

INVESTMENTS & WEALTH MONITOR

A reprinted article from July/August 2022

Demonstrating Hedge Fund Utility: Maintaining Mathematical Civility

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MAINTAINING MATHEMATICAL CIVILITY

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Alternatives, in particular hedge funds, have been around long enough to become traditional. Thirty years ago, alternatives were in fact alternative, but they have now become mainstream. The latest NACUBO-TIAA Study of Endowments reports that more than half of all assets held by university endowments are in a broad array of strategies that we refer to as alternatives.¹ Although the magnitude of allocations to alternatives among institutions and ultra-high-net-worth clients remain skewed to the largest pools, investors of all sizes have increased allocations. During the past decade, allocations continued to increase. The wide dispersion of returns in alternative investments, however, has not changed, making manager oversight a key determinant of success.

Over the past decade, traditional limited partnership (LP) vehicles have been supplemented by offerings of liquid alternatives (liquid alts), i.e., mutual funds, closed-end funds, and exchange-traded-fund (ETF) vehicles that invest in various hedge-fund-like strategies. Liquid alts provide daily liquidity, transparency, and lower fees, opening alternative investing to a wider range of investors.

However, empirical evidence shows that liquid alts significantly underperform similar-strategy hedge funds, suggesting that traditional hedge funds benefit from an illiquidity premium that cannot be transported easily into a mutual fund or ETF format. One might think of liquid alts as driving using merely a gas pedal. Hedge funds, however, because they can use leverage and have the ability to

NEW HEDGE FUND LAUNCHES

As of March 2022, new hedge fund launches rose to the highest level since 2017 as total industry capital remained above the historic \$4-trillion milestone to begin 2022. An estimated 614 new funds launched in 2021, the highest calendar-year total since 2017, when 735 new funds launched.*

** "New Hedge Fund Launches Rise as Industry Capital Surpasses Historic Milestone," Hedge Fund Research (2022), <https://www.hfr.com/news/new-hedge-fund-launches-rise-as-industry-capital-surpasses-historic-milestone>.*

short, can manage performance and risk using a gas pedal, brakes, and a gear box.

For the purposes of this article, hedge funds are defined as semi-liquid, LP vehicles that attempt to deliver distinct and unique risk-reward characteristics during different economic regimes. They are pooled investment vehicles that make extensive use of complex trading strategies and seek to deliver performance and risk experiences not available via the public markets. Their investment mandates vary and are not intended to necessarily outperform the broad equity market, deliver absolute performance, or hedge a portfolio.

EXPLAINING HEDGE FUND UTILITY

Many advisors and consultants have needed to explain the utility of adding hedge funds to a multi-asset class portfolio or evaluate a hedge fund allocation. Advisors often utilize the same tools and metrics they use to educate clients about traditional long-only investment strategies to demonstrate hedge fund utility. The objective of this article is to suggest a more comprehensive and mathematically civilized approach for advisors to use to engage clients when evaluating hedge funds.

To accomplish this, advisors should seek to challenge the mathematically uncivilized notion that standard deviation is an appropriate risk measure and that the Sharpe ratio is an effective risk-adjusted return metric. Specifically, advisors need to understand the difference between modern portfolio theory (MPT) and post-modern portfolio theory (P-MPT). This is critical in demonstrating and discussing hedge fund utility as well as evaluating it.

MPT dates to 1952, and P-MPT arose in October 2008. That's when credit rating agencies and other investment professionals first found they were unable to appropriately measure non-standard risk associated with the less liquid and more sophisticated strategies delivered by hedge funds. The core tenets of P-MPT are the following:

- Hedge funds are not a homogeneous asset class.
- The Sharpe ratio is not an appropriate measure for hedge funds.
- Standard deviation mischaracterizes portfolio and hedge fund risk.
- All four moments of a return distribution should be measured, including skew and kurtosis, not just mean and standard deviation.

- Correlation is not helpful to assess the diversification of assets we already understand are not normally distributed.
- Multi-asset portfolios are often riskier than traditional MPT metrics indicate.
- Liquid alts' performance behavior does not equate to hedge fund strategies.
- Drawdown-based risk metrics (experience based) are incorporated.
- Hedge fund value is demonstrated at the portfolio level.

