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QUANTICA'CAPITAL

QUARTERLY INSIGHTS

QUARTERLY TRENDS ARE YOUR BEST FRIENDS

Why high speeds still aren't necessary for downside protection and upside participation

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Executive summary

This note focuses on one key parameter in the design of a trend-following strategy: the speed or lookback window of its underlying trend-signals. We assess the return sensitivity of a generic trend-following strategy to different model speeds. We report our findings for the exceptional past year 2022, as well as for every calendar year since 2000 in general.

For that purpose, we simulate the returns of a generic trend-following model over a continuous sequence of lookback windows ranging from a few days up to five years. We demonstrate that over the past 23 years an equivalent lookback window of around one calendar quarter (63 trading days) did allow to best capture the trend inefficiencies across the most liquid financial asset classes (equities, bonds, short rates, and currencies) and commodity markets. Moreover, such "medium-term" lookback period not only produced the strongest risk-adjusted returns for the last year and over the long term. It also provided, on average, the strongest portfolio diversification benefits in times of falling equity markets or rising interest rates without sacrificing – in contrast to shorter-term trend models – the attractive upside potential in less challenging equity and interest rate regimes.

In other words, a medium-term trend-following strategy has provided superior "smart diversification" characteristics against a variety of risk factors, such as equity market risk, interest rate and inflation risks, but also commodity, currency and volatility risks.

We also note that the trend-following industry apparently sought to capture faster trends until the mid-2000s, and likely operated with a longer average lookback from 2007 onward. We conclude that the trend-following industry as an aggregate has apparently operated with lookback parameters that are very close to the in-sample optimum over the past decade.

2022: A historically strong year for trend-followers characterized by high manager dispersion

2022 will be remembered as an exceptional year for trend-following CTAs. The SG Trend Index, an industry benchmark composed of the 10 largest trend-following managers by assets, was up 27.4%[1] for the year, outperforming not only traditional asset classes such as equities and bonds, but also most other alternative and hedge fund strategies.

Notably, it was the best calendar year on record for the SG Trend Index since its inception in 2000. However, like in previous years, return dispersion between different trend-following managers was high, despite the high cross correlations between the different strategies: This confirms once again that trend-following is anything but a "generic" strategy.

In fact, highly correlated trend-following strategies can differ a lot in terms of returns. The drivers of the return dispersion are multiple and may be related to investment universe construction, asset class risk exposure targets, portfolio construction methods, overall strategy risk management, or the desired trend speed.

In our first Quarterly Insights in April 2020[2], we have already outlined that the underlying speed of a trend-following model may be a significant driver of return dispersion between different trend-following strategies in certain market periods, especially in periods following sharp market reversals, as at the height of the Covid crisis in the first quarter of 2020. In this note, we seek to revisit our results and to provide a complementary framework and view on the subject.

Relying on our proprietary generic trend-following model, we first showcase its risk-adjusted return sensitivity in 2022 with respect to a range of speeds corresponding to trend-lookback windows spanning from a few days up to five years. Last year's speed sensitivity profile is then compared with those of all the previous years back to the year 2000. We then take the average of all speed sensitivity profiles between 2000 and 2022 to assess which of all trend-following speeds would have yielded on average the strongest risk-adjusted returns over the period.

Given that such a sensitivity analysis can only be performed on simulated returns, which are naturally dependent on our specific model assumptions, we additionally evaluate for each calendar year the daily return correlation sensitivity between our generic trend-following approach and the SG Trend Index. This allows us (1) to identify the trend speed configurations that most closely tracked the industry benchmark, and (2) to detect any shifts in the trend speed over time.

Relying on our benchmark trend-following model, we further run the speed sensitivity analysis on the different asset classes that typically make up a diversified trend follower's investment universe and investigate whether a similar speed optimum exists across some or all asset classes. Finally, we conclude this note by evaluating how the speed of a generic trend-following strategy affects its "smart diversification" characteristics with respect to two of the most common portfolio risk factors: equity market and interest rate risk.

[1] Source: Société Générale
[2] "Why speed matters", Quantica Quarterly Insights, April 2020.

