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Can Derivative-Based Hedging Improve the Risk-Adjusted Returns of Portfolios Holding Alternative Investments?

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ABSTRACT

The inclusion of alternative investments in modern portfolio allocation can significantly increase diversification because investors want returns that are not fully explained by traditional equity and fixed-income holdings. Alternative investments are here defined as financial assets outside stocks, bonds and cash (e.g., hedge funds, private equity, private credit, real estate, commodities and infrastructure). Although these assets improve diversification and have attractive return potential they also come with risks which are often harder to observe or manage than those of traditional securities such as market risk, liquidity risk, credit risk, leverage risk, currency risk and interest rate rise plus non-linear/asymmetric return distributions. Derivatives like futures, options, forwards and swaps allow investors to hedge specific components of this risk without liquidating the underlying positions. This review synthesizes existing literature on derivative-based hedging to test whether it improves risk-adjusted returns of portfolios containing alternative investments. The literature suggests that hedging effectiveness depends on the relationship between the hedging instrument and the exposure being hedged, hedge ratio achieved, investment horizon and market conditions. Hedging costs are incurred, volatility reduction does not translate into improved risk-adjusted return because hedging also requires upside participation so volatility reduction doesn't lead to higher risk adjusted return. From hedge funds, commodities and equity-linked strategies evidence shows that hedging is generally more reliable where underlying risk is systematic and hedging instrument tracks exposure closely but less reliable where risk is idiosyncratic, illiquid or hard to observe which is common in private equity and private credit. In general the literature seems to indicate that derivative-based hedging can enhance risk-adjusted returns of alternative-investment portfolios only if it is applied to identifiable systematic and hedgeable risks, costs are taken into account and so on. Hedging should therefore be viewed as a tool for managing risk exposure and improving efficiency in portfolio management rather than as a guaranteed means of increasing dollar returns.

Keywords: *Alternative Investments, Derivatives, Hedging, Portfolio Management, Risk-Adjusted Returns, Futures, Options, Risk Management, Portfolio Diversification, Sharpe Ratio, Sortino Ratio.*

1. INTRODUCTION

Modern portfolio management was stocks, bonds and cash. Investors now hold alternative investments like private equity, hedge funds, real estate, infrastructure, commodities, private credit and more recently digital assets beyond traditional equity and fixed-income allocations to diversify out of these allocations as well as to access sources of return not explained fully by market risk factors *(Markowitz, 1952)*. This shift is not theoretical; recent industry surveys show that a large majority of institutional investors hold or plan to increase an allocation to digital assets alongside more established alternative-investment categories; this reflects a broader and accelerating move of alternatives into mainstream institutional portfolios *(EY, 2025)*. Diversification depends on how an asset behaves with the rest of the portfolio rather than its risk and return in isolation, so alternative investments are attractive where their return drives rental income, commodity supply and demand, private company operating performance structurally differ from those of listed equities and bonds.

Diversification through alternative investments doesn't remove portfolio risk, it changes its source and character. Some alternative assets have risks that are harder to observe than listed securities such as illiquidity in private equity/private credit, leverage and derivatives heavy hedge fund strategies, currency exposure for internationally held assets. It is this change in nature of risk not its removal that gives rise to active risk management alongside diversification.

Derivative instruments are well known tools for managing this risk. Since the value of a derivative is based on an underlying asset, index, rate or other variable, investors can adjust their exposure to a specific risk without selling the underlying position *(Hull, 2022)*. An investor worried about the systematic-equity component of an alternative portfolio might sell equity-index futures; one exposed to foreign currency would use a currency forward; one worried about sharp market contraction could buy protective puts. The question this review asks is not whether positions like these can be constructed, yes, they can, but whether they improve performance once the portfolio has been properly adjusted for risk.

This distinction matters because a hedge that reduces volatility does not automatically improve outcomes: if the reduction in risk is proportionate to or smaller than the reduction in return then the risk-adjusted return is unchanged or worse. Likewise some risks investors may wish to hedge are simply not hedged with liquid instruments, broad market, interest rate and currency exposures have well developed derivatives markets but idiosyncratic risks like the private-equity operational performance for example do not so must be managed through diversification or due diligence. The investment horizon also exacerbates this problem since a hedge that looks expensive over a short holding period may be justified by an institutional investor managing exposure to infrequent but severe market dislocation over many years. The principal research question addressed by this review is: can derivative-based hedging improve the risk-adjusted returns of portfolios that hold alternative investments? In answering this question, the review also considers:

- How can derivative-related risks be identified and minimised for alternative-investment portfolios?
- Is portfolio volatility a reliable indicator of inferior risk-adjusted returns, or can a hedge reduce volatility without improving them?
- What role do transaction costs and basis risk play in determining hedging outcomes?
- Under what conditions do derivatives offer a superior hedge relative to alternative risk-management approaches?
- Which performance measures are most appropriate for evaluating a hedged, alternative-investment portfolio?

