

A network diagram consisting of numerous grey dots of varying sizes connected by thin grey lines, creating a complex web-like structure that fills the upper half of the page.

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How Portable Alpha Overlays May Enhance Equity Returns

#25 | MARCH 2026

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Executive summary

Over the last ten years, outperforming the S&P 500 on a standalone basis has been challenging to say the least, with the index delivering an annualized total return of 14.6%. This research illustrates how liquid diversification strategies can enhance equity returns, even in such an environment. It analyzes eight liquid equity diversifiers across traditional assets and liquid alternatives, focusing on the trade-off between their capacity to provide downside protection in equity stress periods and their long-term return potential. A key takeaway is that the perceived cost of diversification depends heavily on how it is incorporated into the portfolio. In traditional fixed-weight allocation frameworks such as a 60/40 portfolio, diversification is typically funded by reducing equity exposure. While this approach can improve risk-adjusted returns, it may come at the expense of absolute performance during strong equity market periods. We show that this trade-off is not inherent to diversification itself. When implemented through capital-efficient portable alpha overlays, diversifying strategies can be layered on top of a core equity allocation rather than replacing it.

In this framework, the constraint shifts from capital to risk: the permissible level of diversifier exposure depends on the extent to which it offsets equity risk through its correlation profile.

As a result, a diversifier's effectiveness is driven less by its standalone Sharpe ratio and more by how its long-term expected returns interact with its correlation to equities. A diversifier with persistently low or negative correlation creates additional risk capacity, enabling greater scaling without increasing overall portfolio volatility.

Our empirical results indicate that diversifiers such as trend-following and gold are particularly efficient overlays, combining effective diversification with positive long-term return premia. In contrast, liquid alternative strategies with embedded equity beta or structurally positive correlation to equities offer limited overlay capacity and therefore deliver more modest portfolio-level diversification benefits.

Overall, the findings suggest that effective diversification is less about selecting the highest standalone Sharpe strategy and more about identifying return streams that can be scaled alongside equities without raising total portfolio risk.

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Diversification does not eliminate the risk of experiencing investment losses.

After the Rally: Rethinking the Architecture of Equity Diversification

Over the three-year period from January 2023 through December 2025, the S&P 500 Total Return Index¹, delivered an annualized return of approximately 23%, placing this stretch among the strongest three-year runs for U.S. equities since the 1960s. Comparable periods have been limited to exceptional episodes, most notably the late-1990s technology bubble, the early 2010s post-euro-crisis recovery, and the post-pandemic recovery culminating in 2021.

When equities perform this strongly, the opportunity cost of diversification becomes more apparent, as strategies that dilute headline returns come under scrutiny. At the same time, prolonged bull markets can increase the risk of complacency. When the cycle turns, the key question becomes which strategies genuinely diversify equity risk.

This research note addresses that question by evaluating eight liquid equity diversifiers spanning traditional assets and liquid alternative strategies, and exploring how they can be deployed most effectively within a portfolio when diversification is assessed not only through a risk-adjusted lens, but also in terms of its contribution to absolute returns. Rather than providing an exhaustive survey, our objective is to identify the structural features of effective equity diversification and illustrate how they can be implemented most efficiently in practice.

Our analysis focuses exclusively on liquid and scalable diversifiers, a prerequisite for efficient implementation and timely rebalancing, particularly during periods of market stress, when diversification is most valuable.

After assessing their return characteristics and equity correlation profiles, we analyze how each diversifier impacts portfolio performance within a traditional 60/40 framework, where

diversification is funded by reducing equity exposure. We then contrast this with capital-efficient portable alpha approaches that layer diversifiers on top of a core equity allocation and derive an analytical expression linking expected overlay performance to the diversifier’s excess return and its correlation to equities. We show that the perceived cost of diversification is less an inherent property of the diversifier itself and more a function of how the exposure is funded within the broader portfolio.

Mapping the Landscape of Liquid Equity Diversifier Candidates

The eight liquid diversifiers analyzed in this research note, spanning traditional assets and liquid alternative strategies, are summarized in Table 1. We focus on a small set of widely used liquid instruments with clearly differentiated profiles in terms of downside protection and associated costs. We rely on established

Table 1: Diversifier Candidates and Proxy Benchmarks

Diversifier Candidate	Proxy benchmark
U.S. Treasuries	10-year U.S. Treasury futures (funded)
Gold	Gold futures (funded)
Trend-Following CTAs	SG Trend Index
Equity Market Neutral	BarclayHedge Equity Mkt Neutral Index
Equity Long/Short	BarclayHedge Equity Long/Short Index
Carry	Rule-based implementation
Short Volatility	Rule-based implementation
Long Vol / Tail Risk	Rule-based implementation

Table 1: Overview of eight liquid equity diversifier candidates spanning traditional asset classes and liquid alternative strategies. The selection is illustrative, reflects the authors’ subjective judgment, and is not intended to be exhaustive. References to specific assets, alternative investment strategies, benchmarks, or rule-based implementations do not constitute an offer to sell or a solicitation of an offer to invest in any product or strategy. Please refer to Appendix 1 for detailed descriptions of the proxies used for the liquid alternative strategies. Source: Quantica Capital.

¹ Please refer to the Index Definitions section at the end of this document for further details.

benchmarks as proxies for each diversifier. U.S. equities are represented by the S&P 500 Index, U.S. Treasuries by 10-year Treasury futures, Gold by Gold futures, and Trend-Following CTAs by the SG Trend Index². For most other hedge fund strategies, access to methodologically consistent public data supported by sufficiently long track records is limited. We therefore focus on Equity Long/Short – the largest hedge fund segment, representing roughly 25-30% of industry AUM³ as of 2025 – and Equity Market Neutral, both proxied by *BarclayHedge* benchmarks⁴.

For Carry, Short Volatility, and Long Volatility, we use stylized rule-based implementations designed to capture their core return drivers and structural payoff profiles. While realized manager performance will vary, this approach provides a transparent and consistent representation of their diversification characteristics.

Finally, to ensure comparability, all eight strategies are normalized to a common 12% annualized volatility⁵.

Long-Term Performance Characteristics of Individual Diversifiers

Table 2 presents the key return and risk characteristics of each candidate diversifier relative to U.S. equities over two periods: Jan. 2005 – Feb. 2026 and Jan. 2016 – Feb. 2026.

Over the past 21 years, U.S. equities delivered an annualized return of 10.6% at 14.9% volatility. By comparison, the eight diversifiers – normalized to

a 12% volatility target – generally underperformed equities, with Equity Long/Short the sole exception, outperforming by 0.2% p.a. Excluding Long Volatility, all strategies generated positive returns since 2005, with annualized performance ranging from 4.1% (Carry) to 10.8% (Equity Long/Short).

Since 2016, U.S. equities delivered even stronger returns of 14.6% p.a. – around 4% p.a. above the long-term average – at a similar volatility of 15.0%. Over this period, all diversifiers underperformed equities, while largely maintaining return profiles consistent with their long-term characteristics (e.g., Long Volatility: -5.3% vs. -5.1%; Trend-Following: 4.5% vs. 4.8%). Two notable exceptions stand out. U.S. Treasuries, which were broadly flat amid post-pandemic inflation and rising interest rates that pushed equity-bond correlation into positive territory; and Gold, which strengthened materially, annualizing at 14% over the past decade versus 8.9% over the full sample, while maintaining a near-zero correlation to equities.

Finally, excluding Long Volatility, Trend-Following exhibits the most favorable skewness⁶ among all diversifiers over the full sample and the second most favorable – after Gold – over the past decade. Unlike Sharpe ratios or correlations, skewness captures tail behavior, with higher values indicating fewer extreme downside outcomes and greater upside convexity, key attributes of an effective diversifier.

² Please refer to the Index Definitions section at the end of this document for further details.

³ Preqin estimates that Equity Long/Short funds manage over \$1.3 trillion, or ~27% of total hedge fund AUM, representing roughly one-third of funds globally (Source: [Preqin](#), *Strategy in Focus: Long/Short Equity Hedge Funds*, Aug. 2024). Similarly, HFR data suggests Equity Hedge strategies account for about \$1.5 trillion within a \$5+ trillion industry, also around one-third of total capital (Source: [HFR](#), *Market Commentary*, Jan. 2026).

⁴ All Equity Hedge Fund benchmark comparisons in this report are based on information provided by [BarclayHedge](#), which is used with permission.

⁵ Because hedge fund indices typically report total returns that include a cash component (reflecting collateral invested in Treasury bills or similar instruments), volatility scaling should be applied only to the excess return over cash. Scaling total returns directly would artificially amplify the cash component and overstate achievable returns. Therefore, to avoid this distortion, where required, we first estimate and remove the cash contribution, scale the excess returns to the target volatility (12%), and then add the cash return back.

⁶ Skewness is defined as the third standardized moment of monthly returns and is estimated using the bias-corrected Fisher-Pearson coefficient to account for finite-sample bias. A skewness of +1 indicates a distribution with a materially heavier or longer right tail (e.g., frequent small losses with occasional large gains), while -1 indicates the opposite, reflecting downside tail asymmetry.

