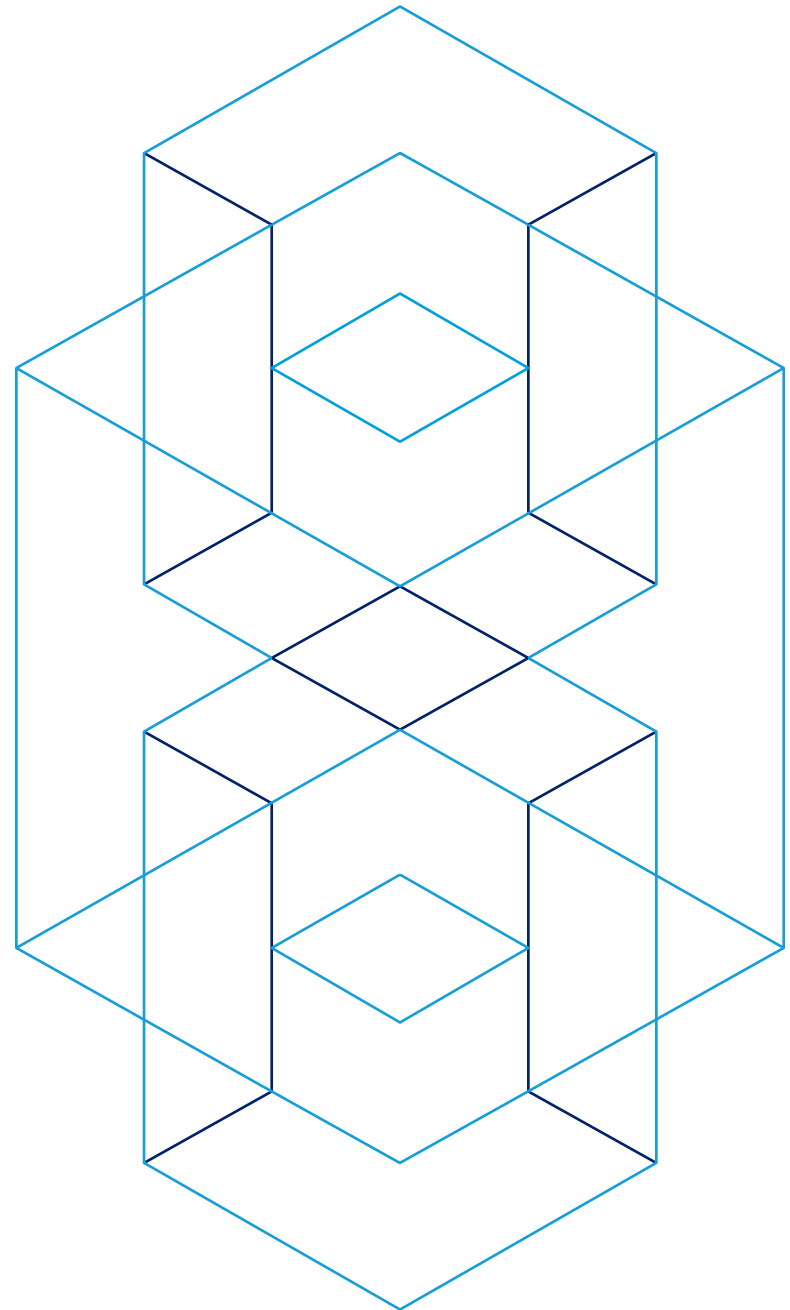# Investing in Adverse and Interesting Times

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Principal

EDHEC The Future of Finance

September 2023

Disclosures

"May You Live in Interesting Times"

Written During 2021, Published in April 2022

Investing Amid Low Expected Returns

Making the Most When Markets Offer the Least

Antti Ilmanen

Foreword by Cliff Asness

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End-2022 Update, In JoPM Early 2023

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the journal of **PORTFOLIO** *management*

MULTI-ASSET STRATEGIES

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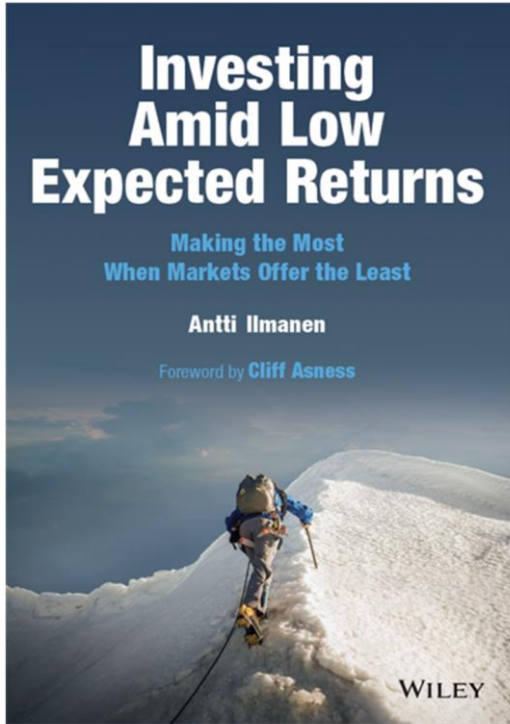
Investing in Interesting Times

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PERSPECTIVES — Volume 49 | Issue 4

KEY FINDINGS
- Expected asset returns rose in 2022 from extremely low levels, at least for bonds. Private asset valuations responded surprisingly little to a sharp rise in the riskless part of the discount rate, partly reflecting the popular return-smoothing feature.
- While both liquid stocks and bonds suffered, long-short strategies fared better. The value strategy, which had experienced large losses between 2018 and 2020, recovered and still looked attractive at the end of 2022.
- The dominance of equity market risk in many portfolios makes risk-mitigating strategies important complements. Trend following was the best-performing risk mitigator in 2022, reflecting the protracted nature of the market drawdown and heightened macro volatility.

ABSTRACT
What happened to major asset prices before 2022 and what changed in 2022? This article covers six key themes. 1) The backdrop of high asset valuations and low expected returns before 2022. 2) Investor responses to low expected returns, notably the boom in flows to private assets. 3) A revised picture after 2022: much higher expected returns at least for bonds (less for private assets so far) after the biggest inflation scare in a generation and central bankers' attempt to contain it. 4) Contrasting fortunes and prospects for long-only assets and long-short strategies. 5) Understanding the rollercoaster ride of value-versus-growth stock selection strategies. 6) The important role of risk-mitigating strategies, especially trend following, amid protracted bear markets and elevated macro volatility.

An old Chinese curse (possibly apocryphal) says, "May you live in interesting times." We certainly do. The year 2022 was pivotal and might go into history books as an even more important year than 2020 or competitors like 2016, 2008, and 2001. I will not discuss the huge geopolitical issues, such as war and reshoring, which of course contributed to economic and investment outcomes, but I will touch on the highest inflation for a generation and the central banks' response

What About Now, Well After Book Publication?

