

Harvesting volatility risk premia across assets

Derivatives Strategy

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- Often, the market-implied volatility of a financial asset exceeds the subsequent realized volatility. This risk premium in volatility can be collected to generate income.
- In recent years, the positive correlation between equities and bonds undermined the robustness of a balanced asset allocation. We believe that volatility risk premia are a valid alternative asset class that can improve the risk-return profile of a portfolio thanks to the low correlation to traditional risk premia such as equity, duration, and credit.
- The CIO Cross-Asset Short-Volatility Portfolio is designed to generate consistent returns while minimizing drawdowns through: 1) diversifying volatility exposure across multiple assets, 2) embedding defensive mechanisms in the design of the volatility-carry strategies, and 3) actively managing the exposures.



Source: UBS

With this report we formally close the theme "Harvesting the equity Volatility Risk Premium," launched in April 2022, and start a new theme focused on harvesting volatility risk premia on multiple assets. The authors would like to acknowledge the assistance of Michael Papadogeorgos in the preparation of this report.

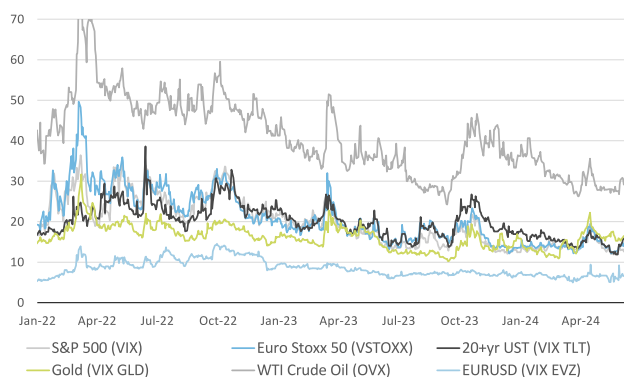
Our view

In recent years, the correlation between equities and bonds has often turned positive, impairing the diversification benefits of combining the two asset classes in a balanced portfolio. The quest for alternative and uncorrelated return sources continues. To reinforce portfolio diversification, investors would need to broaden their scope beyond traditional risk premia such as equity, duration, and credit. We believe volatility risk premia offer an attractive risk-return profile that can complement or even replace standard income sources and help increase portfolio robustness.

Since the COVID-induced market-crisis in March 2020, it took more than three years for the US equity volatility index VIX to return to a low volatility regime. The pandemic followed by the inflation surge in 2022 kept financial market volatility elevated, likely dissuading many investors from selling to generate carry. Over the past 12 months, the resilience of the global economy against high interest rates and the gradual shift of major central banks from rate hikes to rate cuts have supported risk assets. Consequently, cross-asset volatility progressively normalized from late 2023 onwards. Except for interest rates, current volatility levels are relatively low compared to historical standards, making the choice of which asset to sell volatility on and how to sell it, i.e., strategy construction, crucial.

Figure 1 - Cross-asset volatility has normalized...

Levels of volatility indexes across selected assets, since January 2022



Source: Bloomberg, UBS, as of June 2024

Although volatility has declined, the volatility risk premium—or the difference between implied and realized volatility—remains positive in several assets (see Fig. 2). In our view, volatility (risk) premia are an attractive alternative return source. Not only do they generate stable income longer term, but can also help improve diversification in a portfolio. Their low correlation to traditional asset classes are particularly important when correlation between bonds and equities turns positive.