Table 2: Performance and Risk Statistics - U.S. Equities vs. Eight Diversifiers (Scaled to Target Volatility of 12% p.a.)

Jan 2005 – Feb 2026	Equities	Gold	Treasuries	Trend-Following	Equity Mkt Neutral	Equity L/S	Carry	Short Vol	Long Vol
Annualized return	10.6%	8.9%	4.9%	4.8%	10.5%	10.8%	4.1%	7.6%	-5.1%
Annualized volatility	14.9%	12.0%	11.9%	11.9%	12.1%	12.0%	12.2%	12.3%	11.8%
Sharpe ratio (rf = 0%)	0.72	0.74	0.41	0.40	0.87	0.90	0.34	0.62	-0.44
Max. drawdown	-50.9%	-32.2%	-40.7%	-21.9%	-37.5%	-32.3%	-50.3%	-30.3%	-77.5%
Skewness	-0.61	-0.09	0.45	-0.02	-0.95	-0.49	-0.77	-1.50	1.60
Equity correlation	1.00	0.07	-0.08	-0.01	0.23	0.77	0.36	0.77	-0.76

Jan 2016 – Feb 2026	Equities	Gold	Treasuries	Trend-Following	Equity Mkt Neutral	Equity L/S	Carry	Short Vol	Long Vol
Annualized return	14.6%	14.0%	0.1%	4.5%	10.3%	12.4%	4.9%	8.5%	-5.3%
Annualized volatility	15.0%	11.9%	12.1%	11.9%	12.0%	12.0%	12.1%	12.2%	11.8%
Sharpe ratio (rf = 0%)	0.97	1.18	0.01	0.38	0.86	1.04	0.40	0.70	-0.45
Max. drawdown	-23.9%	-15.9%	-42.2%	-21.3%	-42.4%	-21.8%	-27.1%	-22.2%	-51.6%
Skewness	-0.49	0.28	-0.17	-0.04	-0.35	-0.23	-0.56	-1.36	1.39
Equity correlation	1.00	0.06	0.12	-0.07	0.26	0.76	0.25	0.75	-0.75

Table 2: Summary performance and risk characteristics of U.S. equities and selected liquid diversifier candidates based on monthly returns. Results are presented for two sub-periods: Jan. 2005 through Feb. 2026 and Jan. 2016 through Feb. 2026. For comparability, returns for all eight candidates are shown on a “funded” basis and volatility-normalized to a common 12% annualized volatility, and are therefore HYPOTHETICAL. Returns for Equities are not re-scaled. Index data are used for illustrative and analytical purposes only. Please refer to Appendix 1 for detailed descriptions of the proxies used for the liquid alternative strategies. Indices are unmanaged, do not reflect the deduction of fees, transaction costs, or other expenses, and are not available for direct investment. PLEASE SEE IMPORTANT DISCLAIMERS RELATED TO HYPOTHETICAL RESULTS ON PAGE 2. Source: Quantica Capital.

A Correlation-Based Classification of Equity Diversifiers

Correlation profiles to equities differ materially across diversifiers, allowing us to group the candidates into three broad categories and reveal a clear trade-off between a diversifier’s Sharpe ratio and its ability to provide meaningful diversification.

Pro-cyclical diversifiers – Equity Long/Short, Equity Market Neutral, Short Volatility, and Carry – exhibit structurally positive equity correlations of 0.77, 0.23, 0.77, and 0.36, respectively, reflecting meaningful embedded equity beta. While these strategies may enhance portfolio Sharpe ratios, those that are not genuinely market

neutral⁷ cannot be relied upon for equity downside protection. Residual equity exposure remains active during periods of market stress, materially limiting their defensive effectiveness⁸. As a result, they may improve risk-adjusted returns but offer limited protection in equity drawdowns. Within this group, Equity Market Neutral presents a more balanced profile, combining a relatively high Sharpe ratio with materially lower – though still structurally positive – equity correlation, while the Carry proxy appears less compelling, offering a similar correlation with a weaker Sharpe ratio.

At the opposite end of the spectrum, Long Volatility strategies exhibit strongly negative equity correlation (-0.76), providing the most

⁷ Robust and regime agnostic market neutrality in equity long-short strategies can be achieved through explicit constraints on equity beta, gross and net notional exposure, and systematic factor exposures. However, these constraints come with an inherent trade-off: as neutrality is more tightly enforced, the opportunity set narrows, making the generation of attractive absolute returns increasingly challenging.

⁸ These results are corroborated by a hedge fund report published in January 2026 by BNP Paribas. The report highlights that Equity Long-Short hedge funds had a correlation of 0.98 with equity market returns in 2025, the highest annual level since 2019, compared with a three-year average correlation of 0.92 and a five-year average of 0.86. Source: BNP Paribas Capital Introduction.

effective protection in left-tail scenarios. However, this benefit comes at a significant cost: persistent negative carry results in a structurally negative Sharpe ratio (-0.44), making these strategies inherently **expensive diversifiers** to hold over time⁹.

Between these extremes, Trend-Following, Gold, and Treasuries combine low to near-zero long-term equity correlation with positive risk premia, making them the most **cost-effective diversifiers**. While they do not guarantee downside protection like tail-risk protection strategies in every stress episode, their largely independent return profiles make them more efficient diversifiers than strategies with embedded equity beta.

Importantly, full-sample correlations can mask material differences in behavior during periods of market stress¹⁰. To address this limitation, we complement the analysis with a regime-conditional return framework, with results presented in Appendix 2.

Overall, these results indicate that lower correlation to equities often comes at the expense of lower standalone returns, implying a potential performance drag when diversification is funded through reduced equity exposure – particularly in strong equity markets. To quantify this trade-off in practice, we next evaluate the impact of diversification on long-term portfolio returns within a traditional 60/40 framework.

The Cost of Diversification in a 60/40 Portfolio Context

We assess the cost of each of the eight diversifiers by measuring its impact when introduced at a fixed allocation within a traditional 60/40 portfolio¹¹, funded through a corresponding

reduction in equity exposure. Table 3 summarizes the resulting return and risk characteristics for each portfolio.

Since 2005, all eight diversifiers would have improved the portfolio's Sharpe ratio. However, as illustrated in Figure 1, none would have meaningfully increased absolute returns under this conventional allocation approach. Unsurprisingly, the stronger the downside protection characteristics identified earlier, the larger the associated performance drag. Long Volatility would have imposed the largest drag at -5.8% p.a., while a 40% allocation (volatility-adjusted to 12% p.a.) to U.S. Treasuries or Trend-Following CTAs would have reduced annualized returns by -1.8% and -1.9% p.a., respectively.

Gold stands out as an exception, combining positive equity downside behavior with no meaningful long-term return drag when incorporated into a 60/40 portfolio allocation framework.

Even alternative strategies with positive correlation to equities produce only modest changes in long-term portfolio returns: +0.2% p.a. for Equity Long/Short, +0.3% p.a. for Equity Market Neutral, and approximately -1.1% p.a. for Short Volatility. Part of the equity allocation (annualizing at 10.6% since 2005) is permanently replaced with strategies that have historically delivered similar or lower standalone returns, resulting in a persistent drag on long-term portfolio performance, albeit at lower volatility.

Focusing on the most recent decade, the performance drag from fixed-weight diversification increased for all candidate diversifiers except Gold. This largely reflects the exceptional performance of U.S. equities, while the structural risk premia or carry characteristics of most diversifiers remained broadly stable, as

⁹ Notably, our simple proxy likely overstates this cost relative to more actively managed or optimized implementations observed in practice.

¹⁰ The most effective diversifier exhibits a negative correlation to equities in left-tail regimes and a positive correlation in right-tail regimes – structural characteristics typically associated with trend-following strategies. Please refer to Appendix 2 for further details.

¹¹ The term "60/40" refers to a portfolio composed of 60% equities and 40% diversifying assets on a notional basis, rebalanced monthly, with all profits reinvested.