U.S. 2Y Treasury Yield, NASDAQ 100 Index, and KBW Bank Index in 2023
January 1, 2023 – July 31, 2023

- 2Y Treasury Yield (LHS)
- NASDAQ 100 Notional Index (RHS)
- KBW Nasdaq Bank Index (RHS)

Part I: Setting the Stage

The secular low expected return challenge – and investors' responses

Expected returns…	…in all major asset classes fell to historic lows by the end of 2021 – due to negative real cash rates, the common part in all assets' discount rates
Realized returns…	…have been solid as falling yields have caused windfall gains
Managing the disparity	The rearview mirror may breed complacency just when the low expected return challenge is greatest – we've borrowed returns from the future
The path ahead	Low returns will eventually materialize through some mix of slow and fast pain We should be humble about timing the fast pain, but bubbly markets, inflation concerns, and less dovish central banks raise near-term risks
What to do about it	Many investors have not serenely accepted low expected returns More have increased their portfolio risks than tried contrarian market timing Staying the course and moderating expectations is the realistic middle path Good investing practices matter more than ever: **making the most when markets offer the least**

Still a World of Low Expected Returns…on Most Assets

Low starting yields weigh down prospective returns (even after the 2022 repricing)

Simple Expected Real Return of the U.S. Equity Market and 10-Year Treasuries
January 1, 1900 – July 31, 2023

Legend (top chart): U.S. Equity Real Yield — U.S. 10Y Treasury Real Yield
- 3.1% (4th percentile)
- 1.6% (30th percentile)

Legend (bottom chart): US 60/40 Real Yield — Historical Average — Global 60/40 Real Yield
- 2.5% (10th percentile)
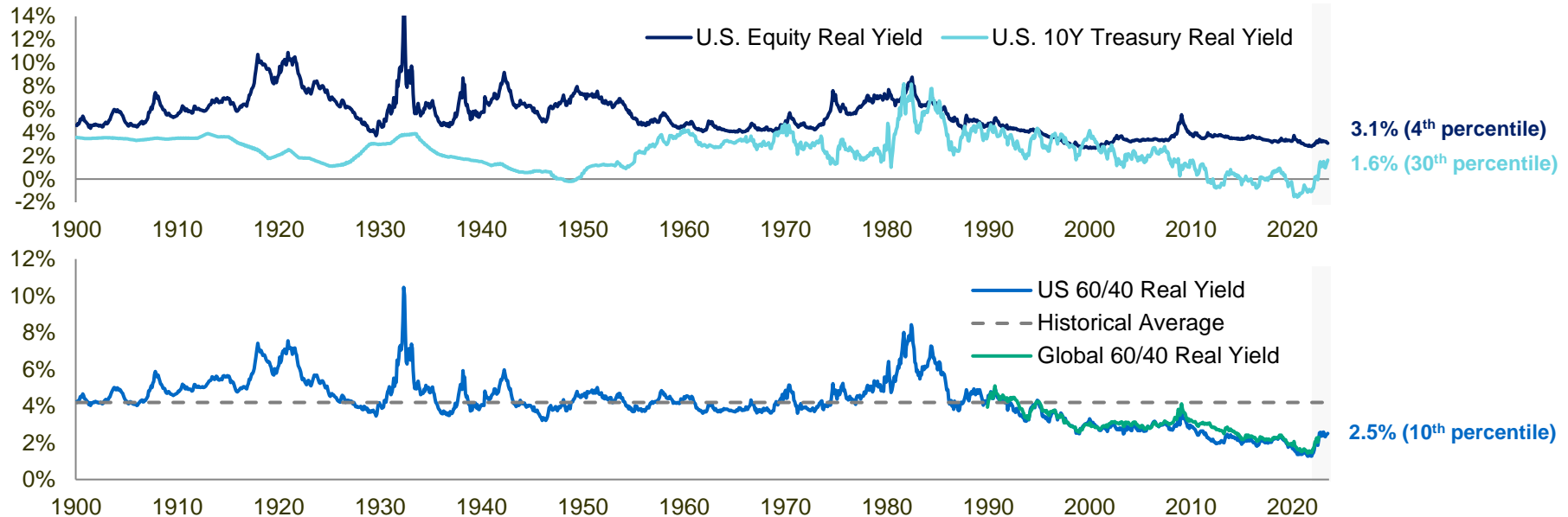
Four decades of falling required real asset yields meant that we "borrowed returns from the future" (without persistent asset richening we would have had somewhat lower returns behind us and better returns ahead)

Danger of "rearview-mirror" expectations after an exceptional decade for most long-only assets (and doubts on diversifiers)

Riskless component of the discount rate had become extremely low by 2021, making most asset classes look historically rich

Some normalization ("fast pain") occurred in 2022 as real bond yields rose (e.g., the 10yr TIPS yield rose from -1% to +1.5%)

Yet equities and especially illiquids hardly repriced enough given their riskless discount rate rises – premia are compressed

