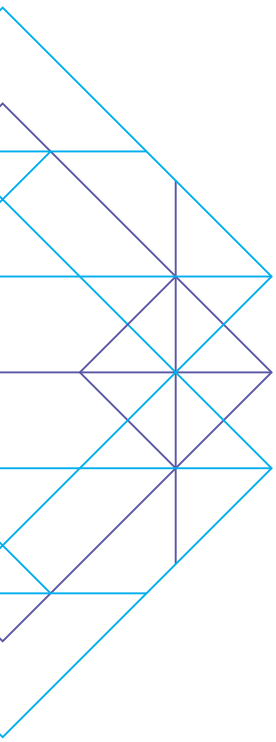
Alternative Thinking | Q4 2022

Should Your Portfolio Protection Work Fast or Slow?



Executive Summary

We have often argued that investments that perform well in protracted market drawdowns may be more valuable than ones that perform better during sharp crashes.[1] This year's drawdown, among the more persistent in recent memory, provides a clear picture for the types of strategies that can actually deliver in a "slow burn".

While some options-based strategies have generated positive returns, in many cases they have disappointed in terms of magnitude. In contrast, trend-following strategies have generally posted very strong returns (consistent with what we've documented in previous market drawdowns and crises). Looking ahead, many of the macro conditions that have been advantageous to trend-following are still in place—and have historically tended to persist.

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1 This can be shown empirically by comparing two equally bad "probability events" of different lengths (e.g., the 5th percentile worst month compared to the 5th percentile worst year)—the longer-lived drawdowns are more likely to prevent investors from reaching their multi-year return objectives. For more discussion on this topic, see McQuinn et al (2020).

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About the Portfolio Solutions Group

The Portfolio Solutions Group (PSG) provides thought leadership to the broader investment community and custom analyses to help AQR clients achieve better portfolio outcomes.

We thank Ashwin Thapar, Dan Villalon and Ekin Zorer for their work on this paper. We also thank Gregor Andrade, Antti Ilmanen, Pete Hecht, Thom Maloney, Yao Hua Ooi, and Lasse Pedersen for helpful comments.

Introduction

It's been a painful year for most portfolios. Against a backdrop of stubbornly high inflation and a historically sharp tightening response from global central banks, traditional asset classes have suffered a protracted decline.[2] With inflation-driven economic concerns compounded by geopolitical risks from an escalating conflict in Europe, policymakers have remained restrictive in the face of a worsening growth outlook and weakening markets—a stark contrast to the aggressive fiscal and monetary accommodation that followed other crises in recent history, notably the Covid crash of 2020.

Alternative assets and strategies have had mixed success amid this market turmoil. Energies showed promise as an inflation hedge early in the year, though have given back some gains on the back of recession concerns. Gold has generally disappointed[3]—not living up to its billing as either an inflation or risk-off hedge. Private assets, many of which are now reporting 2Q returns, are notching losses, with early indications that underlying equity and debt investments are incurring write-downs.[4,5] Options-based hedging strategies, while showing positive returns in some cases, have been disappointing in the magnitude of their contributions.[6]

On the other hand, many "diversifying alternatives" have shown more encouraging results: market neutral value strategies have continued their resurgence with positive returns in 2022,[7] and global macro and trend-following strategies have posted exceptional performance. The latter strategy, in particular, is on track for its best year on record, crucially at a time when strong returns are desperately needed.[8]

While this year's relative winners and losers are clear enough, it is important to recall prior periods of market stress before drawing conclusions. For example, in the short-lived drawdown of March 2020, many options-based strategies produced exceptional gains, while trend-following was generally flat. Bonds also provided offsetting returns that time, as portfolio pain was really driven by equites.

So in thinking about portfolio protection, how much should investors take away from 2022? We would argue, a lot. Prolonged market drawdowns, while relatively rare in the "Goldilocks" environment of the previous decade, are common enough over a longer history. And so too are examples of stocks and bonds simultaneously suffering with central banks compounding, rather than offsetting, losses—one has to go back only a few decades (perhaps a longer period than many pundits choose to draw lessons from) to find analogous historical periods. Most importantly, drawdowns like the current one, in which adverse conditions impact public and private investment strategies in a persistent way, are the most damaging to investor portfolios—so they should matter the most when identifying strategies intended to improve a portfolio's resilience.

2 A decline where both major asset classes—stocks and bonds—suffered simultaneously. See AQR's 2Q2022 Alternative Thinking for more on drivers of correlation between these two asset classes.
3 The S&P GSCI Gold Index lost -9.3% from January 1, 2022 – September 30, 2022.
4 See Jacobius (2022)
5 For example, the Cambridge Associates U.S. Private Equity Index has preliminarily reported a -4.65% return for Q2 (as of 10/5/2022). Related, it's been reported that some pensions have become sellers of private assets (Baker, 2022) on the secondary market at 20% haircuts.
6 The PPUT Index has returned -20.8% this year through September 30, 2022. The protection component itself (i.e., PPUT minus the returns of the S&P 500 index) has returned 3.9% over this same period.
7 See Lee (2022)
8 The SG Trend Index has returned 35.6% this year through September 30, 2022.

Two Kinds of Hedging Strategies: The Tortoise and the Hare

On Panel A of **Exhibit 1** shows the two worst drawdowns for traditional portfolios since the GFC: the "Covid crash" in early 2020, and the one currently underway. Even though their magnitudes are similar (as of 9/30/2022), a crucial difference is the current drawdown has unfolded more slowly.