Defining the trend speed of a generic trend-following approach

In this note we rely on the same generic trend-following model that we introduced as part of our first *Quarterly Insights* publication back in April 2020. The model operates on a representative universe of close to 100 of the most liquid futures contracts across equities, fixed income, short-term interest rates, currencies, and commodities. At its core, Quantica's generic trend-following model relies on the exponentially weighted moving average (EWMA) of an instrument's past risk-adjusted log-returns[3].

We define the "speed" of a trend-following model as the half-life of the underlying EWMA weights[4]. The half-life can be intuitively understood as the time lag up to which the sum of the EWMA weights equals 50%. To parametrize the sensitivity of performance to different trend spreads, we will consider half-lives ranging from as little as one day to up to five years, thereby capturing the whole spectrum of trend-following implementations, from the ultra-fast to the very slow.

The impact of the model speed on a calendar year's trend-following performance

Taking into account realistic trading costs[5], we run the simulated performance of our generic trend-following model for increasing trend speeds associated with half-lives from one day to five years, starting in the year 2000. Figure 1 shows the risk-adjusted returns as a function of the increasing lookback, or EWMA half-life, for each calendar year since 2000.

In 2022, the optimum in terms of risk-adjusted performance, corresponding to an annualized Sharpe ratio of around 2.8, would have been achieved with a half-life between approximately one and two calendar quarters (or 60 to 100 business days). Slower models with half-lives greater than 1 year significantly underperformed, with negative Sharpe ratios recorded for longer half-lives above 1.5 years.

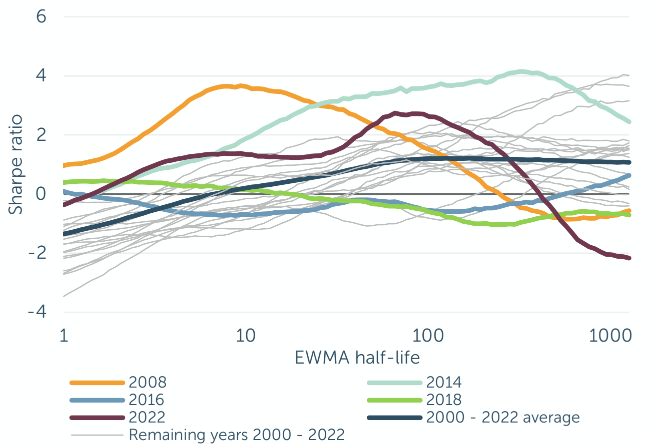

Figure 1: Calendar year Sharpe ratios of a generic trend-following model as a function of the model's signal half-lives between 1 and 1000 business days (log scale), for each year since 2000. Source: Quantica Capital.

Faster models with half-lives between 4 and 30 business days also underperformed, but to a lesser extent, still recording an average annualized Sharpe ratio of around 1.3 (with little dispersion within that range of speeds). Like in previous years, the choice of the model speed could have a material impact on the risk-adjusted performance of a trend-follower in 2022.

Figure 1 also provides some insights into the different sensitivity profiles of trend-following performance as a function of model speed in

[3] As a next step, the EWMA signal is transformed via a continuous, increasing, and bounded function into target risk allocations. Overall portfolio exposures are then proportionally adjusted dynamically to target an annualized volatility of 12%. Additionally, a simple trade-selection logic is applied to minimize transaction costs, which is especially relevant when simulating faster trend-following models.
[4] See the Appendix for details.
[5] Trading costs are taken from Quantica's proprietary trading history.

past years. In some years, like 2016 and 2018, which were among the most challenging for trend-followers in the past two decades, the choice of speed had very little impact on the overall industry performance. In these years, model speed was unlikely a source of dispersion between individual trend managers. Inversely, the year of the Great Financial Crisis, 2008, stands out as showing remarkable risk-adjusted performance dispersion between different levels of speed. Our analysis highlights a strong return dispersion in 2008 between fast and slow trend-speeds. Indeed, while a signal half-life of one calendar quarter still would have yielded approximately a net Sharpe ratio of 2 that year, a much faster model with a half-life of 10 business days could have delivered a Sharpe ratio after costs of 3.8.