It appraises existing theoretical literature on portfolio theory, derivative pricing and hedging, and risk-adjusted performance measurement, in order to synthesise what is currently known and to identify where the literature remains inconclusive.

2. ALTERNATIVE INVESTMENTS AND HIDDEN RISK

Alternative investments are heterogeneous with distinct return and risk profiles so they cannot be usefully treated as a single asset class *(Markowitz, 1952)*. Hedge funds follow long-short global macro event driven relative value derivative based strategies in order to generate returns uncorrelated with equity markets but their reported returns are determined by leverage liquidity constraints strategy specific risk, volatility can make them look stable even where they have fallen sharply.

Private equity returns are based on operational improvement, leverage and exit but the asset class is illiquid and hard to value on an ongoing basis so risk assessment relative to listed equities is harder. Private credit exposes investors to borrower default and credit-quality deterioration in a market outside public bond issuance credit derivatives can reduce some of this exposure but have counterparty and liquidity risk of their own. Real estate returns combine rental income and capital appreciation so interest rates and local economic conditions matter while commodity prices are supply/demand driven by weather and geopolitical factors while infrastructure has relatively stable long term cash flows subject to regulatory and inflation risk.

Volatility for private-market assets can understate true economic risk since these assets are not marked to market every day and valuations are smoothed (*Getmansky et al., 2004)*. An investor who uses reported standard deviation to size a hedge for PE or private credit may underhedge the position relative to its true risk.

Several risk categories recur across alternative asset classes and determine how an exposure can be hedged. Market risk is present even in supposedly uncorrelated strategies since private equity, in particular, can have meaningful indirect market beta so derivatives are the main tool available to manage this exposure without disposing of the underlying holding. Liquidity risk is most acute in private equity, private credit and direct real estate where the underlying position cannot be sold quickly at a price discount. A liquid hedge does not solve this problem because the hedge and underlying exposure may need to be held for different lengths of time. Credit risk is central to private-debt portfolios but credit derivatives exist to offset it but they also carry counterparty and liquidity risk of their own price using option pricing logic common to derivatives generally (*Black & Scholes 1973; Merton)*. Interest rate risk affects valuation of leveraged private-equity transactions as well as real estate financing and is more easily hedgeable, usually interest rate futures or swaps. Currency risk arises wherever an investor holds assets denominated in foreign currency and can be addressed through currency forwards. Leverage risk magnifies gains and losses in hedge fund and private market strategies as well as all of the risks above and interacts with all of them not standing apart from them.

Several alternative strategies have non-linear payoffs (i.e. gains and losses are not proportional to the underlying market move) so standard deviation as a risk measure is no longer useful and an explicit role for options emerges because payoff structures can be matched to a non-linear exposure. Risks related to broad market, interest rate and currency exposures are easy to hedge because there are liquid derivatives markets for them whereas illiquid or operational risks specific to PE/private credit must be managed through diversification and due diligence rather than derivatives. Table 1 summarizes the contributions that lead to this distinction and discussion below.

Table -1: [table title required]

Author(s)	Year	Study Area	Major Contribution	Limitation
Markowitz	1952	Portfolio selection	Established the importance of diversification and covariance in portfolio construction	Relies heavily on mean-variance assumptions
Sharpe	1966	Performance measurement	Developed the Sharpe ratio for risk-adjusted performance	Treats upside and downside volatility similarly
Black & Scholes	1973	Option pricing	Developed a foundational framework for option valuation	Based on simplifying assumptions
Merton	1973	Option pricing	Extended the theoretical foundations of derivative pricing	Primarily theoretical
Ederington	1979	Futures hedging	Demonstrated the usefulness of minimum-variance hedging	Focused mainly on traditional futures markets
Figlewski	1984	Futures hedging	Examined empirical futures-hedge effectiveness and basis risk	Results depend on market and time period
Sortino & Price	1994	Downside risk	Developed downside-focused performance measurement	Requires a defined target return
Fung & Hsieh	1997, 2001	Hedge funds	Examined dynamic trading strategies and hedge fund risk characteristics	Strategy-specific findings
Getmansky, Lo & Makarov	2004	Hedge funds	Examined serial correlation and illiquidity-driven return smoothing	Focused on hedge fund return data
Gorton & Rouwenhorst	2006	Commodities	Documented equity-like returns and low correlation for commodity futures	Findings period-dependent
Erb & Harvey	2006	Commodities	Showed commodity risk premia vary with strategic vs tactical positioning	Sensitive to sample period
Shivaprasad et al.	2022	Options hedging	Found options-hedging effectiveness varies by strategy and market regime	Single-market (Indian derivatives) sample
Lorimer, van Schalkwyk & Szczygielski	2024	Alternative risk measures	Compared portfolio optimisation using CVaR and other downside measures against mean-variance	Findings sensitive to measure and estimation window
Schwalbach & Auret	2025	Tail-risk hedging	Found trend-following/tail-risk overlays improve risk-adjusted returns in stressed markets	Benefit concentrated in crisis periods; costly in calm markets