On Panel B of **Exhibit 1,** we report the cumulative returns of three commonly used risk-mitigation strategies during these two drawdowns:

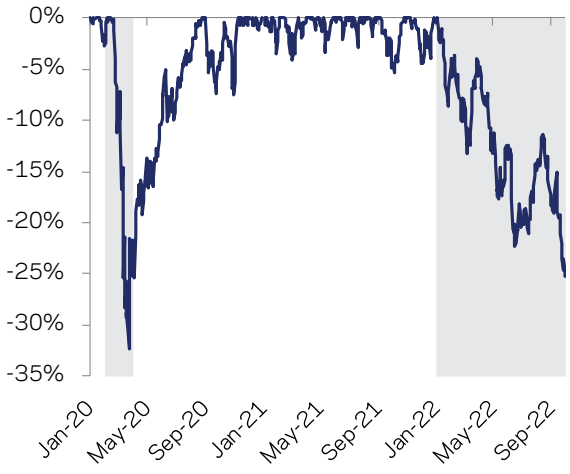
- **Tail-Hedging Funds:** proxied by the EurekaHedge Tail Risk Index
- **Systematic Put Buying:** proxied by the CBOE PPUT Index minus the S&P 500[9]
- **Trend-Following:** proxied by the SocGen Trend-Following Index

Tail-hedging funds—and to a lesser extent the "passive" options strategy—had strong returns during the shorter drawdown, but have been markedly less impressive during the current one. They were the proverbial hare—winning in the drawdown that resembled a sprint but losing in the one that has felt more like a marathon. In contrast, trend-following strategies had little to show for themselves during the Covid drawdown, but like the tortoise, have proven clear winners in the current, longer drawdown.

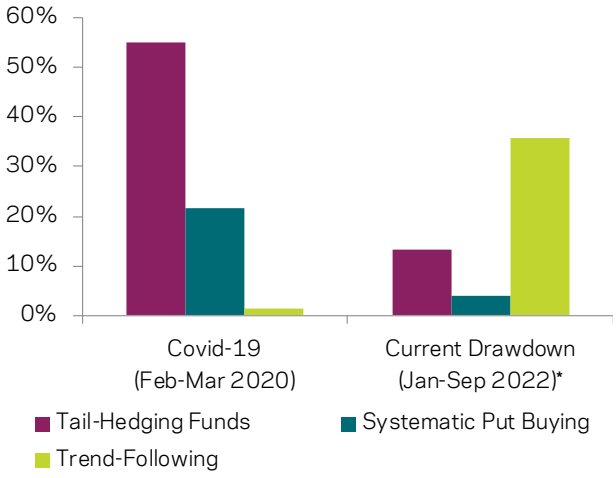
Exhibit 1: A Tale of Two Tails

Panel A: Global 60/40 Peak-to-Trough Drawdowns

January 1, 2020 – September 30, 2022



Panel B: The Tortoise and the Hare(s)



*Current Drawdown is ongoing.
Source: Bloomberg. Global 60/40 is 60% MSCI World, 40% Global Aggregate, using daily data. Systematic Put Buying is proxied by the difference between the CBOE PPUT index and the S&P 500 (to isolate the protective component of PPUT). Market drawdown periods are highlighted in gray on the left chart.

9 A strategy like this might seem like a simple strawman, but investors have been piling into options (Platt and Megaw, 2022), and to the extent professional tail risk managers can do better (or worse), we'd expect to see evidence in their long-term track records (e.g., see **Exhibit 3**)

In this article we argue that of these two kinds of strategies, the tortoise (i.e., trend-following) is more valuable than the hare (i.e., options-based and tail-risk funds) for most investors. On one hand, this may seem obvious—if you know a drawdown is going to be short-lived, then it's probably not going to impair your ability to meet your longer-term objectives.[10] On the other hand, this also suggests an important, yet subtle truth: when it comes to wealth creation, investments that perform better in longer-lived drawdowns may be more valuable than ones that perform better in sharp crashes. More pointedly, portfolio protection strategies that work best over shorter-term "tails" are not as valuable as strategies that can deliver over longer ones.[11]

What About Private Assets?

One of the biggest areas of investment among sophisticated investors since the GFC has been into private and illiquid assets – strategies known to report returns that are less volatile than their public counterparts.

A benefit of these smoothed returns (from a reporting perspective!) is that they conceal risk during sudden market drops with quick recoveries – i.e., they can "smooth over" fast market drawdowns.[12] Thus from a portfolio perspective, illiquid assets may somewhat *lessen* the need for strategies that perform well during quick drawdowns (again, from a reporting perspective only). However, just because a return is smoothed, it doesn't mean its risk goes away. Smoothing can only delay losses for so long: protracted drawdowns lead all risky assets, whether smoothed or not, to reveal their true risk.

The takeaway for all investors (and especially for those with higher allocations to illiquids than they had during the last bear market) is that when it comes to protecting portfolios, slow drawdowns are the big risk to focus on.

21st Century Drawdowns

In **Exhibit 2** we broaden our "tortoise/hare" comparison to include the five largest 60/40 drawdowns since 2000, ordered by duration.[13]

The takeaway from **Exhibit 1** holds up over this longer sample: options-based hedging strategies outperform in shorter drawdowns (left side) but are less impressive in longer ones (right). Trend-following shows roughly the opposite pattern: posting its most impressive returns in the protracted bad times. This is true both during the drawdowns themselves (Panel A), and importantly, from peak to recovery, or "round trip" (Panel B), where the