Another outstanding year with exceptional risk-adjusted returns for trend-following was 2014. That year, however, the speed sensitivity of our generic model proved to be very different: risk-adjusted returns increased monotonically with lookbacks between two weeks up to one year, with resulting Sharpe ratios above 2, and a peak value of 4 corresponding to a half-life of one year.

We conclude that the optimal trend speed yielding the highest Sharpe ratio can vary significantly between different periods under considerations. And the best trend speed configuration is unfortunately only known in retrospect. Predicting which trend speed will perform best in the future is a challenging task. But can we identify any model speed that did deliver superior risk-adjusted returns in the long-run, for instance since the year 2000?

In Figure 2, we show the average speed sensitivity across all years since 2000. Additionally, upper and lower 95% confidence bands provide an indication of the variability around the long-term average[6]. As it turns out, there is a clear relationship between trend model speed and its expected annual risk-adjusted return. Based on the past 23 years of simulated trend-following returns, there is a clear statistical sweet spot between one and two calendar quarters, for which the model has yielded the highest Sharpe-ratio net of conservative implementation cost. While the average realized Sharpe ratio for slower trend models with half-lives up to five years remains surprisingly stable, it is to be noted that the annual return dispersion does increase for these slower trend models.

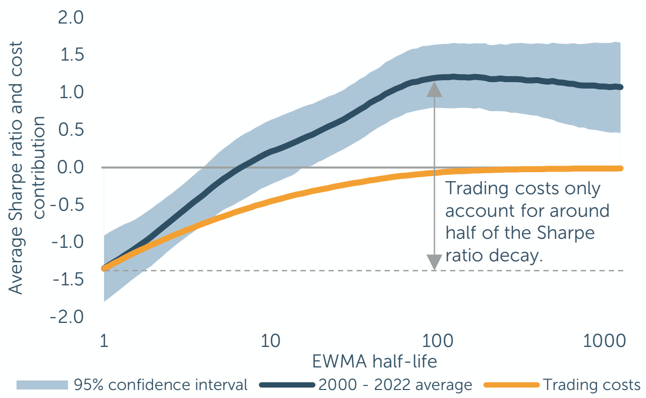

Figure 2: Average calendar year Sharpe ratio and associated drag due to trading costs of a generic trend-following model calculated across all years between 2000 and 2022 as a function of the model's signal half-lives between 1 and 1000 business days (log scale). Source: Quantica Capital.

The Sharpe ratio decay observed for faster model speeds is only partially driven by increased turnover and associated implementation costs. For half-lives between 10 and 100 business days, implementation costs only account for approximately half of the observed Sharpe ratio decay. Indeed, the annual risk-adjusted drag due to implementation costs between the shortest half-life of 1 and the optimal half-life of 100 business days is only -1.3, while the total risk-adjusted return decay is close to -2.6. This points towards the existence of an inherently stronger

[6] Computed using a distribution-agnostic bootstrap methodology.

market inefficiency and greater potential to capitalize on trends measured based on an EWMA half-life of around 60 to 100 business days.

From this perspective, with a Sharpe ratio-maximizing half-life of 60 to 100 business days, 2022 was entirely consistent with the observed longer-term statistical relationship between model speed and realized trend-following performance. While the optimal speed to capitalize on market trends does vary from one year to another, in the long-run, trend inefficiencies may be best captured based on a "medium-term" lookback window of around one to two calendar quarters.

We conclude that a half-life of between 60 and 120 proved to be the most optimal choice of speed over the long run in terms of providing investors with the highest Sharpe ratios after costs, with the full benefit of hindsight.

Reconstructing the average industry trend speed over time

So far, our findings are based upon a generic model used to simulate hypothetical trend-following returns. Next, we attempt to determine the model speed that best replicates the industry benchmark by measuring the correlation of our generic model with the SG Trend Index across the range of trend speeds. Figure 3 shows, for each calendar year since 2000, the correlation (based on daily returns) between the SG Trend Index and our generic trend-following strategy as a function of the half-life of the signal. In addition, we show the historical average of the correlation profiles together with the 95% confidence bands.

