Return	7.04%	6.75%	6.45%	5.54%
Since Inception (1/1995)	5.58%	6.13%	6.67%	8.26%

Correlation Matrix	World 70/30	World 70/30 + 10% RAA_MOD	World 70/30 + 20% RAA_MOD	World 70/30 + 50% RAA_MOD
World 70/30	100.00%	99.72%	98.78%	90.34%
World 70/30 + 10% RAA_MOD	99.72%	100.00%	99.67%	93.28%
World 70/30 + 20% RAA_MOD	98.78%	99.67%	100.00%	95.91%
World 70/30 + 50% RAA_MOD	90.34%	93.28%	95.91%	100.00%

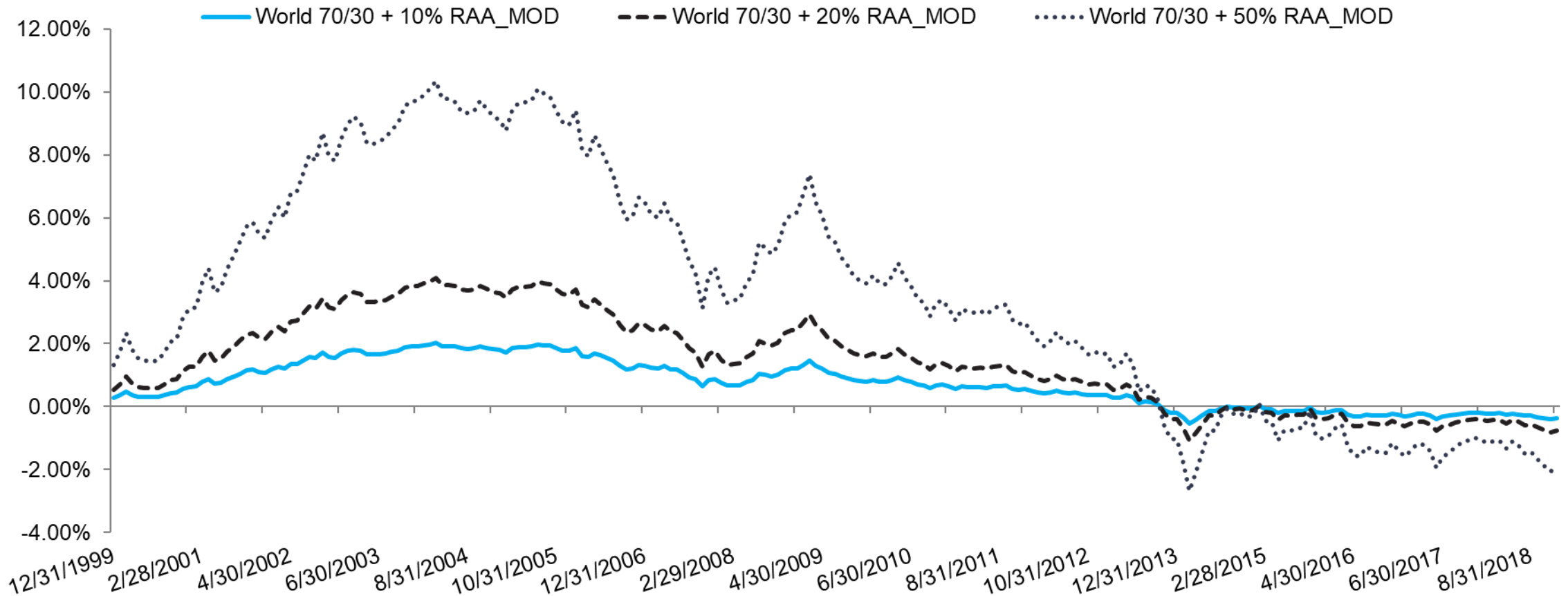
**Bold denotes values less than |.5|

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Simulated Relative Performance

