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NEGATIVE CRISIS BETA AND THE HIDDEN MARKET TIMING ABILITY OF TREND-FOLLOWING CTAS

The contribution of trend-following equity beta to risk mitigation

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Executive summary

In this note, using historical industry performance data since 2000, we argue that part of the performance of trend-following CTAs comes from an intrinsic ability to time equity market risk. We show that allowing for an unconstrained long allocation to equities is (1) key to capturing the full extent of this ability and (2) does not run counter to its risk mitigation properties.

We first show, based on an equity regime conditional attribution analysis of historical quarterly returns, that trend-following CTAs have provided significant equity risk mitigation over the past two and a half decades. Since 2000, we estimate that two thirds of the trend-following CTA industry's total return have been generated during the 16 worst calendar quarters for equity markets, while the remaining 81 quarters have only accounted for the remaining one third. Moreover, trend-following CTAs have not only been uncorrelated with global equity markets over the long term, but have also delivered negatively correlated positive returns during the worst equity market periods and positively correlated positive returns outside of crisis periods.

Based on a univariate decomposition of trend-following returns into an alpha and an equity beta component, we further show that since 2000, more than 80% of the total trend-following performance can be attributed to (positive or negative) equity beta, which made a positive contribution in 70 out of 97 quarters during this period. In particular, we argue that negative crisis beta is a non-negligible source of risk mitigation benefits during periods of equity market stress. The contribution of negative crisis beta was positive in 15 of the 16 worst equity market quarters since 2000, accounting for more than 40% of trend-following CTA performance in these periods. Thus, the consistently positive return contribution of equity beta reported for all equity market regimes highlights a significant equity market timing ability of trend-following over the past 25 years.

Finally, based on three different approaches, we estimate that restricting a trend follower's long equity exposure is likely to be associated with a 20-30% reduction in long-term total performance, corresponding to 1.5% to 1.9% lower annualized excess returns. The benefits of such restrictions in terms of enhanced equity risk mitigation are limited: we show that the annualized performance contribution of trend-following in crisis periods could have been improved by up to +0.5% per year in the best case.

We conclude that the long-term benefits of an unconstrained trend-following approach far outweigh any potential, but short-lived, benefits of limiting equity exposure to protect against market drawdowns. The long-term opportunity cost of restricting long equity exposures, regardless of the methodology employed, appears too high to compensate for the marginal improvement in risk mitigation during the occasional sharp corrections in equity markets.

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The performance data shown in this note is gross of fees but net of estimated trading costs. As such, it does not reflect the deduction of fees and expenses which would have lowered performance. Returns contained herein are shown as excess returns (excl. cash income) and include reinvestment of earnings. The estimated trading costs are based on Quantica's proprietary cost models.

Hypothetical results presented in this note are calculated by taking the prevailing market prices available at the relevant point in time. The case studies included in this presentation are for illustrative purposes only. The information is intended to be educational and is not tailored to the investment needs of any specific investor. There are numerous factors related to the markets in general or to the implementation of any specific program that cannot be fully accounted for in the preparation of hypothetical performance results.