For the whole period 2000-2022, any lookback corresponding to a half-life between 35 and 100 business days would have replicated the industry returns with a correlation higher than 0.8. But importantly, it is for a half-life of 65 business days that the average annual correlation between our generic trend-following model and the SG Trend Index reaches its maximum value of 0.86 over 23 years. At the same time, a half-life of 40 business days were to replicate the industry returns with the narrowest 95% confidence band and a correlation of 0.82.

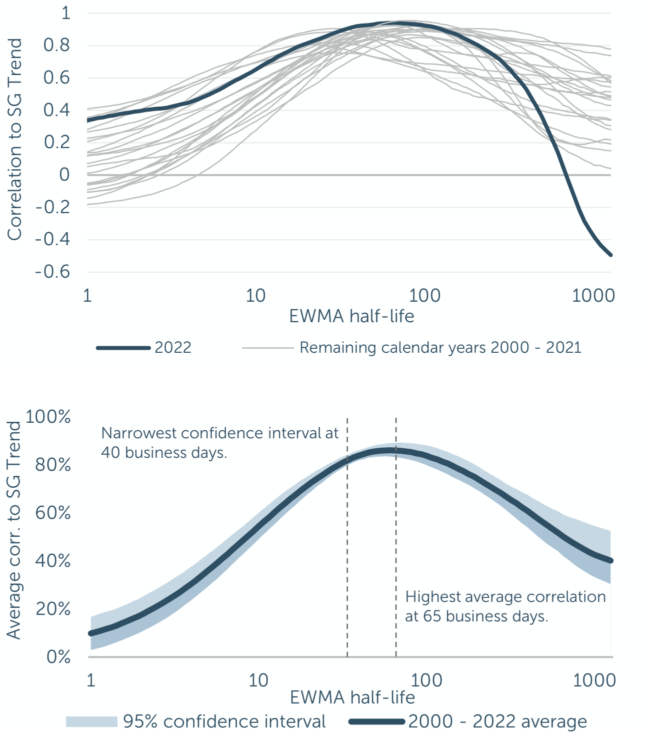

Figure 3: Annual correlation (based on daily returns) for each calendar year since 2000 between the SG Trend Index and a generic trend-following model as a function of the model's half-life. The lower chart shows the historical average of the yearly correlations together with 95% confidence bands. Source: Quantica Capital.

For the year 2022 alone, the maximum correlation was even higher at 0.95, reached for a half-life of 66 days, while any half-life between 35 and 125 days led to a correlation of 0.9 or higher. As Figure 1 highlights, the SG Trend Index delivered a Sharpe ratio of close to 2.3 in 2022, and our replication model resulted in Sharpe ratios between 2 and 2.7 for any lookback half-life between 42 and 167 days.

This indicates that the speed of the trend model was unlikely a key driver of return dispersion between trend-following managers in 2022.

In fact, if anything, our findings indicate that the trend-following industry has done an excellent job of running their models at the right trend speed in the recent past.

For some calendar years, however, the peak correlation with the SG Trend Index is reached for faster trend speeds, as illustrated in Figure 4. There, it is shown that in the years 2000 - 2004 the average half-life best replicating the index was below 30 business days, whereas this value more than doubled to an average of 70 business days for the following 18 years, between 2005 and 2022. Figure 4 therefore provides what we believe to be a realistic approximation of the evolution of the average trend speed used by the trend-following industry since 2000.

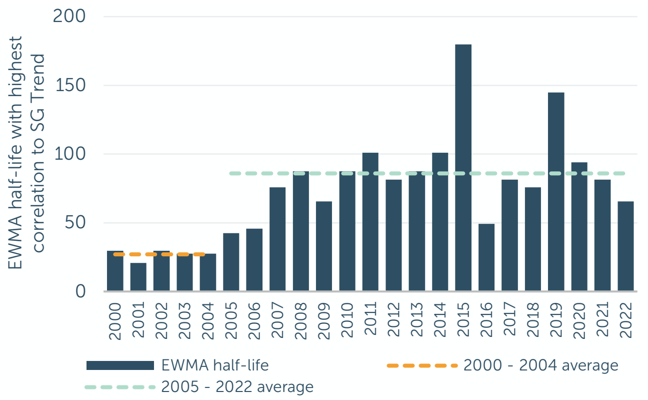

Figure 4: Half-life of a generic trend-following model that would have yielded the model's highest correlation (based on daily returns) with the SG Trend Index for each full calendar year between 2000 and 2022. Source: Quantica Capital.