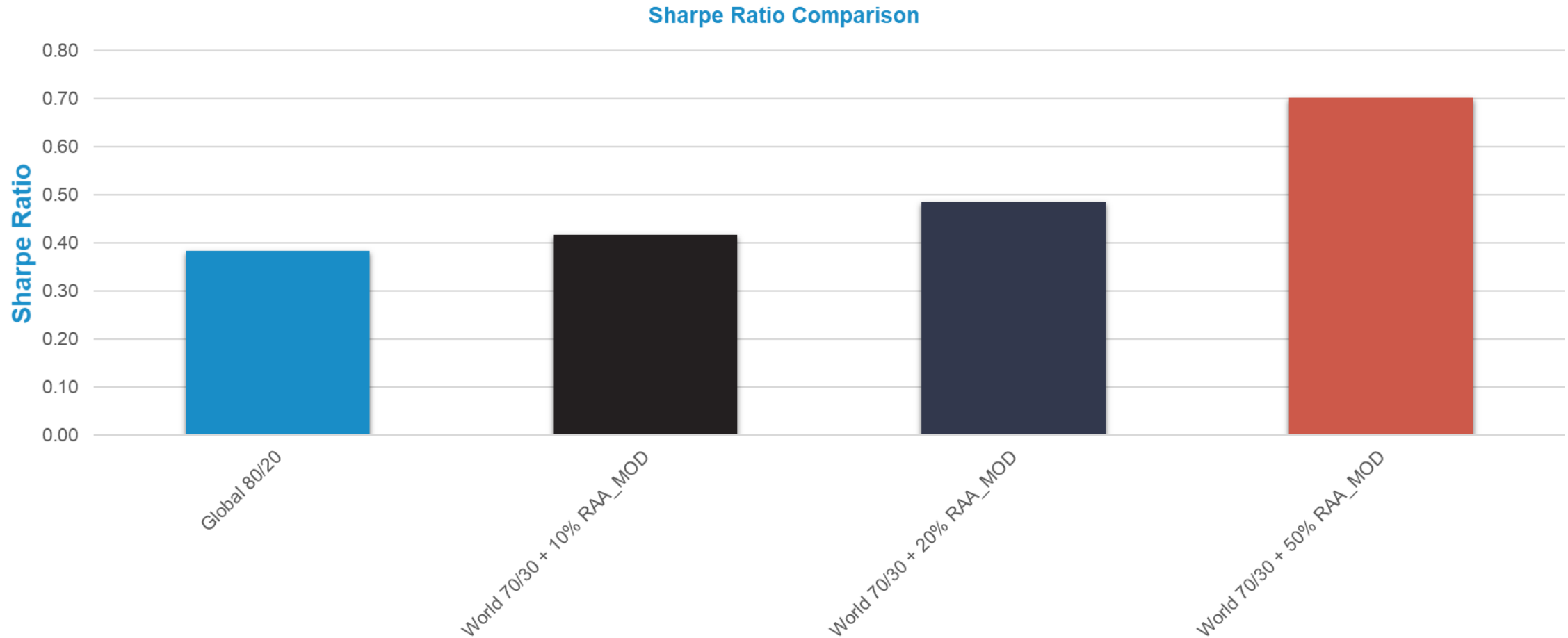
Potential for deviations from standard benchmarks

5-Year Rolling CAGR Relative to World 70/30



Simulated Relative Performance

Potential to enhance risk-adjusted performance





alpha architect

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LEARN MORE**

We Empower Investors Through Education | Affordable Alpha

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Appendix

A dark, moody photograph of a desk. On the right, a silver laptop is partially visible. In the center, a pair of round-rimmed glasses rests on a white notebook. The left side of the image is dominated by a semi-transparent dark overlay, which contains the word 'Appendix' in a clean, white, sans-serif font.

IMPORTANT INFORMATION - DISCLOSURES

There are risks involved with investing, including loss of principal. There is no assurance that the objectives of any strategy or fund will be achieved or will be successful. No investment strategy, including diversification, can protect against market risk or loss. Current and future portfolio holdings are subject to risk. Past performance does not guarantee future results.

There is a risk of substantial loss associated with trading commodities, futures, options and other financial instruments. Before trading, investors should carefully consider their financial position and risk tolerance to determine if the proposed trading style is appropriate. Investors should realize that when trading futures, commodities and/or granting/writing options one could lose the full balance of their account. It is also possible to lose more than the initial deposit when trading futures and/or granting/writing options. All funds committed to such a trading strategy should be purely risk capital.

Certain economic and market information contained herein has been obtained from published sources prepared by other parties, which in certain cases have not been updated through the date hereof. While such sources are believed to be reliable, neither Alpha Architect nor its affiliates assumes any responsibility for the accuracy or completeness of such information and such information has not been independently verified by Alpha Architect.

Index returns are for illustrative purposes only and do not represent actual fund performance. References to an index do not imply that the portfolio will achieve returns, volatility or other results similar to that index. The composition of the index may not reflect the manner in which a portfolio is constructed in relation to expected or achieved returns, portfolio guidelines, restrictions, sectors, correlations, concentrations, volatility or tracking error targets, all of which are subject to change. Index performance returns do not reflect any management fees, transaction costs, or expenses, which would reduce returns.

Indexes are unmanaged and one cannot invest directly in an index. There are no active components of indexes; therefore, using them as a proxy can be of limited value because there is no guarantee that the portfolio would have been managed to match the index. Realized returns and/or volatility may come in higher or lower than expected.