Table 3: Performance and Risk Statistics – U.S. Equities vs. 60/40 Portfolios with Liquid Equity Diversifiers

2005 – 2026	Equities	60/40 Gold	60/40 Treasuries	60/40 TF CTA	60/40 Mkt Neutral	60/40 Eqy L/S	60/40 Carry	60/40 Short Vol	60/40 Long Vol
Annualized return	10.6%	10.4%	8.8%	8.7%	11.0%	10.8%	8.3%	9.6%	4.9%
Annualized volatility	14.9%	10.4%	9.7%	10.0%	11.0%	13.0%	11.6%	13.1%	6.0%
Sharpe ratio (rf = 0%)	0.72	1.00	0.91	0.88	0.99	0.83	0.72	0.73	0.81
Max. drawdown	-50.9%	-30.3%	-25.1%	-27.9%	-36.5%	-43.9%	-35.0%	-42.3%	-25.2%
Skewness	-0.61	-0.71	-0.66	-0.30	-0.70	-0.62	-0.86	-0.93	-0.13

2016 – 2026	Equities	60/40 Gold	60/40 Treasuries	60/40 TF CTA	60/40 Mkt Neutral	60/40 Eqy L/S	60/40 Carry	60/40 Short Vol	60/40 Long Vol
Annualized return	14.6%	14.9%	9.0%	11.0%	13.3%	13.9%	11.0%	12.3%	7.0%
Annualized volatility	15.0%	10.4%	10.7%	9.8%	11.3%	13.0%	11.3%	13.1%	6.2%
Sharpe ratio (rf = 0%)	0.97	1.43	0.84	1.12	1.18	1.06	0.97	0.94	1.13
Max. drawdown	-23.9%	-17.5%	-25.5%	-11.4%	-21.3%	-19.8%	-19.5%	-20.6%	-12.4%
Skewness	-0.49	-0.38	-0.45	-0.27	-0.55	-0.51	-0.90	-0.74	-0.21

Table 3: Summary performance and risk characteristics of U.S. equities and 60/40 portfolios, each comprising 60% equities and 40% allocated to a selected liquid diversifier, based on monthly returns. Results are presented for two sub-periods: Jan. 2005 through Feb. 2026 and Jan. 2016 through Feb. 2026. For comparability, returns for all eight diversifiers are volatility-normalized to a common 12% annualized volatility. Index data are used for illustrative and analytical purposes only. Please refer to Appendix 1 for detailed descriptions of the proxies used for the liquid alternative strategies. Indices are unmanaged, do not reflect the deduction of fees, transaction costs, or other expenses, and are not available for direct investment. ALL RETURNS ARE HYPOTHETICAL. PLEASE SEE IMPORTANT DISCLAIMERS RELATED TO HYPOTHETICAL RESULTS ON PAGE 2. Source: Quantica Capital.

Figure 1: Incremental Annualized Return Contribution of Liquid Diversifiers in a 60/40 Portfolio

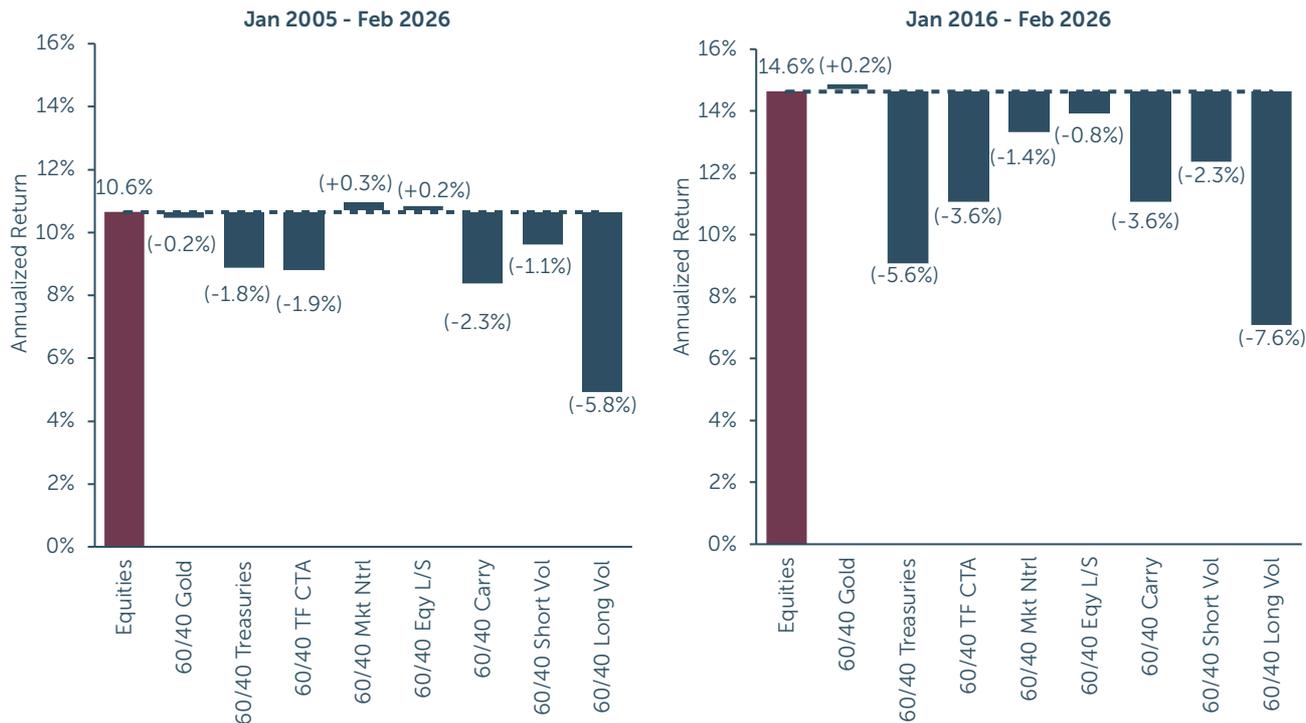


Figure 1: Incremental compound gross annualized return contribution of selected liquid diversifiers when combined with U.S. equities in a 60/40 portfolio, relative to a standalone U.S. equity allocation. For comparability, diversifier returns are presented on a funded basis and normalized to a common 12% annualized volatility. Results are shown for two periods: January 2005 – February 2026 (left) and January 2016 – February 2026 (right). Indices are unmanaged, are not available for direct investment and are not subject to management fees and other fees and expenses. HYPOTHETICAL RESULTS. PLEASE SEE IMPORTANT DISCLAIMERS ON PAGE 2. Source: Quantica Capital.

we have observed. Even so, all but two strategies – Treasuries and Short Volatility – would have improved risk-adjusted 60/40 portfolio returns since 2016.

Finally, beyond pure return considerations, and excluding Long Volatility, Trend-following delivered the largest improvement in portfolio skewness across both periods. Over the past 21 years, equity skewness improved from -0.61 in a standalone allocation to -0.30 when combined with Trend-following, indicating a meaningful reduction in downside tail risk. By contrast, adding Equity Market Neutral or Carry worsened skewness to -0.70 and -0.86, respectively. Unlike these strategies, which can exacerbate negative tail risk, Trend-following improves the symmetry and resilience of the portfolio’s return distribution.

Under a traditional 60/40 approach, investors face an inherent trade-off: accepting lower headline returns (and lower volatility) in exchange for improved risk-adjusted performance and greater downside protection. By construction, part of the equity allocation is permanently replaced with strategies that historically delivered similar or lower standalone returns, often creating a persistent drag on long-term compounding. Importantly, this trade-off is not inevitable. Rather than relying on traditional fixed-weight allocations such as 60/40 (or 80/20, or 90/10), investors can adopt an alternative portfolio construction approach that combines equities with diversifiers without diluting core equity exposure. Specifically, diversification can be implemented by layering the diversifier on top of the equity allocation, rather than funding it through a reduction in equity beta – an approach commonly referred to as *Portable Alpha*¹².

Capital-Efficient Diversification Without Opportunity Costs

Portable alpha portfolios replicate equity beta in a capital-efficient manner – typically through equity index futures or total return swaps – freeing capital that can be allocated to diversifying strategies¹³. Such structures are best suited to liquid asset classes and liquid alternatives where exposures can be efficiently obtained via derivatives, as illustrated in Figure 2. Trend-Following strategies are particularly well suited to this framework because their futures-based implementation leaves a large portion of capital unencumbered (often up to 85%)¹⁴. This capital can be deployed into additional return sources or retained as a margin buffer, reducing

Figure 2: How Portable Alpha Works

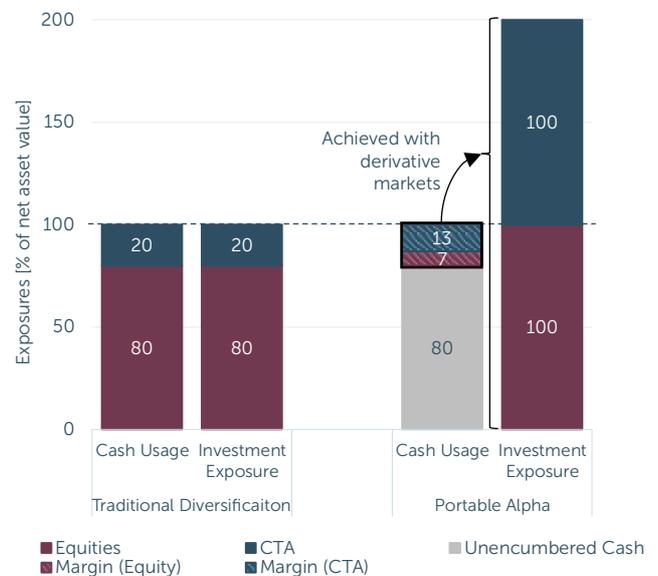


Figure 2: Illustrative notional exposure attributions of a traditional 80/20 equity-diversifier portfolio versus a portable alpha implementation combining 100% equity exposure with 100% diversifier exposure (CTA in this example). In this example, equity futures are assumed to require 7% initial margin and CTA exposure 13%. For illustration purposes only. Source: Quantica Capital.

