

Smile! CTA convexity is not lost . . .



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Marketing communication



About the authors.

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He has master's degrees in mathematics from the University of Dijon in France and in financial engineering from the University of Evry in France.

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Deputy Global Head of Multi-Asset



Steeve oversees CANDRIAM's systematic and global macro funds. He started his career in 1997 within the private client group of Merrill Lynch before moving to Refco Securities as in the equity derivative division in 1999. He joined CANDRIAM as a Systematic Fund Manager in 2001, when he conducted extensive research on trading systems and systematic portfolio allocation. In 2007, he became Head of Systematic Funds, and became one of the first to diversify from the traditional trend following, by mixing trend following, pattern recognition and counter trend models. His team was among the first in the industry to offer an CTA UCITS fund. Steeve holds a Masters with honours from the Ecole Supérieure de Gestion-Finance in Paris.

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The flattening of CTA convexity.

Candriam Diversified Futures bucks the trend

As a category, CTAs¹ offer an investment [which is uncorrelated](#) with the major investment asset classes. Some of this ability to ride through volatile markets results from their so-called 'convexity' to changes in underlying asset prices. This valuable convexity has been declining over the long term.

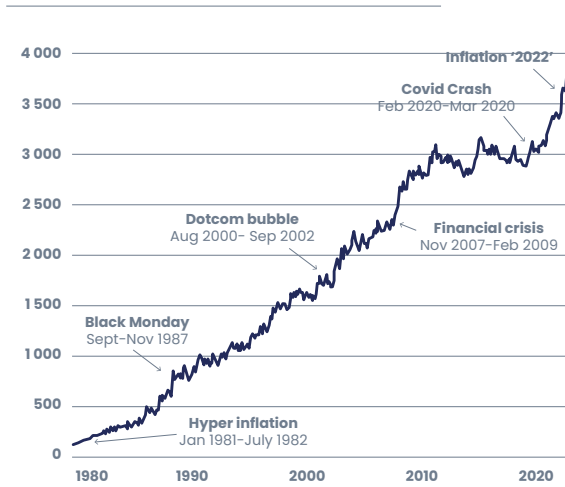
CTAs, or Managed Futures funds, are usually absolute return funds applying quantitative models to identify financial market trends. Long or short positions are taken to benefit from the continuation of the movement using futures contracts, options, and forward contracts.

This ability to profit from both upside and downside movements across a wide range of asset classes has made CTAs an increasingly popular source of *decorrelated* absolute return over the last forty years. CTAs have been providing steady positive returns since they were first developed and popularized, as demonstrated by the Barclays CTA Index in figures 1 and 2. This absolute performance and decorrelation has been particularly noteworthy during historical financial crises.



Figure 1:

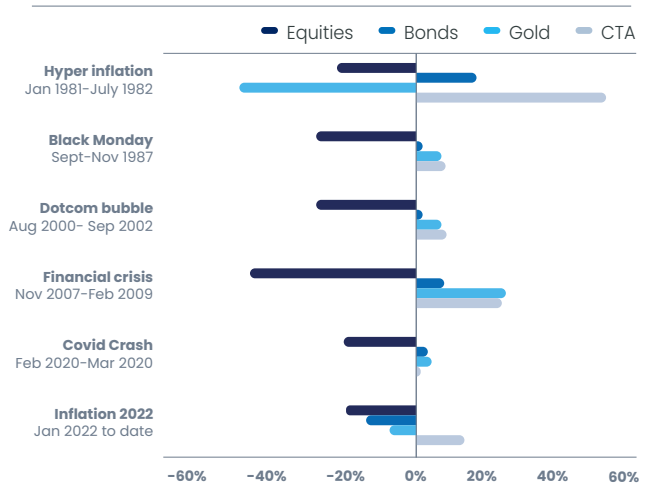
CTA Index performance -- 1980 to Oct 2022



Past returns are no indicator of future performance.
 Source: BarclayHedge Ltd, Candriam.

Figure 2:

Performance of CTAs and select asset classes during crises



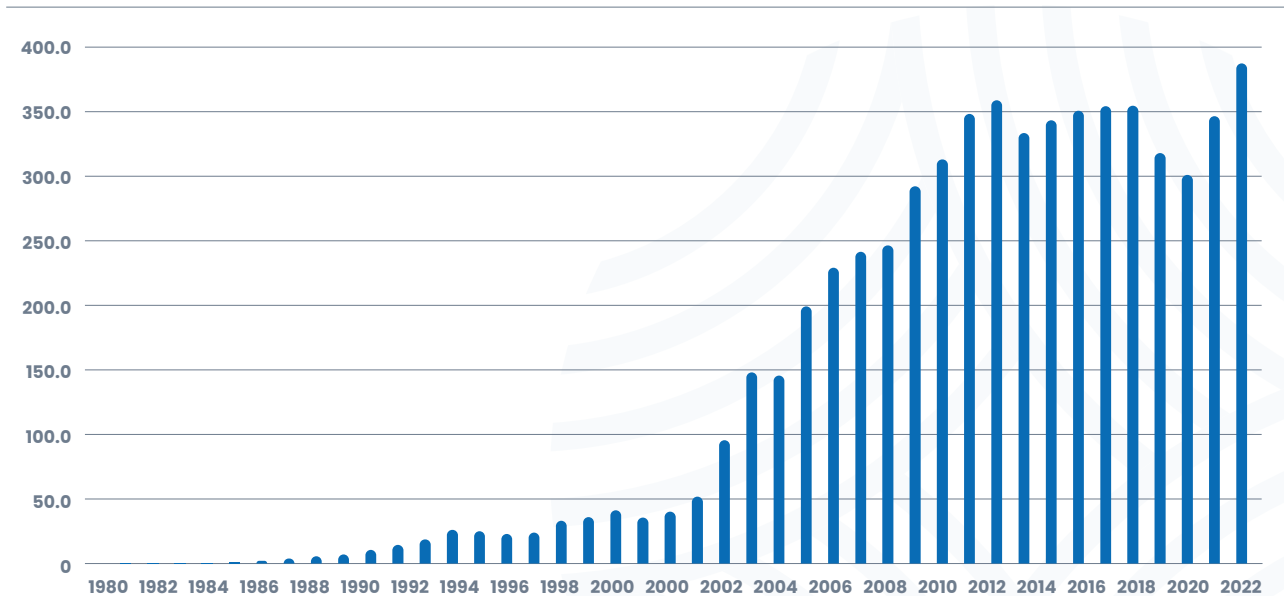
Past returns are no indicator of future performance.
 Source: BarclayHedge Ltd, Candriam.

This history of sustained performance during market turmoil is only one of the advantages of CTAs. Others include low correlations to traditional asset classes, a broad and liquid investment universe, and typically, disciplined quantitative models. These features have the CTA segment grow from \$300 million in 1980 to more than \$350 billion today. Figure 3 demonstrates the acceleration following the dot-com bubble.

Figure 3:

Growth in CTA assets under management
 Managed futures total assets, \$billions

Managed Futures Total Assets (\$ U.S. Billions)



Past returns are no indicator of future performance.
 Source: BarclayHedge, Ltd.