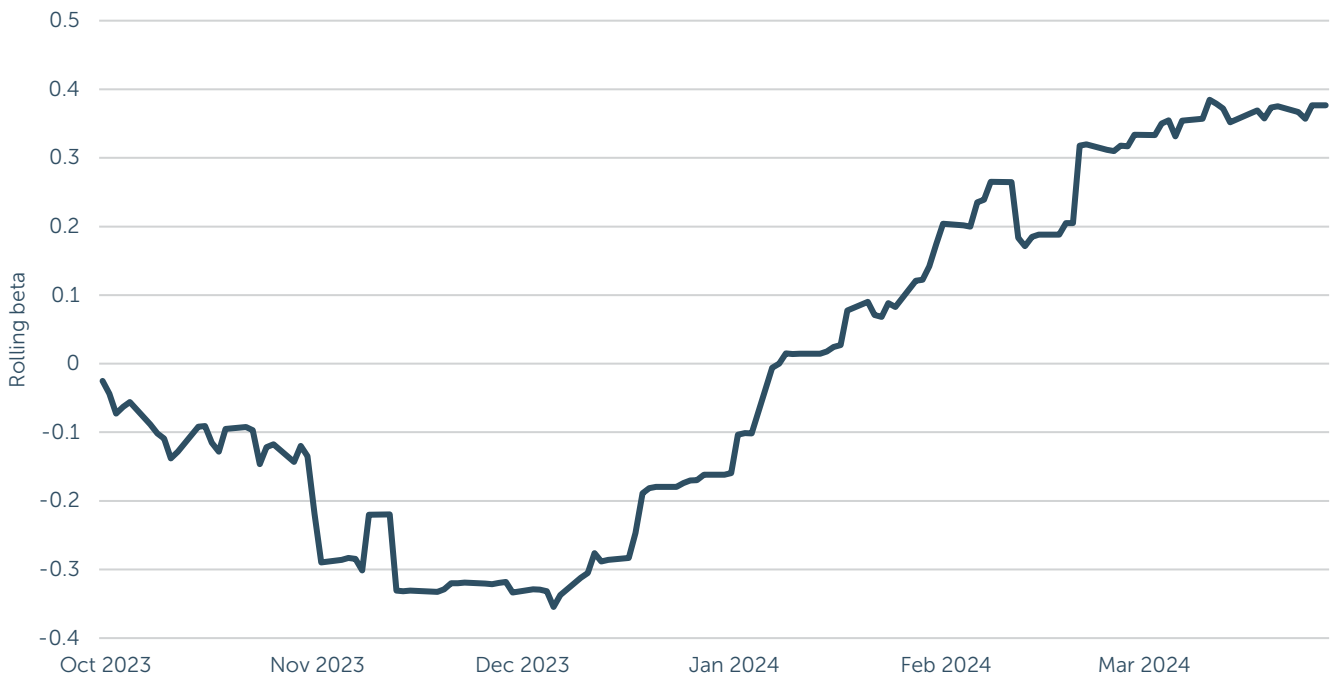
Introduction

Trend-following CTAs have performed strongly in the first quarter of 2024. The SG Trend Index, which tracks the performance of ten of the largest trend-following CTAs and serves as an important industry benchmark[1], returned +12.2% in the first three months of the year, making it the eighth best quarter on record for the index since its inception in 2000. Alongside other, more idiosyncratic trends, much of these profits were driven by long positions in equity index futures, capitalizing from the sustained rally in global equity markets that began back in mid-October 2023. Although exact figures are not publicly available, our internal models suggests that the average notional equity exposure of trend-following CTAs may have reached a historically above average level in the first quarter of 2024.

Such a high level of long exposure to equities is not common. The last time our internal estimates reached similar levels was in the last quarters of 2017 and of 2019, respectively.

The above can be corroborated by quantifying the risk exposure of the CTA industry to equities, as measured by equity beta. Figure 1 shows the rolling exponentially weighted beta of the SG Trend Index against S&P 500 Index futures[2]. As the chart shows, the equity risk of trend-following CTAs has increased significantly since December 2023, reaching a relatively high level of 0.4 in March 2024[3].

Figure 1: Rolling equity beta for the SG Trend Index against the S&P500 Index futures since Oct. 2023



[1] The SG Trend Index is designed to track 10 of the 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 reconstituted annually. The Index is not directly investable. Source: Société Générale.

[2] In this note, the equity beta measures the sensitivity of the SG Trend index returns with respect to the S&P 500 future returns.

[3] It is worth pointing out that a positive statistical equity beta may not necessarily imply a positive notional equity exposure, as it may be the result of diversification and correlation effects from other asset-class exposures, such as bonds, currencies, or commodities, which are typically part of a diversified CTA's investment universe. Nevertheless, an equity beta of 0.4 indicates significant long equity risk and a greater sensitivity to potential short-term equity market reversals.

Regardless of the market environment, such a high exposure to long equity risk may be of concern to investors looking at trend-following strategies from a risk mitigation perspective. Indeed, most institutional portfolios are largely dominated by long equity risk, and many institutions allocate to trend-following CTAs to diversify away from their equity market risk, improve risk-adjusted portfolio returns, and expect their CTAs to perform well during equity market downturns.

The fact that equity risk mitigation is seen as one of the key benefits of trend-following in a portfolio context is driven by historical evidence. As measured by the SG Trend Index, trend-following CTAs have delivered positive returns with close to zero long-term correlation to global equity markets over the past 25 years[4]. Additionally, trend-following CTAs have historically performed best in the most difficult years for equity markets, such as in 2008 and 2022[5].

However, during periods of prolonged bull markets, such as the one observed for the first months of 2024, a trend-follower may build up a significant long equity exposure, thereby compromising its ability to protect investors from sudden and sharp price declines. It is therefore natural for investors and CTA managers alike to question the benefits of building significant long equity positions from a risk mitigation perspective, and to be tempted to limit equity exposures so that they do not become too large. This leads us to ask the following questions: What contribution have equity positions made in the past to the performance of trend-following CTAs depending on the type of market environment? And what are the costs and benefits of restricting a trend-follower's long equity risk allocation in terms of expected long-term returns and diversification potential?

To answer these questions, we start by quantifying the equity risk mitigating characteristics of trend-following CTAs based on an analysis of the conditional attribution of their quarterly returns to three distinct equity market regimes. Based on a univariate regression-based model we then decompose quarterly CTA returns into an alpha and an equity beta component and review the contribution of both components in each of the three equity market regimes, with a particular focus on crisis periods.

In a final section, we present three different methodologies of restricting a trend-follower's long equity exposure and quantify the hypothetical impact of each constraint on overall and regime-conditional performance, as well as the contribution from the alpha and equity beta components. We conclude with a comparative assessment of the costs and benefits of such equity constraints versus an unconstrained trend-following approach.

Trend-Following CTAs have historically provided strong equity risk mitigation benefits

To quantify the risk mitigation benefits of trend-following CTAs, we perform a regime conditional or "smart diversification" analysis over a quarterly investment horizon. We believe that analyzing the performance and diversification characteristics of a medium-to-long-term trend-following CTA based on returns sampled at a quarterly frequency, is most consistent with its tactical investment horizon and average holding period of a few weeks to several months.

[4] The SG Trend index has annualized at 6.1% p.a. with a long-term correlation to the S&P 500 Index of 0.01 over the period 1.1.2000 – 31.03.2024.

[5] In 2008, the SG Trend Index gained +20.9% while the S&P 500 future lost -39.3%, its worst year since 2000. In 2022, the SG Trend Index gained +27.4%, its best year on record, while the S&P 500 futures lost -19.8%, its third worst year since 2000.