¹² Portable alpha overlay strategies are also sometimes referred to as “return stacking”, a term popularized by Corey Hoffstein, Co-founder and Portfolio Manager at Return Stacked® ETFs.

¹³ It is referred to as *Portable Alpha* because the “alpha” component is separated from the underlying “beta” exposure, allowing it to be layered onto a core allocation. In a standard factor model $r_t = \alpha + \beta f_t + \epsilon_t$, β represents exposure to systematic risk factors, while α captures the average return independent of those exposures. Portable alpha strategies aim to generate α separately and combine it with independently sourced beta exposures (e.g., via futures or swaps), enabling alpha to be “ported” across different portfolio allocations without altering core exposures.

¹⁴ By contrast, private market strategies, including private equity, private credit, and real estate, lack both liquidity and capital efficiency. Their drawdown structures, capital calls, and illiquidity constraints make them incompatible with a portable alpha overlay architecture.

the risk of forced deleveraging during periods of market stress, precisely when diversification is most valuable.

Which Diversifiers Qualify as Effective Portable Alpha Overlays?

In a portable alpha overlay, the underlying equity exposure is preserved, allowing the incremental contribution of the overlay to be assessed directly relative to the equity benchmark. This provides a clean and transparent framework for evaluating the true impact of a diversifier.

With core equity exposure maintained at 100%, the objective of the portable alpha approach is straightforward: to enhance returns relative to the underlying equity benchmark, with the option of preserving its standalone risk profile. If the core equity volatility profile is to be preserved, any strategy layered on top of the equity allocation must exhibit sufficiently low or negative correlation to equities.

Diversification benefits arise only if the additional return stream is truly distinct from equity beta. If a “diversifier” embeds structural equity exposure, the result may be little more than leveraged

equity, increasing volatility and consuming risk capacity without providing meaningful protection in stress regimes.

Portable alpha shifts the focus from capital to risk allocation. We next evaluate which strategies can be layered onto a 100% equity exposure while preserving the volatility characteristics of standalone equities.

Overlay Capacity and the Role of Correlation: How Much Can Be Added Without Increasing Risk?

To formalize this concept, we quantify the conditions under which a diversifier can be layered onto a 100% core equity allocation **without mechanically increasing total portfolio volatility.**

Put differently, we ask: how much notional exposure, w_{max} , to a given diversifier can be added to form a “100% equities + w_{max} % diversifier”-overlay portfolio while preserving standalone equity volatility?

The formal relationship governing overlay capacity is derived in **Box 1** and is a function of

Box 1: What is the maximum diversifier allocation that can be added to a 100% equity portfolio without increasing annual volatility by more than 1%?

Consider a portfolio consisting of a 100% core equities allocation and a diversifier layered on top with a notional overlay weight w . If we denote by σ_E and σ_D the annualized volatilities of equities and the diversifier, respectively, and ρ the correlation between equities and the diversifier, the resulting portfolio variance is:

$$\sigma_p^2 = \sigma_E^2 + w^2 \sigma_D^2 + 2w\rho\sigma_E\sigma_D$$

To preserve the volatility profile of standalone equities, we impose the following volatility constraint:

$$\sigma_p \leq \sigma_E + \delta$$

where δ defines the tolerated increase in equity volatility (e.g., $\delta = 1\%$ for a 1% p.a. volatility overshoot).

Solving for the maximum permissible positive overlay w_{max} consistent with the upper volatility bound yields:

$$w_{max}(\rho) = \frac{\sigma_E}{\sigma_D} \left(-\rho + \sqrt{\rho^2 + \kappa} \right), \kappa = 2 \frac{\delta}{\sigma_E} + \left(\frac{\delta}{\sigma_E} \right)^2$$

For $\delta = 0.01$, $\kappa \approx 0.1378$.

Example:

If $\sigma_E = 15\%$ and $\sigma_D = 12\%$, then $\sigma_E/\sigma_D = 1.25$ and:

$$w_{max} \approx 1.25 \left(-\rho + \sqrt{\rho^2 + 0.1378} \right)$$

with $w_{max}(\rho = 1) \approx 8.3\%$ and $w_{max}(\rho = -1) \approx 258\%$.

three parameters: (1) the standalone equity volatility σ_E , (2) the diversifier volatility σ_D , and (3) the correlation ρ between equities and the diversifier¹⁵.

Figure 3 visualizes the closed-form nonlinear relationship between the correlation ρ and overlay capacity w_{max} : as correlation becomes more negative, scaling capacity expands rapidly, whereas positive structural correlation sharply limits the amount of diversifier exposure that can be added without increasing portfolio risk.

Intuitively, a strategy with negative correlation to equities offsets equity risk and thereby creates overlay capacity: the more negative the correlation, the larger the notional exposure that can be added without breaching a given risk budget. Conversely, strategies with positive equity beta quickly consume risk capacity, so adding them increasingly resembles leveraged equity exposure rather than genuine diversification.

We then apply this formula to each of our candidate diversifiers to calculate the maximum notional exposure that can be added to a 100% core equity allocation, subject to the constraint that total portfolio volatility does not exceed that of standalone equities by more than 1% per annum. This allows us to position all eight diversifiers along the curve shown in Figure 3.

Owing to its favorable correlation profile, Trend-Following would have supported one of the largest scalable overlays when all strategies are normalized to a 12% volatility target over the past 21 years. Maintaining core equity volatility would have allowed for a notional overlay of approximately 48% in Trend-Following – only lower than Treasuries at roughly 58% and Long Volatility, while exceeding Gold at around 38%.

Over the more recent 10-year period, overlay capacity has remained broadly stable for Trend-Following (56%) and Gold (40%). In contrast, the maximum allocation to Treasuries declined

Figure 3: Theoretical Maximum Overlay Capacity as a Function of a Diversifier’s Correlation to Equities

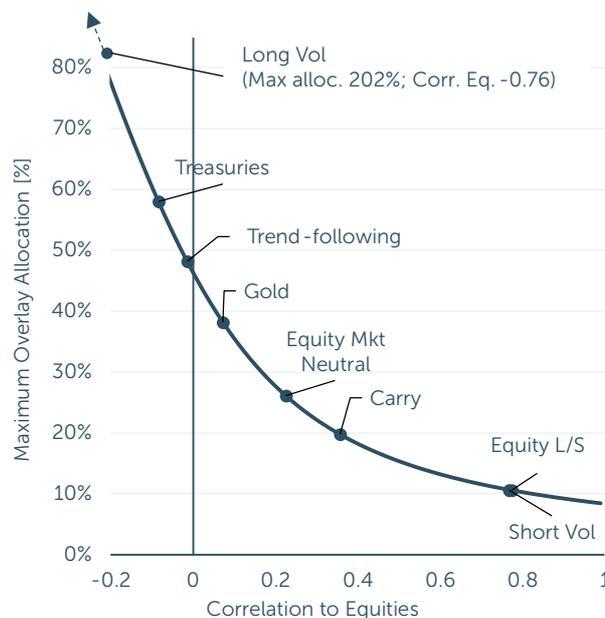


Figure 3: Theoretical maximum notional allocation w_{max} that can be layered onto a 100% core equity exposure without increasing annualized portfolio volatility by more than 1% p.a., shown as a function of the diversifier’s correlation ρ to equities. Assumptions: 15% annualized equity volatility and 12% annualized diversifier volatility. Based on correlation of monthly returns from Jan 2005 to Feb 2026. HYPOTHETICAL RESULTS. PLEASE SEE IMPORTANT DISCLAIMERS RELATED TO HYPOTHETICAL RESULTS ON PAGE 2. Source: Quantica Capital.

almost by half to roughly 34%, reflecting a structurally higher equity–bond correlation over the period.

By contrast, strategies with embedded equity beta – such as Equity Long/Short, Equity Market Neutral, and Short Volatility approaches – offer only limited overlay capacity. Because their correlation structure does not meaningfully offset core equity risk, incremental allocations quickly increase total portfolio volatility, thereby constraining scalable exposure. In most cases, the permissible overlay does not exceed 10-25% before the overall equity risk profile rises materially. A distinct case is Long Volatility strategies, which can be scaled to notional allocations of up to +202% without breaching the standalone equity risk budget, driven by their structurally negative equity correlation.

¹⁵ For simplicity, we assume time-invariant volatilities for both equities and the diversifier, as well as a constant correlation between the two.

Portable Alpha Versus 60/40: From Theory to Practice

With an estimate of w_{\max} for each diversifier, we can now evaluate the return and risk characteristics of the corresponding portable alpha implementations¹⁶. The results are summarized in Table 4 and reported for two distinct sample periods: since 2005 and since 2016. It is worth noting that the empirically realized volatilities over both the 21-year and 10-year horizons are very close to the 16% annualized target across all eight overlay

implementations. This suggests that the simplified analytical expression used to determine maximum overlay capacity provides a reasonable approximation in practice.