From A World of Low Riskless Rates to Compressed Premia

Equities and private assets did not reprice enough in 2022

Expected Real Returns for U.S. Asset Classes December 31, 2019 – June 30, 2023
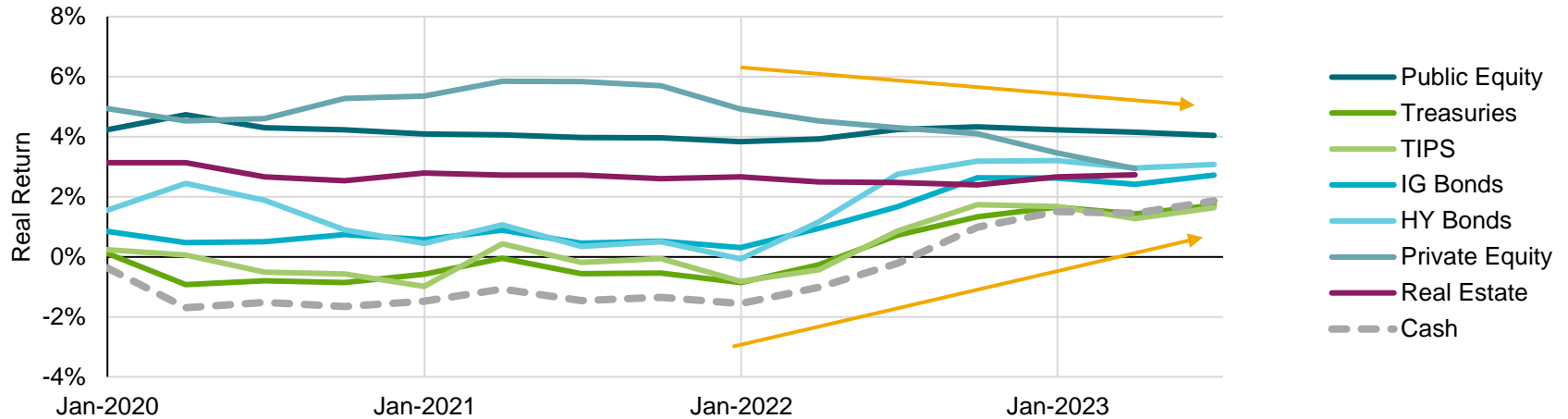
Expected Excess-of-Cash Returns for U.S. Asset Classes December 31, 2019 – June 30, 2023
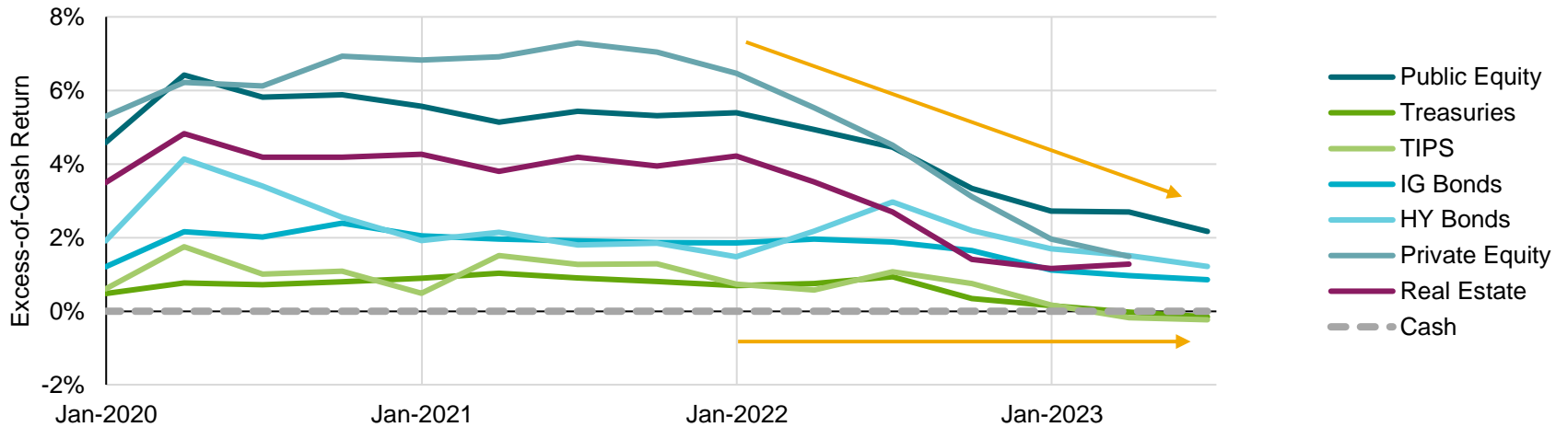
Does a Higher Cash Rate Tide Lift All Asset Return Boats?

Not historically – but liquid alts have benefitted from cash holdings

U.S. 3-Month T-Bill Rate and a Composite Level Regime Indicator January 1972 – February 2023
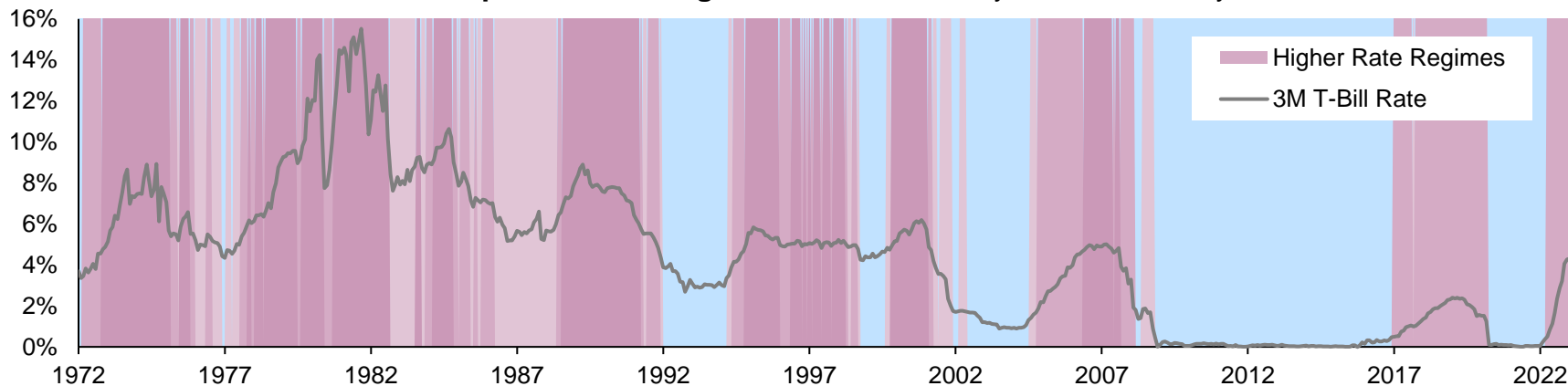
Since 1972, when starting **cash** rates were higher…

- **Equities, credit** and **real estate** earned *lower* total returns (tighter financial conditions)

- **Treasuries** earned higher total returns

- **Liquid alternatives** (or L/S ARP) that maintain cash holdings earned 'cash plus' returns

Average Total Return by Starting Rate Level
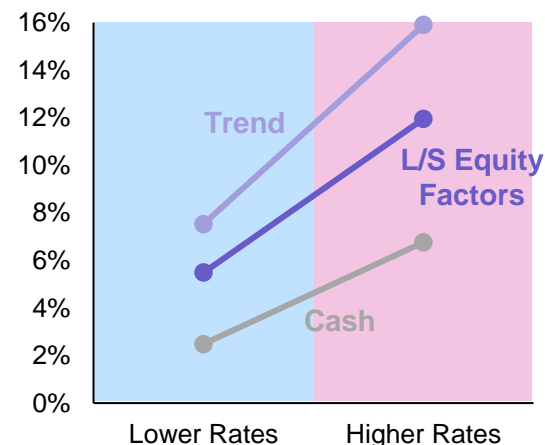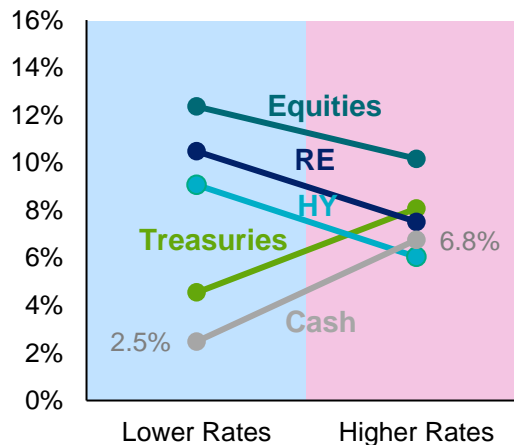
Understanding Treasury Yield Moves

Consensus forecasts of inflation and short rates help decompose yields

All three components of Treasury yield contributed to the 40-year decline and to the rise since the 2021 record-lows: inflation expectations, real policy rate expectations, and required bond risk premia

Both real policy rate expectations and required bond risk premia rose from negative to positive in 2022

Negative survey-based bond risk premia through the 2010s likely reflected lack of inflation risk premium, negative stock-bond correlation, and QE