Note. Table adapted and extended by the author from the studies cited to summarise the literature underpinning this review.

3. DERIVATIVE INSTRUMENTS AND HEDGING

Four types of instrument dominate the hedging literature for alternative-investment portfolios. A futures contract is a standardized exchange-traded obligation to transact in an underlying asset at some future date at a price agreed today an option gives its holder the right but not the obligation to buy or sell an asset at a specified price, an asymmetry that is relevant to the non-linear payoffs common among alternative investments. A forward contract is customized over-the-counter equivalent of a futures contract but trades less liquid than an exchange-traded future and carries counterparty risk; an interest-rate swap exchanges a floating stream of interest payments for a fixed one or vice versa which used to manage financing-cost exposure of leveraged alternative-investment positions *(Hull, 2022).*

Beyond instrument choice, effectiveness is also determined by the hedge ratio. The proportion of the underlying exposure covered by the hedging position; formally the value of the hedging position divided by the value of the underlying exposure. So if an investor has 10 crore of a position and wants to hedge 50% of its value then he takes a hedging position covering about 5 crore. In practice however it reflects beta, correlation and sensitivity as well as notional match between hedge and underlying position. An incorrectly sized hedge ratio incurs asymmetric cost, under-hedging leaves part of the exposure uncovered while over-hedging sacrifices upside on the covered portion should market move so the ratio itself should typically be treated as dynamic rather than fixed.

The literature is more skeptical about the reliability of any hedge ratio than textbook treatments imply. Stock index futures hedges are often imperfect in practice because basis risk exist. For alternative investments it is magnified since a liquid asset-specific derivative rarely exists so investors substitute a proxy instrument and accept the mismatch. Studies on options-based hedging strategies in the Indian derivatives market also find realized hedging effectiveness heavily depends on strike selection and volatility prevailing when the hedge is put on but is not uniform across strategies or markets. These studies show that instrument choice and hedge-ratio estimation are necessary but not sufficient conditions for an effective hedge The relationship between the derivative and the specific exposure being hedged as well as conditions prevailing when the hedge is put on matter at least as much as mechanics of the instrument itself *(Shivaprasad et al. 2022).*

4. MEASURING THE OUTCOME: RISK-ADJUSTED PERFORMANCE

Assessing whether a hedge has improved outcomes requires performance measures that account for risk, not just return. The Sharpe ratio, portfolio excess return divided by its standard deviation, remains the most widely used risk-adjusted measure *(Sharpe, 1966),*

but treats upside and downside volatility as equally undesirable, a weak assumption for the skewed, non-normal distributions common among alternative investments. The Sortino ratio corrects for this by measuring return relative to downside deviation alone *(Sortino & Price, 1994),* while maximum drawdown captures the largest peak-to-trough decline an investor would have experienced, a measure of particular relevance to institutional investors managing redemption or liability risk. Value-at-Risk estimates the loss not expected to be exceeded at a given confidence level over a set horizon, and Expected Shortfall extends this by estimating the average loss beyond that threshold, which makes it more informative for the return distributions typical of alternative investments *(Jorion, 2007; McNeil et al., 2005)*. A hedge frequently reduces volatility, downside risk and return simultaneously; the choice of measure can determine whether the same hedge appears to improve, or fail to improve, risk-adjusted returns.

5. EVIDENCE ACROSS ASSET CLASSES

Equity-linked exposure is the most studied hedging application for alternative-investment portfolios. Commodity exposure follows the same pattern but with an important qualification about the direction of effect: commodity futures have produced equity-like returns and are low correlated to equities and bonds so they can be used both as diversifier and hedge against commodity-price risk in a broader alternative portfolio.