Table 1: Equity regime conditional return attribution of trend-following CTA

Jan 2000 – Mar 2024 quarterly (log-)returns	S&P 500 futures	trend-following CTA	Correlation
Bear regime average	-14.4%	6.1%	-0.30
Normal regime average	2.4%	0.3%	0.10
Bull regime average	11.9%	1.6%	0.02
TOTAL average	1.2%	1.5%	-0.06

Jan 2000 – Mar 2024 annualised contribution	S&P 500 futures	trend-following CTA	TF Equity beta
Bear regime annual contribution	-9.5%	4.1%	-0.15
Normal regime annual contribution	6.5%	0.8%	0.09
Bull regime annual contribution	7.8%	1.0%	0.02
TOTAL annual (log-) return	4.9%	5.9%	-0.04

Table 1: Regime-conditional quarterly logarithmic returns (top table) and annualized return contribution (bottom table) for S&P 500 futures and trend-following CTAs represented by the SG Trend Index over the period 1.1.2000 – 31.03.2024. Regime-conditional correlations (top table) and empirical beta (bottom table) of trend-following CTAs represented by the SG Trend Index against SP& 500 futures, based on daily returns, are also shown over the same period. "Bear" and "Bull" regimes are defined by the 16 worst and 16 best calendar quarters in terms of S&P 500 futures performance out of 97, respectively. The "Normal" regime is composed of the remaining 65 quarters in between the other two regimes. Data as per 31.03.2024. Source: Quantica Capital, Societe Generale.

Throughout this research note, we will use the S&P 500 Index futures and the SG Trend Index as benchmark proxies for equity and trend-following CTA returns, respectively[6].

Our regime-conditional performance analysis is based on the series of 97 quarters from January 2000 (corresponding to the inception date of the SG Trend Index) to March 2024. More specifically, we rank the 97 quarterly returns of the S&P 500 futures[7] in ascending order from the worst (a loss of -22.9% in the fourth quarter of 2008) to the best (a gain of 20.7% in the second quarter of 2020), and define three different equity market regimes:

- a bear market (or "crisis") regime composed of the 16 worst performing calendar quarters[8],
- a bull market regime composed of the 16 most profitable calendar quarters, and
- a normal market regime composed of the remaining 65 calendar quarters in between the other two regimes.

Empirically, since 2000, the bear market regime has included any quarter in which the S&P 500 futures has lost more than 5% of its value. The bull market regime has encompassed any quarter in which the index futures has gained at least 9%. All other quarters have fallen into the normal market regime defined above.

Table 1 provides an overview of the average quarterly (logarithmic) returns of both the S&P 500 futures and the SG Trend Index, as well as their cross-correlation[9], for each of the three regimes introduced above, and in aggregate. Additionally, we report the annualized contribution of each quarter to the total performance as well as the regime-conditional and aggregate beta of the SG Trend Index to S&P 500 futures returns.

[6] The results in this research note are not sensitive to either choice of benchmark for equities or trend-following CTA returns. The benchmark used as a proxy for CTA returns should be representative of the returns generated by a typical medium-to-long-term trend-following model.
[7] S&P 500 Index futures returns are *unfunded* and represent *excess over risk-free* S&P 500 Index returns.
[8] We rely on the 16% and 84% quantiles to classify a given quarter into a bear or bull market regime. This corresponds to a quarterly return that is bigger than one-standard-deviation away from the mean, assuming a normal distribution.
[9] Correlations over any period are computed using daily logarithmic returns. Logarithmic returns are additive over any time period, which is the main reason for using them for the purpose of this note.

The main findings are as follows:

- While the long-term correlation between trend-following CTAs and equities has been close to zero over the entire 24-year period, it has been significantly negative in crisis quarters, and positive in normal and bull market quarters. Since 2000, the trend-following industry has not only produced equity-like returns with no long-term correlation to equities, but it has also delivered negatively correlated positive returns during the worst periods for equities, and positively correlated positive returns during favorable periods (which make up the vast majority of time).

- During its 16 worst calendar quarters since 2000, the S&P 500 Index has lost an average of -14.4% per quarter, while trend-following CTAs have returned an average positive 6.1% per quarter.

- Historically, over the past 24 years, two thirds of trend-following CTA returns have been generated during the 16 bear market quarters (4.1% p.a. out of the 5.9% p.a.), while the remaining 81 quarters have contributed on average only 1.8% per year.

After the Great Financial Crisis in 2008, a term was coined to describe the ability of trend-followers to generate positive returns during periods of equity market stress: "crisis alpha". In statistics, the Greek letter alpha is used to denote the constant in a regression model to explain the contribution of a variable (e.g. trend-following returns) that is uncorrelated with an explanatory variable (e.g. equity market returns). In quantitative finance, the letter is used to describe an (out-) performance that cannot be explained by any standard risk-factor (such as an equity market benchmark) and is used to measure the “skill-based” portion of a manager’s performance that cannot be explained by beta.

In the following, we look at each of the 16 equity bear market quarters since 2000 in more detail. We seek to quantify the proportion of historical trend-following CTA performance that can be attributed to pure equity beta on the one hand, and to alpha (that is the fraction of returns that cannot be explained by a univariate regression beta factor to equities) on the other hand.

Decomposition of trend-following returns into an alpha component and an equity beta component

To decompose trend-following returns into an alpha and an equity beta component, we run for each calendar quarter the following linear regression:

$$r_t^{\mathrm{TF}} = \alpha + \beta r_t^{\mathrm{S\&P500}} + \epsilon_t$$

where r_t^{TF} and $r_t^{\mathrm{S\&P500}}$ are the daily log-returns and $t = 1, \dots, T$ the number of observations during the quarterly period.

Denote by $\hat{\alpha}$ and $\hat{\beta}$ the least-squares estimates of the regression coefficients, and by $R_T^{\mathrm{TF}} = \sum_{t=1}^{T} r_t^{\mathrm{TF}}$ and $R_T^{\mathrm{S\&P500}} = \sum_{t=1}^{T} r_t^{\mathrm{S\&P500}}$ the total (quarterly) log-returns.