Model Speed and Asset Class Performance Contribution

In a next step, we assess the impact of the model speed on the return contribution from the main asset classes of a trend-follower's typical investment universe: equities, government bonds, short-term interest rates, currencies, and commodities.

Figure 5 shows the breakdown of the annualized generic trend-following returns across the five asset classes for the period 2000 – 2022, as a function of different model speeds from one day to five years.

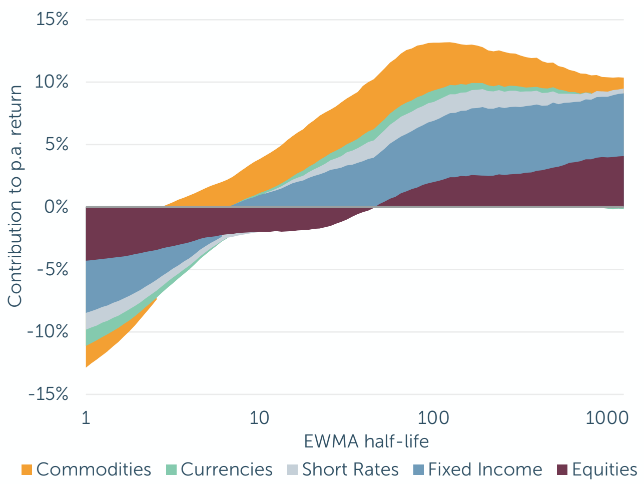

Figure 5: Annualized attribution of returns by asset class of a generic trend-following model as a function of the model's signal half-lives between 1 and 1000 business days. Period: 2000 – 2022. Source: Quantica Capital.

First of all, it is noteworthy that for the half-life of between 60 and 100 business days, which had yielded the highest annualized return over the past 23 years, each asset class would have contributed positively.

Importantly, the optimality of speeds between one to two calendar quarters is not driven purely by one or two particular asset classes in the universe. Furthermore, our analysis shows very clearly that the relation between trend speed and return contribution varies fundamentally for the different asset classes.

For commodities, our generic trend-following model already generated positive returns for all half-lives greater than 3 days. However, even for the commodity sector, a lookback between one and two calendar quarters would have produced the highest returns. For longer half-lives, return contribution decreases and almost disappears for very slow models.

Fixed income, short rates and FX markets had a very similar pattern: lookbacks shorter than one to two weeks produced negative trend-following returns net of costs, and return contributions get indeed positive for slower models and reach their maximum for half-lives of between one and two calendar quarters, after which they decrease and finally disappear for FX and short rates, while they remain positive for very long models in fixed income.

Equities appear to be the most sensitive to model speed, as their contribution to overall trend-following returns has been historically systematically negative for half-lives below one calendar quarter. Interestingly, return contribution seems to increase monotonically with the half-life of the trend signal. One could hence argue that the generic trend-following model was not able to exploit a meaningful "trend-following market inefficiency" in equities on a large scale but was rather profitable by exploiting the positive market risk premium in this asset class.

More generally, the results shown in Figure 5 give rise to an important interpretation of trend-following in the context of financial economics: Increasing the lookback period to an eventually multi-year period transforms a generic trend-following approach into a "risk premia strategy" capturing the long-term risk premia embedded in the different asset classes.

Therefore, it is not surprising to see that in the case of the longest half-life of five years considered in this analysis, trend-following returns are almost entirely attributable to equities and fixed income, which did appreciate strongly over the past 23 years. This confirms the economic wisdom that a long-term risk premium is indeed embedded in those two asset classes. For all other asset classes, the positive return contribution decreases and eventually almost vanishes with multi-year lookback periods, supporting the economic hypothesis that there is no long-term risk premium embedded in those markets. In fact, the systematically positive return contribution for medium-term trend-following can thus be attributed to a trend-following market inefficiency rather than a longer-term risk premium for those asset classes.