These tenets are equally important as part of the ongoing portfolio oversight and quarterly review and reporting investment process. The following key concepts summarize the major components of P-MPT. Advisors should seek fluency with these concepts, in order to effectively engage clients in the evaluation, discussion, and appropriate application of hedge funds in client portfolios.

MPT VERSUS P-MPT

MPT was developed at a time when most investors allocated to only a handful of stocks and bonds. But with the proliferation of mutual funds and ETFs, nearly all investors own the equity and debt of hundreds, perhaps thousands, of companies. The MPT framework assumes returns are normally distributed and that capturing two of the four moments of a return distribution is sufficient to determine the risk view of a manager, asset class, or portfolio. The broad risk metric referenced in the MPT framework is standard deviation, or volatility, without any perspective toward skewness or kurtosis, otherwise known as "tail risk." Volatility is the statistical measure of the variation or noise that surrounds an average value or outcome. The often-cited Sharpe ratio is well suited for this portfolio framework.

The traditional standard deviation metric fits with the premise that most outcomes, over time, occur around a central measure, with few outlying events. But when investing in less-efficient asset classes (i.e., hedge funds) or within multi-asset class portfolios

with hedge fund allocations, standard deviation may present an incomplete picture of risk.

In contrast, P-MPT suggests that a more mathematically sensitive approach may be utilized to measure risk given the illiquidity, leverage, derivatives, and shorting that may permeate a more complex strategy or portfolio. Specifically, P-MPT highlights the need to incorporate all moments of a return distribution (mean return, standard deviation, skewness, and kurtosis) because non-normality is considered as part of the risk analysis.

P-MPT also suggests that clients understand risk best via drawdown-based measurements that include the frequency, depth, duration, and recovery time of loss. For example, the Pain Index may be a more civilized, relatable metric to assess hedge fund risk when engaging clients. The Omega ratio, Modified Sharpe, and Conditional Value-at-Risk are other metrics that are helpful for internal (non-client facing) analysis purposes because they provide more sensitive and complete views of risk for hedge funds.

Drawdown-based metrics suggest a more intuitive approach to expressing risk than a volatility-based measure because clients are more apt to understand loss of portfolio value than abstract statistical terminology. Linking behavioral finance with mathematics can be a powerful technique for

contrasting alternative investment strategies with clients.

HEDGE FUNDS COME IN DIFFERENT FLAVORS

Hedge fund strategies range from the traditional long-short to global macro and relative value to event-driven strategies (with many others in between). However, the following four groups represent the supersets of the hedge fund universe (see table 1).

Equity hedge strategies. The most prevalent of the hedge fund universe, equity funds take long positions in stocks perceived as undervalued and short positions in stocks considered overvalued. Equities' correlations with macroeconomic factors mean they are seen as a riskier class for investment than cash and bonds. They are highly susceptible to systematic risk factors (i.e., risks associated with the broader stock market), such as inflation, which can negatively impact future cash flows. Investors in equity hedge funds also need to consider the risks associated with correlation to other equity investments held within their portfolios. These strategies can be undertaken in a variety of ways depending on the amount of desired market exposure.

Event-driven strategies. Characteristically, event-driven hedge funds undertake trades in the securities of specific companies, seeking to exploit pricing inefficiencies that may occur

Table 1 HEDGE FUND STRATEGIES

Equity Hedge Strategies	Event-driven Strategies	Relative Value Strategies	Global Macro Strategies
Market neutral strategy	Merger arbitrage strategy	Fixed income convertible arbitrage strategy	Trade opportunistically in: • Fixed income market • Derivatives market • Equity market • Currency market • Commodity market
Fundamental growth strategy	Distressed/restructuring strategy	Fixed income asset-backed strategy	
Fundamental value strategy	Activist hedge fund strategy	Fixed income general strategy	
Quantitative directional strategy	Special situations strategy	Volatility strategy	
Short bias strategy		Multi-strategy	
Sector-specific strategy			

before or after a corporate event. The fund will invest to profit when the expected event takes place as predicted. Such events can include earnings calls, bankruptcy, mergers and acquisitions, recapitalizations, or spin-offs. Depending on the event, the exact strategy of the fund will differ.

Relative value strategies. These funds generate profits by capturing price differences between two closely related securities; therefore, they tend to use arbitrage. These strategies bear similar risk to event-driven strategies but on a smaller scale. They face minimal systemic risk, which contrasts with equity strategies. Traditional relative value strategy funds tend to profit during normal market conditions with less volatility and lower returns, usually making small, frequent profits with occasional large losses.