Decomposing the 10-Year Treasury Yield Using Survey Data, 1983 –2023
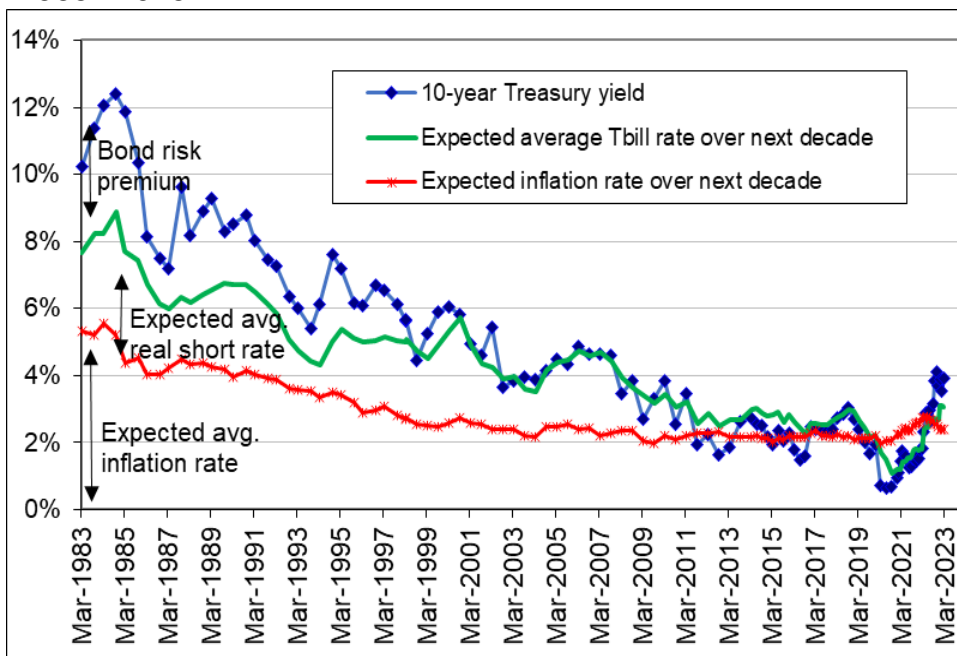
The Three Components of the 10-Year Treasury Yield, 1983-2023

Sources: Bloomberg, Blue Chip Economic Indicators, Consensus Economics.
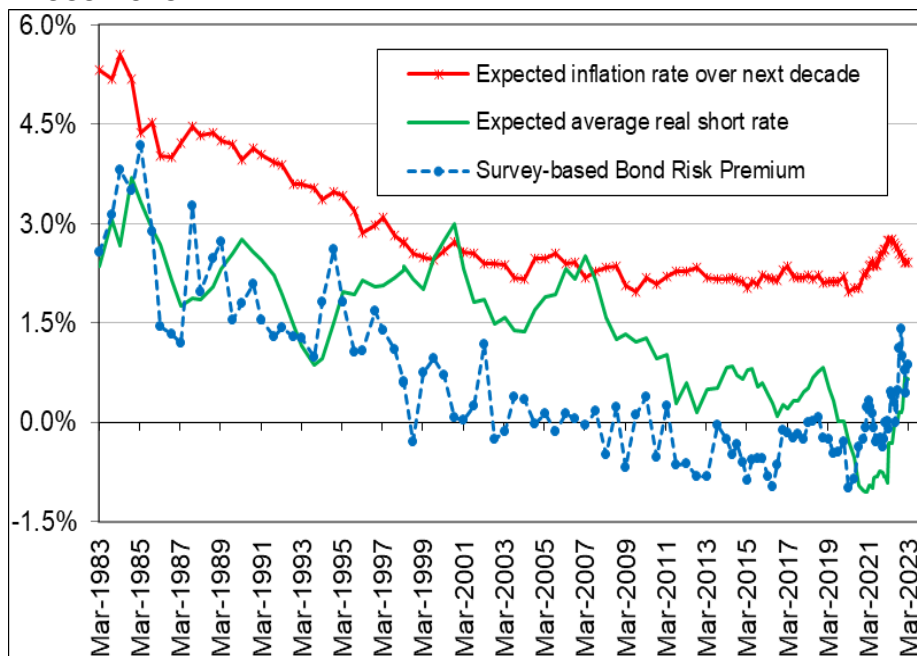
End of an Era?

Negative stock/bond correlation threatened by inflation uncertainty

Rolling Correlation Between U.S. Equity and U.S. Treasury Returns
January 1, 1900 – June 30, 2023
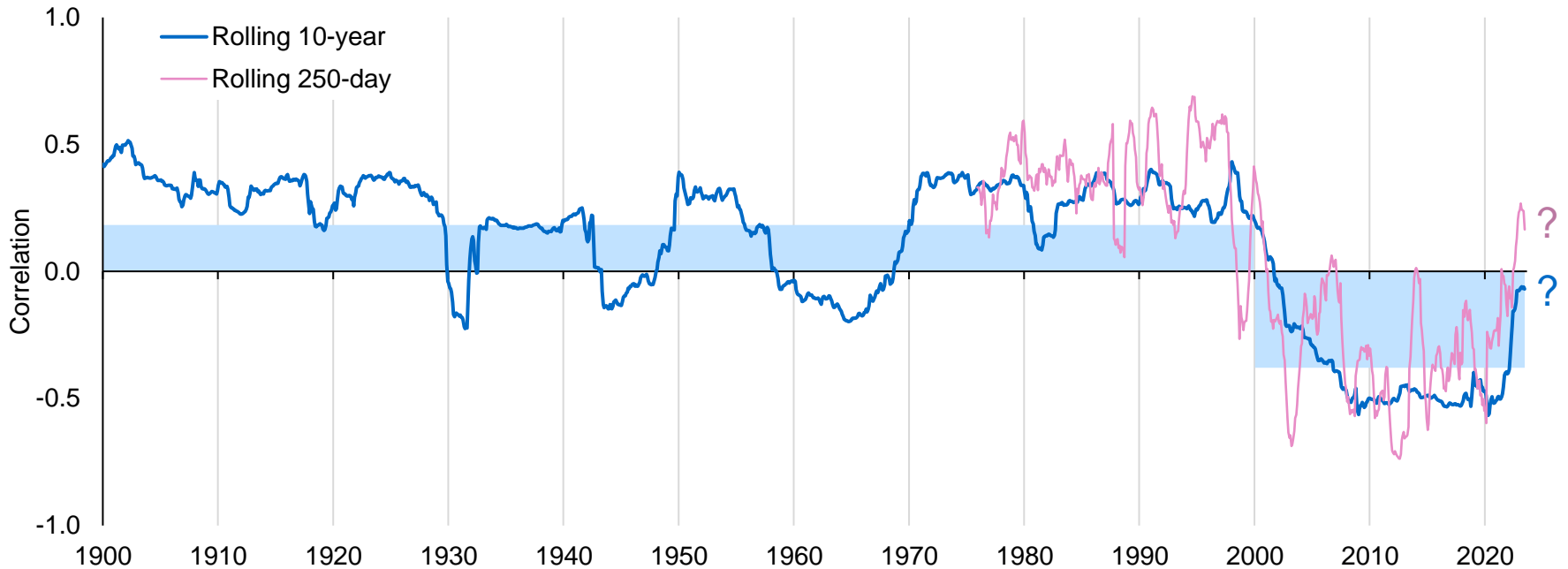
Negative correlation from 2000 to 2020 was a consequence of low inflation risk and demand effects

Shift to sustained positive correlation IF we get longer-term inflation uncertainty and/or further supply-driven inflation shocks and/or monetary policy errors

This scenario remains a tail risk for investors

Source: Global Financial Data, Bloomberg and AQR. Rolling 10-year series based on overlapping 3-month returns at monthly frequency. Rolling 250-day series based on overlapping 3-day returns at daily frequency. Shading shows average correlations in 20th and 21st Centuries. For illustrative purposes only.