We can then decompose the total (quarterly) trend-following Return R_T^{TF} into an alpha component R_T^{α} and an equity-beta component R_T^{β} by setting

$$R_T^{\alpha} := \hat{\alpha} T, \qquad R_T^{\beta} := \hat{\beta} R_T^{\mathrm{S\&P500}}$$

From the additivity of the log-returns and the fact that the sum of the regression residuals is zero, we get the decomposition

$$R_T^{\mathrm{TF}} = \hat{\alpha} T + \hat{\beta} R_T^{\mathrm{S\&P500}} = R_T^{\alpha} + R_T^{\beta}$$

Quantifying the contribution from crisis alpha and negative crisis beta to trend-following CTA performance

To quantify to which extent trend-following CTA performance during equity crisis periods is driven by positive crisis alpha or negative crisis beta, we first run a linear regression on the daily logarithmic returns of the SG Trend Index against S&P 500 index futures to compute both the alpha and the beta coefficients for each crisis quarter. We then decompose trend-following returns into:

- an alpha component, which reflects the portion of trend-following returns which, in the context of a univariate regression[10], are independent of equity market risk (i.e. uncorrelated to equity returns), and
- a beta component, which fully reflects the portion of trend-following returns with an empirical correlation of ± 1 to the equity returns during the quarter.

The decomposition of returns into a crisis alpha and a crisis beta contribution for each of the 16 equity bear market quarters since 2000 is provided in Table 2. In addition, the performance of equities and trend-following CTAs, as well as their (in-sample) empirical beta to equities, are shown for each quarter.

[10] Alpha is to be understood in the context of a univariate regression model in which trend-following returns are regressed against a single risk-factor: the S&P 500 index futures. This implies that a large portion of our estimated alpha will likely be explained by other risk-factors and asset classes other than equities. Identifying those other beta exposures is beyond the scope of this research note.

Table 2: Trend-following CTA return and crisis alpha and crisis beta decomposition in Equity Bear market quarters

Date	S&P 500 futures return	TF CTA return	TF CTA crisis alpha return	TF CTA crisis beta return	empirical beta
31.12.2008	-26.1%	11.9%	9.6%	2.4%	-0.09
31.03.2020	-22.5%	2.3%	2.0%	0.2%	-0.01
30.09.2002	-19.5%	16.6%	10.9%	5.7%	-0.29
30.06.2022	-18.0%	9.2%	7.3%	1.9%	-0.10
28.09.2001	-16.9%	3.8%	-3.5%	7.4%	-0.44
31.12.2018	-15.4%	-5.2%	-5.7%	0.5%	-0.03
30.09.2011	-15.0%	2.4%	1.4%	1.0%	-0.06
28.06.2002	-15.0%	14.7%	8.5%	6.2%	-0.41
30.03.2001	-14.3%	10.1%	4.0%	6.1%	-0.43
30.06.2010	-12.3%	-3.1%	-1.1%	-2.1%	0.17
31.03.2009	-12.0%	-2.8%	-5.0%	2.2%	-0.18
31.03.2008	-11.0%	8.1%	7.3%	0.8%	-0.07
29.12.2000	-10.0%	28.5%	24.1%	4.4%	-0.44
30.09.2008	-9.3%	-7.2%	-9.3%	2.2%	-0.23
30.09.2015	-6.9%	4.0%	2.6%	1.4%	-0.21
30.09.2022	-5.6%	5.0%	3.2%	1.8%	-0.32
Average	**-14.4%**	**6.1%**	**3.5%**	**2.6%**	**-0.20**

Table 2: Logarithmic returns of S&P 500 futures and corresponding trend-following CTA returns represented by the SG Trend Index in each of the 16 worst calendar quarters for S&P 500 futures over the period 1.1.2000 – 31.03.2024. Trend-following CTA returns are additionally decomposed into a crisis alpha and a crisis beta component using a linear regression over each quarter. Please refer to Page 9 for a definition of the alpha and beta components. The estimated beta coefficient from the regression for each quarter is also provided. Data as per 31.03.2024. Source: Quantica Capital.

The following key observations can be drawn from Table 2:

- Trend-following CTA returns were positive in 12 out of 16 bear market quarters since 2000, with an average quarterly outperformance of more than 20% (+6.1% vs -14.4%) against equities.

- Almost 60% of the trend-following CTA returns in bear market quarters, or on average 3.5% per quarter, cannot be explained by equity beta alone. This implies a positive return contribution from non-equity risk-factors and asset classes that display no correlation to equities. The alpha component has been negative in only 5 of the 16 crisis quarters.

- The crisis beta component has been positive in 15 out of 16 crisis quarters, accounting for more than 40% of the trend-following CTA bear market regime performance. This is the direct result of the negative beta to equities recorded in 15 out of the 16 bear market quarters[11]. This significant negative crisis beta indicates strong "timing ability" of CTAs during equity market corrections, which translates into highly beneficial equity risk mitigating properties for trend-following CTAs[12].

[11] There has been only one bear market quarter (the second quarter of 2010) for which the correlation and the equity beta have been positive, and hence the crisis beta component of CTAs has been a detractor to their performance!

[12] It is important to note that the significantly negative equity beta during periods of equity market stress is not necessarily the result of short equity market positions; in fact, most of it can possibly be explained either by long positions in negatively correlated assets, e.g. rising bond markets during periods of equity market stress, or by short positions in positively correlated assets, e.g. some commodity or currency markets with positive sensitivity to equity markets.