Figure 4 complements this analysis by comparing the incremental contribution to portfolio performance delivered by each diversifier under the portable alpha implementation. Portable alpha overlays using Trend-Following, Gold, and Treasuries would have outperformed a pure equity allocation by approximately 1.8%, 3.0%, and 2.2% per annum, respectively, over the past 21 years. Over the more recent 10-year period,

Table 4: Performance and Risk Statistics – U.S. Equities vs. Volatility-Preserving Portable Alpha Portfolios

2005 – Feb 2026	Equities (funded)	+ Gold	+ Treasuries	+ TF CTA	+ Eqy Mkt Neutral	+ Eqy L/S	+ Carry	+ Short Vol	+ Long Vol
Overlay Allocation	100%	38%	58%	48%	26%	11%	20%	11%	202%
Annualized return	10.6%	13.7%	12.9%	12.4%	13.1%	11.6%	11.1%	11.2%	-2.7%
Annualized volatility	14.9%	15.9%	15.9%	15.8%	15.9%	15.9%	15.9%	15.9%	15.6%
Sharpe ratio (rf=0%)	0.72	0.86	0.81	0.79	0.82	0.73	0.70	0.70	-0.17
Max. drawdown	-50.9%	-48.7%	-40.0%	-45.6%	-52.3%	-53.3%	-51.5%	-52.6%	-65.4%
Skewness	-0.61	-0.69	-0.66	-0.37	-0.63	-0.61	-0.71	-0.67	1.49

2016 – Feb 2026	Equities (funded)	+ Gold	+ Treasuries	+ TF CTA	+ Eqy Mkt Neutral	+ Eqy L/S	+ Carry	+ Short Vol	+ Long Vol
Overlay Allocation	100%	40%	34%	56%	24%	11%	25%	11%	199%
Annualized return	14.6%	19.9%	13.9%	16.3%	16.7%	15.7%	15.4%	15.3%	-0.3%
Annualized volatility	15.0%	16.0%	16.0%	15.9%	16.0%	16.0%	16.1%	16.1%	15.5%
Sharpe ratio (rf=0%)	0.97	1.24	0.87	1.03	1.04	0.98	0.95	0.95	-0.02
Max. drawdown	-23.9%	-26.7%	-32.6%	-18.9%	-23.0%	-24.8%	-24.1%	-24.4%	-45.0%
Skewness	-0.49	-0.46	-0.43	-0.30	-0.56	-0.49	-0.68	-0.53	1.41

Table 4: Summary performance and risk characteristics of U.S. equities and volatility-preserving portable alpha portfolios (100% core equities, including cash returns, plus the maximum diversifier overlay (w_{\max}) that preserves standalone equity volatility), based on monthly returns. Results are presented for two sub-periods: Jan. 2005 – Feb. 2026 and Jan. 2016 – Feb. 2026. For comparability, excess returns for all diversifiers are volatility-normalized to a common 12% annualized volatility. Index data are used for illustrative purposes only. Indices are unmanaged, do not reflect the deduction of fees, transaction costs, or other expenses, and are not available for direct investment. ALL RETURNS ARE HYPOTHETICAL. PLEASE SEE IMPORTANT DISCLAIMERS RELATED TO HYPOTHETICAL RESULTS ON PAGE 2. Source: Quantica Capital.

¹⁶ The proposed portfolios are assumed to be implemented by replicating equity beta using futures or swaps and using the substantial portion of available unencumbered cash to establish an exposure to the selected diversifier, again via futures or swaps. The funded returns r^P of the portable alpha overlay are constructed as the sum of the equity excess return r_{excess}^E and the scaled excess return of the diversifier, $w_{\max} r_{\text{excess}}^D$, where r_{excess}^D is volatility-targeted to a 12% p.a. level. We then add back the corresponding cash contribution, r^{rf} , generated by the collateral:

$$r^P = r^{rf} + r_{\text{excess}}^E + w_{\max} r_{\text{excess}}^D$$

The portable alpha portfolios are rebalanced monthly with full reinvestment of gains and losses. This rebalancing mechanism can itself become an additional source of return or, in some cases, a drag on performance depending on the correlation of the diversifier with equities. As a result, the long-term relative return of the overlay portfolio versus the equity benchmark, $r^P - r^E$, is not mechanically equal to the diversifier's excess return contribution $w_{\max} r_{\text{excess}}^D$. Under a monthly rebalancing approach, a diversifier with negative correlation to equities tends to generate gains during equity drawdowns. The rebalancing process then mechanically reallocates capital from the outperforming diversifier sleeve back into equities, while reducing diversifier exposure following equity recoveries.

Figure 4: Volatility-Preserving Portable Alpha Overlays – Relative Returns Over Standalone Equities

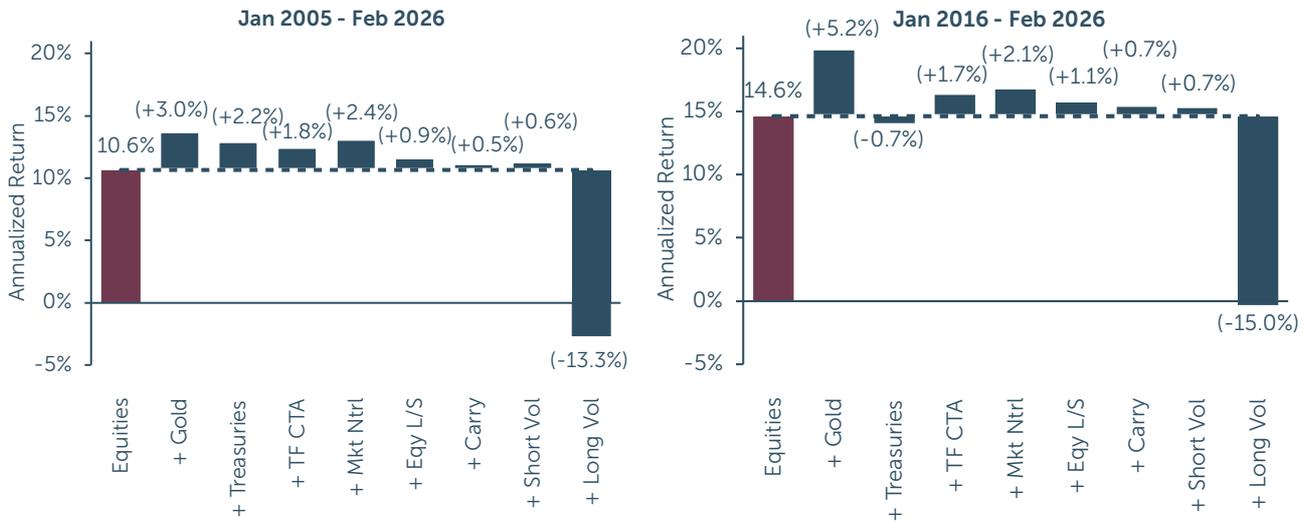


Figure 4: Incremental compound gross annualized return contribution of selected liquid diversifiers when combined with U.S. equities in a portable alpha structure under diversifier allocation constrained by combined portfolio volatility not increasing by more than 1% p.a., relative to standalone U.S. equity total return. For comparability, diversifier returns are normalized to a common 12% annualized volatility. Results are shown for two periods: January 2005 – February 2026 (left) and January 2016 – February 2026 (right). Indices are unmanaged, are not available for direct investment and are not subject to management fees and other fees and expenses. Based on monthly return data from Jan. 2005 to Feb. 2026 (left) and from Jan. 2016 to Feb. 2026 (right). HYPOTHETICAL RESULTS. PLEASE SEE IMPORTANT DISCLAIMERS ON PAGE 2. Source: Quantica Capital.

the Treasury-based overlay turned negative: maximum allocation capacity declined to roughly 34%, reflecting higher equity–bond correlation, while weaker bond returns further reduced its contribution. Over that same period, Trend-Following and Gold overlays would have generated excess returns of approximately 1.7% and 5.2% p.a., respectively – differences largely driven by cyclical variation in their underlying risk premia.

By contrast, alternative strategies with structurally positive correlation to equities such as Equity Long/Short, Equity Market Neutral, Carry, and Short Volatility have limited overlay capacity, allowing only a small portion of their standalone premia to be deployed. Despite having more than twice the standalone Sharpe ratio of Trend-Following (0.40 vs 0.87), Equity Market Neutral would have outperformed it by only about 0.7% p.a. in the overlay framework over the full sample period (13.1% vs 12.4%). Finally, while Long Volatility strategies can in theory be scaled to large notional overlays, beyond moderate sizing

the persistent insurance premium outweighs their diversification benefits, rendering the overlay’s expected contribution negative. Consistent with the 60/40 results, only Trend-Following (excluding Long Volatility) meaningfully improved overlay skewness across both periods – highlighting Trend-Following’s distinctive role in enhancing portfolio convexity within a portable alpha framework.

The Correlation–Return Trade-Off in Portable Alpha Overlays

The framework developed above shows that the magnitude of return improvement from a risk-preserving equity overlay is driven by two core variables:

- (i) the diversifier’s long-term expected **correlation with equities**, and
- (ii) its expected standalone **excess return**.