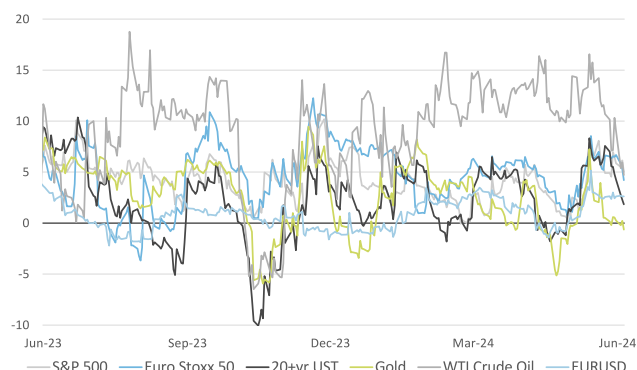
Our analysis shows that harvesting volatility premia generated positive returns in recent years across most major asset classes. However, investors should be aware of the risk of selling volatility. Events like the US banking crisis in March 2023 demonstrated that unexpected risk-off periods can lift market volatility. Short-volatility, or simply volatility carry strategies, are particularly sensitive to sudden spikes in volatility, especially when it increases from very low levels. To mitigate the risks of left-tail or “black swan” events in markets, a robust volatility carry strategy should, in our view, rely on three pillars:

1. Diversification: Spread the systematic monetization of the volatility risk premium across several assets, ideally with different risk-return profiles.
2. Defensiveness: Deploy techniques to limit drawdowns by adjusting exposure to volatility according to moves in the underlying asset as well as prevailing volatility levels.
3. Active management: Monitor volatility levels and adjust accordingly exposures to single volatility premia. Keep track of the latest advances in derivative markets (e.g., new instruments) to improve efficiency and robustness.

We believe this approach can help investors navigate volatility markets and, in our view, enhance the risk-return profile of a short-volatility strategy compared to a static single-asset solution.

Figure 2 - ...but volatility risk premia remain positive

Volatility risk premia of selected assets computed as implied volatility minus subsequent one-month realized volatility



Source: Bloomberg, UBS, as of May 2024

Risk and return characteristics of harvesting volatility risk premia

In our publication [“Selling options in a portfolio context,”](#) we explained the nature of the volatility risk premium (VRP) in equities and when it is most attractive to harvest it. While most financial assets show a positive average VRP, this premium is not constant and varies according to imbalances in supply and demand of options. In general, high levels of VRP indicate higher risk aversion in markets and typically happen after a volatility spike when implied volatility remains elevated

VRP is not constant but, on average, positive

In the appendix, we show the one-month VRP of selected assets over the past 12 years. As can be seen, long-term averages are positive, but large swings, in particular to the downside, have occasionally occurred. For most assets, the premium quickly turns negative when realized volatility surges but subsequently reverts staying elevated for a prolonged period. This can be explained by implied volatility staying more firm while realized volatility slowly normalizes. A positive VRP is therefore more pronounced after a volatility spike, regardless of the underlying asset.

Left-tailed distribution

The distribution of the VRP is not normal. Although for most assets the distribution has a positive average value, it also shows a pronounced left tail, i.e., infrequent but large

negative values. The last two columns of Table 1 show that the frequency of very negative VRP values in most assets was larger compared to a normal distribution (data since 2011).

This negative skewness in the VRP distributions is particularly important in the selection of the strategy. In our publication [“Investment strategies to harvest the volatility risk premium,”](#) we list the common solutions that investors use to get exposure to volatility premia. While the VRP is frequently measured as the difference between implied and realized volatility, most strategies provide exposure to the difference between implied and realized variance. Being the variance the square of the volatility, extreme negative VRP values (left-tail events) result in larger losses when measured on variance compared to volatility, posing an even greater threat for investors.

Table 1 - Key parameters of VRP distributions

Based on daily data since April 2011

	Average	Std. dev. (σ)	Skewness	Share of positive	Share of < $3\sigma^1$	Share of < $4\sigma^1$
S&P 500	4.1%	7.2%	-4.2	86.5%	1.3%	0.8%
Euro Stoxx 50	4.1%	6.7%	-2.1	81.0%	1.3%	0.6%
Nikkei 225	4.3%	6.3%	-0.9	82.1%	1.5%	0.6%
S&P/ASX 200	2.6%	5.6%	-4.8	80.5%	0.8%	0.7%
20+yr UST	1.9%	4.4%	-3.9	77.8%	1.1%	0.9%
Gold	3.2%	4.6%	-1.6	84.5%	1.5%	1.0%
WTI Crude Oil	7.3%	14.1%	0.6	82.7%	0.7%	0.6%
EURUSD	5.5%	12.6%	-5.9	83.4%	1.1%	0.7%

Normal dist.