Global macro strategies. These are actively managed strategies with the primary aim of profiting from the broad market swings caused by political or economic events. Macro funds tend to participate in all major markets—equities, bonds, currencies, and commodities—using financial instruments to maintain long and short positions based on their research of the global market environment. Managed

futures funds, run by commodity trading advisors, invest in a similar manner. These funds tend to use proprietary quantitative trading systems to forecast market trends and determine which trades to make. Managed futures funds take long or short positions in futures contracts across metals, grains, equity indexes, and soft commodities, as well as foreign currency and U.S. government bond futures. These funds offer the potential for reduced portfolio volatility and the ability to earn profit in any economic environment, but they also may be subject to spikes in volatility and drawdowns over short time periods.

Hedge funds should not be considered a homogeneous asset class but rather vehicles that can deliver several unique investment strategies that cannot easily be replicated in liquid, long-only funds. They are classified by a combination of the instruments in which they are invested, the trading philosophy followed, and the types of assumed risks. In fact, there can be significant deviation among hedge fund strategies and these differences often are highlighted during periods of extreme volatility. Even hedge funds that invest in the same sub-asset class and follow similar investment strategies may exhibit large variances in behavior (see figure 1).

This is especially important to understand when investment professionals select hedge funds as they build multi-asset class portfolios with the objective to reduce volatility, increase risk-adjusted returns, and increase long-term performance. Understanding the performance nuances of different hedge fund asset classes is critical for managing client expectations as well as building portfolios. In reality, adding almost any asset to a portfolio has a denominator effect that will lower volatility and increase the Sharpe ratio. So adding assets to a portfolio may lower volatility, but it does not necessarily increase diversification or achieve the desired investment results, at least within the P-MPT design.

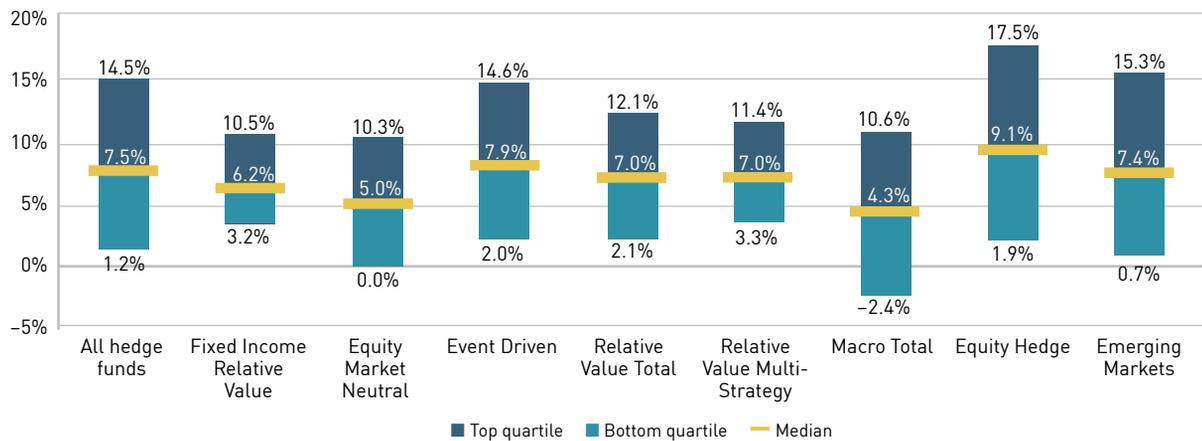
Although the Sharpe ratio is mathematically correct and accounts for one type of risk (volatility), it does not necessarily explain the capital at risk, especially when adding a distressed credit or a global macro strategy, which is what happened in October 2008.

CLARIFYING THE SHARPE RATIO

The Sharpe ratio is one of the most widely used methods for calculating risk-adjusted return. According to MPT, adding assets to a diversified portfolio that has low correlations can decrease portfolio risk without

Figure 1

HEDGE FUND MANAGER DISPERSION (BASED ON RETURNS FROM DECEMBER 2011–DECEMBER 2021)



Source: JP Morgan Asset Mgmt.

sacrificing return. In this instance, risk is identified as upside and downside volatility (which may be asymmetric) and effectively measures a normal returning strategy (i.e., long-only investments). The more non-normal the return distribution of an investment, the less effective and applicable volatility is as a measure of risk.