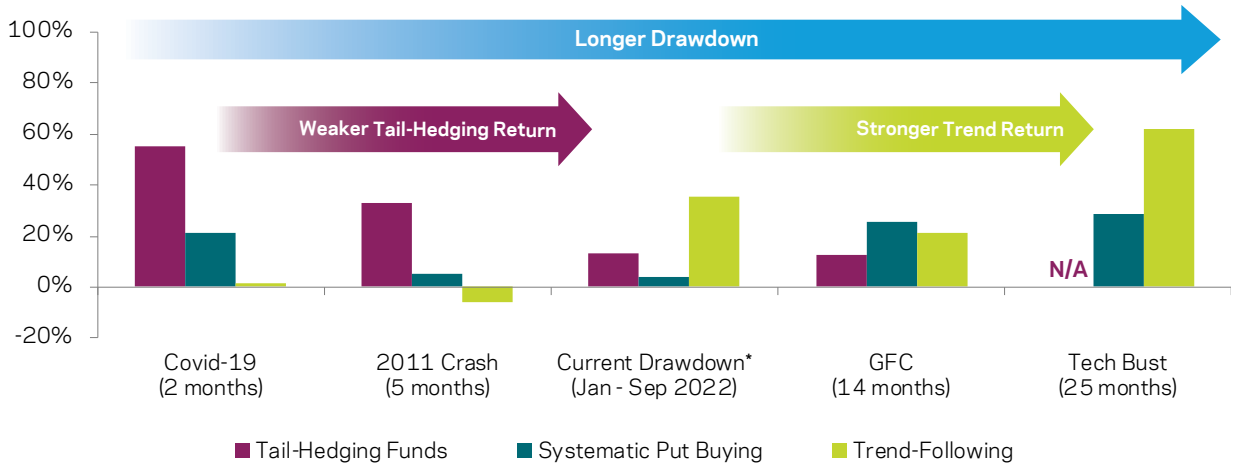
10 Of course, even short drawdowns can lead to real problems, such as funding and liquidity needs.
11 This point is underappreciated given that, as we show in Part 2, markets appear to place a significant premium on the short-term protection offered by options strategies—as reflected in significant negative average returns.
12 A related point is that returns are generally reported on a lagged basis. Both of these phenomena may lead to reported losses in a given drawdown period being understated.
13 Note: The Eurekahedge Tail Risk index data starts January 2008, but given its long-term negative average return (see **Exhibit 3**) and correlation to simple options strategies we've tested in previous studies, we would expect a continuation of the pattern shown in **Exhibit 2**.

advantages for trend-following are even more pronounced.

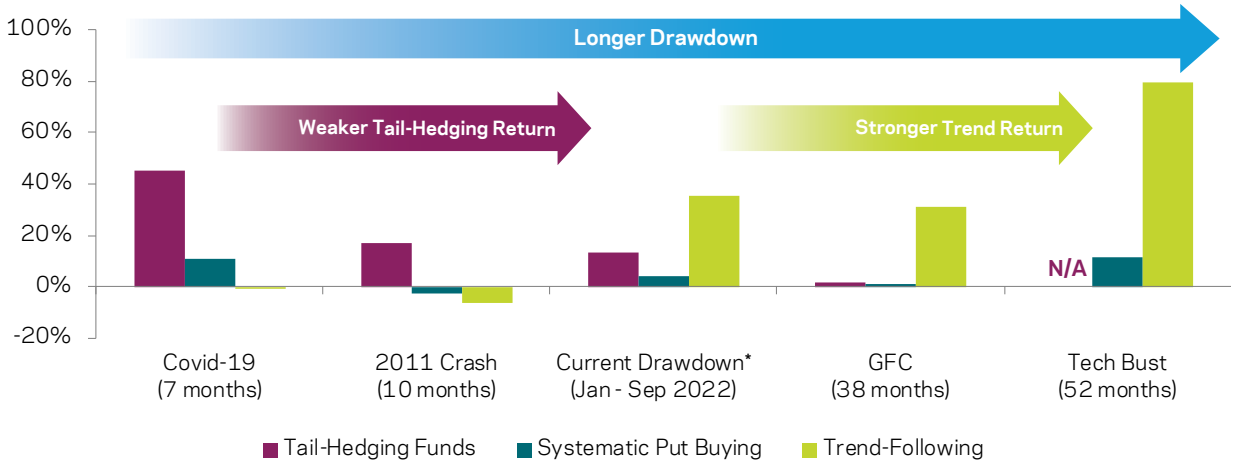
This "round-trip advantage" makes sense economically: the price of protection from options increases amid drawdowns (e.g., via higher premiums), resulting in greater-than-typical losses in the recoveries that follow. For trend-following there is no such mechanical link, and while they may struggle around the turning point, they have an ability to participate in recoveries. In other words, trend-following strategies may be expected to hold on to (or even add to) their "drawdown gains" better than options-based strategies.

Exhibit 2: Going the Distance

Panel A: Peak-to-Trough



Panel B: "Roundtrip" (i.e., Peak-to-Recovery)