The more negative the diversifier’s correlation ρ with equities, the larger its maximum allocation capacity w_{max} , and therefore the greater its

Figure 5: Portable Alpha Overlay Outperformance as a function of Diversifier Excess Return and Correlation to Benchmark

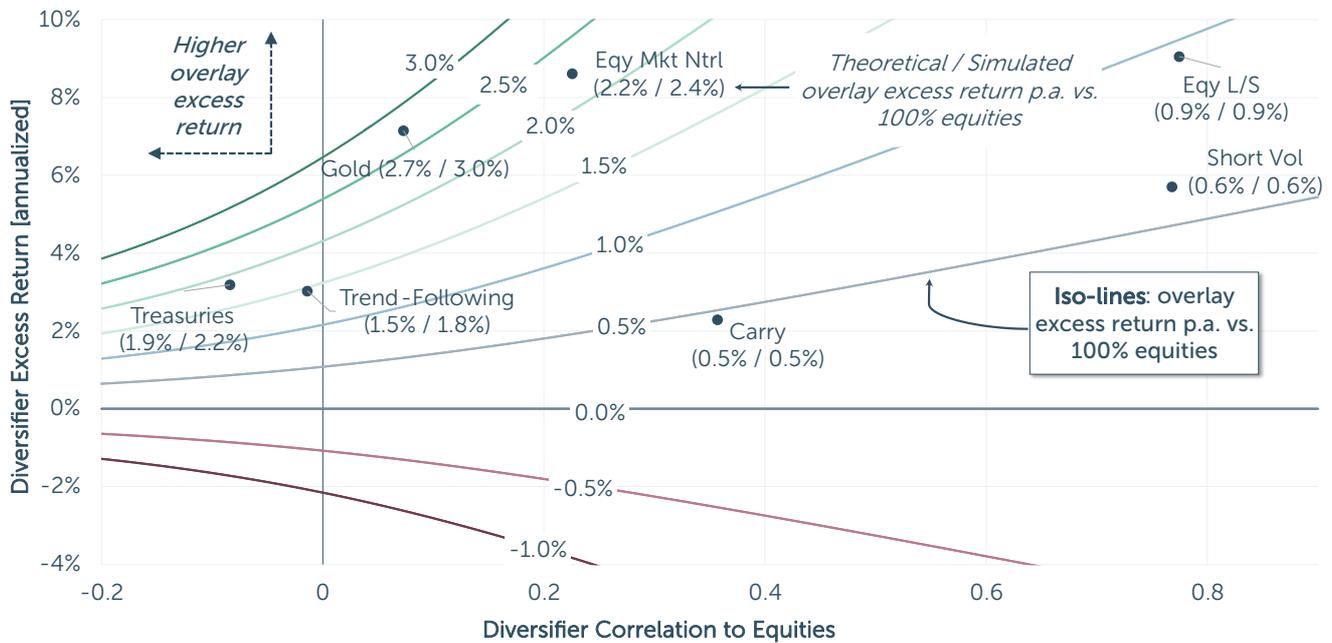


Figure 5: Contour plot of the excess return generated by a “100% * Equities + $w_{\max}(\rho)$ * Diversifier” portable alpha overlay portfolio relative to a standalone 100% equity allocation, where $w_{\max}(\rho)$ denotes the maximum notional allocation to the diversifier that preserves total portfolio volatility within a 1% p.a. tolerance above standalone equities. Overlay excess returns relative to equities are shown as a function of the diversifier’s excess return r_D (vertical axis) and its correlation ρ with equities (horizontal axis). For each level of ρ , the overlay is implemented at the corresponding weight $w_{\max}(\rho)$. Each iso-curve represents combinations of r_D and ρ that produce the same overlay excess return relative to the standalone equity exposure. Combinations above (below) a given curve enhance (detract) overlay returns. Seven of the eight diversifiers analyzed in this study are plotted as dots, based on their historical excess returns and correlations to equities over the period 2005–2026. Long Volatility is excluded due to its strongly negative excess return and its correlation to equities falling outside the chart range. The two values associated with each dot indicate the overlay outperformance to equities, with the first number showing the theoretical (formula-based) value and the second the simulated result. HYPOTHETICAL RESULTS. PLEASE SEE IMPORTANT DISCLAIMERS ON PAGE 2. Source: Quantica Capital.

potential contribution to total portfolio returns. For a given ρ , a higher long-term expected diversifier excess return directly translates into a larger performance uplift relative to a standalone 100% equity allocation. These relationships can be formalized analytically, as shown in **Box 2**. Figure 5 illustrates the framework by plotting the overlay’s excess return relative to a 100% equity benchmark as a function of the diversifier’s expected excess return r_D (vertical axis) and its correlation ρ with equities (horizontal axis). For each level of ρ , the overlay is implemented at the corresponding volatility-preserving weight $w_{\max}(\rho)$. The iso-lines trace all combinations of r_D and ρ for which the overlay produces identical excess returns over standalone equities – analogous to iso-return lines on an efficient frontier. The empirically realized combinations of excess

Box 2: When Does a Volatility-Preserving Portable Alpha Overlay Increase Returns?

Consider a portable alpha implementation consisting of 100% notional core equities plus a diversifier overlay. The overlay is sized at $w_{\max}(\rho)$ such that its volatility remains consistent with standalone equity volatility. The overlay portfolio’s expected arithmetic return is:

$$r_{\text{overlay}} = r_E + w_{\max}(\rho) r_{\text{excess}}^D$$

where r_E and r_{excess}^D denote the expected funded equity returns and excess diversifier returns, respectively. Because $w_{\max} \geq 0$, a volatility-preserving portable alpha overlay increases absolute expected returns *if and only if* the diversifier carries a positive expected excess return ($r_{\text{excess}}^D > 0$). This result holds in the absence of rebalancing effects. The magnitude of the improvement depends on the diversifier’s excess return and its correlation with equities: the more negative the correlation ρ , the larger the admissible overlay w_{\max} and the greater the expected return contribution.

returns and correlations to equities for our eight diversifiers – together with the corresponding theoretical and empirically realized overlay outperformance – are superimposed on the chart, revealing only minor deviations from the theoretical model¹⁷.

Together, the analytical framework and the empirical evidence point to a clear conclusion: in a portable alpha context, a diversifier’s ability to improve equity returns without increasing risk depends less on its standalone Sharpe ratio and more on the interaction between its long-term excess return and – critically – its structural correlation to equities.

The economic risk premium underlying many diversifier strategies is inherently cyclical and may expand or compress across macroeconomic regimes. Their effectiveness cannot be assumed to be constant over time, as the example of Gold discussed in **Box 3** illustrates all too well. While Gold has delivered strong diversification benefits over the past two decades, its longer-term history includes the decade of the 1990s during which it would have detracted significantly from portfolio performance.

Correlation, by contrast, often exhibits greater structural persistence. This is a strength of Trend-Following, whose negative correlation in equity drawdowns is a structural feature. Importantly, overlay capacity is not constant across market regimes. Diversifiers with negative left-tail conditional correlations, such as Trend-Following, expand scaling capacity precisely when diversification is most valuable, allowing larger exposures to be layered onto a core equity allocation without breaching the portfolio’s risk budget. Conversely, a diversifier whose correlation with equities rises in crises can see its scaling capacity shrink, implying that an allocation sized under normal conditions may suddenly exceed the intended risk budget. For portfolio construction, this distinction is decisive.

Box 3: Gold in the longer-term historical context

While Gold has delivered exceptional diversification benefits over the past two decades, its longer-term history highlights that such outcomes are not guaranteed. During the period from January 1990 to December 1999, Gold futures generated a cumulative return of approximately -53%, acting as a persistent drag on portfolio performance. In that environment, incorporating Gold into a U.S. equity allocation would have reduced overall risk-adjusted returns. This episode underscores that, much like U.S. Treasuries over the past 10 years, Gold can experience extended periods in which it fails to provide meaningful diversification benefits or attractive standalone returns. The strong performance observed over the past 21 years should therefore be viewed in a broader historical context.

1990 – 1999	Equities (funded)	Gold (funded)	60/40 Gold	100 + Gold
Return p.a.	18.2%	-2.4%	10.0%	13.4%
Volatility p.a.	13.4%	11.8%	8.9%	14.5%
Sharpe ratio (rf=0%)	1.36	-0.21	1.13	0.92

Table 5: Summary return and risk characteristics of U.S. equities, Gold futures, a 60/40 Equity-Gold, and a portable alpha portfolio consisting of 100% equities and a Gold overlay allocation to preserve standalone equity volatility within a 1% margin, based on monthly returns from January 1990 through December 1999. For comparability, Gold futures returns have been scaled to a 12% annualized volatility. HYPOTHETICAL RESULTS. PLEASE SEE IMPORTANT DISCLAIMERS ON PAGE 2. Source: Quantica Capital.