Our CTA papers series

Going with the trend: How CTAs work and what they can do in the age of low interest rate markets

November, 2021

CTAs attempt to capitalise on market trends regardless of market direction. This is an increasingly interesting property in an era of near-zero interest rates, as government bonds are no longer as powerful a counterbalance to equity corrections in balanced portfolios. We believe the right balance between short-term and longer-term trend identification is central to the usefulness of these funds for asset allocators. All CTAs, regardless of their specific approach, capitalise on macro cycles, market psychology/sentiment, and their ability to simultaneously track and take long or short positions in multiple asset classes.

CTAs are often viewed as 'long volatility', because they tend to perform well during market crises. We show that the trend-following tendency of managers and models to increase long (or short) positions when the price of the underlying asset rises (or falls) makes CTAs actually 'long gamma'. The further from the last price, the more sensitive the position is to the change in the underlying. As a result, during periods of volatility, CTAs may help reduce volatility in an overall balanced portfolio while increasing performance during the period of volatility.

Interest rates go up: A threat or an opportunity for Commodity Trading Advisor (CTA) strategies?

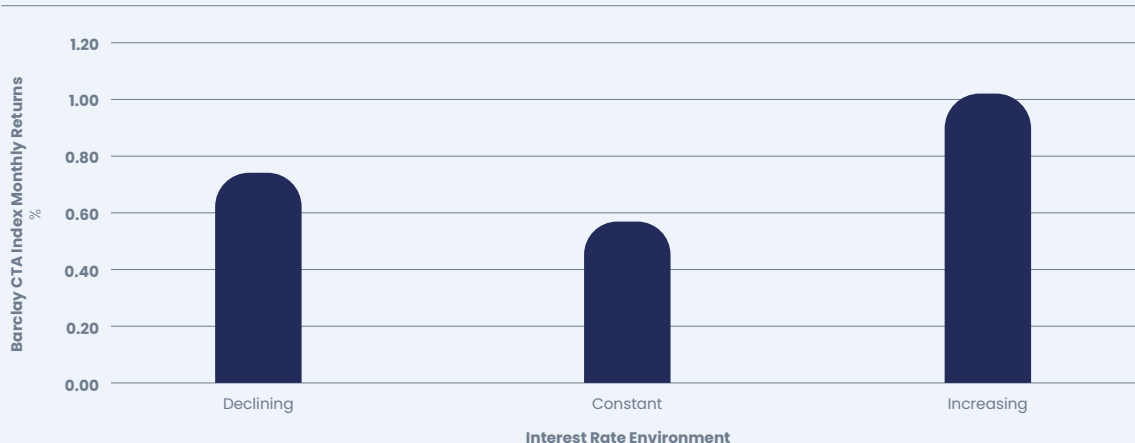
May, 2022

This brief note shows that over the last 40 years, CTAs generated their lowest absolute performance during stable interest rates – and their best during periods of *rising rates*.

Figure:

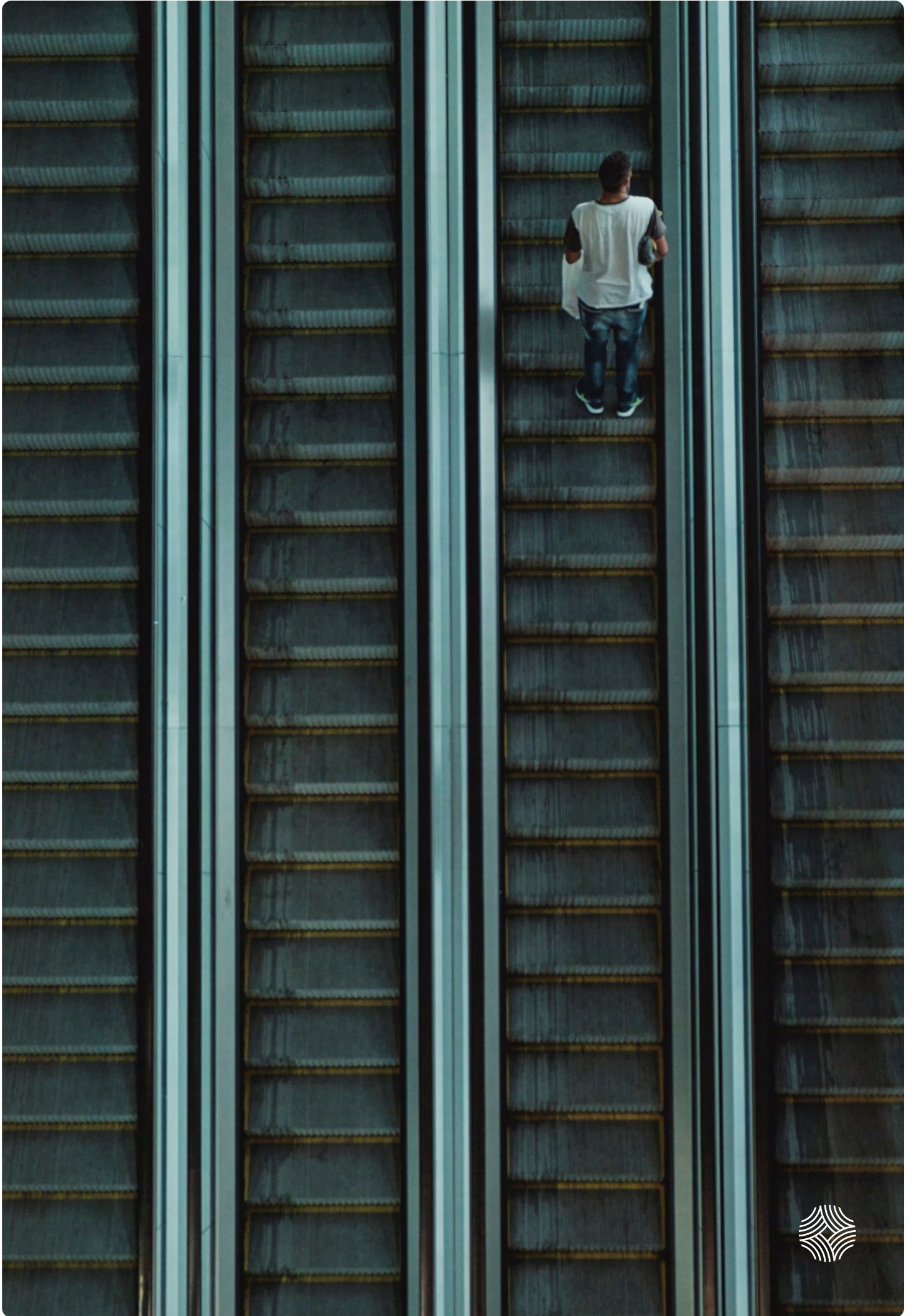
Performance of the BarclayHedge CTA Index during rising, falling, and stable interest rate regimes, 1980 to 1Q 2022

BarclayHedge CTA Index Monthly Returns since 1980



Past returns are no indicator of future performance.

Source: BarclayHedge CTA Index, Candriam as at Apr 2022.



Convexity of CTAs: Is the smile fading?