Annual performance is calculated based on monthly return streams, geometrically linked as of the end of the specified month end.

Results, unless cited otherwise, are shown gross of fees and do not reflect the effect of investment fees which would lower performance. Performance reflects the reinvestment of dividends and other earnings. The following hypothetical illustrates the compound effect fees have on investment return: For an account charged 1% with a stated annual return of 10%, the net total return before taxes would be reduced from 10% to 9%. A ten year investment of \$100,000 at 10% would grow to \$259,374, and at 9%, to \$236,736 before taxes. For a complete description of all fees and expenses, please refer to Alpha Architect's Form ADV Part 2A.

IMPORTANT INFORMATION - DISCLOSURES

Performance figures contained herein are hypothetical, unaudited and prepared by Alpha Architect, LLC; hypothetical results are intended for illustrative purposes only.

Past performance is not indicative of future results, which may vary.

Hypothetical performance results (e.g., quantitative backtests) have many inherent limitations, some of which, but not all, are described herein. No representation is being made that any fund or account will or is likely to achieve profits or losses similar to those shown herein. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently realized by any particular trading program. One of the limitations of hypothetical performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or adhere to a particular trading program in spite of trading losses are material points which can adversely affect actual trading results. The hypothetical performance results contained herein represent the application of the quantitative models as currently in effect on the date first written above and there can be no assurance that the models will remain the same in the future or that an application of the current models in the future will produce similar results because the relevant market and economic conditions that prevailed during the hypothetical performance period will not necessarily recur. There are numerous other factors related to the markets in general or to the implementation of any specific trading program which cannot be fully accounted for in the preparation of hypothetical performance results, all of which can adversely affect actual trading results. Hypothetical performance results are presented for illustrative purposes only.

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IMPORTANT INFORMATION - DISCLOSURES

- Simulated Historical Performance: All returns are total returns and include the reinvestment of distributions (e.g., dividends).
- Index Characteristics Data Source: Characteristics are from FactSet and derived via the ETFs that track the respective Indexes. Characteristics are holdings-weighted. The data for the performance and factor attribution analysis are from Alpha Architect and Solactive.
- The S&P 500 Index (SP500) is a capitalization-weighted index that measures the performance of the broad U.S. equity market.
- The MSCI EAFE Index (EAFE) is a capitalization-weighted index that measures the performance of developed market equities, excluding the U.S. and Canada.
- The MSCI World Index is a capitalization-weighted index that measures the performance of developed market equities.
- EBIT/TEV is defined as earnings before interest and taxes divided by total enterprise value.
- Momentum (2-12) is defined as the cumulative total return for the past 12 months, excluding the last (12th) month.
- Size is defined as the total market value of the company's listed equity.
- Return on assets is defined as net income divided by total assets.
- Compound annualized growth rate, or CAGR, is defined as the annualized growth of an initial investment to the ending investment value if you assume that the investment has been compounding over the time period.
- Standard Deviation: Sample standard deviation
- Downside Deviation: Sample standard deviation, but only monthly observations below 41.67bps (5%/12) are included in the calculation
- Sharpe Ratio (annualized): Average monthly return minus treasury bills divided by standard deviation
- Sortino Ratio (annualized): Average monthly return minus treasury bills divided by downside deviation
- Appraisal Ratio (annualized): CAPM regression intercept estimate divided by regression residual volatility
- Worst Drawdown: Worst peak to trough performance (measured based on monthly returns)
- Rolling X-Year Win %: Percentage of rolling X periods that a strategy outperforms
- Sum (5-Year Rolling MaxDD): Sum of all 5-Year rolling drawdowns
- Down %: The Down Number Ratio is a measure of the number of periods that the investment was down when the benchmark was down, divided by the number of periods that the benchmark was down. The smaller the ratio, the better
- Up %: The Up Number Ratio is a measure of the number of periods that the investment was up when the benchmark was up, divided by the number of periods that the benchmark was up. The larger the ratio, the better
- Tracking Error: Tracking Error is measured by taking the square root of the average of the squared deviations between the investment's returns and the benchmark's returns
- Negative Correlation: Correlation of returns relative to benchmark returns when the benchmark is negative
- Positive Correlation: Correlation of returns relative to benchmark returns when the benchmark is positive
- Performance figures contained herein are hypothetical, unaudited and prepared by Alpha Architect, LLC; hypothetical results are intended for illustrative purposes only. Past performance is not indicative of future results, which may vary. Index returns are for illustrative purposes only and do not represent actual fund performance. Index performance returns do not reflect any management fees, transaction costs, or expenses, which would reduce returns. Indexes are unmanaged and one cannot invest directly in an index.