A similar breakdown of returns by asset class as above may be made for any given period. As such, Figure 6 explores the return sensitivity for different trend speeds of each asset class specifically for the year 2022. Some interesting observations can be drawn:

- When applied to global equity indices, a generic approach to trend-following did not generate any positive performance in 2022, regardless of the speed of the model.
- Again, a model half-life of around one calendar quarter corresponded to the optimal model speed for each of the five asset classes.
- In 2022, the biggest trend opportunities were in Fixed income and Short Rates, where any EWMA half-life between one day and one year led to positive contributions mainly through short positions. Only models with a half-life greater than one year were not able to profit from the significant increase of global interest rates and the corresponding price correction in bond and interest rates markets.
- At the same time, the sensitivity of the return contribution to model speed was the highest in fixed income and short-term rates. An increase of the half-life from 30 days to 57 days can already explain a total return difference of up to 7% coming from the rates sector only. This is why we believe the most important factor to explain trend-following manager return dispersion in 2022 is fixed income and short rates contribution, which were also the most sensitive asset classes to the speed of the trend signals. However, as concluded earlier, different trend speeds alone are not able to explain the large return dispersion between CTA managers witnessed in 2022.

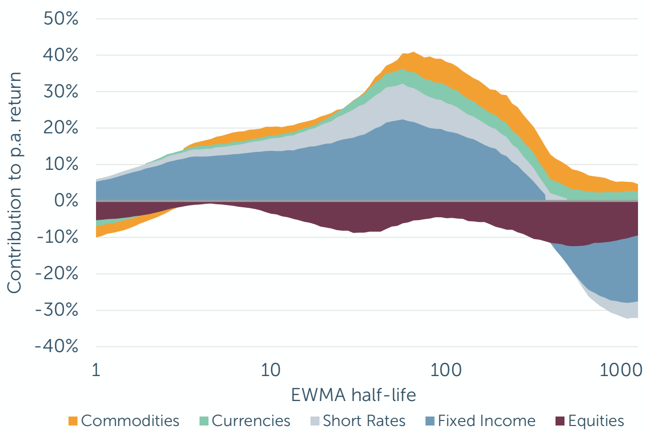

Figure 6: Annualized attribution of returns by asset class of a generic trend-following model as a function of the model's signal half-lives between 1 and 1000 business days for the year 2022. Source: Quantica Capital.

How does model speed impact smart diversification characteristics?

In this last section, we highlight one of the key strengths of trend-following: its proven ability to deliver attractive risk-adjusted returns that are regime independent against traditional risk factors, such as equity or interest rate risks. Those return characteristics are the source of valuable "smart diversification" benefits, translating into negative correlation to key risk factors during adverse market regimes, and a positive correlation in all other market environments. From a risk perspective, institutional portfolios are highly exposed not only to the equity risk factor, but also to interest rates, inflation and other economic risk factors. From this perspective, 2022 has shown the real benefits of complementing any traditional portfolio with investment solutions such as trend-following that have a proven track-record of delivering returns that are independent of any macro-economic and correlation regime. In the remainder of this note, we evaluate the impact that different model speeds may have on the equity and interest rate risk diversification benefits of trend-following.

In order to gain a deeper understanding of the return sensitivity of different model speeds in different equity market environments, we perform a "smart diversification" analysis, which is essentially a regime conditional return attribution analysis[7]. In short, it defines three different market regimes - a Bear, a Normal, and a Bull market regime - based on non-overlapping quarterly returns of a traditional risk factor, e.g. a global equity market index, and calculates the annualized returns of a trend-following program during each regime. Figure 7 shows the breakdown of annualized log-returns for trend-following across these regimes over the period 2000 – 2022, for different half-lives of the trend models ranging from one day to five years.