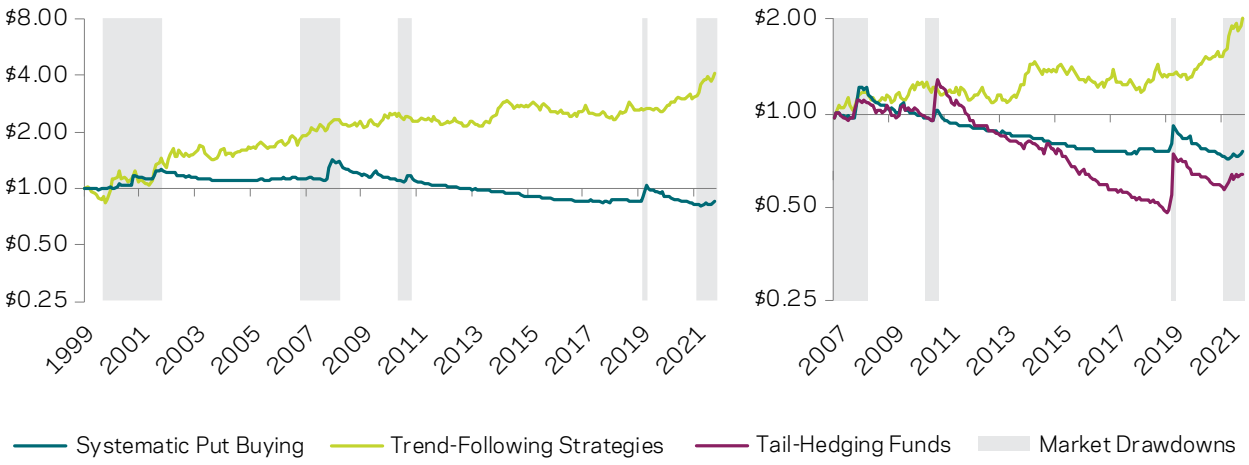
*The current drawdown is still ongoing. Source: Bloomberg, Datastream. Markets considered only where data existed during the time period. Market drawdowns are determined by the drawdowns of the Global 60/40 portfolio where 60% is global equities, a cap-weighted series of Germany, France, Netherlands, Canada, Japan, Italy, U.S., Australia, U.K. and Spain equity indices. The indices are the gross total return equity index for that country aside from US, which is the S&P500. Indices are source local and then hedged monthly. 40% is global bonds, a GDP weighted bond portfolio of individual country Datastream bond indices. Drawdowns chosen based on the top 5 worst drawdowns since the inception of SG Trend Index. Eurekahedge Tail Risk Index was incepted in January 1, 2008, so Tail-Hedging Funds are excluded during the Tech Bust drawdown and for comparability the GFC drawdown starts two months later than the actual start of the drawdown, November 1, 2008 (results are directionally similar regardless). Chart is provided for illustrative purposes only and is not based on an actual portfolio AQR manages.

There's another contributor to these differences: the influence of average returns outside of specific drawdown episodes. **Exhibit 3** plots long-term cumulative returns for options-based and trend-following strategies since the inception of the SocGen Trend Following Index (Panel A) 2000 and the EurekaHedge Tail Risk Index (Panel B) 2008. A clear wedge emerges, suggesting that in exchange for crash protection, options-based strategies suffer negative long-term average returns; whereas trend-following—beyond its tendency to deliver in longer-term drawdowns—also has positive average returns at its back.[14]

Exhibit 3: Put Down

Panel A: Cumulative Returns Since Inception of SocGen Trend Index (Log-Scaled)
January 1, 2000 – September 30, 2022

Panel B: Cumulative Returns Since Inception of Eurekahedge Tail Risk Index (Log-Scaled)
January 1, 2008 – September 30, 2022



Source: Bloomberg. Markets considered only where data existed during the time period. Chart is provided for illustrative purposes only and is not based on an actual portfolio AQR manages. Market drawdowns in this exhibit correspond to the ones shown in **Exhibit 2** and are highlighted in gray.

Yet, despite the drawbacks of options-based tail hedging strategies shown in **Exhibits 2** and **3**, investors still allocate to them after drawdowns.[15] This is hard to reconcile with the evidence that longer lasting drawdowns—ones where these strategies tend to disappoint—actually cause portfolios more harm.[16]

Why are "fast drawdown" strategies like these so popular? One possibility is that market participants assign a large premium for instantaneous protection—willing to pay handsomely not to be caught wrong-footed in a crash.[17]

Regardless of investor preferences, the evidence suggests a clear trade-off between short-term crash protection and long-term returns. For fundamental economic reasons, a strategy that can do well on both dimensions is very unlikely to exist, and we have yet to find documented evidence of any manager

14 For a series extending to 1985, see Ilmanen et al (2020), which finds a similar pattern.
15 See Platt and Megaw (2022) and Wallerstein (2022)
16 See, for example, **Exhibit 2** of McQuinn et al (2021) for empirical evidence.
17 This leads to the central question: is short-term hedging success worth it for long-term investors? See Litterman (2011) for more discussion on this. and for who should rationally be on which side of options-based tail risk hedging.

consistently able to deliver on these two objectives. Given shorter term drawdowns aren't as important to long-term wealth accumulation, we think 2022 is a valuable case study to (re)consider how much weight a portfolio should have in "tortoise" versus "hare" risk-mitigating strategies.

New Trends in Trend-Following

Trend-following strategies aren't new, but are likely to see renewed interest on the heels of recent strong performance. So what should investors look for when comparing strategies?

Investors often focus on innovations and enhancements to any core strategy over time. However, for trend following, we believe investors should be especially cautious. Because trend following has a dual mandate of 1) positive returns on average, and 2) convexity in bad times, investors need to make sure that so-called innovations haven't implicitly traded off one mandate at the expense of the other.

We thus believe that any additions to a trend following strategy must meet the high bar of adding to, or at least maintaining, *both* aspects of the dual mandate. While such innovations thus have a doubly-high hurdle, we believe the best way to find them is to stick to the core investment philosophy—namely, capturing the tendency of markets to under-react to new information.

Two such applications have shown particular promise:

- **Trends in "alternative" assets:**[18] If trend-following works because of persistent and pervasive investor behavior, then you would *expect* to find evidence for it beyond "tried and true" asset classes. Trend-following in more exotic assets, like non-index commodities or equity factors, may be a natural extension of the core thesis of trend-following, and as such (not surprisingly) has also shown a similar ability to deliver in persistent drawdowns and on average. However, there is a challenge for these alternative implementations: because they are harder to access, they require more skill to implement efficiently.