How Did Investors Respond to Low Expected Return Challenge?

Reach for yield and other efforts to boost returns in the 2010s

Possible Solution	Motivation	Challenges
1. Even More Equities	**Belief in Equity Premium**: Highest conviction exposure; confidence in long horizon	**Concentration**: already dominant risk to many; not cheap; future returns may not match the past
2. More Illiquid Private Assets	**'Endowment Model' Beliefs**: High returns historically; perceived illiquidity premium	**Illiquidity**; contain much equity exposure; also historically rich; overrated illiquidity premia
3. Add Factor Tilts and Alternative Risk Premia	**Multi-Factor Beliefs**: Long-run evidence on multiple rewarded factors; long/short less affected by low yields	**Leverage** and other tools required to meet return targets; mixed performance in recent years

Part II: Building Blocks of Long-Term Expected Returns

Covering historical and forward-looking returns

5. Alpha and its cousins

- Valuable, scarce, elusive … or is it beta?

4. Alternative risk premia (value and other style premia)

- Great long-run evidence, mixed recent history

3. Illiquidity premia (private assets and other premia)

- Fair reward for illiquidity offset by smoothness preference?

2. Market risk premia (equity and other asset class premia)

- Dominant source of risk/reward; average or below-average today

1. Cash

- Expected inflation +/- something real
- Was at record lows until 2022's policy hikes
- The base of the pyramid is still underwater in some markets…

*Most investments are **blends** of the above*

A Menu of Timeless Market and Alternative Risk Premia

Return sources with most compelling long-run empirical support

Either harvest many premia (diversify risks) or let equity risk dominate (but then look for risk-mitigators)
- The latter approach is easier to stick with (patience advantage).

Hypothetical Annual Excess Returns and Sharpe Ratios of Main Asset Class Premia and Alternative Risk Premia, 1926-2020

Multi-Year Bad Times Can Still Challenge Investor Patience

There can be painful variation around the good long-run performance

Range of 3-Year Rolling Sharpe Ratios across Hypothetical Factors and Asset Classes

Legend:
— Long-Term Sharpe Ratio
■ Range of 3-Year Rolling Sharpe Ratios

V: Value **M**: Momentum **C**: Carry **D**: Defensive
VMD/VMCD/VMC: Multi-Factor **EQ**: Equities **FI**: Fixed Income

Value Style's Rollercoaster Years – and Exceptional Opportunity

Being on the wrong side of the growth-stock bubble in 2018-20 hurt Value

Hypothetical Global Value Factor Cumulative Performance, Drawdown, and Value Spread

January 1, 1990 – July 31, 2023

Tech Bubble

Global Financial Crisis

Recent Value Drawdown

Value Cheap

Value Expensive

Why Illiquidity Premia on Private Assets May Be Overrated

Prospects tempered by high valuations, even before the 2022 non-repricing

Limited long-run evidence for **illiquidity premium**, after adjusting for factor and sector exposures

Most PE outperformance occurred before popularity of endowment model, and narrowing of valuation gap

Ex Ante Valuation Gap Between Public and Private Equity
January 1, 1998 – December 31, 2022

S&P 500 EBITDA/EV
PE EBITDA/EV at Purchase
Wide Valuation Gap
Narrow Valuation Gap
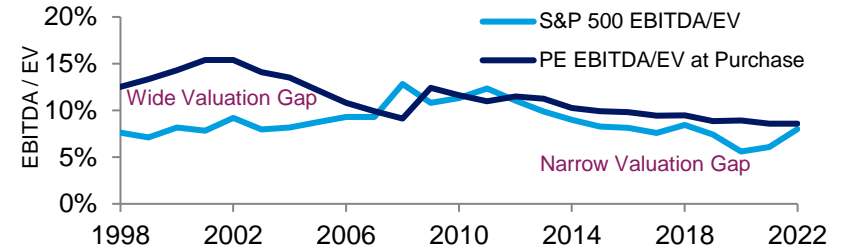
Paying more for a "smoothing service" may offset some of the fair illiquidity premium in private assets

Investors may know reported risks are understated, yet still value them for regulatory or accounting reasons

Investors Prefer Smooth Sailing to a Bumpy Ride

Beware 'slow beta': true risks of illiquids show up at longer horizons

Private equity is equity; private credit is credit

Annualized Volatility at Different Frequencies of Return
January 1986 – June 2021