Source: Bloomberg, UBS, as of June 2024

¹ Share of VRP levels 3- and 4-standard-deviation below the average.

Different correlation to asset returns

Replacing part of the allocation to traditional asset classes with a VRP strategy can improve the risk-return profile of a portfolio. In our report [“New theme: Harvesting the equity volatility risk premium,”](#) we illustrate the case of adding a systematic S&P 500 short variance swap strategy to a 60/40 equity bond portfolio and demonstrate the benefits to performance.

In a portfolio context, a key parameter becomes the correlation between the VRP and the returns of the underlying asset. In Figure 3, we decomposed the VRP according to past monthly returns of the underlying asset and computed its average in each return decile. Two considerations can be drawn:

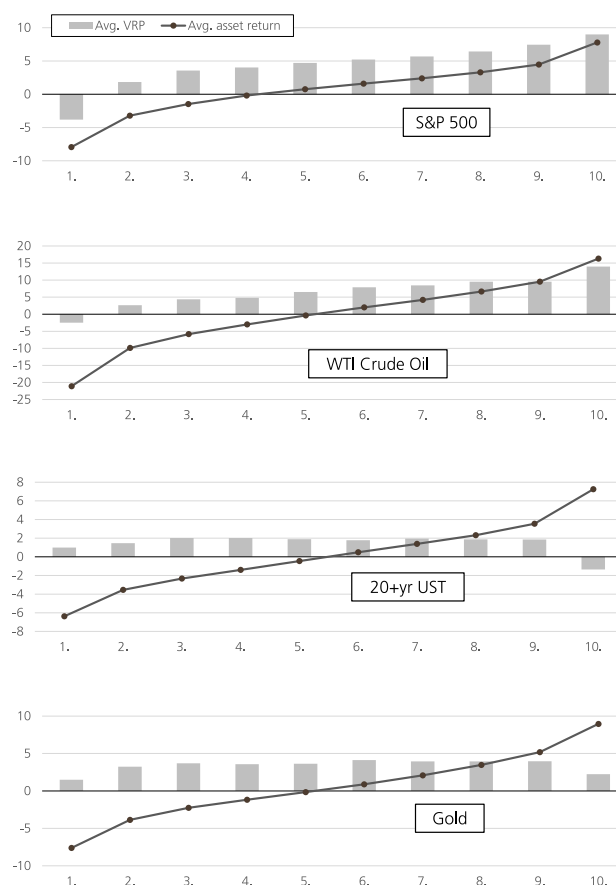
1. As expected, the VRP tends to be positive when asset price's movements are limited (low realized volatility). This confirms that a short-volatility strategy can generate

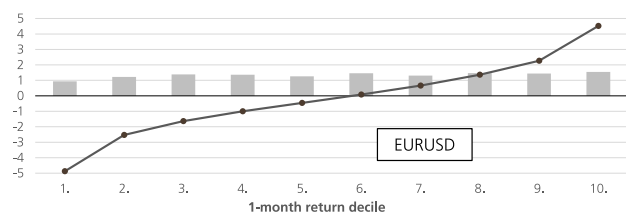
income in sideways markets, also when asset returns are moderately negative.