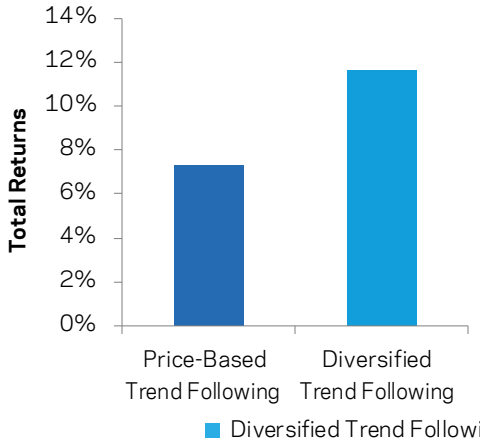
- **Economic trend-following:**[19] This is a more subtle application of the basic strategy. Following trends in prices is a clear way to profit from under-reaction, as a single metric—the price—should (at least in theory) incorporate all information about fundamentals. A potential shortcoming, however, is that price changes are not always fundamentally driven, and certain returns, e.g., those driven by price pressures or hedging flows, may revert. A more direct (albeit more challenging) approach to capturing under-reaction to evolving fundamentals is to measure news about fundamentals directly, i.e., going long assets for which fundamental macroeconomic trends are improving, and short assets for which fundamental macroeconomic trends are deteriorating. The challenge in this approach is in the wide range of inputs to consider: assets are impacted by many fundamentals. Of course, this challenge

18 For more, see Babu et al (2019).
19 For more, see Brooks (2017).

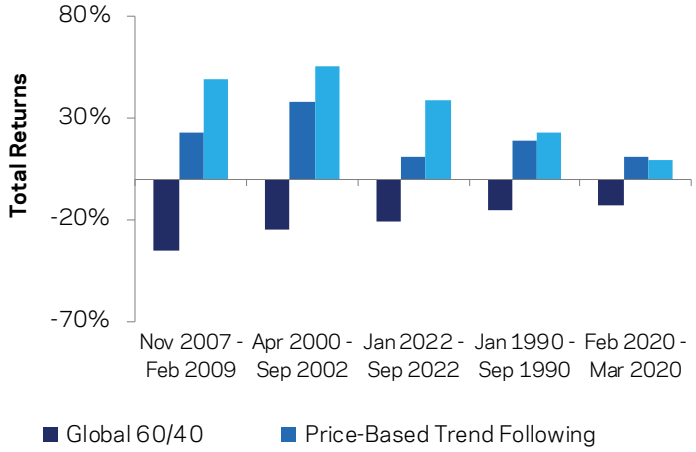
is also an opportunity for managers to differentiate themselves.

While these strategies may be correlated to a more traditional approach (they share an investment philosophy, after all), **Exhibit 4** shows they can still provide valuable diversification—improving the ability of the strategy to both provide positive returns on average (Panel A), and, importantly, returns during market drawdowns (Panel B).

Exhibit 4: Invite All Your Trends
Panel A: Positive Returns
January 1, 1990 – September 30, 2022



Panel B: Performance When Most Needed



Source: AQR. The Hypothetical Diversified Trend-Following Strategy performance is a backtest that is 40% Price-Based Trend Following, 40% Economic Trend Following and 20% Alternative Trend Following. The returns are net of a 1.25% mgmt. fee and 20% performance fee, and net of estimated transaction costs. The 60/40 portfolio has 60% invested the MSCI World Net Total Return USD Index and 40% invested in the Bloomberg Barclays Global Aggregate Total Return Index. The portfolio is rebalanced monthly. The 3-Month T-Bill is the risk-free rate used to derive the Sharpe ratio. Please read performance disclosures in the Appendix for a description of the investment universe and the allocation methodology used to construct the Price-Based, Alternative and Economic Trend-Following Strategies. Markets considered only where data existed during the time period. Chart is provided for illustrative purposes only and is not based on an actual portfolio AQR manages. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix. Diversification does not eliminate the risk of experiencing investment losses.

Conclusion: Better Late Than Never

Papers on tail risk tend to come out after markets lose money, leaving investors with the unappealing prospect of buying insurance *after* it was actually needed. We believe this hesitation is justified for options-based strategies. Their tendency for negative long-term returns makes them a poor portfolio addition in general, and they often see rising prices (via higher premiums) after periods of market stress—making these among the worst times to invest. Research suggests trend-following strategies are a different story.[20] They have shown the ability to deliver over the long term and particularly in "slow" challenging market environments, and—crucially today—do not have a tendency to "richen" amid market drawdowns.

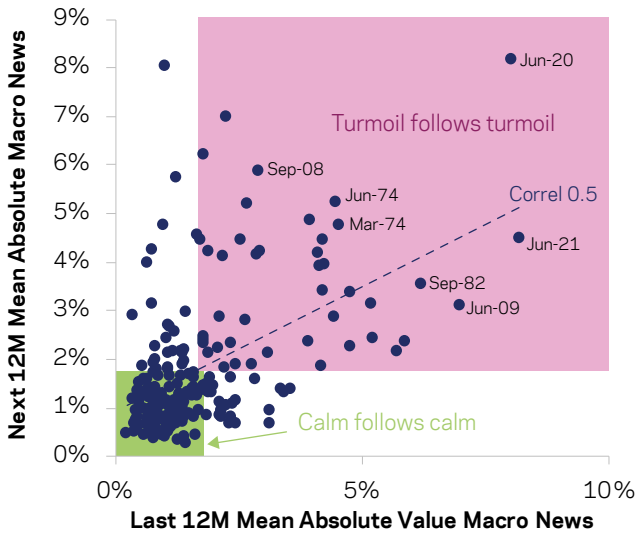
Even though an allocation to risk-mitigating strategies should be a strategic decision, the

20 See for instance, Ilmanen et al (2021), Asvanunt et al (2015), Hurst et al (2017), AQR Alternative Thinking 3Q2015 and 3Q2018, and references therein.