Within a risk-preserving overlay framework, strategies with stronger structural diversification – allowing greater scalable allocations – can ultimately provide greater value even if their standalone Sharpe ratios are lower.

Portable alpha therefore reframes the diversification debate. The relevant question is not which strategy outperforms equities in isolation, but which one can be layered on top of equities in meaningful size without increasing expected equity risk, thereby enhancing long-term equity performance.

¹⁷ This supports the simplifying assumption of time-invariant equity correlations. While correlations do vary over time, they have remained broadly stable for most diversifiers over the past two decades – Treasuries in recent years being the notable exception – making long-term correlation averages a reasonable input for the analytical framework.

Conclusion

Warren Buffett famously wagered that hedge funds would fail to outperform a simple S&P 500 index fund over a decade. He won. And likely would have won again over the past 10 years¹⁸. But this comparison misses a crucial point: alternative strategies should not be judged solely on their ability to beat equities on a standalone basis. Their value lies in how they interact with equities inside a portfolio.

We have made the distinction between capital allocation and risk allocation. When diversification is funded by reducing equity exposure, it improves Sharpe ratios but mechanically sacrifices equity upside – especially in strong bull markets. By contrast, a portable alpha overlay framework shifts the constraint from capital to risk. The relevant question is no longer what to replace, but how much diversifying exposure can be layered on top of equities without increasing total portfolio volatility. The amount of notional deployed to the diversifying asset becomes a function of how much additional risk capacity it is able to free up through its correlation structure to equities.

True diversification requires return streams with structurally negative correlation to equities and positive long-term premia – a rare combination. Viewed through a portable alpha lens, Trend-Following has emerged as a more structurally efficient overlay over the past two decades and stands out among the eight liquid alternatives considered.

Despite underperforming the S&P 500 on a standalone basis, its favorable correlation characteristics in the left tail of the equity return distribution lead to scalable overlay capacity, which, in combination with its long-term trend-following risk premium and its derivatives-based implementation, makes it effective in a portable alpha overlay structure to improve both absolute and risk-adjusted portfolio returns.

Strategies with embedded equity beta, such as Equity Long/Short, Equity Market Neutral, or Short Volatility, carry structural residual equity exposure that quickly translates into higher total portfolio risk, thereby rapidly exhausting available risk capacity. Explicit tail hedges (Long Volatility) provide substantially greater overlay capacity but suffer from persistent high negative carry that makes deploying that capacity too costly. Treasuries have lost much of their diversification benefits over the past ten years, driven by higher inflation and a rising-rate environment. Gold has been strong but remains a single-asset exposure with meaningful idiosyncratic drawdown risk¹⁹.

When implemented through capital-efficient structures, certain diversifiers – most notably Trend-Following – can enhance both absolute and risk-adjusted returns while preserving the equity risk profile. In that framework, the question is no longer whether you can beat the S&P 500 – but whether you are using your risk budget efficiently.

¹⁸ Source: [Institutional Investor](#), January 2018.

¹⁹ By contrast, Trend-Following is implemented across a broad cross-asset universe, making its return profile less dependent on any single market and more diversified across asset classes. At the same time, Gold – like Trend-Following – has maintained a persistently near-zero correlation to equities and, given their low and stable correlation with each other, may form a particularly effective diversification pairing within a portable alpha framework.

Appendix 1: Liquid Alternative Strategy Specifications

This appendix outlines the construction methodology for the proxies used to represent the liquid alternative strategies considered as equity diversifier candidates in this note. It clarifies the economic exposures and payoff profiles underlying each strategy.

Equity Hedge Fund Strategies

- Equity Long/Short

The Equity Long/Short strategy benchmark used in this report is derived from the **BarclayHedge Equity Long/Short Index**. This index reflects the average net performance of hedge funds employing a directional equity strategy in which managers take both long and short positions in equities and equity-related instruments. The objective is not to be market neutral. Managers have the ability to shift from value to growth, from small to medium to large capitalization stocks, and from a net long position to a net short position.

- Equity Market Neutral

The Equity Market Neutral benchmark used in this report is derived from the **BarclayHedge Equity Market Neutral Index**. This index compiles the net returns of hedge funds that construct portfolios with approximately equal long and short equity positions designed to minimize overall market exposure (i.e., market beta). Market neutral portfolios are designed to be either beta or currency neutral, or both. Well-designed portfolios typically control for industry, sector, market capitalization, and other exposures. Leverage is often applied to enhance returns.

Both *BarclayHedge* indices represent composite performance measures of actively reporting

hedge funds within their respective strategy categories. They provide a consistent industry standard basis for comparing the diversifiers analyzed in this report against peer strategy performance across time. While index performance offers useful context, it should be noted that these indices reflect aggregated historical returns and are subject to survivorship, reporting, and sampling characteristics inherent to hedge fund benchmarking methodologies.

All benchmark comparisons in this report are based on information provided by *BarclayHedge* (www.barclayhedge.com) and are used with permission.

As our proxies are calibrated to a 12% annualized volatility target and given that equity hedge fund indices typically exhibit realized volatility below this level and report total returns inclusive of a cash component (reflecting collateral invested in Treasury bills or similar instruments), we first estimate and remove the cash contribution. We then scale the excess returns to the target volatility (i.e., 12% p.a.) before reintroducing the cash return.

Jan 2005 – Feb 2026	BarclayHedge Equity Long/Short Index	BarclayHedge Equity Market Neutral Index
Annualized return	3.6%	5.8%
Annualized volatility	2.4%	5.2%
Sharpe ratio (rf=0%)	1.48	1.11
Max. drawdown	-6.3%	-14.2%
Skewness	-0.86	-0.53
Correlation	0.49	

Table 6: Summary performance and risk characteristics of BarclayHedge Equity Long/Short and Equity Market Neutral Indices, based on monthly returns. Jan. 2005 through Feb. 2026. Source: BarclayHedge.

Trend-Following CTAs

The Trend-Following CTA strategy benchmark used in this report is the SG Trend Index.

Carry

- Short VIX Futures (Term-Structure Carry)

This strategy maintains a constant short position in front-month VIX futures, rolling exposure into the next maturity on a predefined schedule. Collateralized with Treasury bills, it seeks to capture the volatility risk premium typically embedded in the upward-sloping VIX futures curve. Systematically shorting the front month tends to generate positive roll yield in stable markets, but volatility spikes during equity sell-offs can lead to large losses. The resulting return profile is characterized by steady carry punctuated by episodic, often severe drawdowns.

- Cross-Asset Carry

This strategy harvests carry premia across asset classes by taking long positions in higher-yielding assets and short positions in lower-yielding ones – for example, high versus low interest-rate currencies, higher versus lower yielding bonds, or equity indices with higher versus lower dividend yields. In commodities, carry is captured through the futures term structure by going long backwardated markets and short markets in contango, thereby harvesting roll yield.

The carry signal is a cross-sectional z-score of risk-adjusted carry within each asset class, measuring each asset's relative attractiveness versus its peers, with higher values indicating more favorable carry.

In stable environments, carry strategies generate steady returns from persistent risk premia, but can unwind sharply during periods of stress, leading to episodic drawdowns. Their return profile thus

reflects consistent carry income punctuated by losses in risk-off regimes.

Unlike long-volatility strategies, which pay for insurance, carry strategies effectively sell insurance, performing well in calm markets but remaining structurally exposed to volatility spikes and severe equity drawdowns.

Long Volatility / Tail-Risk Hedging

This strategy maintains a long position in front-month VIX futures, rolling into the next maturity on a predefined schedule (ten days before contract expiration). Exposure is scaled to a constant notional allocation and collateralized with short-term Treasury bills. Because the VIX futures curve is often in contango – where longer-dated contracts trade above near-term futures – the strategy typically incurs a negative roll yield in stable or rising equity markets. In exchange, it can generate substantial gains when implied volatility spikes during sharp equity drawdowns. The implementation deliberately excludes tactical timing or dynamic positioning to isolate the structural return profile of a continuously maintained long-volatility allocation.

Tail-risk protection can also be implemented through systematic purchases of S&P 500 put options with fixed maturity and strike, rolled regularly to maintain constant exposure. While our analysis focuses on the long VIX futures implementation, the results are broadly comparable to a long put framework, which represents a more convex – but also more costly – form of tail protection.

Appendix 2: Regime-Conditional Performance Analysis of Diversifiers

To evaluate the protection characteristics of each candidate diversifier, we begin by analyzing equity left-tail regime-conditional²⁰ returns over the 21-

year period from January 2005 through February 2026, as summarized in Figure 6. We condition each candidate diversifier’s return and equity correlation on the worst 16% of quarterly equity returns, during which the equity benchmark contributed -7.6% per annum to total returns over the full simulation period.