Investors view CTAs as an 'Equity Tail Risk Hedge' due to their historical performance during market crises. [In a previous paper](#) (see box), we demonstrated that managed futures strategies are long *gamma*, not just long volatility. These strategies can harness value in both down and up markets. The smile (equity gamma) can be demonstrated using a scatter plot of monthly returns of the BarclayHedge CTA Index² against the MSCI World³ equity index. Fitting a second-order polynomial function results in a smile – demonstrating convexity to financial market changes.

Figure 4:

CTA smile, from inception (1980 to Sep 2022)

Monthly returns -- Barclay Hedge CTA index vs MSCI World TR



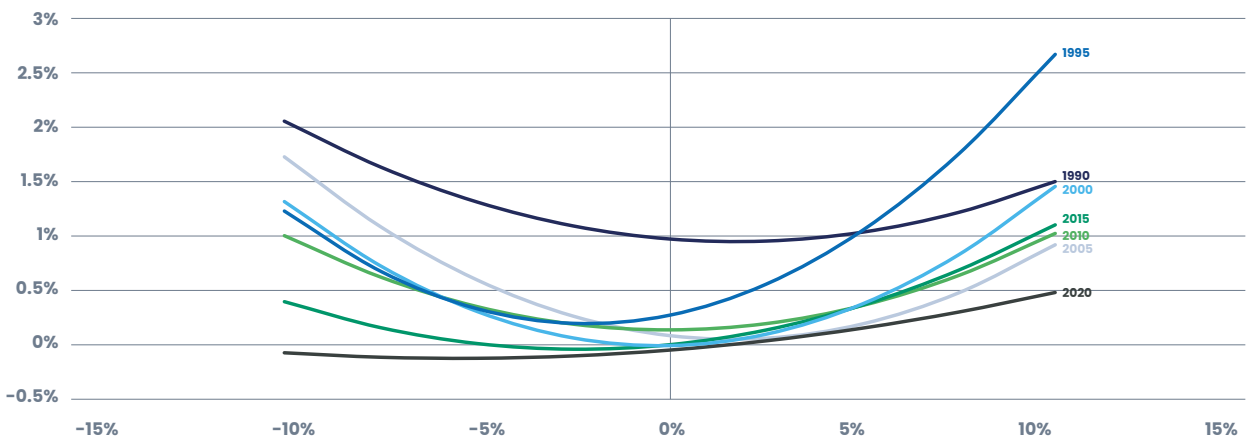
Past returns are no indicator of future performance.

Source: Candriam, BarclayHedge Ltd, MSCI, Bloomberg, 1980 to Sep 2022

Actually, this convexity is by construction. CTAs are designed to be convex relative to trends of the underlying asset classes.⁴ Nevertheless, it is interesting to see how the results have followed the intent over time. We analysed this behaviour over time, examining the evolution of the rolling 10-year smiles of the Barclay CTA Index.

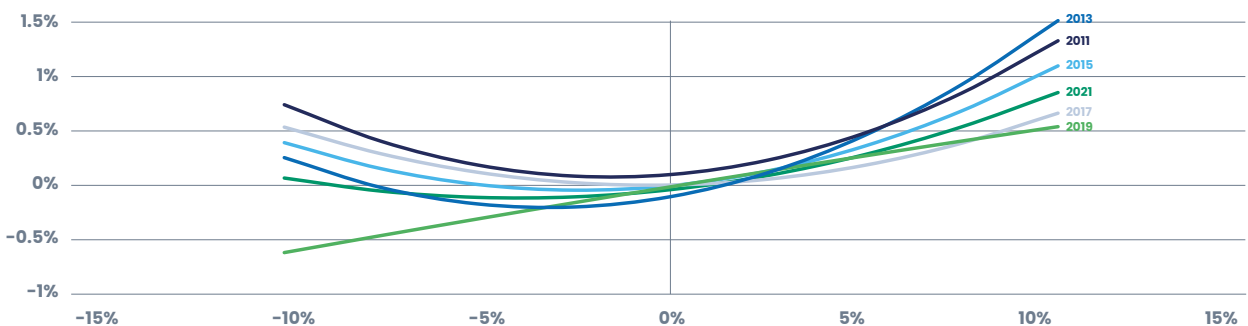
We have found that the smile effect is fading (figure 5). This is particularly true if we focus on the most recent decade (figure 6), which has seen a flattening in the tail of the smile.

Figure 5:
CTA equity convexity fading over three decades
Equity smiles of BarclayHedge CTA Index
Ten-year rolling data, shown at 5-year intervals since 1990



Past returns are no indicator of future performance.
Source: Candriam, BarclayHedge, MSCI, Bloomberg

Figure 6:
CTA equity convexity fading over ten years
Equity smiles of BarclayHedge CTA Index
Ten-year rolling data, shown bi-annually since 2011



Past returns are no indicator of future performance.
Source: Candriam, BarclayHedge, MSCI, Bloomberg

CTAs offer convexity to bonds, too...

In our [May 2022 paper](#), (see box), we demonstrated that CTAs have historically performed in all interest rate environments, including times of declining rates, constant rates, and even during periods of *increasing* interest rates. The history of positive results during rising rate environments is particularly interesting as we see rising inflation worldwide, with market participants pressuring central banks for aggressive rate hikes.

Being by nature convex, and typically encompassing bond and interest rate futures within their trading models, one would expect managed futures strategies to exhibit convexity to interest rate changes.

To examine the interest rate 'smile' we applied the same methodology as for equity. That is, we created a scatter plot of BarclayHedge CTA Index⁵ returns against the Bloomberg US Aggregate Total Return bond Index. Again, fitting a second-order polynomial function results in a smile.

Figure 7:

CTA interest rate smile, from index inception (1980 to Sep 2022)
Monthly returns -- BarclayHedge CTA index vs Bloomberg Aggregate Index



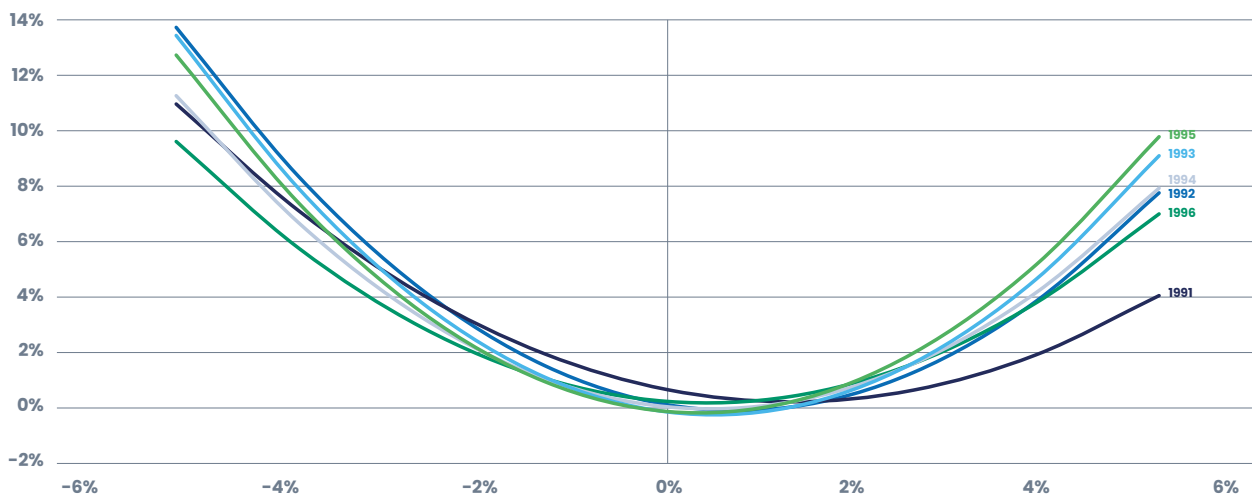
Past returns are no indicator of future performance.