S&P500   Cambridge PE

Monthly   Quarterly   6m   12m   24m

Part III: Putting It All Together

'Alpha beyond expected returns' – the whole investment process matters

- Diversification – its power, and its dark sides

- Portfolio construction

- **Risk management**

- ESG investing

- Costs and fees

- Tactical timing

- Bad habits and good practices

Apple Harvesting Parable of Bad Investing Practices
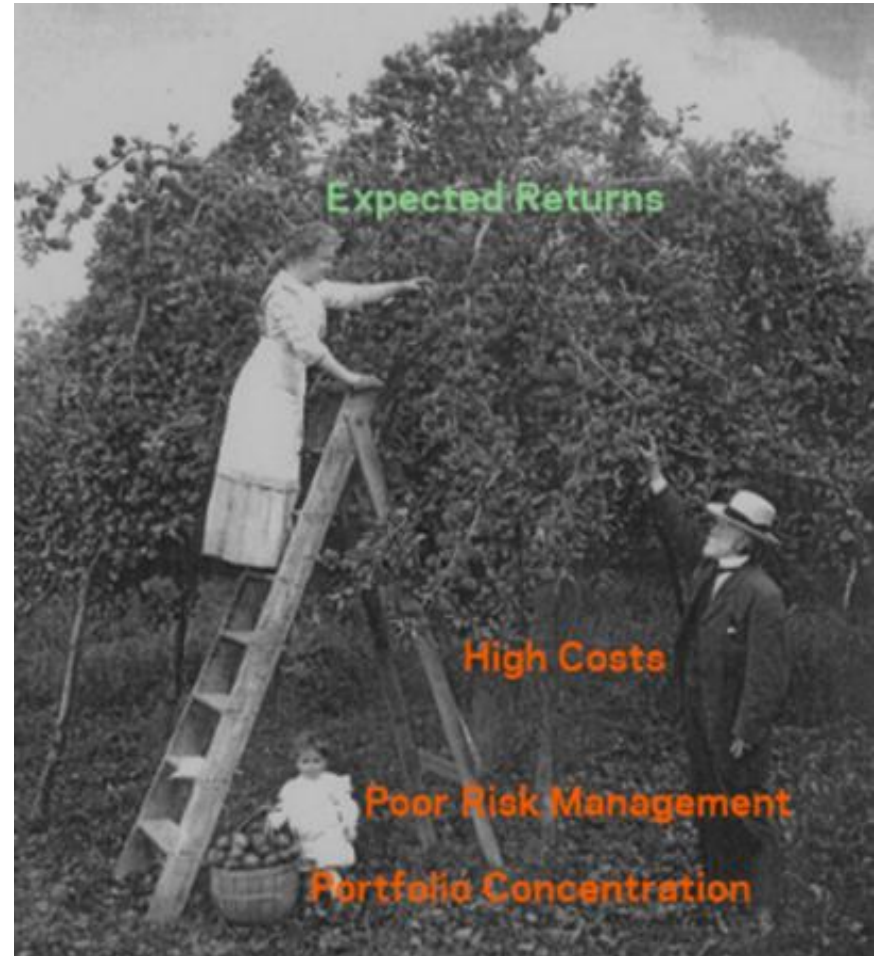
Which Risk Mitigation Strategies Can Help When It Matters Most?

Equity risk dominates most investor portfolios, so we study equity drawdowns

Risk-Mitigating Strategies' Performance in the 19 Largest Drawdowns of the U.S. Equity Market Over a Century

Peak	Trough	Length P-T	Depth P-T	Put	Trend	Treasury	Gold	QMJ US SS
Mar-1920	Aug-1921	17	-26%		19%	-4%		
Aug-1929	Jun-1932	34	-84%		50%	-1%		
Jan-1937	Mar-1938	13	-50%		-5%	6%		
May-1946	Nov-1946	6	-22%		6%	-1%		
Jul-1956	Dec-1957	17	-18%		15%	-1%		1%
Nov-1961	Jun-1962	7	-23%		11%	0%		0%
Jan-1966	Sep-1966	8	-18%		10%	-2%		2%
Nov-1968	Jun-1970	19	-37%		57%	-13%		34%
Dec-1972	Sep-1974	21	-50%		102%	-11%	129%	5%
Nov-1980	Jul-1982	20	-35%		26%	-6%	-59%	13%
Jun-1983	Jul-1984	12	-15%		6%	-6%	-28%	17%
Aug-1987	Nov-1987	3	-31%	23%	-4%	0%	7%	4%
Aug-1989	Oct-1990	14	-18%	-6%	24%	-1%	-4%	29%
Apr-1998	Aug-1998	4	-15%	11%	14%	4%	-12%	12%
Mar-2000	Sep-2002	30	-49%	11%	32%	23%	5%	96%
Oct-2007	Feb-2009	16	-52%	31%	25%	14%	14%	53%
Apr-2011	Sep-2011	5	-16%	9%	-2%	10%	4%	20%
Dec-2019	Mar-2020	3	-20%	27%	1%	10%	4%	1%
Dec-2021	Sep-2022	9	-24%	3%	35%	-14%	-10%	10%

Contrasting Long-Term Performance of Hypothetical Put and Trend Strategies
January 1, 1985 – December 31, 2022

Legend: Index Put Strategy; Multi-Asset Trend Following
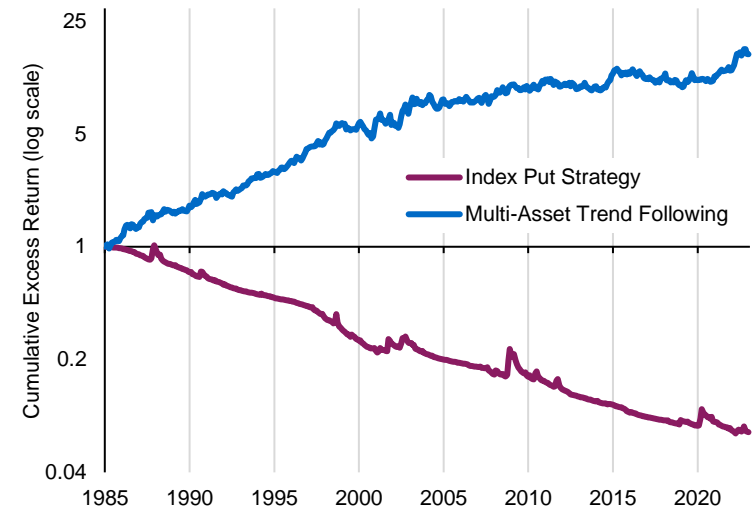
Source: AQR, Bloomberg, Commodity Systems Inc., and Option Metrics. The Hypothetical Put strategy is a backtest which involves buying a 5% out-of-the-money one-month put on the S&P 500 index (pre-1996 on the S&P100) at mid-month and rebalancing into a new put at expiry. Put returns are expressed as a percentage of the underlying index NAV, gross of trading costs and fees. For comparability, the series is scaled to 10% volatility based on the 6% volatility of the unlevered return over the full sample, implying a leverage of 1.67. Multi-Asset Trend Following is the Hypothetical Price-Based Trend-Following Strategy described in the Appendix until 12/31/1999. From 1/1/2000 onwards, Multi-Asset Trend Following is the SG Trend Index. Both Put and Trend returns are in excess of cash (US 3-month LIBOR) or using self-financed futures/forwards.

Higher Macro Volatility Gives Tactical Tailwinds for Trend
Historical analysis identifies trend strategies as pockets of resilience

Hypothetical U.S. Macro Volatility and Trend Performance Per Decade, January 1970 – June 2023