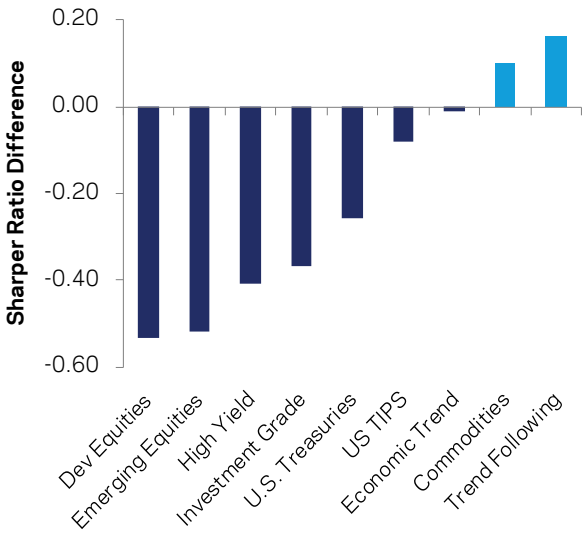
reality for many investors is if "now" is still the right time. We believe the macroeconomic environment remains favorable for strategies like trend-following. Macro uncertainty tends to be persistent, suggesting the turmoil we've seen so far this year is unlikely to go away any time soon (see Panel A of **Exhibit 5**, which shows tumultuous times tends to be sticky at annual horizons). Trend-following is among the few investments that has tended to outperform amid tumultuous times (Panel B), which suggests a continued tactical case for inclusion in a portfolio.

Exhibit 5: The Macro Postman Often Rings (At Least) Twice

Panel A: Macro News Indicator, Last 12M vs Next 12M
January 1, 1972 – June 30, 2022



Panel B: Relative Performance During Macro Turmoil



Source: AQR, Bloomberg, St. Louis Federal Reserve, U.S. Bureau of Labor Statistics. The Macro News Indicator is based on changes in real GDP growth, changes in inflation, inflation surprises, real GDP growth surprises, and industrial production growth surprises. Changes are calculated as simple difference between year-on-year inflation or growth and year-on-year inflation or growth 12 months earlier. Surprises are calculated as simple difference between year-on-year inflation or growth and 1-year forecasts 12 months earlier from the Fed Survey of Professional Forecasters. Time period based on availability of data.

Appendix

Hypothetical Alternative Trend-Following Strategy

The Hypothetical Alternative Trend-Following Strategy is based on the methodology described in "A Century of Evidence on Trend-Following Investing" [Hurst, Ooi, Pedersen (2017)], applied to a different set of assets. It is constructed with an equal-weighted combination of 1-month, 3-month, and 12-month trend-following strategies for markets across 6 major asset groups—equity factor portfolios, credit indices, interest rate swaps, emerging currencies, alternative commodities, and volatility futures—from January 1990 onward. Since not all markets have the same length of historic return data available, we construct the strategies using the largest number of assets for which return data exist at each point in time. We use futures returns when they are available. The strategy targets long-term volatility target of 10% but does not limit volatility during periods where realized volatility may be higher or lower than this number.

In order to calculate net-of-fee returns for the time series momentum strategy, we subtracted a 2% annual management fee and a 20% performance fee per annum from the gross-of-fee returns to the strategy. The performance fee is calculated and accrued on a monthly basis, but is subject to an annual high-water mark. In other words, a performance fee is subtracted from the gross returns in a given year only if the returns in the fund are large enough that the fund's NAV at the end of the year exceeds every previous end of year NAV. The transactions costs used in the strategy are based on AQR's proprietary estimates of transaction costs for each market traded, including market impact and commissions.

This model is not based on an actual portfolio AQR manages. The benchmark and relevant cash rate is assumed to be 3-month Treasury bills.

Hypothetical Price-Based Trend-Following Strategy

The Hypothetical Price-Based Trend-Following Strategy model uses data from January 1880 onward. The investment strategy is based on trend-following investing which involves going long markets that have been rising and going short markets that have been falling, betting that those trends over the examined look-back periods will continue. The strategy was constructed with an equal-weighted combination of 1-month, 3-month, and 12-month trend-following strategies for 67 markets across 4 major asset classes: 29 commodities, 11 equity indices, 15 bond markets, and 12 currency pairs. Since not all markets have return data going back to 1880, we construct the strategies using the largest number of assets for which return data exist at each point in time. We use futures returns when they are available. Prior to the availability of futures data, we rely on cash index returns financed at local short rates for each country. Please see **Figure 2** for additional details. The strategy targets a long-term volatility target of 10% but does not limit volatility during periods where realized volatility may be higher or lower than this number.

Hypothetical performance is net of fees and net of transaction costs. In order to calculate net-of-fee returns, we subtracted a 2% annual management fee and a 20% performance fee from the gross-of-fee, net-of-transaction-cost returns to the strategy. Actual fees may vary depending on, among other things, the applicable fee schedule. The transactions costs used in the strategy are based on estimates of average transaction costs for each of the four asset classes, including market impact and commissions. The transaction costs are assumed to be twice as high from 1993 to 2002 and six times as high from 1880–1992. The transaction costs used are shown in **Figure 1**.