Source: Candriam, BarclayHedge, Bloomberg. CTA index adjusted for variations in Fed Funds rate. 1980 to September 2022.

The question arises whether the interest rate convexity has diminished over time as it has for equity. Applying the same methodology, we fitted curves to the 10-year rolling convexity functions of the CTA index to bond returns. Our analysis, shown in figures 8 through 10, demonstrates that even if there has been some change in the smile during different interest rate regimes, interest rate convexity has **not** been fading over the years.

Figure 8:

CTA interest rate convexity during falling rate regime
 Interest rate smiles of BarclayHedge CTA Index
 Ten-year rolling data, shown at annual intervals during the rising rates of the 1980 and 1990s

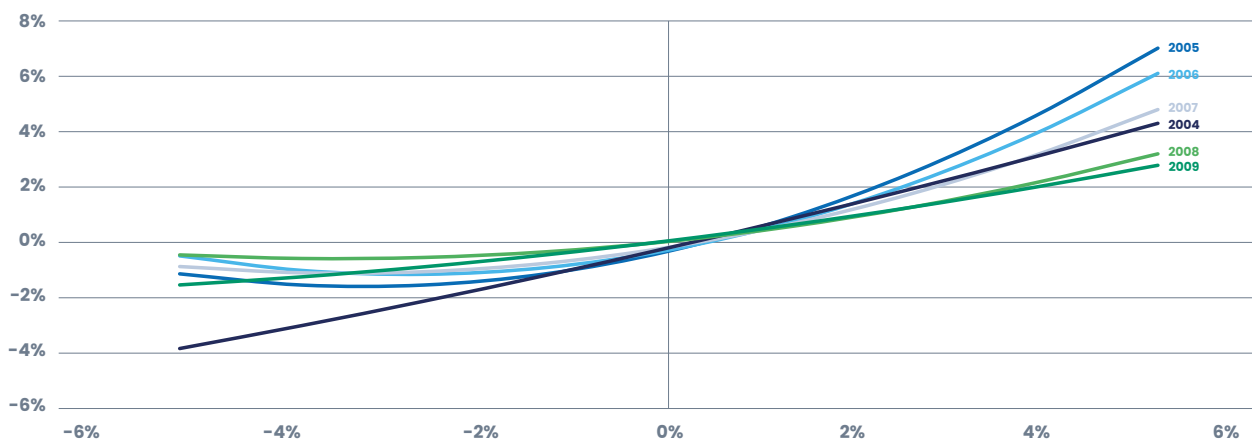


Past returns are no indicator of future performance.

Source: Candriam, BarclayHedge, Bloomberg US Aggregate Bond Index. CTA index adjusted for variations in Fed Funds rate.

Figure 9:

CTA interest rate convexity during years surrounding the debt crisis
 Interest rate smiles of BarclayHedge CTA Index
 Ten-year rolling data, shown at annual intervals

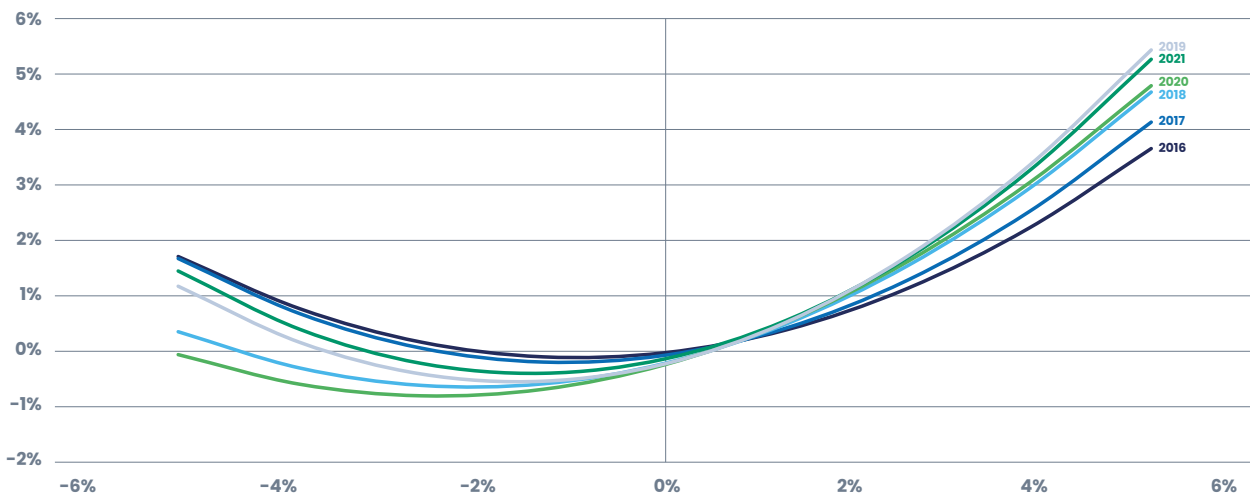


Past returns are no indicator of future performance.

Source: Candriam, BarclayHedge, Bloomberg US Aggregate Bond Index. CTA index adjusted for variations in Fed Funds rate.

Figure 10:

CTA interest rate convexity during recent years of low rates
Interest rate smiles of BarclayHedge CTA Index
Ten-year rolling data, shown at annual intervals since 2016



Past returns are no indicator of future performance.

Source: Candriam, BarclayHedge, Bloomberg US Aggregate Bond Index. CTA index adjusted for variations in Fed Funds rate.