Legend: ■ Trend Annual Performance ■ Inflation YoY Volatility (RHS) ■ Real GDP Growth YoY Volatility (RHS)
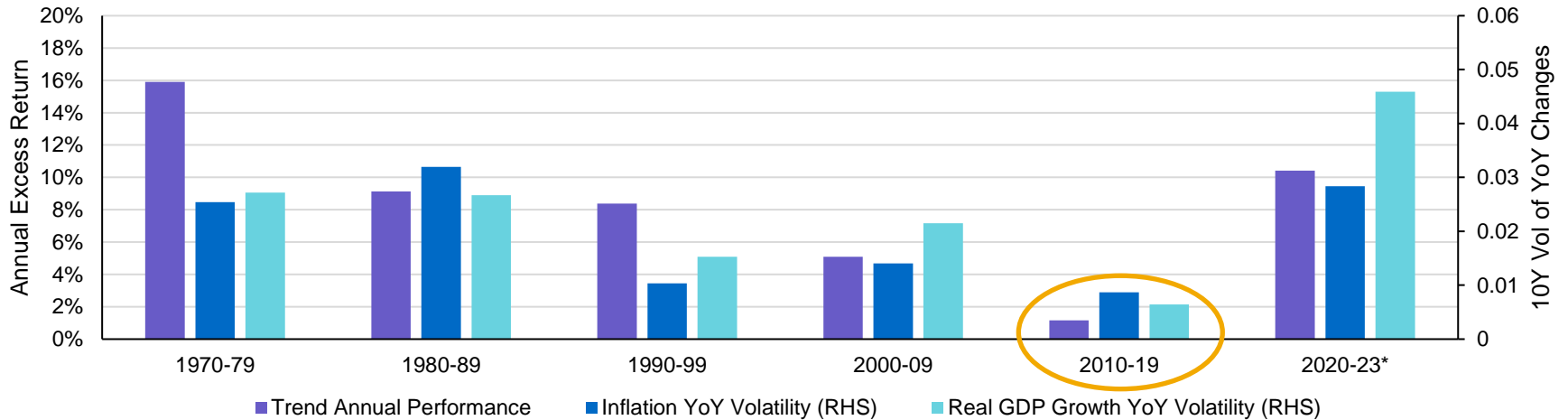
Relative Performance of Asset Classes and Hypothetical Strategies During Macro Turmoil
January 1972 – June 2023

Trend Following and Macro Resilience

Trend strategies have tended to thrive in tough environments

Performance of Global 60/40 and Hypothetical Trend Strategies in Worst 10 Drawdowns for Global 60/40

January 1970 – March 2023

Legend: Global 60/40, Price Trend, Economic Trend
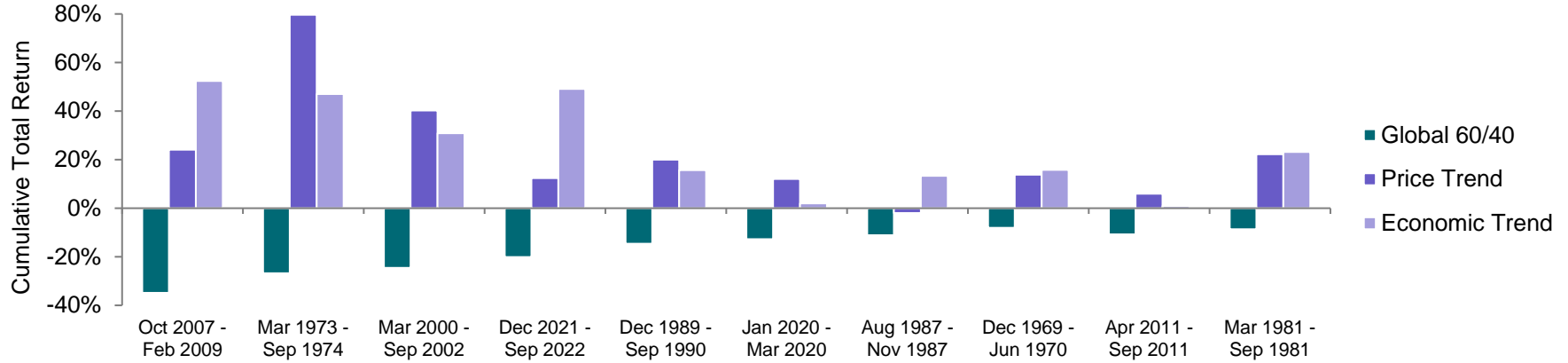
Not Just 60/40 Drawdowns: Hypothetical Performance in Various Macroeconomic Regimes

January 1970 – March 2023

Legend: Global 60/40, Price Trend, Economic Trend

Trend Following and Macro Convexity
Mapping non-linear sensitivities, January 1970 – March 2023

Even More Relevant for Portfolios With Private Assets

Trend strategies and private assets: a match made in heaven?

Hypothetical Performance in Ten Worst 6-Month Periods for Private Equity
January 1, 1990 – March 31, 2023

6M Ending	Private Equity	Private Credit	Real Estate	Price Trend	Econ Trend	Alt Trend	S&P 500	10Y Treasuries	Hedge Funds
12/31/2008	**-22.9%**	-13.3%	-9.3%	17.4%	31.6%	12.4%	-29.1%	14.3%	-19.4%
3/31/2001	**-15.7%**	0.7%	2.6%	12.2%	0.6%	20.4%	-21.3%	5.9%	-4.9%
12/31/2001	**-10.7%**	4.7%	0.5%	2.6%	11.4%	16.4%	-7.2%	3.0%	0.2%
9/30/2002	**-8.5%**	-3.3%	2.5%	14.1%	22.5%	21.8%	-29.0%	16.1%	-3.5%
3/31/2020	**-6.2%**	-8.2%	1.2%	1.4%	-1.3%	7.2%	-13.2%	6.1%	-8.6%
9/30/2022	**-5.8%**	-1.5%	3.3%	-1.3%	23.1%	10.5%	-20.7%	-8.3%	-4.2%
9/30/1998	**-5.0%**	-12.2%	5.1%	9.7%	19.4%	3.0%	-9.5%	7.6%	-10.6%
9/30/2000	**-4.6%**	-1.6%	3.0%	2.2%	-11.2%	1.0%	-6.5%	2.4%	-2.3%
6/30/2008	**-3.3%**	-1.3%	1.0%	1.3%	10.6%	14.3%	-13.0%	3.3%	-1.6%
12/31/1990	**-3.3%**	-8.2%	-4.8%	7.5%	7.3%	19.2%	-9.8%	1.8%	-5.9%
Average	-8.6%	-4.4%	0.5%	6.7%	11.4%	12.6%	-15.9%	5.2%	-6.1%
LT Ann. Exc. Ret.	11.9%	7.7%	7.6%	3.8%	5.6%	11.0%	7.0%	2.9%	6.0%