When evaluating hedge funds or portfolios that include hedge funds, investors often find comfort understanding their investments have “superior risk-adjusted returns,” as measured by the Sharpe ratio. Unfortunately, this description may be misleading and investors’ comfort with the term may be misplaced. In order to appropriately measure the risk attributes of a non-normally returning strategy, it is important to evaluate all four moments of a distribution, especially skew and kurtosis. Hedge fund illiquidity and lack of daily pricing gives the illusion that a hedge fund is less risky due to an artificially low volatility measure, which in turn delivers a misleading (high) Sharpe ratio.

A strategy with many small gains and large but infrequent losses would produce a Sharpe ratio that would not reveal the true high risk of such a strategy. This is especially true when utilizing distressed credit strategies that deliver high Sharpe ratios primarily due to low standard deviations. As we saw in 2008, however, these strategies lost as much as 80 percent of their value.

Other common risk measurement metrics such as the Treynor, information, and Sortino ratios also have been cited in investor presentations. They, too, suffer from many of the same shortcomings as the Sharpe ratio.

Compared with standard deviation, drawdown-based factors are superior measures of risk because they pick up all moments of a return distribution without assuming normality, congruent with the design of most hedge fund strategies.

THE SHARPE RATIO

The Sharpe ratio, defined as

$$(\text{average return} - \text{risk-free rate}) / \text{standard deviation of returns}$$

has been around since 1966 and has endured its share of controversy. Its founder, Nobel laureate William Sharpe, has admitted that the ratio has problems. One drawback of the Sharpe ratio is that it measures assets that do not follow a normal return distribution while assuming normality and accounting for only two of the four moments in a return distribution. When assessing risk, the frequency, depth, duration, and recovery time matter, not just the average variation around the mean.

As an example, consider the following two portfolios:

Portfolio A: First month 10-percent return, second month 20-percent return, Sharpe ratio = 2.98

Portfolio B: First month 10-percent return, second month 100-percent return, Sharpe ratio = 1.22

Portfolio B clearly outperforms portfolio A, but its Sharpe ratio is much lower.

Many practitioners fail to understand that the Sharpe ratio is intended for one’s whole portfolio. Yet individuals and institutional investors have the habit of allocating as if high Sharpe ratios are all it takes to build strong client portfolios, piece by optimized piece. A combination of good Sharpe ratios doesn’t necessarily result in a portfolio with a high Sharpe ratio.

NORMAL VS. NON-NORMAL DISTRIBUTIONS

Generally, long-only strategies follow a normal return distribution, but hedge funds (and even some of the more esoteric long-only strategies) follow a non-normal return distribution. This is critical in understanding why we cannot measure a multi-asset class portfolio (with a hedge fund allocation) utilizing tools from the MPT discipline, i.e., standard deviation, correlation, Sharpe, Treynor, etc.

In contrast to traditional MPT, P-MPT suggests that risk not be measured by a single statistic that focuses on volatility, which is the variation around the mean return. Instead, P-MPT suggests that risk is best understood through a broader lens.

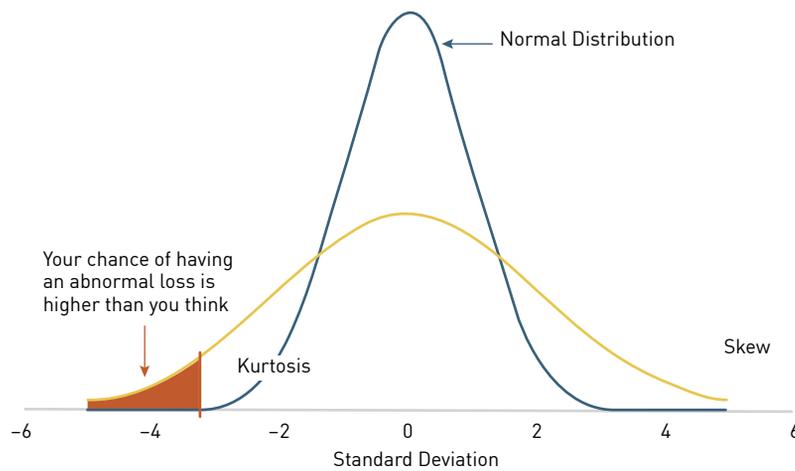
Skewness and kurtosis are two important elements for understanding strategies that are less liquid and have anomalous or asymmetric return distribution characteristics. These two metrics matter because they, in conjunction with standard deviation and mean, help to provide a clearer picture of risk.