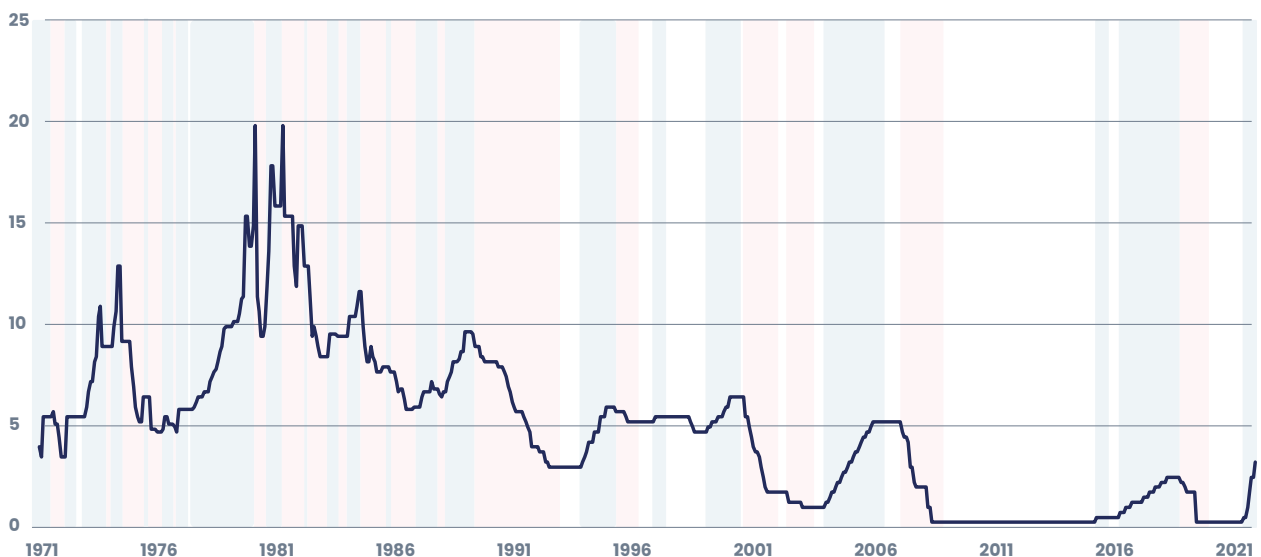
While the interest rate convexity does not show a declining trend, it certainly does show that the shape of the smile varies in different interest rate environments. Those regimes could be explained by the carry premia of long bond positions during declining and constant interest rate environments, which were typically the case for much of the last few decades. The shape of the left-hand tail seen

during the nineties is due to the somewhat longer period of rising rates, and to the environment in which *the rate hikes were both stronger and faster*. As we demonstrated in our [May 2022 paper](#) on interest rates and CTA performance (see box), CTAs have historically performed surprisingly well during rising-rate environments. Figure 11 shows the rate environments of the last five decades.

Figure 11:

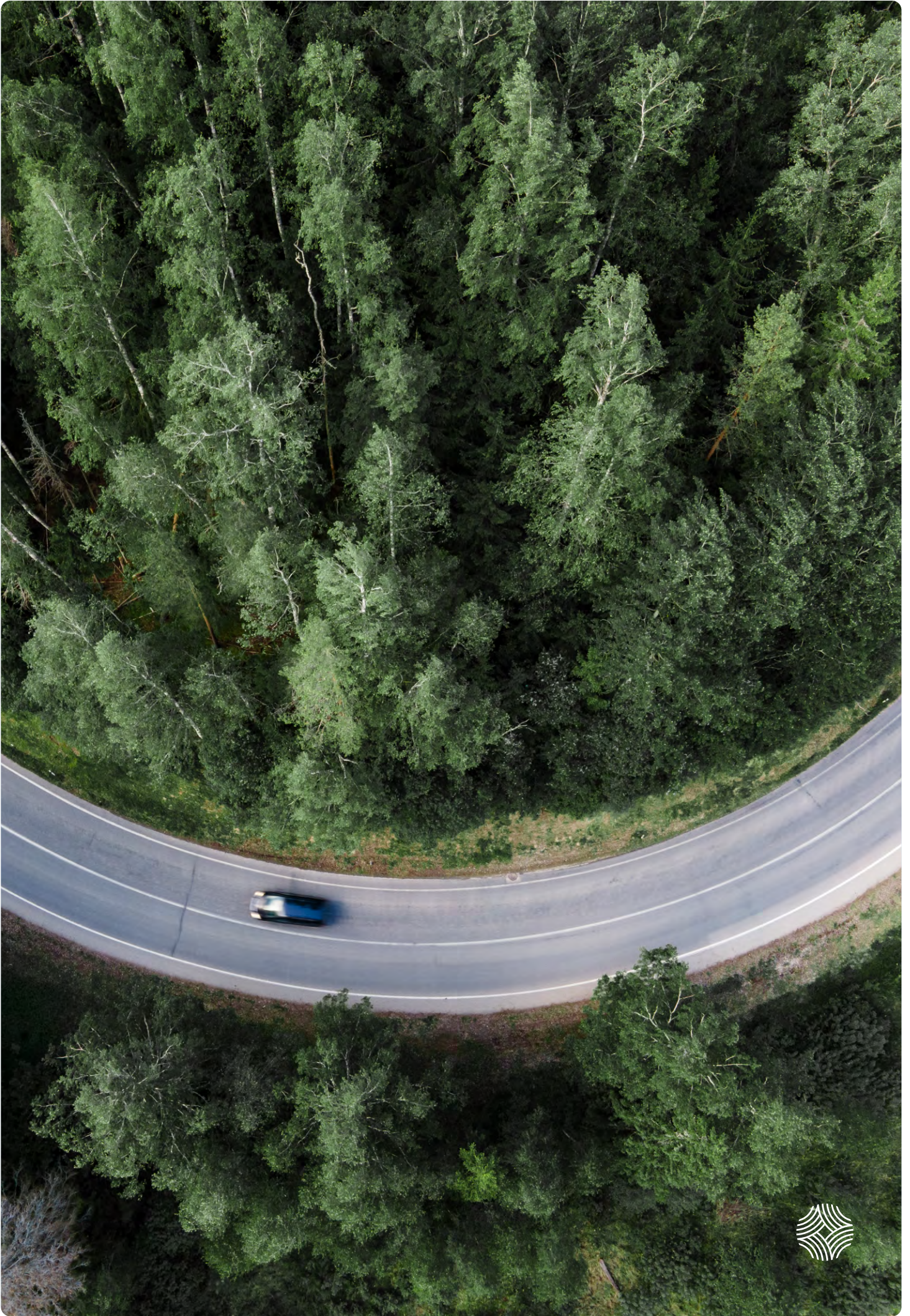
Interest rates -- Declining, constant, and rising rate environments
January 1971 through Sept 2022

■ Fed. Fund Target Rates
■ Declining Environment ■ Rising Environment



Past returns are no indicator of future performance.

Source: Data From Bloomberg, Candriam.