2. The behavior of the VRP in the lowest and highest return deciles is not the same across assets. While for risk assets (e.g., equities, oil) VRP levels are positively correlated with price returns, defensive assets such as high-quality bonds and gold show a more balanced VRP distribution with a tendency of lower VRP levels in extreme returns. The difference can be explained by the correlation between price returns and volatility, which tends to be negative for risk assets and more nuanced for defensive assets. More insights into the difference between gold and equity volatility can be found in our report [“Gold: Time to consider your options.”](#)

Figure 3 - Correlation between volatility premia and asset returns

Average one-month volatility risk premium according to the return decile in the specific asset, in %





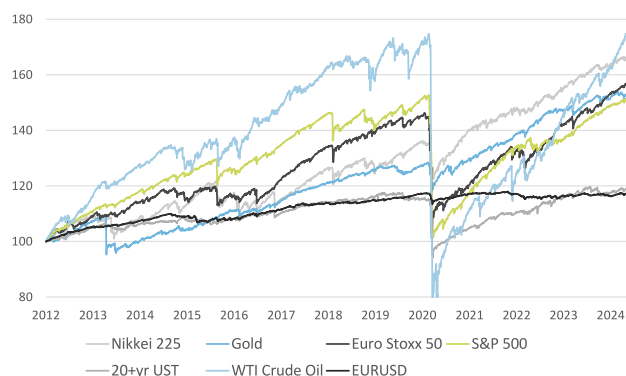
Source: Bloomberg, UBS, as of June 2024

Note: VRP measured using the following volatility indexes: VIX (S&P 500) since 1990, TLT VIX (20y+ US Treasuries) since 2004, Cboe Gold ETF Volatility Index (Gold) since 2008, Cboe Crude Oil ETF Volatility Index (WTI Crude Oil) since 2007, Cboe EuroCurrency Volatility Index (EURUSD) since 2007.

In Figure 4, we simulated short-volatility strategies that harvest volatility risk premia by systematically selling 1-month variance swaps on the respective asset (20 bps notional sold monthly). We used volatility indexes such as the VIX or VSTOXX to derive 1-month variance swap strikes. For illustrative purposes, we assumed these indexes were tradable, although in practice liquidity in option markets can be a limitation. As expected, average yearly returns in all strategies are positive with low realized volatility outside major drawdowns. Except for March 2020, corrections in the strategies show low correlation, demonstrating the benefit of diversification. Nevertheless, the synchronized sell-off in 2020 suggests that diversification alone is not enough. Including additional mechanisms to limit drawdown sensitivity is therefore crucial to improve return expectations.

Figure 4 - Shorting volatility generated positive returns

Cumulative excess return of strategies that sell 1-month variance swaps on selected asset classes (daily sale of 20bps vega, divided by 21), time series rebased to 100 in January 2012



Source: Bloomberg, UBS, as of June 2024

Note: The results do include an estimate of prevailing trading costs, but omit any management fee that a product replicating the strategy may have. Please see the back-test disclaimer at the end of this document.

How to reduce drawdown risks when selling volatility

Selling volatility can generate steady positive returns longer term, but big drawdowns can happen occasionally. Timing a volatility shock is notoriously difficult and, as we explained, often the return outlook improves after such events. We therefore favor a systematic approach to sell volatility based on three pillars: 1) diversifying across multiple assets, 2) embedding defensive mechanisms in the design of the strategies, and 3) actively managing the volatility exposures. Compared to a single-asset static solution, we believe the combination of these components can improve the outcome of harvesting volatility premia by lowering sensitivity to downside risks without impairing carry.

1. Diversify exposure to volatility premia

We previously illustrated the presence of a positive volatility premium with skewed distribution in several financial assets. Furthermore, assets with different risk-return characteristics show different VRP dynamics. Harvesting volatility premia across multiple assets can therefore reduce risks while keeping positive income generation by the virtue of diversification. Similar to traditional portfolio construction approaches, the allocation of investments to a variety of assets, regions, markets or asset classes can effectively reduce risks. Ideally, the wider the list of assets with a positive VRP and distinct risk-return profiles, the better the outcome in terms of risk-adjusted return and drawdown mitigation of a volatility carry portfolio.