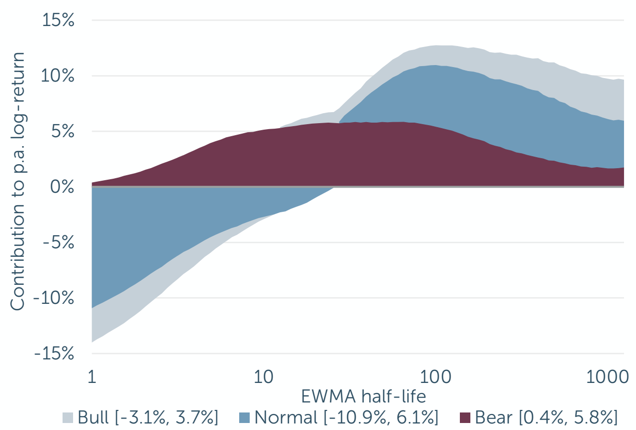

Figure 7: Annualized attribution of log-returns by equity market regimes of a generic trend-following model as a function of the model's signal half-lives between 1 and 1000 business days. Minimum and maximum annualized return per regime in brackets. Period: 2000 – 2022. Source: Quantica Capital.

Most striking in this analysis is the stability of the strategy's return contribution during equity bear

[7] To show the smart diversification benefits, we calculate p.a. trend-following returns during different market regimes. The regimes are inferred from an arbitrary benchmark (e.g. global equities, global bonds or a 60/40 equity/bond portfolio) and are classified into a Bull, Bear or Normal regime, according to whether they belong to the top 16%, the bottom 16% or the middle 68% of all quarters, respectively. For more information please refer to our report "60/40 Portfolios and the Need for Smart Diversification".

market regimes, irrespective of the model speed. Indeed, regardless of the half-life being anywhere between 10 and 100 business days, a generic trend-following approach would have generated a similar 5% annualized return in the Bear market regime, i.e. during the worst 16% of all calendar quarters for global equities. Only at longer half-lives of more than 100 business days do the benefits of equity downside risk diversification fade, while remaining positive even at the longest half-life of five years in our analysis. This result might be counter-intuitive given the findings of the previous section, where we showed that the performance contribution of equity markets was only positive for slower models. However, the positive return of trend-following in equity bear markets rarely comes from equity market positions. In fact, it is mostly attributable to persistent trends in other asset classes during equity stress periods (such as fixed income and rates both in 2008 and 2022).

While the attractive smart diversification benefits of generic trend-following returns in an equity bear market regime are relatively robust to different model speeds, the returns generated by the strategy in the other two equity market regimes are much more sensitive to the selected model half-life. Indeed, trend-following strategies with a half-life of more than one month have delivered positive returns in all three equity market regimes on average. Faster models with shorter half-lives below 20 business days, however, have endured significant losses in the "normal" market regime (notably accounting for two-thirds of the quarterly periods under consideration), with the magnitude of losses increasing with the speed of the underlying model. Faster generic trend-following programs have hence paid a far more expensive premium for equity downside protection compared to their slower counterparts. Such premium can be seen as a combination of higher trading costs (due to higher turnover) and multiple false signals if short-lived equity corrections do not develop into a significant crisis.

To conclude, we have already demonstrated that a lookback horizon to measure trends equivalent to one to two calendar quarters offered the strongest risk-adjusted returns and a highly diversified return attribution across asset classes. As it turns out, those lookback periods also offer the strongest smart diversification benefits, striking the right balance between generating equity downside protection in a bear market regime while at the same time capturing the long-term upside associated with the equity risk premium.

Lastly, such smart diversification analysis may be performed on any other relevant risk factor, such as global interest rates. Figure 8 illustrates how the speed of its signal impacts the smart diversification characteristics of our generic trend-following model across three different interest rate regimes. As with the equity risk factor, a half-life of one calendar quarter would have offered the strongest smart diversification characteristics with respect to rising or falling interest rates over the past 23 years.

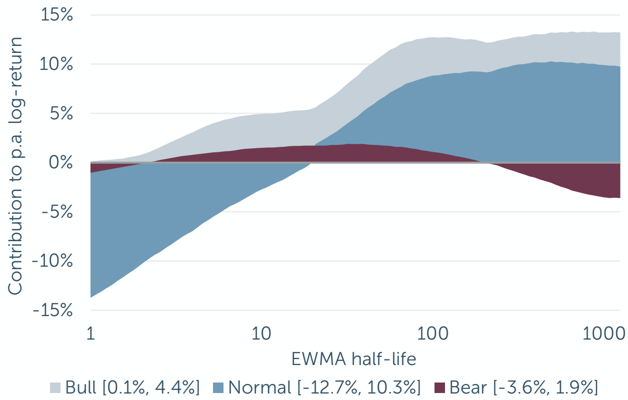

Figure 8: Annualized attribution of log-returns by interest rate regimes of a generic trend-following model as a function of the model's signal half-lives between 1 and 1000 business days. Minimum and maximum annualized return per regime in brackets. Period: 2000 – 2022. Source: Quantica Capital.