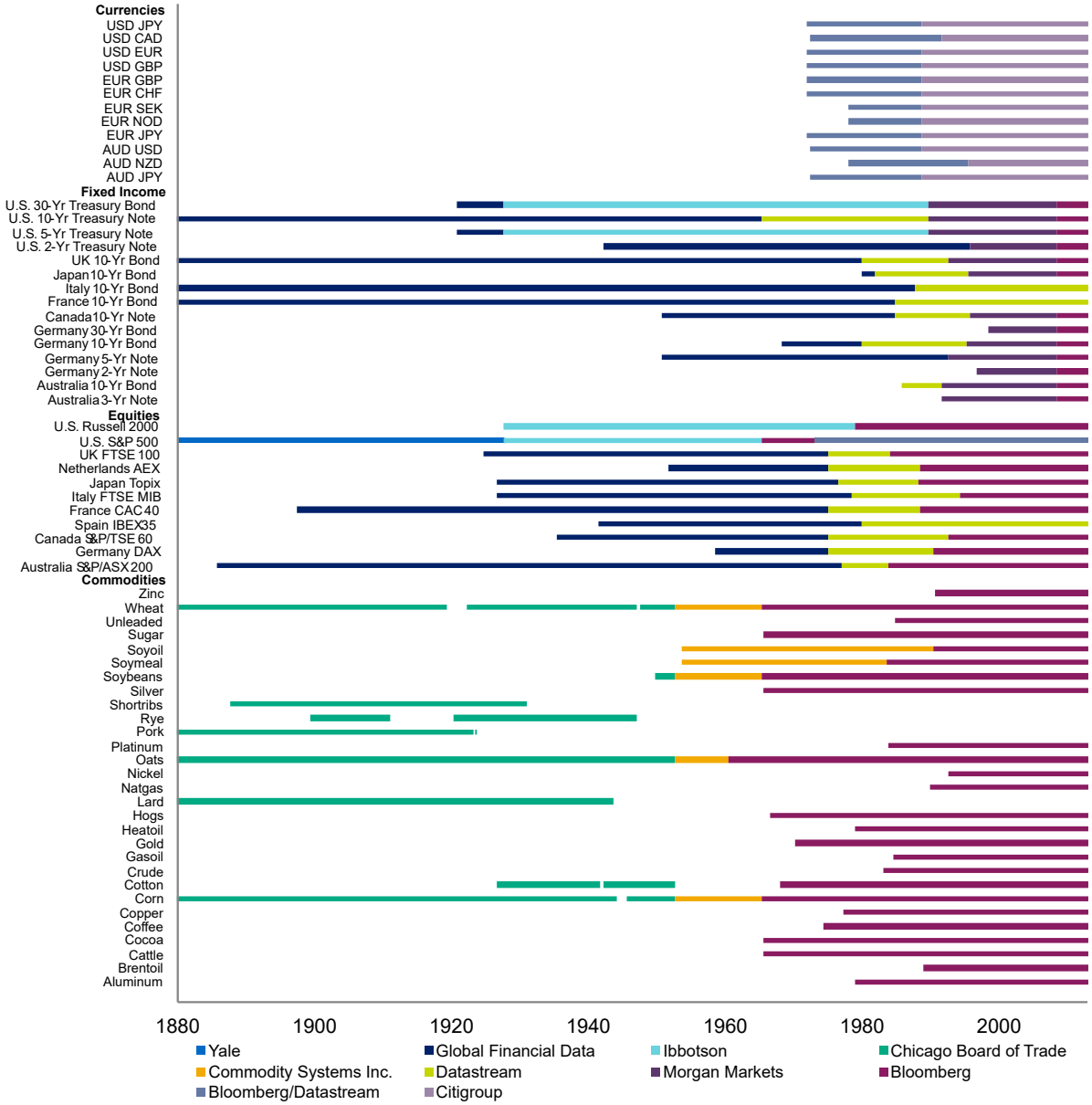
This model is not based on an actual portfolio AQR manages.

The benchmark and relevant cash rate is assumed to be ICE BofAML 3-Month T-Bill. Prior to 1929 when 3-month Treasury bills became available, the benchmark and relevant cash rate is assumed to be the NYSE call money rates (the rates for collateralized loans) through 1920, and returns on short-term government debt (certificates of indebtedness) from 1920 until 1929.

Figure 1

Asset Class	Time Period	One-Way Transaction Costs (as a % of notional traded)
Equities	1880 – 1992	0.34%
	1993 – 2002	0.11%
	2003 – Present	0.06%
Fixed Income	1880 – 1992	0.06%
	1993 – 2002	0.02%
	2003 – Present	0.01%
Currencies	1880 – 1992	0.18%
	1993 – 2002	0.06%
	2003 – Present	0.03%
Commodities	1880 – 1992	0.58%
	1993 – 2002	0.19%
	2003 – Present	0.10%

Figure 2



Limitations of Backtested Performance. The returns presented reflect hypothetical performance an investor would have obtained had it invested in the manner shown and does not represents returns that any investor actually attained. The information presented is based upon the following hypothetical assumptions.

Hypothetical Economic Trend-Following Strategy Backtest Construction

The Hypothetical Economic Trend-Following Strategy uses data from February 1970 onward. The investment strategy is based on trend following which for each theme (Growth, Inflation, International Trade, Monetary Policy, Risk Aversion) and within each asset class, takes a long position in assets in which economic trends are improving and a short position in assets in which economic trends are deteriorating. Each individual position is sized to target the same amount of volatility, both to provide diversification and to limit the portfolio risk from any individual market. The theme portfolio across all assets is scaled to target 10% forecasted annual volatility.

Not all markets and assets have returns going back to 1970; details outlined on the following page.

Growth: Growth trends are captured using one-year changes in forecasts of real GDP growth. From 1990 onward forecast data is from Consensus Economics. Prior to 1990, we use one-year changes in realized year-on-year real GDP growth, lagged one quarter (this definition is equivalent to changes in forecasts assuming that real GDP growth follows a random walk). The series is from the OECD. Increasing growth is assumed to be bullish for equities (cash-flow impact), commodities (increasing demand),

and currencies (Balassa-Samuelson hypothesis), and bearish for fixed income (both government bonds and interest rates) via both inflationary pressures and upward pressure on real interest rates.