A few challenges remain when using diversification in selling volatility. First, investors can only sell volatility of assets or securities that have a liquid option market. The available universe is therefore smaller compared to traditional investment solutions. Second, finding assets that react differently to markets events is challenging, as surges in volatility often propagate across markets impairing the effect of diversification (see COVID crisis in March 2020). Nevertheless, the universe of instruments to trade volatility is rapidly expanding and already covers sufficient assets to allow for an efficient use of diversification when selling volatility.

2. Defensive design

When implementing a short-volatility strategy, specific design choices can be applied to reduce drawdown sensitivity. We differentiate techniques, that take advantage of market dynamics to minimize risk without directly impacting income generation, from the selection of

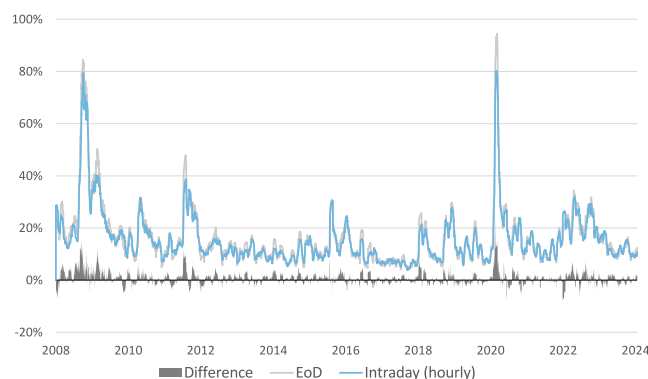
parameters that alter the balance between carry and drawdown.

In [“New theme: Harvesting the equity volatility risk premium,”](#) we discussed the use of shorter tenors and option replication to variance swap strategies as two effective methodologies to reduce drawdowns and times to recovery, but also to increase carry. More recently, the introduction of new option expiries on major equity indexes allowed the implementation of short-volatility strategies that target the rich one-to-zero-day volatility premium (see [“10+1 Q&As on ODTE options and the VIX1D”](#)).

Increasing the frequency of delta-hedging to multiples time during the day is a further technique to optimize income versus risks. In theory, the delta should be continuously hedged, but in practice discrete intervals when adjusting the delta are used. The conventional sampling frequency is daily, typically based on closing prices (end-of-day), but increasing the frequency of delta-hedging (e.g., every hour) can improve the outcome. Trading volumes are not constant during the day and their impact on the price of a security can vary significantly in a trading session (e.g., higher end-of-day flows due to rebalancing). As evidence, the realized volatility of the S&P 500 has been, on average, marginally higher if computed using closing prices compared to hourly prices (see Fig. 5).

Figure 5 - End-of-day versus intraday volatility

One-month realized volatility of the S&P 500 computed using daily-closing prices (EoD) and hourly prices (Intraday)



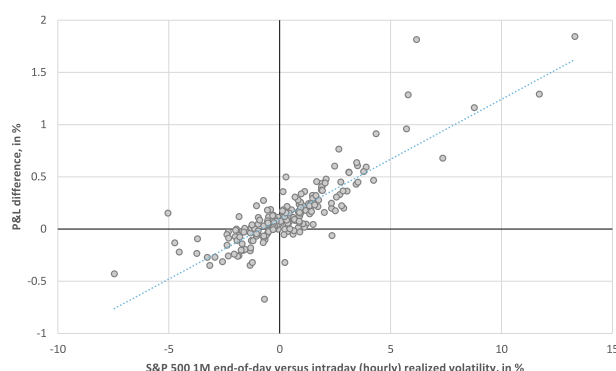
Source: UBS, as of June 2024

The difference has been particularly elevated during drawdown periods, when intraday price movements of the index were more trending (i.e., positive correlation between hourly returns). Since the performance of a short delta-hedged option position is proportional to the difference between implied and realized volatility, having a lower measure of realized volatility is ultimately beneficial. Moreover, Figure 6 shows that the benefits of delta-hedging

more frequently are proportional to the difference between the realized volatility measures (i.e., end-of-day versus hourly sampling frequency).