Currency and interest-rate exposures are, by contrast, the asset classes for which the literature is most consistent in finding a hedging benefit. Currency forwards and interest-rate swaps or futures can be matched closely to notional and duration of the exposure being hedged so basis risk is smaller than for equity or commodity hedges and the improvement in risk-adjusted returns is correspondingly more reliable assuming investor accepts that gains from favourable currency or rate movements are also given up. This pattern holds generally across asset classes too. Hedging effectiveness is highest where derivative tracks well defined systematic exposure and lowest where underlying risk is idiosyncratic or available derivative only proxy for true exposure *(Gorton and Rouwenhorst 2006).*

6. OPTIONS, DYNAMIC HEDGING AND PORTFOLIO PROTECTION

Protective puts and covered calls are the two option-based strategies most often applied to alternative-investment portfolios. A long position in the portfolio combined with a long put option, caps downside loss at the cost of the premium while preserving upside participation; its effectiveness depends on the strike price and expiry chosen, since a far out-of-the-money put is cheap but provides limited protection, while a near-the-money put is more expensive but more protective. The sale of a call option against an existing holding, generates income in flat or moderately bullish markets but caps the upside beyond the strike price, and is better understood as an income and partial risk-management strategy than as downside protection. Option-based hedging strategies empirically and find that no single strategy dominates across market conditions.

Whether a hedge should be static or dynamically adjusted is a related and unresolved question in the literature. A static hedge holds the hedge ratio or number of contracts roughly constant, while a dynamic hedge adjusts the ratio in response to changes in beta, volatility and correlation between the hedge and the underlying exposure (Table 2). Dynamic hedging is more responsive to changing risk conditions, but here it is clear that this responsiveness comes at a cost, more frequent rebalancing raises transaction costs and introduces timing risk, since a hedge increased too early can forgo gains, while one increased too late may fail to provide adequate protection. Neither approach dominates the other; the literature instead suggests static hedging is preferable where the underlying exposure is stable, and dynamic hedging where it changes materially over time.

Table -2: Static Versus Dynamic Hedging

Feature	Static Hedging	Dynamic Hedging
Hedge ratio	Relatively constant	Frequently adjusted
Complexity	Lower	Higher
Transaction costs	Lower	Higher
Responsiveness	Lower	Higher
Timing risk	Lower	Higher
Monitoring	Less frequent	More frequent
Adaptability	Limited	High

Note. Adapted from Hull (2022) and the dynamic-hedging literature reviewed above.

Tail-risk hedging, typically implemented through protective puts or volatility derivatives, addresses the risk of severe, infrequent losses associated with financial crises, market crashes or geopolitical shocks. Trend-following and tail-risk hedging overlays on global equity portfolios, find that such overlays can materially improve risk-adjusted returns during periods of market stress, but that the improvement is highly sensitive to the length of the evaluation period measured only over calm markets, the same overlay appears to be a persistent drag on returns because the investor pays for protection that is not needed. *Schwalbach and Auret (2025)*. This is consistent with the broader distinction that draws between static, strategic hedging, appropriate for an investor seeking consistent, long-run protection against a currency or tail-risk exposure, and tactical hedging, adjusted in response to short-term market views, which the literature associates with a higher risk of poor timing outweighing any protective benefit.

7. COSTS AND FAILURE MODES

A set of factors that determine whether a hedge that reduces risk also improves risk-adjusted returns, several of which recur across the asset-class evidence discussed above and are drawn together here rather than repeated. Basis risk, arising because the available derivative does not exactly match the position being hedged, is especially relevant to alternative investments precisely because asset-specific derivatives rarely exist; an investor hedging a private-equity allocation with an equity-index future, for example, is exposed to the risk that the two move by different amounts even though they are correlated *(Figlewski, 1984)*. Correlation risk compounds this problem, since the relationships a hedge relies on can weaken or shift during periods of market stress, which is exactly when

protection is most needed. Hedging strategies should be stress-tested against scenarios such as equity-market crashes, rapid interest-rate increases, currency depreciation, sharp commodity-price moves, recessions and liquidity crises, rather than evaluated only under ordinary market conditions *(McNeil et al. 2005)*

Hedging also incurs direct and indirect costs, option premiums, brokerage fees, bid-ask spreads, exchange and clearing fees, margin requirements, financing costs, futures-rolling costs and rebalancing costs, which nets against any hedging gain to arrive at the net hedged return:

$$\textit{Net Hedged Return} = \textit{Portfolio Return} + \textit{Hedge Gain/Loss} - \textit{Hedging Costs}$$

Because option premiums in particular accumulate over the life of a hedge, a position that appears beneficial before costs can have a materially worse risk-adjusted profile once they are accounted for, and this effect grows with the length of time *(Jorion, 2007).* Model risk, the risk that an incorrect assumption about volatility, correlation or the pricing relationship between hedge and exposure leads to a mis-sized hedge ratio, and counterparty risk, most relevant to over-the-counter forwards and swaps, further reduce the reliability of a hedge relative to its effectiveness.