Conclusion

We have demonstrated that a lookback window of around one calendar quarter has translated into the most robust performance characteristics for a generic trend-following strategy over the past 23 years. Indeed, while the optimal speed of a trend-following model does naturally vary from one year to another, over the long-run, a lookback window of around one calendar quarter has led to both the highest risk-adjusted returns and the strongest smart diversification characteristics with respect to key traditional risk factors such as equities and interest rates.

We also found that it is likely that the trend-following CTA industry as an aggregate has been operating during the last decade on a speed that is very close to this in-sample optimum.

While the relation between trend speed and return contribution varied fundamentally across major asset classes, every asset class did contribute positively for the lookback period of one calendar quarter.

For faster models, trend-following returns have been significantly lower for all asset classes over the past 23 years, a reduction which can not only be explained with higher turnover and implementation costs. Interestingly, commodities are the only asset class that performed consistently well with faster models, while those performed particularly bad in equity markets.

Increasing the lookback period to a multi-year period essentially transforms a trend-following approach into a "risk premia strategy", which simply captures a long-term risk-premia associated with the asset class.

For an extremely long half-life of five years, trend-following returns are almost entirely attributable to equities and fixed income, which did appreciate strongly over the past 23 years. For all other asset classes, the positive trend-following return contribution decreases and eventually disappears with multi-year lookback periods. These findings strongly support the economic hypothesis that a positive long-term risk-premium is embedded in equities and government bonds, whereas such long-term risk-premia is not present in commodities, FX, and short-term interest rates markets. The systematically positive return contribution for medium-term trend-following in asset classes other than equities and bonds can thus be attributed to a "trend-following market-inefficiency" rather than an economic long-term risk-premium.

Finally, and strikingly, a generic trend-following model with a lookback period of one calendar quarter delivered the same protection in falling equity markets and rising interest rates regimes as any model with faster trend speeds. Compared to any faster implementation it delivered significantly better performance in other, less challenging market environments. That means, not only risk-adjusted performance, but also smart diversification characteristics have been superior for medium-term trend-following strategies.

Appendix

The "speed" of a trend-following program based on an exponentially weighted moving average (EWMA) of past returns may be parameterized via the *half-life* of the EWMA weights. The EWMA weight w_k of a return at lag k is given by

$$w_k = (1-\lambda)\lambda^k,$$

for some fixed decay factor $0 < \lambda < 1$. The *half-life* is then defined as the lag k such that

$$\frac{w_k}{w_0} = \frac{1}{2},$$

i.e. the lag at which the weight has decreased by half. Consequently, a given decay factor λ and its corresponding half-life HL are related as follows:

$$\mathrm{HL} = -\frac{\log(2)}{\log(\lambda)}, \quad \lambda = \left(\frac{1}{2}\right)^{\frac{1}{\mathrm{HL}}}.$$

Below also some examples of typical half-lives and their corresponding decay factors:

Half-life	Corresponding approximate λ
5	0.871
21	0.968
63	0.989
252	0.997

Table 1: Example decay factors λ corresponding to representative half-lives. Source: Quantica Capital.

The reason for using this parameter as a speed proxy is that in the case of an EWMA the half-life also coincides with the *median of the weight distribution*, i.e. the lag up to which the sum of the weights equals $\frac{1}{2}$. This follows immediately from the fact that the sum of the first n weights is given by

$$\sum_{k=0}^{n-1} w_k = 1 - \lambda^n .$$

Being the median of the weight distribution, the half-life of an EWMA can thus be intuitively understood as the amount of time it takes for new information to make up more than half of the total information flowing into the EWMA.

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

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