Skewness is broadly characterized as the degree of asymmetry of a distribution around its mean. Positive skewness indicates a distribution extending toward more positive values. Negative skewness indicates a distribution extending toward more negative values.

Kurtosis describes the distribution of returns around the mean. High kurtosis indicates a strategy with fat tails and a low, even distribution. Low kurtosis

Figure 2

FAT TAILS



Source: ResearchGate

'DRAWDOWN' DEFINED

In practice, a drawdown is defined as the percent change in a manager's net asset value from a high-water mark to the next low-water mark (before resetting a move upward). A net asset value qualifies as a high-water mark if it is higher than any previous net asset value and if it is followed by a loss. Effectively, drawdown measures the amount of capital lost over a period. Understanding drawdown is an important investment consideration because recouping capital loss is difficult. Consider that if an account loses 75 percent of its capital, it needs to gain back 300 percent to break even.

points to a strategy with skinny tails and a distribution concentrated around the mean (see figure 2).

Risk may be one word, but it is best described by a multi-dimensional measurement process and not a single number.

THE ADVISOR TOOL SET

Understanding hedge funds' nuanced metrics is critical in selecting, measuring, and setting appropriate client expectations.

Fundamental ground rules for building, discussing, and measuring hedge funds

- Drawdown-based metrics demonstrate the value of adding hedge funds to a portfolio.
- Analysis of the hedge fund contribution should be focused at the portfolio

level, not strictly the product or fund level. A comparison of the client's current asset mix versus the target asset mix demonstrates the impact of adding a new strategy to the portfolio. Using historical event-risk scenarios (9/11, March 2020, Black Monday, etc.) as well as forward-looking hypothetical scenarios can inform clients of the implications of any portfolio changes.

- An often overlooked but critical analysis is understanding the potential for factor redundancy that a hedge fund may introduce relative to the other portions in the portfolio. This is most apparent with distressed credit, equity, and long-short strategies tracking closely to the broad equity asset class during stressed periods; global macro and event-driven strategies are less likely to demonstrate cross asset-class redundancies.

- Ensure that the client understands the unique characteristics and behavior of different types of hedge funds, as well as their roles in a portfolio, during changing economic regimes. As Peter Lynch, former manager of the Magellan Fund at Fidelity Investments, once quipped: "Know what you own, and why you own it." Some long-short equity strategies may provide downside protection during a cooling economic regime, but another type of long-short strategy may seek to profit directly from a cooling economic regime, i.e., market neutral versus net short. Not all long-short equity strategies are constructed with the same risk-reward objectives. To complicate this further, managers may express their strategies with their own idio-synchratic nuances centered around sector, region, size, or directional risk preference.

Metrics to consider when assessing hedge funds

The Modified Sharpe ratio (MSR) is a variation of the standard Sharpe ratio that takes return asymmetry into account. The MSR replaces the standard deviation in the denominator with the Modified VaR as follows:

$$MSR = \frac{r - r_f}{MVaR}$$

where:
r = return and r_f = risk-free rate

Conditional Value-at-Risk (CVaR)

is an improvement on the traditional Value-at-Risk (VaR) metric that assumes normality and does not pick up skewness and kurtosis.

$$CVaR_{\alpha}(X) = \mu - \frac{1}{1 - \alpha} f(z_{\alpha})\sigma$$

where:
p(x) dx = the probability density of getting a return with value "x"
c = the cut-off point on the distribution where the analyst sets the VaR breakpoint

CVaR provides a more practical and relevant estimate of downside risk for a manager compared to other metrics.

CVaR calculates losses one may experience under the worst-case scenarios. It provides an estimate of a loss and its associated likelihood. More importantly, CVaR is explicitly designed to measure tail loss. Therefore, CVaR is the most practically useful risk metric for an investor interested in minimizing declines in portfolio values at stress or pain points while maximizing returns.