Figure 6 - Intraday delta-hedging can improve performance

P&L difference of 1-month S&P 500 at-the-money short call positions with end-of-day and hourly delta-hedging compared to the difference in realized volatility (end-of-day versus intraday), data since 2008



Source: Bloomberg, UBS, as of June 2024

Other solutions can be applied to reduce risks in a short-volatility strategy, but given their impact to income we consider them more a design choice or parameter selection than a pure optimization. Forgoing some income to buy downside protection, in form of deep out-of-the-money puts, when selling delta-hedged strangles on equities, can effectively limit downside risks. Another methodology is to combine a short and a long variance swap position with the latter normally targeting a longer tenor. By increasing the (vega) notional from the short to the long position, the risk-return profile of the combined strategy can be shifted from carry to more defensive or even protection.

Although many of these techniques lead to a higher volume and frequency of trades, in our view this added complexity should not be understood as end in itself but a mean to achieve specific goals: namely increasing resilience against volatility events in markets and achieving a smoother risk-adjusted return.

3. Active management

The third pillar involves the active management that should serve as additional optimization layer to direct VRP harvesting toward the most attractive assets. Timing market sell-offs is challenging, with volatility risk premia often increasing after volatility spikes when investor risk aversion is high. While we consider diversification and defensive features the primary defenses against volatility shocks, adjusting exposure through active management can help

monetize more efficiently elevated volatility premia in the aftermath.

The VRP is influenced by shifts in supply and demand within option markets. High VRP levels often draw in volatility sellers. The emergence of new derivative instruments can exert further pressure and eventually compress specific segment of the volatility surface. Consequently, volatility premia may linger below long-term averages for extended periods, diminishing the risk-reward of selling volatility. Continuously monitoring the volatility and the product landscape enables adjusting the allocation toward more attractive premia when necessary. Finally, it also ensures that the strategy remains aligned with the latest innovations and developments in financial engineering.

Our solution: The CIO Cross-Asset Short-Volatility Portfolio

The popularity of capital-at-risk products such as reverse convertibles and the recent trend in option-selling exchange-traded funds highlight investors' appetite for yield-enhancing solutions that sell volatility. However, some skepticism remain with critics primarily pointing to the losses incurred by volatility carry products during the February 2018 market shock and the COVID crisis in March 2020. These events had a profound impact on volatility markets undermining the confidence of many investors in short-volatility strategies.

The CIO Cross-Asset Short-Volatility portfolio aims to offer the optimal platform for harvesting volatility premia by applying the three components introduced in the previous section.

Portfolio design

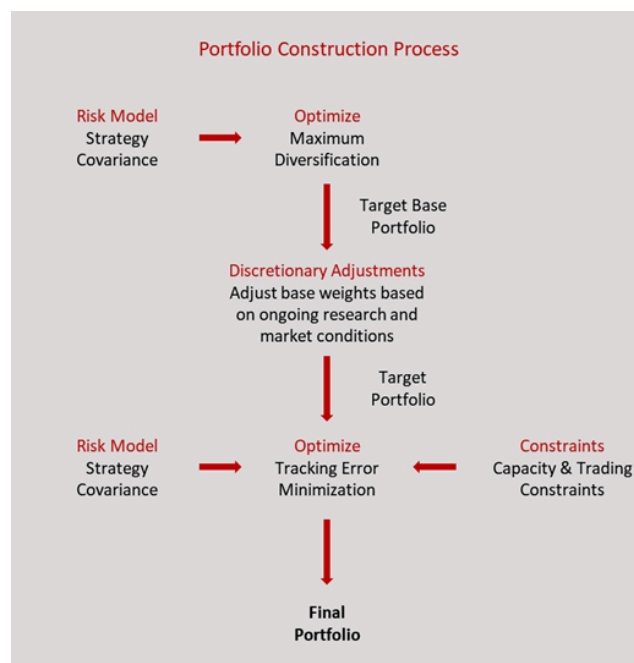
The portfolio is designed to generate consistent returns while maximizing diversification across the underlying strategies, minimizing drawdowns, and accounting for market liquidity. Further, the portfolio construction accommodates discretionary views in accordance with contemporary market conditions and ongoing research.