In a next section we extend the above analysis to the 81 normal and bull equity regime quarters to compare the contribution from both the alpha and beta components across all types of equity market regimes.

The alpha and beta contribution of trend-following CTAs in non-crisis quarters

Table 3 provides of the trend-following CTA return decomposition into its alpha and beta components for each of the three equity bear, normal, and bull market regimes since 2000. Additionally, similarly to Table 2, the average performance of both equities and trend-following CTAs, as well as their (in-sample) empirical $\hat{\beta}$ to equities is shown for each of the three regimes.

Table 3 shows that trend-following CTAs have on average delivered positive returns in all three equity regimes, albeit to a much lower degree in normal and bull market quarters relative to crisis quarters. However, unlike in the equity crisis regime, the CTA industry has struggled to generate a positive alpha contribution in those non-bear market quarters. Strikingly, over the full period since 2000, more than 85% of the total trend-following performance can be attributed to its equity beta contribution!

Another way of visualizing the results provided in Table 2 and 3 is to plot, as shown in Figure 2, the cumulative sum of the logarithmic returns of S&P 500 futures in ascending order and the cumulative sum of the alpha and beta components of trend-following CTA returns over the full sample of 97 calendar quarters.

Table 3: Regime conditional return attribution and alpha and beta return decomposition of trend-following CTA

Equity market regimes	S&P 500 futures average return	TF CTA averages return	TF CTA alpha return contribution	TF CTA average beta return contribution	empirical beta
Bear quarters	-14.4%	6.1%	3.5%	2.6%	-0.20
Normal quarters	2.4%	0.3%	-0.7%	1.0%	0.23
Bull quarters	11.9%	1.6%	0.2%	1.4%	0.14
Total	1.2%	1.5%	0.2%	1.3%	0.14

Table 3: Regime-conditional average quarterly logarithmic returns of S&P 500 Futures and trend-following CTA returns represented by the SG Trend Index for the period 1.1.2000 – 31.03.2024. "Bear" and "Bull" quarters are defined by the 16 worst and 16 best calendar quarters in terms of S&P 500 futures performance out of 97, respectively. "Normal" quarters are those 65 not classified as "Bear" or "Bull". Trend-following CTA returns are additionally decomposed into a crisis alpha and a crisis beta component using a linear regression over each quarter. Please refer to Page 9 for a definition of the alpha and beta components. The estimated average beta coefficient from the regression for each of the three regimes is also provided. Data as per 31.03.2024. Source: Quantica Capital.

Figure 2: Cumulative equity alpha & beta contribution of trend-following CTA returns versus cumulative Equity returns from January 2000 to March 2024

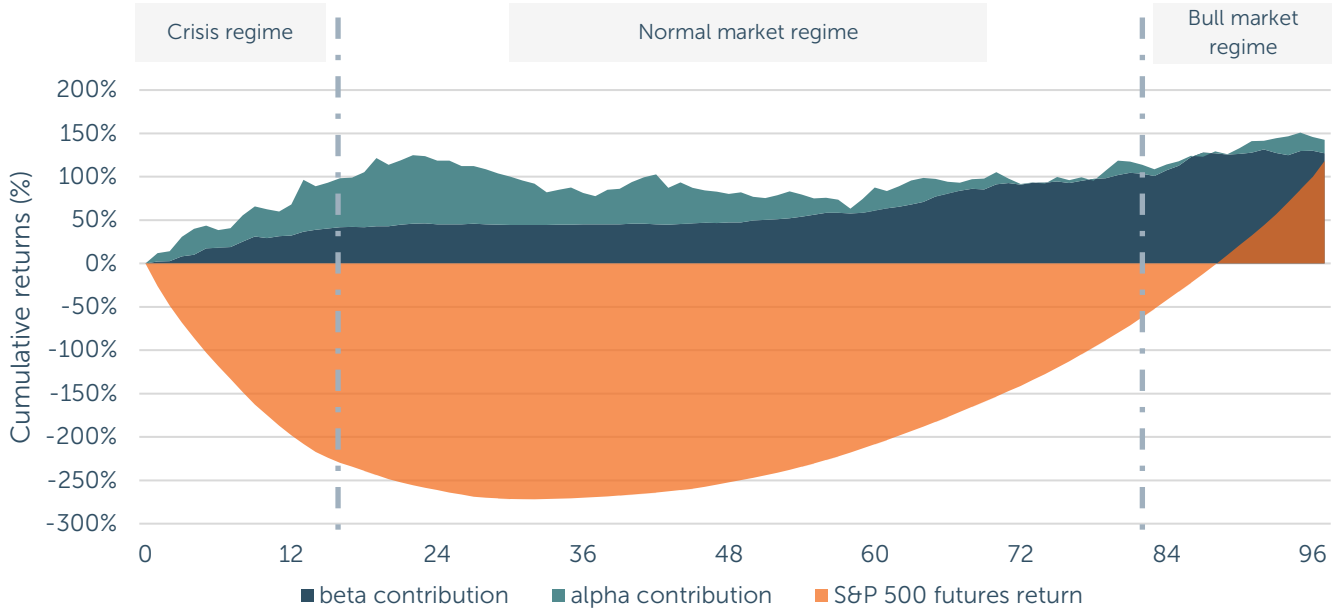


Figure 2: Cumulative sum over the full sample of 97 calendar quarters (from Jan. 2000 to Mar 2024) of the logarithmic returns of S&P 500 futures in ascending order and, on the basis of the same order, of the alpha and beta components of trend-following CTA returns represented by the SG Trend Index. "Crisis" and "Bull market" regimes are defined by the 16 worst and 16 best calendar quarters in terms of S&P 500 futures performance out of 97, respectively. Please refer to Page 9 for a definition of the alpha and beta components. Data as per 31.03.2024. Source: Quantica Capital.