Inflation: Inflation trends are captured using one-year changes in forecasts of CPI inflation. From 1990 onward forecast data is from Consensus Economics. Prior to 1990, we use one-year changes in realized year-on-year CPI inflation, lagged one quarter (this definition is equivalent to changes in forecasts assuming that CPI inflation follows a random walk). The series is from the OECD. Increasing inflation is assumed to be bearish for equities (see Katz and Lustig (2017)), bullish for currencies (see Clarida and Waldman (2008)), and bearish for fixed income.

International Trade: International trade trends are captured using one-year changes in spot exchange rates against an export-weighted basket. Data is from DataStream. A depreciating currency is bullish for equities (exports become more competitive), bearish for currencies (very similar to price momentum), bearish for fixed income (other things equal, a depreciating currency reduces the pressure on a central bank to reduce interest rates), and bearish for commodities (depreciation of the currencies of commodity consumers means commodities, which are generally priced in USD, are effectively more expensive).

Monetary Policy: Monetary policy trends are captured using one-year changes in the front end of the yield curve. From 1992 onwards, I use two-year yields, while prior to 1992 I use Libor and its international equivalents. Both data series are from Bloomberg. Expansionary monetary policy is bullish for equities (see Bernanke and Kuttner (2005)), bullish for currencies (see Eichenbaum and Evans (1995)), bullish for commodities, and bearish for fixed income.

Risk Sentiment: Changes in risk sentiment are captured using one-year equity market excess returns. Data is from DataStream. Increasing risk sentiment—i.e., strong equity market returns—is bullish for equities, commodities, and currencies, and bearish for fixed income.

The model employs relatively simple measures as they afford long data availability and are less susceptible to concerns about data mining. The strategy is therefore intended as a proof of concept, and can potentially be enhanced by employing additional and improved measures of economic trends.

Backtest returns are hypothetical gross of transaction costs and fees. Even after adjusting for transaction costs and fees, backtest returns are likely overstated, despite best effort to employ simple and transparent signals, due to unavoidable hindsight bias. Hypothetical data has inherent limitations, some of which are disclosed herein.

As the backtest is constructed to take a long position in assets in which economic trends are improving and a short position in assets in which economic trends are deteriorating, the strategy would likely underperform in a period of sharp reversals across asset classes and investment themes or in an environment in which price trends and economic trends diverge. However, due in part to the diversification benefits of the four asset classes and four investment themes, the performance of the backtest has been consistent over a wide variety of macroeconomic and financial environments over the last 50 years.

Hypothetical Economic Trend-Following Strategy Universe:

Equity index return data is from Bloomberg. Start dates are the earliest available date of the series:

- 1970: Australia, Germany, Canada, Spain, France, Italy, Japan, Netherlands, U.K., U.S.
- 1975: Switzerland
- 1980: Denmark, Hong Kong, Sweden
- 1988: New Zealand

Government bond return data is from Bloomberg and DataStream. Start dates are

- 1970: Germany, Canada, U.K., U.S.
- 1980: Japan
- 1981: Switzerland
- 1985: Denmark
- 1986: Australia
- 1987: Sweden

Currency return data is from Citi and Reuters. Start dates are

- 1971: Germany, Japan, Switzerland, U.K.
- 1972: Australia, Canada
- 1978: New Zealand, Sweden

Interest rate futures return data is from IFS. Start dates are

- 1987: U.S.
- 1988: U.K.
- 1989: Australia, Europe (Euribor)
- 1991: Canada, New Zealand, Switzerland

Commodity futures return data is from Bloomberg. Start dates are

- 1970: Cattle, Corm Cotton, Hogs, Soybeans, Soymeal, Soyoil, Sugar, Wheat
- 1974: Coffee
- 1979: Heat Oil
- 1983: Crude Oil
- 1984: Gas Oil
- 1985: Unleaded
- 1989: Brent Oil
- 1990: Natural Gas
- 1991: Zinc
- 1993: Nickel

References

AQR Alternative Thinking. (3Q 2015). Good Strategies for Tough Times. [*white paper*]

AQR Alternative Thinking. (3Q 2018). It Was the Worst of Times: Diversification During a Century of Drawdowns. [*white paper*]

AQR Alternative Thinking. (2Q 2022). The Stock/Bond Correlation: Drivers and Implications. [*white paper*]

Asvanunt, A., Nielsen, L.N. and Villalon, D. (2015). Working Your Tail Off: Active Strategies Versus Direct Hedging. *The Journal of Investing, 24[2], pp.134–145.*

Hurst, B., Ooi, Y.H. and Pedersen, L.H. (2017). A Century of Evidence on Trend-Following Investing. *The Journal of Portfolio Management, 44[1], pp.15–29.*

Ilmanen A., Thapar A., Tummala H., Villalon D. (2021). Tail Risk Hedging: Contrasting Put and Trend Strategies. [*white paper*]

Jacobius, A. (2022). Investors in for rude awakening on alts returns. *[online] Pensions & Investments 19 Sep.*

Lee, J. (2022). Quants Are Back Making Money on Factor Trades Like Good Old Days? *[online] www.bloomberg.com 20 Sep.*

Litterman, R. (2011). Who Should Hedge Tail Risk? *Financial Analysts Journal, 67[3], pp.6–11.*

McQuinn, N., Thapar, A. and Villalon, D. (2020). Portfolio Protection? It's a Long [Term] Story.... *The Journal of Portfolio Management, 47[3], pp.35–50.*

Platt, E. and Megaw, N. (2022). Investors pile into insurance against further market sell-offs. *[online] Financial Times 24 Sep.*

Wallerstein, E. (2022). Wary Investors Struggle to Evade Market Tumult. *[online] WSJ 30 Sep.*

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