Treasuries have long been considered the primary hedge against equity risk, largely due to their historical tendency to exhibit negative correlation during periods of market stress. Figure 6 confirms

Figure 6: Equity Regime-Conditional Returns and Correlations of Selected Liquid Diversifiers (2005 – 2026)

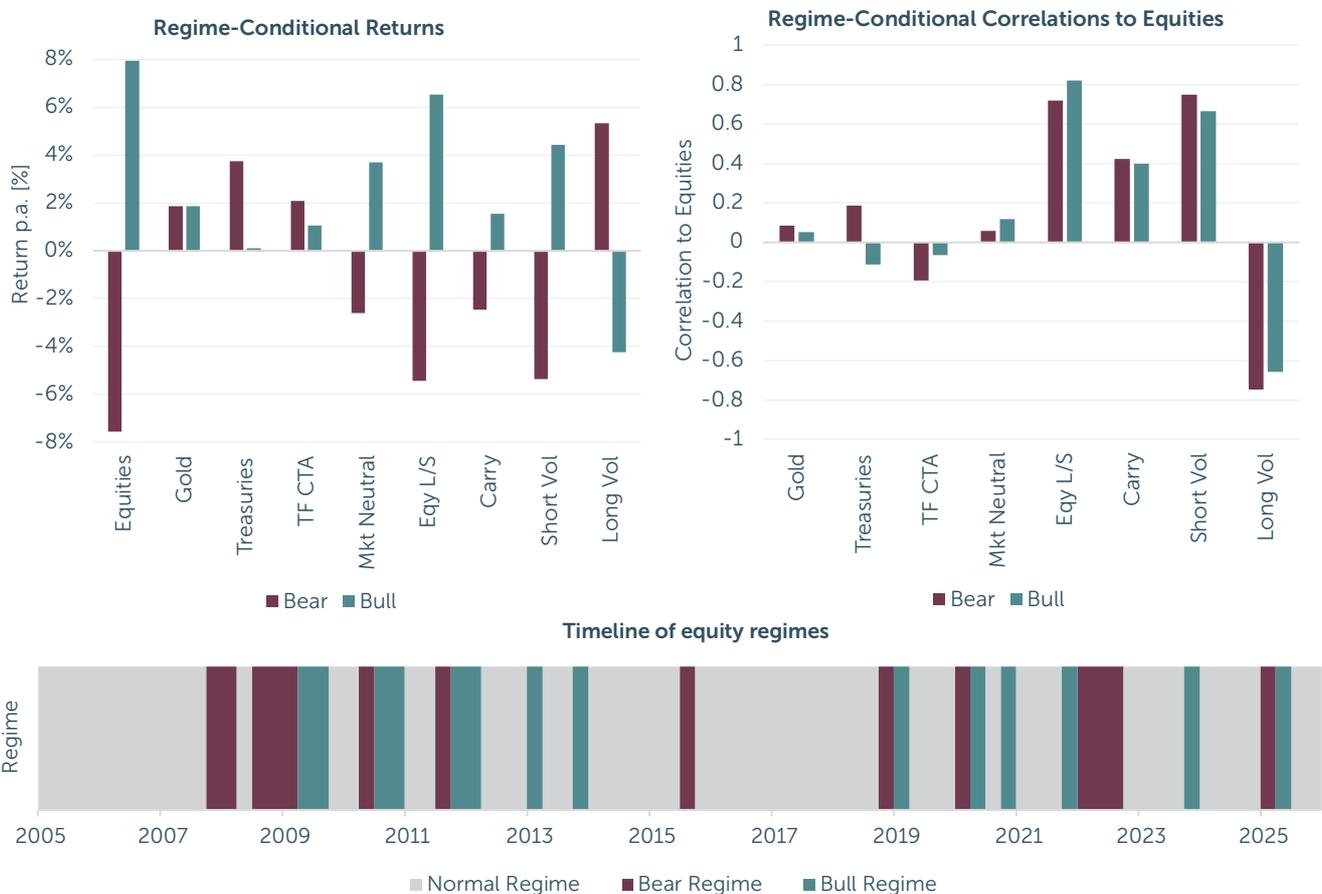


Figure 6: (Top) Equity-regime conditional (log-) return attribution and equity correlations of eight liquid diversifier candidates for the period Jan. 2005 – Feb. 2026. Equity regimes are defined based on calendar-quarter returns of the S&P 500 Total Return Index, with Bear and Bull regimes corresponding to the 16% left and right tails of the return distribution, respectively (14 quarters each). A Bull regime contribution of 8% p.a., for example, indicates that the cumulative log-returns over these 14 quarters contribute 8% per annum to the total log- returns over the full sample. Correlations are calculated on monthly returns. (Bottom) Timeline of left- and right-tail equity market regimes, identified at a quarterly frequency since 2005. For comparability, all eight diversifier returns are funded and normalized to a 12% annualized volatility target. Please refer to Appendix 1 for detailed descriptions of the proxies used for the liquid alternative strategies. Indices are unmanaged, are not available for direct investment and are not subject to management fees and other fees and expenses. Return and correlations are all HYPOTHETICAL. PLEASE SEE IMPORTANT DISCLAIMERS RELATED TO HYPOTHETICAL RESULTS ON PAGE 2. Source: Quantica Capital.

²⁰ Equity regimes are defined based on calendar-quarter returns of the S&P 500 Total Return Index, with Bear and Bull regimes corresponding to the left and right 16% tails of the quarterly return distribution, respectively (14 quarters each over the sample). We believe that using quarterly equity return percentiles to define regimes aligns well with the time horizons most relevant for institutional allocators and strategic asset allocation decisions.

this behavior empirically: over the past 21 years, 10-year U.S. Treasuries contributed average annualized returns of nearly +4% during left-tail equity quarters (after normalizing their returns to a 12% annualized volatility).

Gold has recently regained prominence as a hedge against U.S. dollar debasement risk. Our data also indicate a consistent track record of positive performance during extended equity drawdowns, with average annualized returns of +1.9% in the worst 16% of equity quarters since 2005.

Similarly to Treasuries and Gold, Trend-Following CTAs have historically generated positive average annualized returns of +2.1% during the worst 16% of equity quarters, accompanied by a negative correlation to equities of -0.19 in those periods.

In contrast, equity-oriented alternative strategies have provided materially weaker downside protection: Equity Long/Short strategies generated average losses of approximately -5.4% p.a. during adverse equity quarters, consistent with their positive correlation to equities of +0.72 during those periods. Although Equity Market Neutral strategies exhibit a comparatively lower regime-conditional correlation to equities in left-tail environments (+0.06), they nevertheless produced average losses of approximately -2.6% p.a. during those periods.

Index Definitions

The **S&P 500 Total Return Index** is widely regarded as the best single gauge of large-cap U.S. equities. The index includes 500 leading companies and covers approximately 80% of available market capitalization. The S&P 500 Total Return (TR) assumes dividend reinvestments. The Index is not directly investable. Source: S&P Global.

The **SG Trend Index** is designed to track the 10 largest trend following CTAs (by AUM) which meet a list of criteria (as defined by SG) and be representative of the trend-followers in the managed futures space. The SG Trend Index is equally weighted, and rebalanced and reconstituted annually. The Index is not directly investable. Source: Société Générale.

The **BarclayHedge Equity Long/Short Index** reflects the average net performance of hedge funds employing a directional equity strategy in which managers take both long and short positions in equities and equity-related instruments. The objective is not to be market neutral. Managers have the ability to shift from value to growth, from small to medium to large capitalization stocks, and from a net long position to a net short position. The Index is not directly investable. Source: BarclayHedge.

The **BarclayHedge Equity Market Neutral Index** compiles the net returns of hedge funds that construct portfolios with approximately equal long and short equity positions designed to minimize overall market exposure (i.e., market beta). Market neutral portfolios are designed to be either beta or currency neutral, or both. Well-designed portfolios typically control for industry, sector, market capitalization, and other exposures. Leverage is often applied to enhance returns. The Index is not directly investable. Source: BarclayHedge.

²¹ The persistence of long-term positive returns generated by trend-following strategies, despite this convex payoff structure, is often interpreted as evidence of a structural market inefficiency.

Short Volatility closely resembles Equity Long/Short, with a strongly positive left-tail, regime-conditional correlation of 0.75 and a consistent average loss of -5.4% p.a. during adverse equity quarters. Carry, by contrast, delivered an average return of approximately -2.5% in these regimes – comparable to Equity Market Neutral – offering limited protection in equity drawdowns. Notably, its left-tail correlation to equities was significantly higher than that of Equity Market Neutral (0.42 vs. 0.06), an undesirable feature for a strategy intended to diversify equity tail risk.

At the opposite extreme, Long Volatility exhibits the strongest downside protection with average annualized returns of +5.3% during adverse equity regimes, alongside a strongly negative left-tail correlation of -0.75.

More broadly, among our eight candidate diversifiers, Trend-Following and Gold displayed the most balanced trade-off between downside protection and long-term upside capture, delivering positive returns on average in both left- and right-tail equity regimes²¹. Trend-Following CTAs stand out in particular, having historically generated positive average returns while maintaining a negative correlation to equities in *both* bear and bull market environments.

Since 2003, Quantica Capital's mission has been to design and implement the best possible systematic trend-following investment products in highly liquid, global markets. To the benefit of our investors and all our stakeholders.

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