One of the most commonly adopted systematic portfolio construction approaches is risk parity. In this approach portfolio weights are calculated such that the risk contributed to the portfolio from each of the underlying constituents is the same. Risk Parity has been successfully adopted by many institutional investors, particularly for asset allocation and equity portfolios. The technique is especially suitable where the underlying instruments exhibit clear periods of heterogeneous volatility clustering, and

where increased volatility is associated with decreased performance, such as with global equities. However, the time series of returns of volatility carry strategies do not normally exhibit volatility clustering, and thus short-term measures of risk are not normally predictive. In fact, some of the periods with the highest performance can be observed at points where risk is high, and, as discussed, it can be challenging to reliably forecast the volatility premia over short horizons. Accordingly, we have established long-term base weights for the portfolio that are calibrated using maximal data across numerous market regimes. We then tilt the weights from the base weights according to observed market conditions and in accordance with CIO views and research.

Figure 7 - Portfolio construction

Illustrative diagram of the portfolio construction optimization



Source: UBS, as of June 2024

To incorporate the design aspects, the portfolio is constructed in three phases as illustrated in Figure 7. We first calculate the long-term base weights by optimizing with maximum diversification as described by Choueifaty and Coignard (2008). The method maximizes the ratio of the weighted-sum of individual strategy volatilities to the portfolio volatility, thus exploiting the diversification offered by the correlations between strategies. In the second step, discretionary inputs tilt the portfolio according to market conditions, forming a 'target' portfolio. Finally, a second optimization process is used where the tracking error to the target portfolio is minimized subject to capacity and liquidity constraints, forming the final portfolio.

Target investors

In our view, such a portfolio is suitable for three types of investors:

1. Income-oriented investors who tilt their asset allocation toward high-yielding asset classes such as credit or dividend stocks could benefit from an additional income source. Harvesting volatility premia demonstrated its ability to generate stable income outside significant market risk-off events. Our portfolio mitigates the common downside risks of a short-volatility strategy while maintaining an attractive carry profile.
2. Due to its low correlation to traditional asset classes, the CIO Cross-Asset Short-Volatility portfolio is particularly well suited to investors seeking to enhance the overall diversification and robustness of their portfolio. Volatility risk premia become particularly attractive when traditional diversification sources, such as high-quality bonds, come under pressure. A recent example is the bond bear market of 2022, during which market volatility was elevated. During this period, harvesting volatility risk premia in specific assets like Eurozone equities or oil delivered positive performance.
3. Considering its sophisticated nature, the CIO Cross-Asset Short-Volatility portfolio can be considered as alternative investment. It can help investors who want to enhance their allocation to non-traditional investments. Thanks to its low correlation to alternative investments like risk-parity or hedge funds, it is in our view a valid complement.

Risks of the CIO Cross-Asset Short-Volatility portfolio

The goal of the portfolio is to generate positive income while reducing drawdown sensitivity and maximizing diversification within the constituent strategies and versus traditional asset classes. At the end, however, the strategy sells market insurance in form of volatility or options and thus risks cannot be fully mitigated but only minimized. In our view the following is a list of major risks.

First, history confirms that from time to time financial markets experience bouts of heightened volatility. These risk-off periods typically are the result of any number of factors such as economic uncertainty, monetary or fiscal policy changes, financial contagion or geopolitical tension. In such events, the realized volatility of an asset can quickly rise, exceeding prevailing implied volatility. While the principle of diversifying volatility exposure across multiple underlying assets helps mitigate drawdown sensitivity, negative returns during volatile periods are still possible.