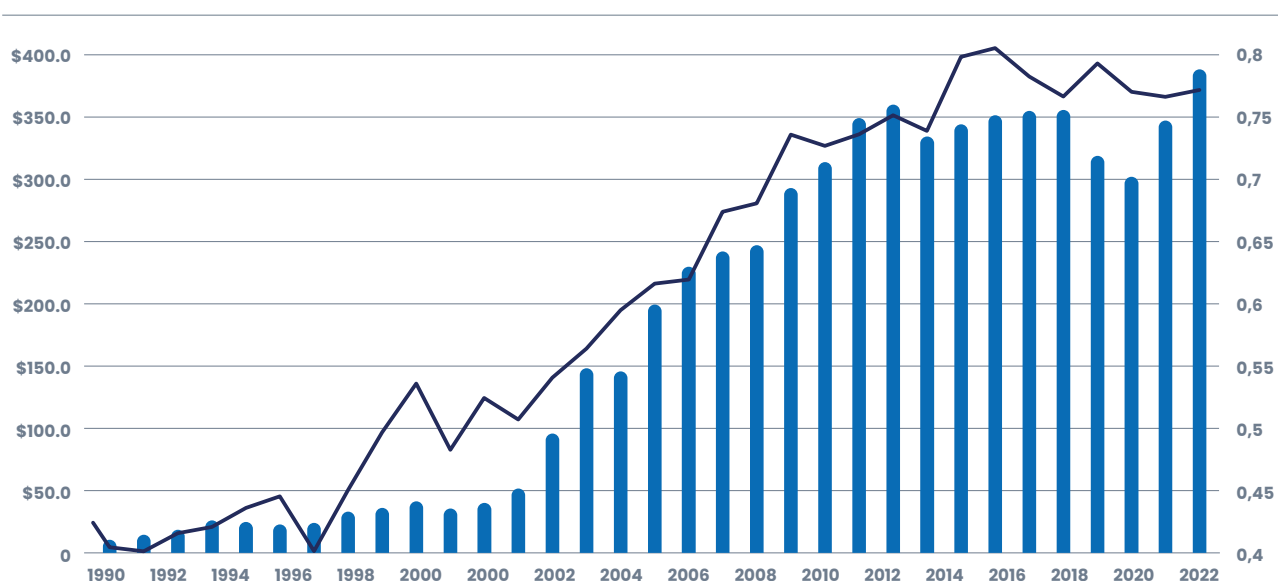
Decreasing trade frequency: Does this explain the fading equity smile?

CTAs have historically been resilient during crises, providing welcome contributions to performance and mitigation of portfolio drawdown. The asset class has enjoyed rapid growth in assets under management since dotcom bubble,⁶ rising from less than \$50 billion to over \$350 billion in 2022 (figure 12). Such inflows forced CTA managers to adapt. Even though Managed Futures portfolios are the largest traders of the most liquid futures contracts, it is obviously not the same managing a \$100 million portfolio as it is to manage \$5 billion of assets. As managers grew, they probably sought to manage both their trading costs as well as their market impact.

Figure 12:

Growth in CTA assets under management
Shown against long-term correlation of one-year trend-following strategy
and BarclayHedge CTA index

■ Managed Futures Total Assets (\$ U.S. Billions)
■ 10Y Correlation BARCCTA - Benchmark one year



Past returns are no indicator of future performance.
Source: Candriam, Bloomberg, BarclayHedge CTA Index

As asset classes become increasingly correlated during each period of market turmoil, decorrelated asset classes such as CTAs become increasingly sought-after. By extension, we would expect investors and asset allocators to find convexity increasingly valuable. (The scenarios presented are an estimate of performance based on evidence from the past on how the value of this investment varies, and/or current market conditions and are not an exact indicator. What you will get will vary depending on how the market performs and how long you keep the investment/product.)

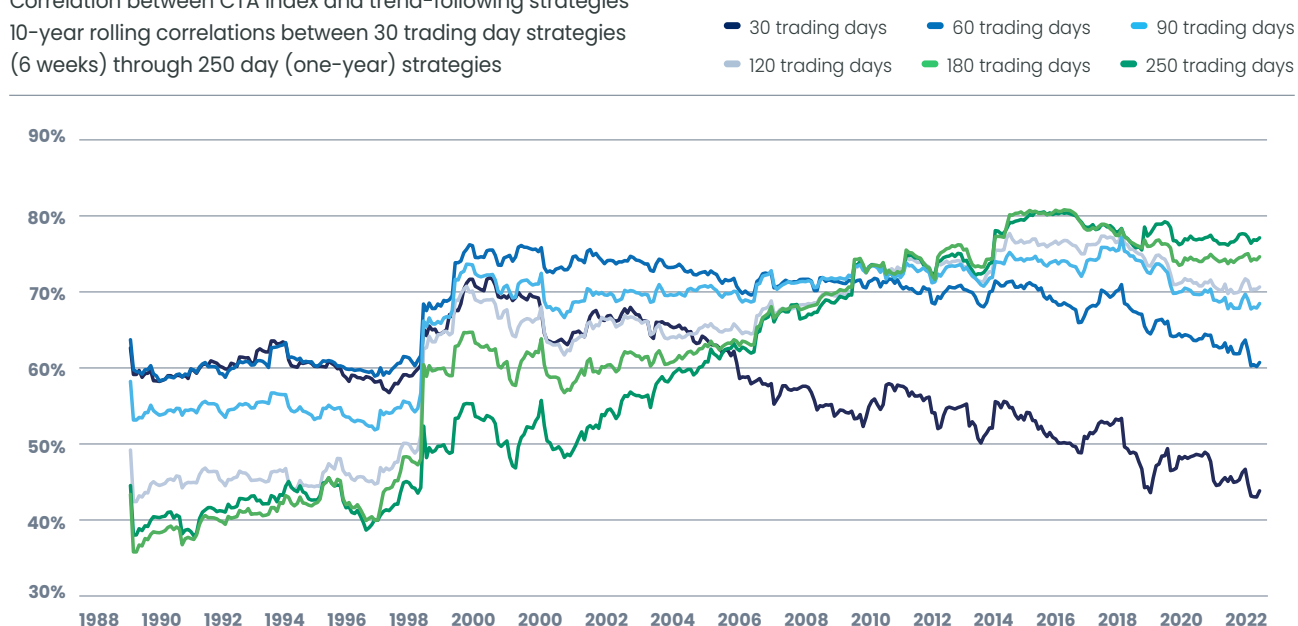
One hypothesis for the decline in equity convexity is that CTA managers are lengthening the time frame used to identify trends, and that the choice of using longer-lasting trends is contributing to a lower trading frequency. To examine this possibility, we constructed a hypothetical pool of trend-following strategies employing 40 futures contracts (appendix), based on simple moving average models over a range of different time horizons. We equally weighted the risk among the positions, and targeted portfolio volatility of 15%.

The results are consistent with a lengthening of the time frame used by CTA managers to determine trends. A 10-year rolling correlation of these model strategies versus the BarclayHedge CTA Index, shows that the model strategies based on the longer-term trends are the most correlated with the index. Further, this correlation has been strengthening dramatically over time, reaching 70% since 2010. Conversely, shorter trends strategies using trends from 30 days to 3 months have been less correlated with the index, particularly since the late 1990s. Strategies employing medium-term trends of 90 days to 6 months have decorrelated moderately from the CTA index since 2012.

Together, figures 12 and 13 illustrate the joint evolution of CTAs assets and the correlation of their performance with a long-term trend-following strategy.

Figure 13:

Correlation between CTA Index and trend-following strategies
10-year rolling correlations between 30 trading day strategies (6 weeks) through 250 day (one-year) strategies



Source: Candriam, BarclaysHedge, Bloomberg.

Can convexity be maintained?

Greater convexity indicates better protection against tail risk.

Long-term trend models and signals are by construction less sensitive to small changes in flat markets, and so they more easily avoid false signals. The cost is that it takes longer to confirm a reversal and therefore longer to reverse an investment position, so these approaches can sometimes be penalized significantly during sharp market reversals.