While the alpha contribution was consistently positive and strong in the equity crisis periods (i.e., producing uncorrelated and mostly positive returns during periods of market stress), it declined in the normal equity quarters and leveled off in the best equity quarters. In fact, the alpha contribution was positive in 11 of the 16 crisis quarters but negative in 47 of the 81 non-crisis quarters, adding up to a total alpha contribution of slightly less than 0.7% p.a.

The beta component, on the other hand, consistently contributed to returns, albeit naturally somewhat less in the transition from negative to moderately positive equity quarters. In fact, the equity beta contribution of trend-following CTAs has been positive in 71 of the 97 quarters since 2000, adding up to more than 5% p.a., or more than 85% of the total return. The steady increase in the beta component illustrates the significant equity risk timing capabilities of trend-following CTAs over the past 25 years.

The cost and benefits of restricting long equity exposure in trend-following

At this stage, it is reasonable to ask whether and how the addition of a restriction on a trend follower's long equity exposure may improve its risk mitigating characteristics and can help boost both its positive crisis alpha and its negative crisis beta. The remainder of this note focuses on answering this question and address investor concerns that that may call into question the rationale for significant long equity exposures in a trend-following CTA from a risk-mitigation perspective.

For that purpose, we introduce different methodologies for restricting the long equity exposure of a trend-following approach and quantify the impact of each constraint on risk mitigation benefits, long-term returns, and on the alpha and beta return components.

More specifically we define three different implementations of a long equity exposure constraint as follows:

1. **No equities**: the most straightforward approach to restrict long equity exposure consists in simply excluding all equity instruments from the investment universe, hence restricting exposures to only fixed income, interest rate, commodity and currency markets.

2. **Exposure constrained**: this methodology only allows for short positions on any traded equity market instrument, thus restricting the trend model from building any long exposure in any equity instrument.

3. **Beta constrained**: this methodology aims to neutralize any positive trend-following beta to the S&P 500 index futures with a corresponding short position in the S&P 500 future[13]. This constraint leads to an always negative ex-ante equity beta and hence to trend-following returns which are by construction always negatively correlated to equities on an ex-ante basis.

Of the above three constraints, only the beta-constrained approach is free of any modelling assumptions and may be implemented as a hypothetical overlay on the historical SG Trend index returns. Evaluating the hypothetical impact of the first two approaches is not feasible without some additional modelling assumptions, as the list of instruments traded and their corresponding historical exposures in the programs that compose the SG Trend Index are not publicly available.

We therefore rely on a version of our internal generic trend-following replication model designed to produce return characteristics which are representative of the trend-following CTA industry[14]. To adjust past realized trend-following CTA returns for the "no equities" restriction, we simulate hypothetical past returns for our generic trend-following model, first based on the entire investment universe (including all equity instruments), and then based on the same universe, but excluding all equity instruments and reallocating the risk proportionally to all other asset classes. The difference in hypothetical simulated returns between both versions of the constrained and unconstrained model is then added to the SG Trend Index returns to obtain hypothetical returns of a typical trend-following CTA excluding any equity exposure.

A similar approach is used to obtain an approximation of the hypothetical returns of a representative trend-following CTA that is restricted from taking any long exposure in any of the traded equity instruments.

A comparative overview of the regime-conditional performance characteristics of the unconstrained (as already shown in Table 3) and the three equity-constrained trend-following CTA model implementations is provided in Table 4.

From a pure risk mitigation perspective, the benefits from constraining the long equity exposure of a trend-follower vary depending on the chosen constraint implementation but are limited at best.

[13] More specifically, our "beta constrained" methodology is based on the following 2-step procedure:
1. by estimating a rolling ex-ante, exponentially weighted average beta of the SG Trend Index against S&P 500 futures, based on daily returns, and
2. in case such beta is positive, by adding the return of a short position in the S&P 500 future, such that the estimated positive beta is neutralized, to the next day's SG Trend Index return.

[14] Quantica's generic trend-following model operates on a representative universe of the most liquid futures contracts across equities, fixed income, short-term interest rates, currencies, and commodities.

Table 4: Equity regime conditional return contribution for unconstrained and three different equity constrained TF methods

Jan 2000 - Mar 2024 annualised contribution	S&P 500 futures	TF CTA	hypothetical TF CTA no equities	hypothetical TF CTA exposure constrained	hypothetical TF CTA beta constrained
Bear regime	-9.5%	4.1%	3.7%	4.6%	4.5%
Normal regime	6.5%	0.8%	0.8%	-0.1%	-0.4%
Bull regime	7.8%	1.0%	0.2%	-0.4%	-0.1%
TOTAL annual (log-) return	4.9%	5.9%	4.8%	4.1%	4.0%

Table 4: Regime-conditional annualized return contribution of S&P 500 futures, trend-following CTAs represented by the SG Trend Index, and three different equity constrained trend-following CTA implementations (without equities, exposure constrained, and beta constrained) for the period 1.1.2000 – 31.03.2024. "Bear" and "Bull" regimes are defined by the 16 worst and 16 best calendar quarters in terms of S&P 500 futures performance out of 97, respectively. The "Normal" regime is composed of the remaining 65 quarters in between the other two regimes. The three equity-constrained trend-following CTA implementations are hypothetical and based on Quantica's generic trend-following model designed to produce returns which are representative of the trend-following CTA industry. HYPOTHETICAL RETURNS. PLEASE SEE IMPORTANT DISCLAIMERS ON PAGE 2. Data as per 31.03.2024. Source: Quantica Capital.