Second, although defensive mechanisms in the single strategies and the active management are meant to adjust

exposure to volatility according to risks and volatility levels, unexpected spikes in volatility can happen very quickly within a few hours or, in the worst case, when markets are closed. In such situation, any adjustment of the exposure would likely come too late to prevent initial losses in the strategies.

Third, VRP levels are the major drivers of performance in the single strategies. As a consequence, periods of prolonged low volatility risk premia in several assets may translate into subdued performance of the portfolio. We see the active management as a way to mitigate this risk by reallocation to assets with more attractive volatility risk premia.

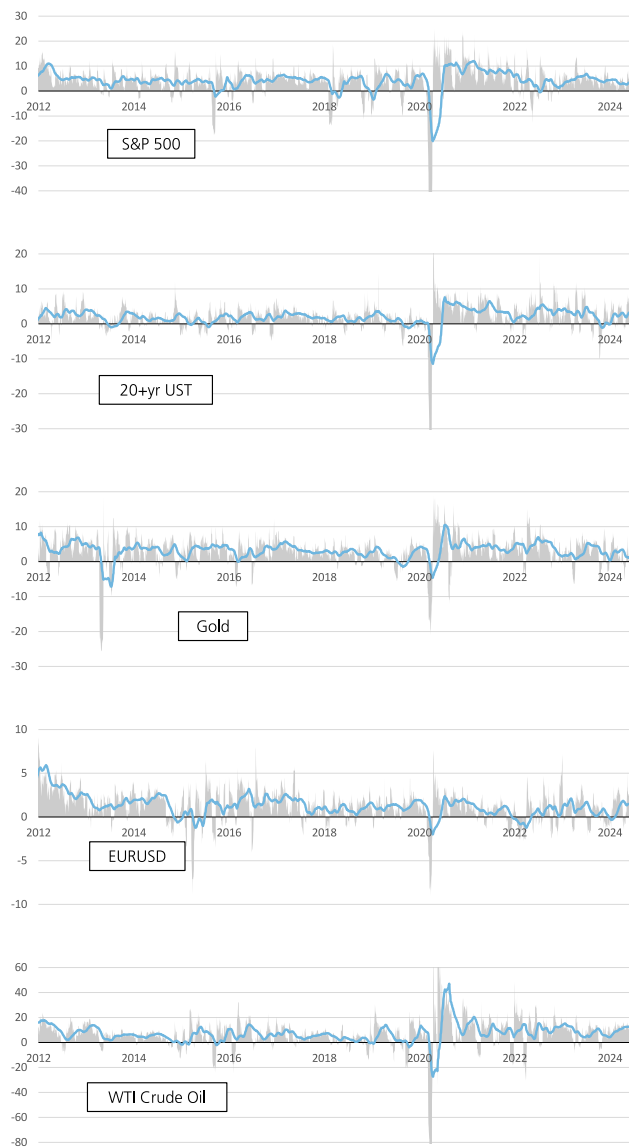
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Appendix

Figure 8 - Volatility risk premia across assets

One-month volatility risk premium (difference between implied and subsequent realized volatility) on selected assets, in volatility points



Source: Bloomberg, UBS, as of June 2024

Note: VRP measured using the following volatility indexes: VIX (S&P 500), TLT VIX (20y+ US Treasuries), Cboe Gold ETF Volatility Index (Gold), Cboe Crude Oil ETF Volatility Index (WTI Crude Oil), Cboe EuroCurrency Volatility Index (EURUSD).

Back-test disclaimer

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Main risks of investing in options

Unlike owning or shorting a security, option contracts are, by definition, governed by a finite duration. An option buyer faces the risk of losing the entire amount of the premium paid. An option writer, however, faces a higher level of risk, as the potential loss can be significant if the option expires in-the-money. Since options investments usually require less capital compared with an equivalent position in the underlying asset, the losses of an option investor are usually smaller. The exception to this general rule occurs when options are used to provide leverage.

Appendix

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