Conversely, short-term trend models offer more reactivity to short-lived trends, or the early detection of long-term trends. Obviously the trade-off is that these short-term models are more sensitive to noisy markets, and detect false signals. This is why we believe most CTA processes are moving away from short-term models, a category trend demonstrated by the reduction of equity convexity of the typical CTA portfolio over time (as represented by the CTA index, figures 5 and 6)

To be reactive to market trends as soon as they begin to emerge, CTA managers would like to improve this trade-off in short-term trend-following, by harnessing short-term information while isolating noise. We believe a solution can be to mix contrarian strategies with trend-following strategies.



Convexity for Candriam Diversified Futures

Within our own CTA fund, Candriam Diversified Futures,⁷ our approach combines short- to medium-term trend-following strategies with contrarian and pattern recognition models. While more complex, we believe this approach can fulfil the typical role of CTAs, which aim to generate performance in all types of markets and tail risk protection during periods of market turmoil.

The internal management of the fund⁸ aims at a 70% risk allocation to a trends bucket, and 15% each to a contrarian and pattern recognition bucket. Our diversified approach of using multiple models aims to, differentiate us from the majority of the investment processes in the CTA asset class. (The scenarios presented below are an estimate of performance based on evidence from the past on how the value of this investment varies, and/or current market conditions and are not an exact indicator. What you will get will vary depending on how the market performs and how long you keep the investment/product.)

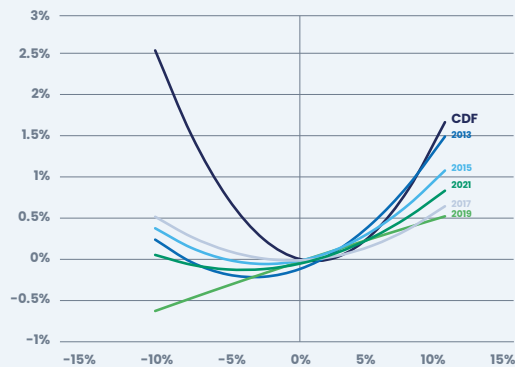
In developing and refining our Managed Futures processes, we continually study the properties of trends, including their frequencies and behaviours. The long-term data shows that equity convexity is diminishing for the BarclayHedge CTA Index, which includes more 300 CTA funds (figure 6). We applied the same method for CDF⁹, studying and calibrating a second order polynomial of its monthly returns scatter to monthly returns of MSCI World Total Returns and Bloomberg US Aggregate Bond Index from 2012 to 2022, a 10-year period. We compare it to the smiles of Barclay CTA Index on different years. The portfolio construction to date demonstrates that Candriam equity convexity remains intact (figure 14).

The Candriam Diversified Futures fund demonstrates above-average convexity. Recalling Figure 6, in which we showed the fading smile of the BarclayHedge CTA Index to equities, we show the Candriam smile against those of the index. Figure 14 is simply Figure 6 with the Candriam Diversified Futures 10-year convexity through 2022 shown against the rolling ten year convexity smiles of the index, including the most recent ten years through 2022. In Figure 15, we do the same for bonds,¹⁰ comparing the Candriam Diversified Futures 10-year convexity to that of the rolling ten years of bond convexity first shows in Figure 10.

These figures show that the convexity of the Candriam Diversified Futures CTA approach has sharply exceeded that of the average of 300 CTA funds.

Figure 14:

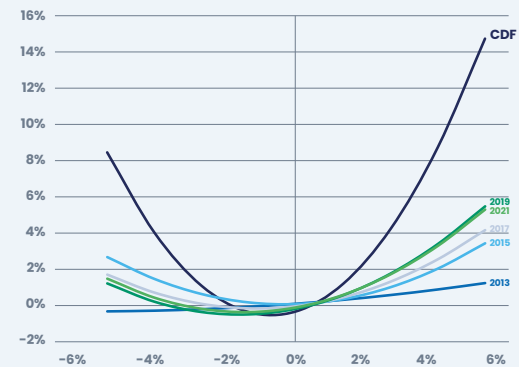
Candriam Diversified Futures Equity Convexity compared to CTA Index Equity Convexity



Past returns are no indicator of future performance.
 Source: Candriam, BarclayHedge, MSCI, Bloomberg

Figure 15:

Candriam Diversified Futures Interest Rate Convexity compared to CTA Index Interest Rate Convexity

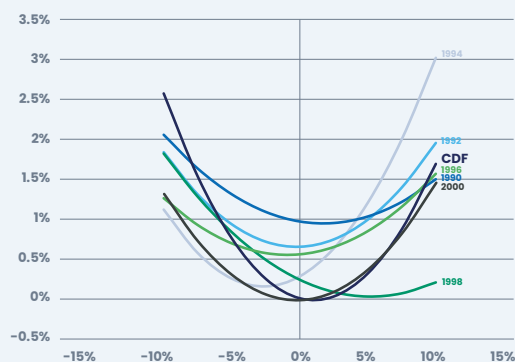


Past returns are no indicator of future performance.
 Source: Candriam, BarclayHedge, Bloomberg US Aggregate Bond Index. CTA index adjusted for variations in Fed Funds rate.

Then we “raised the bar”, and compared the current/recent 2022 Candriam Diversified Futures smiles seen today to the *best* of the BarclayHedge CTA Index behaviour during the golden age of the 1990s. The results are shown in Figures 16 and 17.

Figure 16:

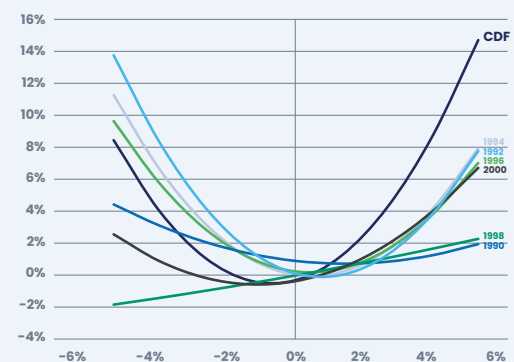
Candriam Diversified Futures Convexity today, compared to CTA Index Equity Convexity during the best years for the index, notably 1990s



Note: when comparing figure 17 to figure y, note the difference in the y-axis scale.
 Past returns are no indicator of future performance.
 Source: Candriam, BarclayHedge, MSCI, Bloomberg

Figure 17:

Candriam Diversified Futures Interest Rate Convexity today, compared to CTA Index Interest Rate Convexity ten year convexity curves during the 1990s



Past returns are no indicator of future performance.
 Source: Candriam, BarclayHedge, Bloomberg US Aggregate Bond Index. CTA index adjusted for variations in Fed Funds rate.

*These internal figures are indicative only and may change over time. Please see the prospectus.

Conclu-

Conclusion: Keep on smiling!

Investors consider Managed Futures to be a Tail Risk Hedge, and rightly so. CTAs have shown resilience to several crises and have offered investors diversification and performance contribution over the years. As a result, investments in CTA funds have grown consistently.

Using the BarclayHedge CTA Index as the reference for the asset class, unfortunately we are seeing that the capacity to deliver value in declining equity markets has been weakening over time. This is possibly a consequence of expanding the time horizon over which trends are identified, that is, identifying and investing in longer-term rather than shorter-term signals. Happily, the typical CTA fund continues to offer convexity to changes in interest rates.