Indeed, stripping the investment universe off its equity constituents would have historically led to a deterioration of trend-following performance during bear market regimes from 4.1% to 3.7% p.a.! This is a direct reflection of a slightly less negative beta contribution, implying that equity positions themselves made a positive contribution to negative crisis beta during bear market quarters, which in turn implies an average net negative notional exposure to equities from trend-following CTAs during these quarters. In other words, removing equities from the investment universe would historically have weakened a trend-follower's negative crisis beta component while at the same time reducing long-term annualized returns by close to 20%, from 5.9% to 4.8% p.a., as a result of a lower positive beta contribution in rising equity market environments.

Conversely, both exposure- and beta-constrained methodologies would likely have led to an improvement in a trend follower's ability to mitigate equity risk, as evidenced by an increased, but still relatively limited, average annualized return improvement of 0.4% to 0.5% per annum during past bear market quarters. While this may seem beneficial at first glance, it is remarkable that these long equity restrictions would also have completely eliminated any positive contribution to trend-following performance during normal and bull market periods. The premium paid for restricting a trend-following CTA from running long equity positions or an overall positive portfolio beta to equities even leads to negative returns in normal and bull markets over the long-term.

The long-term negative impact of the hypothetical exposure- and beta-constrained implementations is even higher than in the case of the hypothetical no-equities implementation! In fact, the 0.4-0.5% annual improvement in performance during the crisis quarters comes at the cost of a 30% reduction in overall performance over the long term, equivalent to a 1.8% to 1.9% lower annualized return!

Figure 3: Comparison of alpha and beta contributions to returns by different equity constrained methods