The Pain Index seeks to measure the frequency, depth, and duration of drawdown and recovery time. It picks up all four moments of a distribution, not just two.

$$Pain\ Index = abs\left(\frac{\int_{t_1}^{t_2} D(t)}{t_2 - t_1}\right)$$

where:

$D(t)$ = the drawdown between time t_1 and t_2

The Pain Index, developed by Zephyr Analytics, is made-up of the frequency, depth, and duration of drawdowns. It essentially measures the difference in volume between the break-even line and the drawdown line. If the above lines are thought of as measuring cups, the Pain Index is the volume of liquid required to fill the drawdown space. The deeper the losses, the longer the losses, and the more frequent the losses, the larger the volume of “pain.” Obviously, the investor would prefer that volume to be as small as possible. The smaller the Pain Index, the better. (Zero would be best, indicating the manager never lost money.) This ratio best exemplifies the integration of behavioral finance and advanced investment risk analysis (or P-MPT).

The Omega ratio is a relative measure of the likelihood of achieving a given return, such as a minimum acceptable return (MAR) or a target return.

$$\Omega = \frac{\int_r^b (1 - F(x))dx}{\int_a^r F(x)dx}$$

where:

r = the threshold return

F = cumulative density function of returns

$F(x)$ = cumulative distribution of returns

Omega doesn't assume a normal distribution of returns and it accounts for all moments in a distribution. It represents a ratio of the cumulative probability of an investment's outcome above an investor's defined return level (a threshold level), to the cumulative probability of an investment's outcome below an investor's threshold level. Because clients broadly think in terms of returns, and not always risk relative to returns, this can be a compelling metric that thoughtfully incorporates outcome-based analysis.

Many of the aforementioned metrics may not be appropriate for all client situations; however, they are important tools to consider (sometimes behind the scenes) in assessing hedge fund performance and impact on a portfolio. Although there is no substitute for advisor experience, utilizing the most appropriate math and P-MPT to counsel clients cannot be understated.

The Pain Index generally is the most interesting metric for clients, and it is the one they tend to gravitate toward during client engagements. This likely is because the Pain Index describes a phenomenon they have experienced and can relate to more easily than a statistical descriptor.

CONCLUSION

Two dangerous myths about hedge funds can lead investors, portfolios, regulators, and policymakers into making inappropriate decisions. The first myth is that all hedge funds are alike, implying that alternative investments make up a homogeneous asset class composed of investments with similar characteristics and returns that move in concert. The second myth is that all hedge funds are unique, implying no commonalities and, therefore, no implications for diversification or systemic risk.

The freedom with which hedge funds are allowed to invest their capital gives them unique breadth of coverage as an

industry and unique depth of expertise at the individual fund level. However, their unconstrained and varied investment strategies contain non-standard forms of risk including illiquidity, nonlinearities, and operational risks that are captured poorly by conventional metrics. More-sophisticated risk models are available, but they require greater training and experience.

The adaptiveness of the hedge fund industry also implies that hedge funds can serve as an invaluable monitoring system for identifying trouble spots throughout the financial system

The highly competitive nature of this industry implies rapid innovation and attrition, which can greatly benefit the nimble and risk-tolerant investor—but which can be a source of great stress and financial loss for the naïve and inattentive investor. But considering the suitability of the various risk dimensions associated with each hedge fund investment style along with the potential for generating targeted performance, advisors may construct an investment process that incorporates hedge fund investments into more traditional portfolios.

The adaptiveness of the hedge fund industry also implies that hedge funds can serve as an invaluable monitoring system for identifying trouble spots throughout the financial system. The Great Financial Crisis of 2007-2009 left a significant mark on the industry, ending an era of excessive optimism about hedge fund returns while emphasizing the importance of operational due diligence, not just investment due diligence during the manager selection and supervisory process.

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DEMONSTRATING HEDGE FUND UTILITY

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The hedge fund industry will continue to evolve rapidly in response to new challenges and opportunities, and continuous monitoring and research will be necessary for the investment community to keep up with these changes.

Appropriate risk analytics mixed with thoughtful client education are integral in the development and management of

a multi-asset class portfolio. Advisors must remain mathematically civilized in demonstrating hedge fund value and ensure that clients fully understand “what they own, and why they own it.” ●

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ENDNOTE

1. See <https://www.nacubo.org/research/2021/nacubo-tiaa-study-of-endowments>.

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