This decrease in equity convexity has not yet become a broadly-discussed topic in the asset management industry. Our work shows asset class averages based on the index, while some managers still exhibit this desirable convexity. Much has been written on increased correlation among asset classes during market turmoil, increasing the value of convex assets in allocation decision.

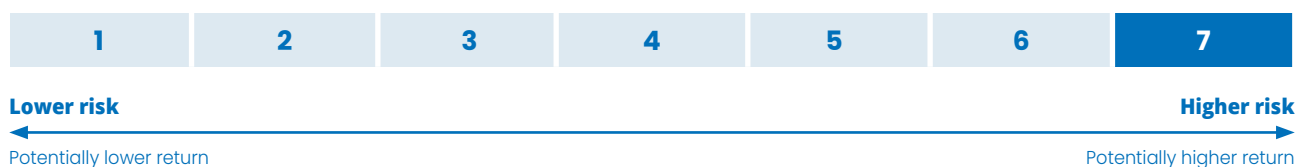
Investors are looking for stable expected returns whatever the market conditions. What is your forecast for the next period of market volatility?

Risks.

The risk level reflects the maximum between, on the one hand, the fund's historical volatility and, on the other, the volatility equivalent to that of the risk limit adopted by the fund. The volatility indicates the extent to which the value of the fund may fluctuate upwards or downwards. This risk level 7 essentially results from exposure to equity, interest rate and foreign exchange risks. Historical data, such as that used to calculate the synthetic indicator, may

not be a reliable indicator of the UCI's future risk profile. The indicated category may vary over time. The lowest category does not mean "risk-free". There is no guarantee or mechanism to protect the capital.

To fully understand the fund's risk, it is recommended that investors carefully read the official prospectus which describes the fund and its risks in more detail.



The main risks associated with the investment in the Candriam Diversified Futures fund include:

- Risk of capital loss
- Equity risk
- Foreign exchange risk
- Model Risk
- Volatility risk
- Leverage risk
- Credit risk
- Operational risk
- Legal risk
- Interest rate risk
- Derivatives risk
- Risks arising from discretionary management and the arbitrage strategy
- Emerging markets risk
- Counterparty risk
- Delivery risk
- Risk of conflicts of interest
- Custody risk
- Risk of changes to the benchmark index by the index provider(s)

All or some of the fund share classes are authorized in the following countries:



Fund Characteristics

Candriam Diversified Futures – August, 2022

Launch date: November 16, 2009	Frequency of valuation: Daily
Management fee (max.):* 1,20%	ISIN Code (I – Cap): FR0010813105
Subscription fees (max.):* 1,00%	Domicile: France
Redemption fees (max.):* 1,00%	Management company: Candriam
Performance fees (max.):* 20%	Legal form: UCITS – FCP
Fund AUM: 322 million	Depository bank: CACEIS Bank, Luxembourg Branch
Fund currency: EUR	Benchmark: Capitalised €STR©
SFDR classification: Article 6	Recommended investment horizon: 3 years

* Real fees indicated in the KIID or annual report

The fund is actively managed and the investment process implies referring to a benchmark index, the capitalised €STR index for euro denominated units, the capitalised SONIA index for GBP denominated units, or the capitalised EFR index for USD denominated units.

Appendix.

List of frequently-used contracts

Indices	Energy	Bonds	Currencies	Agriculture
CAC 40	Brent	Bobl	AUD (vs USD)	Corn
Dax	Crude Oil	Bund	GBP (vs USD)	Cotton
Dow Jones	Heating Oil	EuroBTP	CAD (vs USD)	Live Cattle
Eurostoxx	Natural Gas	EuroOAT	EURO (vs USD)	Soybean
FTSE	RBOB	TBond	JPY (vs USD)	Sugar
Hang Seng		TNote10Y	NZD (vs USD)	Wheat
Nasdaq	Metals	TNote5Y	Peso (vs USD)	
NIKKEI	Aluminium	JGB	CHF (vs USD)	
Russel	Copper	Korean3Y	ZAR (vs USD)	
S&P 500	Gold		JPY (vs EUR)	
SPI 200	Silver			
Topix	Zinc			

Description of indices

BarclayHedge CTA Index

(Source: Bloomberg)

The BarclayHedge CTA Index provides a benchmark of representative performance of commodity trading advisors (CTAs). In order to qualify for inclusion in the Index, a CTA must have four years of prior performance history. When a CTA already in the Index introduces an additional program, this additional program is added to the Index after its second year. In order to limit potential upward bias, only CTAs with at least four years of performance history are included in the Index and the performance history begins with year five, ignoring the first four years of performance. In 1999, 319 CTA programs were included in the calculation of the Barclay CTA Index. The index is unweighted and rebalanced at the beginning of each year.

Bloomberg Barclays US Agg Total Return Value Unhedged USD

(Source: Bloomberg)

The Bloomberg Barclays US Aggregate Bond Index is a broad-based flagship benchmark that measures the investment grade, US dollar-denominated, fixed rate taxable bond market. The index includes Treasuries, government-related and corporate securities, MBS (agency fixed-rate and hybrid ARM pass-throughs), ABS and CMBS (agency and non-agency).

MSCI World Net Total Return USD Index

(Source: Bloomberg)

MSCI Daily Total Return Net World USD. Morgan Stanley Capital International Equity Indices in US Dollars. Indices with net dividends reinvested use the same dividend minus tax-credit calculations, but subtract withholding taxes retained at the source for foreigners who do not benefit from a double taxation treaty.

Notes & References.

- 1** For the purposes of this document, we use the terms CTA funds and managed futures funds interchangeably. CTA is an acronym for Commodity Trading Advisor.
- 2** Due to low margin requirements for CTAs and high interest rates during certain periods, we adjust BarclayHedge CTA Index monthly returns to reflect Fed Funds rates.
- 3** See Appendix for definitions.
- 4** A basic trend model could present the profit as a difference between long term and short term variance.
- 5** BarclayHedge CTA Index monthly returns are also Fed Fund Rates adjusted .
- 6** By 'dot-com bubble', we refer in particular to the late 1990s to mid-2000 in the US.
- 7** The Candriam Diversified Futures fund is actively managed with respect to a benchmark, the Capitalised €STR, Capitalised SONIA (Sterling Overnight Index Average), or Capitalised Effective Federal Funds Rate – EFFF or Fed Fund, depending on the currency of the share class.
- 8** Indicative data may change over time.
- 9** Historical data of Candriam Diversified Futures (CDF) has been rebuilt from 2012 to 2014 using auditing and validated data, removing off Commodities due to their discontinuation in Feb 2014. Monthly returns have been adjusted by Fed Fund Rates, like Barclay CTA Index was.
- 10** The index smiles in Figures 10 and 15 are the same – we had to extend the y axis in order to display the Candriam CTA bond convexity on the same chart.



€143 B

AUM as of
30 June 2022



600

Experienced and
committed professionals



25 years

Leading the way in
sustainable investing

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