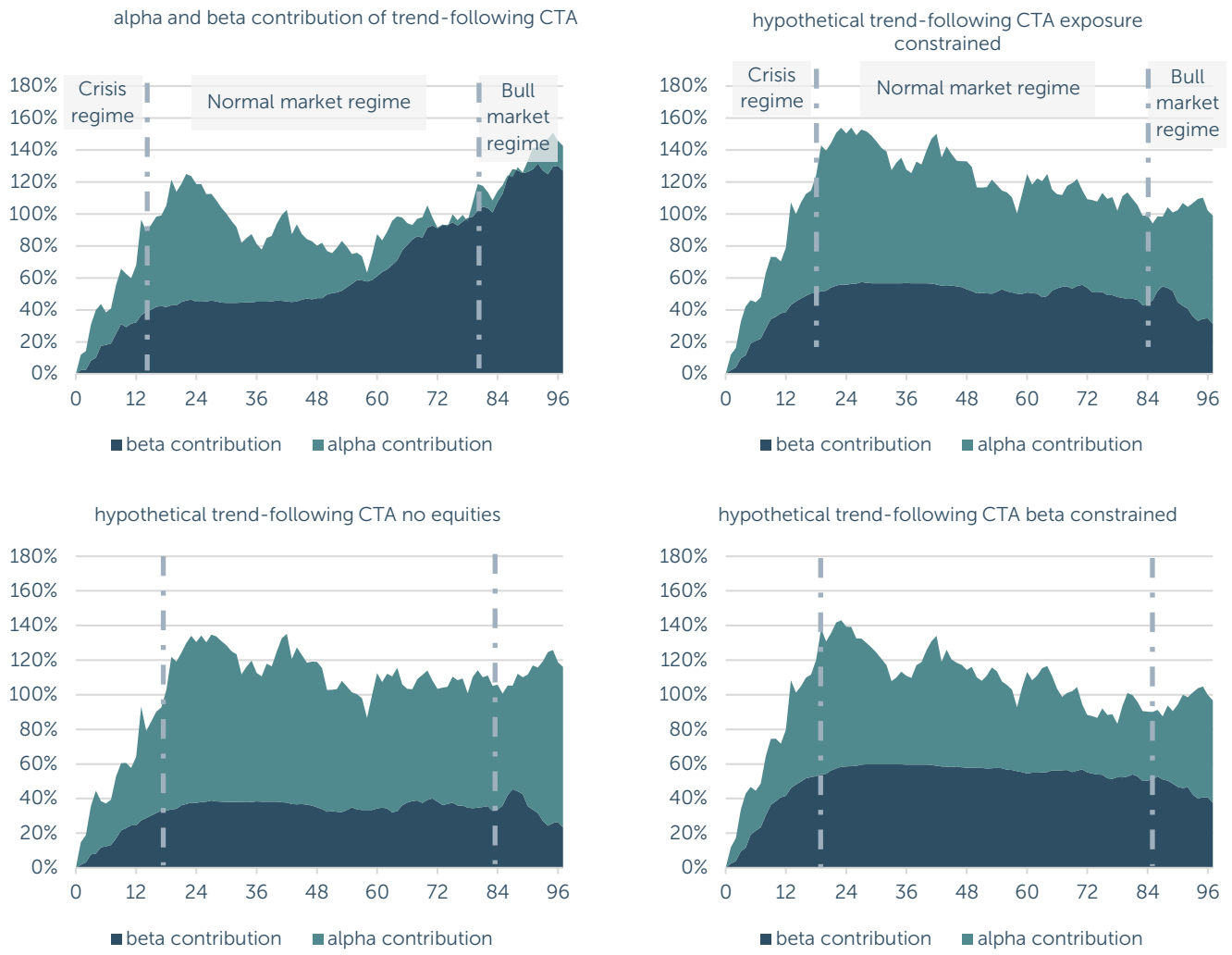


Figure 3: Cumulative sum over the full sample of 97 calendar quarters (from Jan. 2000 to Mar 2024) of the logarithmic returns of S&P 500 futures in ascending order and, on the basis of the same order, of the alpha and beta components of four types of trend-following CTA returns (top left: unconstrained, top right: no equities, bottom left: exposure constrained, bottom right: beta constrained). Please refer to Page 9 for a more detailed description of each of the four trend-following CTA models. "Crisis" and "Bull market" regimes are defined by the 16 worst and 16 best calendar quarters in terms of S&P 500 futures performance out of 97, respectively. Please refer to Page 9 for a definition of the alpha and beta components. The three equity-constrained trend-following CTA implementations are hypothetical and based on a version of Quantica's internal generic trend-following model designed to produce returns which are representative of the trend-following CTA industry. HYPOTHETICAL RETURNS. PLEASE SEE IMPORTANT DISCLAIMERS ON PAGE 2. Data as per 31.03.2024. Source: Quantica Capital.

Finally, we apply our proposed decomposition of quarterly trend-following returns into an uncorrelated alpha and an equity beta component to each of the three equity-constrained trend-following implementations.

Figure 3 repeats the analysis made in Figure 2 based on unconstrained trend-following returns and complements it with the alpha and beta decomposition profile for each of the three constraint methodologies.

Firstly, all three equity restrictions heavily penalize the equity beta contribution to overall performance during normal and bull market periods when compared to an unrestricted implementation. This may not come as a surprise, as with each constraint, a trend-follower will not be able to capitalize on any positive equity beta in a rising market environment. In fact, for our three constrained trend-following implementations, the cumulative contribution from equity beta

would have been mostly neutral in "normal" quarters, and negative in bull market quarters. This stands in stark contrast to the unconstrained implementation which has been able to capitalize on equity beta in each of the three equity regimes. It is only in the crisis regime that the constraints do not reduce the equity beta contribution.

Secondly, from a more technical perspective, it is worth highlighting that both the exposure- and beta-constrained implementations show a very similar alpha and beta contribution. It should be recalled that the former is based on a generic trend-following model, while the latter is free of any model assumptions. The similarity in performance attribution profiles across the three regimes can be taken as an indication that our proposed model-based approach to constraining long equity exposures is a valid replication of the alternative, model-agnostic approach to constraining equity beta.

And finally, when taking a closer look at the alpha and beta decomposition of the "no equities" implementation, it is striking to observe that, even without the ability to invest in any equity instrument, around one-third of the returns generated in the crisis regimes are attributable to equity beta contribution! This observation supports the hypothesis that as cross-asset class correlations increase during equity crisis periods, trend-following CTAs hold positions in non-equity assets which are highly (positively or negatively) correlated with equities, and thus are able to enhance risk mitigation benefits through negative crisis beta.

Taken together, the above results strongly suggest that the long-term benefits of an unconstrained trend-following approach far outweigh any potential, but short-lived, benefits of limiting equity exposure to protect against equity market drawdowns. The long-term premium paid to limit long equity exposures, regardless of the methodology employed, appear to be too high to compensate for the marginal relief from the occasional painful experience of sharp drawdowns due to short-term equity market corrections.

Conclusion

Although the equity beta of a typical trend-following CTA is close to zero over the long term, it can vary widely and become significantly positive over shorter time horizons, such as at the end of the first quarter of 2024, when we estimate a positive beta of around 0.4 for the trend-following CTA industry. Because such positive beta to equities may be viewed with skepticism for a strategy that is often used for equity risk mitigation purpose, we have provided a detailed quantification of the contribution from equity beta to trend-following performance across different types of market environments and over the long-term, based on publicly available returns for trend-following CTAs going back to 2000.

By decomposing quarterly trend-following returns into an alpha component and an equity beta component, we have shown that equity beta contributed positively in 15 out of 16 of the worst calendar quarters for equity markets since 2000 and accounted for more than 40% of trend-following CTA performance in these crisis periods. More generally, the contribution from equity beta to trend-following CTA performance was positive in 71 of the past 97 quarters (!), and accounted for more than 85% of total trend-following performance over that period, or more than 5% per annum. Our results indicate that equities play a beneficial role over the long-term in enhancing a trend-follower's negative crisis equity beta, but also in capturing the upside of a positive equity beta in a rising market environment. This regime-conditional equity beta contribution profile reflects a significant equity market timing ability of trend following CTAs over the past 25 years.

Restricting the long equity exposure of a trend-following CTA with the aim of enhancing its risk-mitigating properties offers little benefit but comes at a potentially significant long-term cost. To support this hypothesis, we have shown that the application of each of three different and illustrative implementations of a long equity restriction would have resulted in a meaningful deterioration in performance of 20-30%, or 1.2-1.9% p.a., over the past 25 years. This opportunity cost of not being able to participate in upward equity market trends far outweighs any equity risk mitigation benefits, reflected in a performance improvement in market crisis periods of at best 0.5% per year. In fact, for the constraint that completely avoids any equity exposure, we have shown that the risk-mitigation properties actually worsen.

Historically, equities have made a positive contribution to trend-following performance not only in times of rising prices, but also in the most adverse market environments. Our results therefore support a trend-following approach that does not limit exposure to equities.

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CONTACT US

Tel: +41 (44) 556 69 00
info@quantica-capital.com
www.quantica-capital.com

Licensed asset manager with FINMA
Registered CTA and CPO with the CFTC

Quantica Capital AG
Zurich Branch, Bärengasse 29
CH-8001 Zurich
Switzerland