Table -3: Illustrative Comparison of Typical Hedged and Unhedged Portfolio Statistics Reported in the Literature

Performance Measure	Unhedged Portfolio	Hedged Portfolio
Annual return	14.0%	12.0%
Volatility	25.0%	12.0%
Maximum drawdown	30.0%	15.0%
Sharpe ratio	0.48	0.67
Sortino ratio	0.65	1.04

Note. Figures are illustrative, constructed to show the pattern of results typically reported in the hedging literature (e.g., Bodie et al., 2021), not original data generated by this review. In this illustration the hedged portfolio underperforms the unhedged portfolio by roughly two percentage points of annual return but achieves materially better risk-adjusted returns, which is precisely the trade-off this review identifies as central to answering the research question.

Table 3 illustrates the pattern of results typically reported across comparable studies of hedged and unhedged alternative-investment portfolios: hedged portfolios tend to show materially lower volatility and maximum drawdown than their unhedged counterparts, together with a modestly lower annual return, but the net effect on ratios depends on whether the reduction in volatility outweighs the reduction in return once hedging costs are included *(Sharpe, 1966; Sortino & Price, 1994).*

Over-hedging a portfolio's systematic risk carries a further, more structural cost: to the extent that expected returns include compensation for bearing that risk, removing it also removes part of the return an investor would otherwise earn for holding the asset. Tactical hedging strategies, in which an investor repeatedly adjusts protection in response to a market view, are particularly exposed to this problem, since the literature associates poor market timing with additional cost that a purely strategic, stable hedge would not incur *(Schwalbach & Auret, 2025).*

8. CONCLUSION

This review set out to answer whether derivative-based hedging can improve the risk-adjusted returns of portfolios holding alternative investments. It supports a qualified answer: hedging can improve risk-adjusted returns, but only where it is directed at an identifiable, systematic risk that a liquid derivative can track closely, and where its costs are properly weighed against the risk reduction achieved. The evidence is most consistent for currency and interest-rate exposures, reasonably consistent for equity and commodity exposures once basis risk and regime-dependence are accounted for and least consistent for the characteristic of private equity, private credit and certain hedge fund strategies, where reported volatility is often smoothed and a genuinely matched derivative rarely exists.

A hedge's contribution should be judged by its effect on downside risk and risk-adjusted performance measures, the Sortino ratio, maximum drawdown, Value-at-Risk and Expected Shortfall in particular, rather than by its effect on absolute return alone, since a well-constructed hedge frequently reduces both volatility and return simultaneously. Whether the resulting trade-off is favourable depends on cost structure, the horizon over which the hedge is evaluated and the market regime prevailing at the time, which is why the literature does not support a categorical claim that derivative-based hedging is universally beneficial for alternative-investment portfolios, it supports a more limited claim that hedging is beneficial when applied selectively, to identifiable risk, and assessed over a sufficiently long horizon to capture its costs as well as its benefits.

Two limitations in the existing literature stand out. First, most work on hedging effectiveness has been conducted on traditional equity and fixed-income exposures, and comparatively little research directly connects derivative hedging to the valuation Second, the literature on risk-adjusted performance measurement itself is still adapting to these characteristics, the Sharpe ratio remains widely used despite treating upside and downside volatility, while downside-focused alternatives are better suited to the skewed, non-normal distributions typical of alternative investments but are not yet applied consistently *(Lorimer et al., 2024).* Future primary research adopting a comparative framework, constructing matched hedged and unhedged alternative-investment portfolios and evaluating them across market regimes using both traditional and downside risk measures, would be well placed to test the conditional relationships.

The implication is that derivatives are best treated as part of an integrated portfolio risk-management process, beginning with the identification of material and hedgeable risk exposures, rather than as stand-alone instruments layered onto a portfolio after the fact. Institutional investors with capital-preservation objectives are likely to find the greatest value in this approach, individual investors

should approach derivative-based hedging cautiously and only with a clear understanding of margin requirements, pricing and the potential for loss.

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