Trend: A Look at Live Industry Results

Managers have delivered attractive returns and equity-downside protection

Adding Trend Following to a Global 60/40 Portfolio

January 1, 2000 – June 30, 2023

	Global 60/40 Portfolio	SG Trend Index	Global 60/40 +20% SG Trend Index
Annualized Returns	5.0%	5.9%	5.4%
Annualized Volatility	9.6%	13.6%	7.9%
Sharpe Ratio	0.33	0.31	0.46
Worst Drawdown	-34.9%	-20.7%	-25.8%
Correlation to MSCI World	0.99	-0.09	0.93
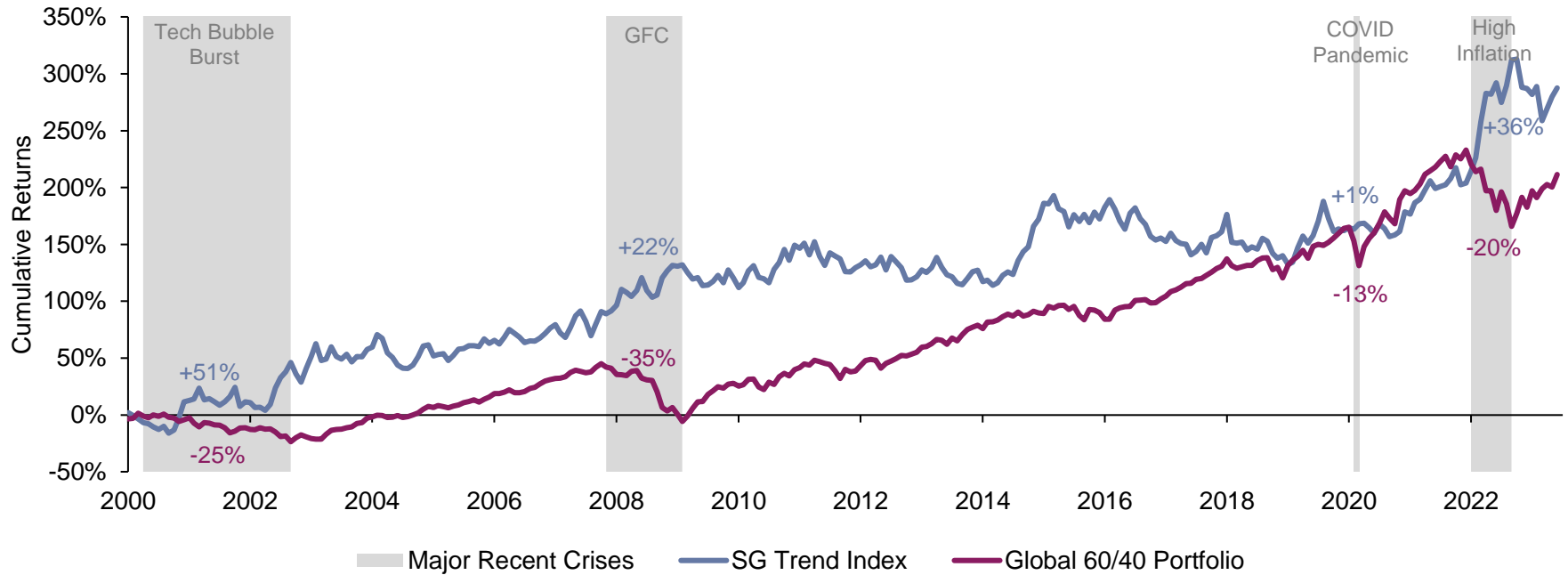
Our Enhancements to Traditional Price Trend

Trend following on economic data and alternative markets can improve returns

Trend Following on Economic Data

- Follows trends in macroeconomic data
- Key themes include growth, inflation, monetary policy, trade and risk aversion
- Diversifying to price-based trend-following signals, and delivers alpha to traditional and other alternative investments
- Delivers the "dual mandate"

Trend Following in Alternative Markets

- Follows price-based trends in harder to access, less liquid, alternative assets
- Includes credit, niche commodities (e.g., Malaysian palm oil), and equity factors (e.g., global value)
- Source of alpha relative to equities, bonds, and traditional trend-following strategies
- Delivers the "dual mandate"

- *Many other CTAs "improved" their standalone performance by adding positive-beta strategies like carry to classic price trend, thereby hurting the dual mandate (risk mitigation ability)*

Diversified Trend-Following Relying on Old and New
Seeking to enhance long-term returns while maintaining tail protection

Mandate #1: Positive Returns (Hypothetical)
January 1, 1990 – September 30, 2022

Chart: Total Returns
- Price-Based Trend Following: ~7.3%
- Diversified Trend Following: ~11.5%
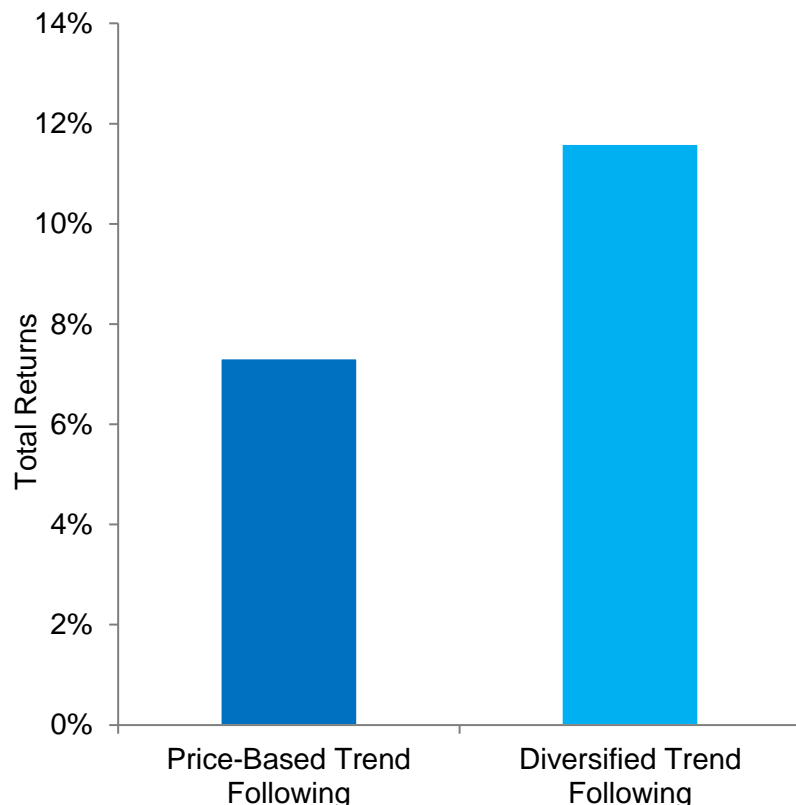
Mandate #2: Performance When Most-Needed (Hypothetical)
January 1, 1990 – September 30, 2022

Chart: Total Returns by period

Periods: Nov 2007 - Feb 2009, Apr 2000 - Sep 2002, Jan 2022 - Sep 2022, Jan 1990 - Sep 1990, Feb 2020 - Mar 2020

Legend:
- Global 60/40
- Price-Based Trend Following
- Diversified Trend Following

Part III: Putting It All Together

Key takeaways

Alpha beyond expected returns	A view on good building blocks is not enough – they need to be assembled efficiently
	There is potential alpha in other parts of the investment process: portfolio construction, risk management, cost control, increasingly also ESG
A good starting point	Diversify well across rewarded sources, diversify away unrewarded exposures
	Constraints on illiquidity, leverage, and ESG often matter more than unconstrained mean-variance optimization
Strategic diversification…	…trumps any long-run benefits from tactical timing
	Empirical finding favors bold diversification and humble timing in most circumstances
Good investing…	…requires both good investments and good investors
	Understand and communicate what consistency is feasible in competitive markets
	Multi-year return chasing and capitulations may be the premier bad habits to resist
Investment beliefs	Setting out a clear set of investment beliefs makes it easier to be a serene and consistent investor…
	…essential characteristics when a strategy is good only if you can stick with it

Appendix
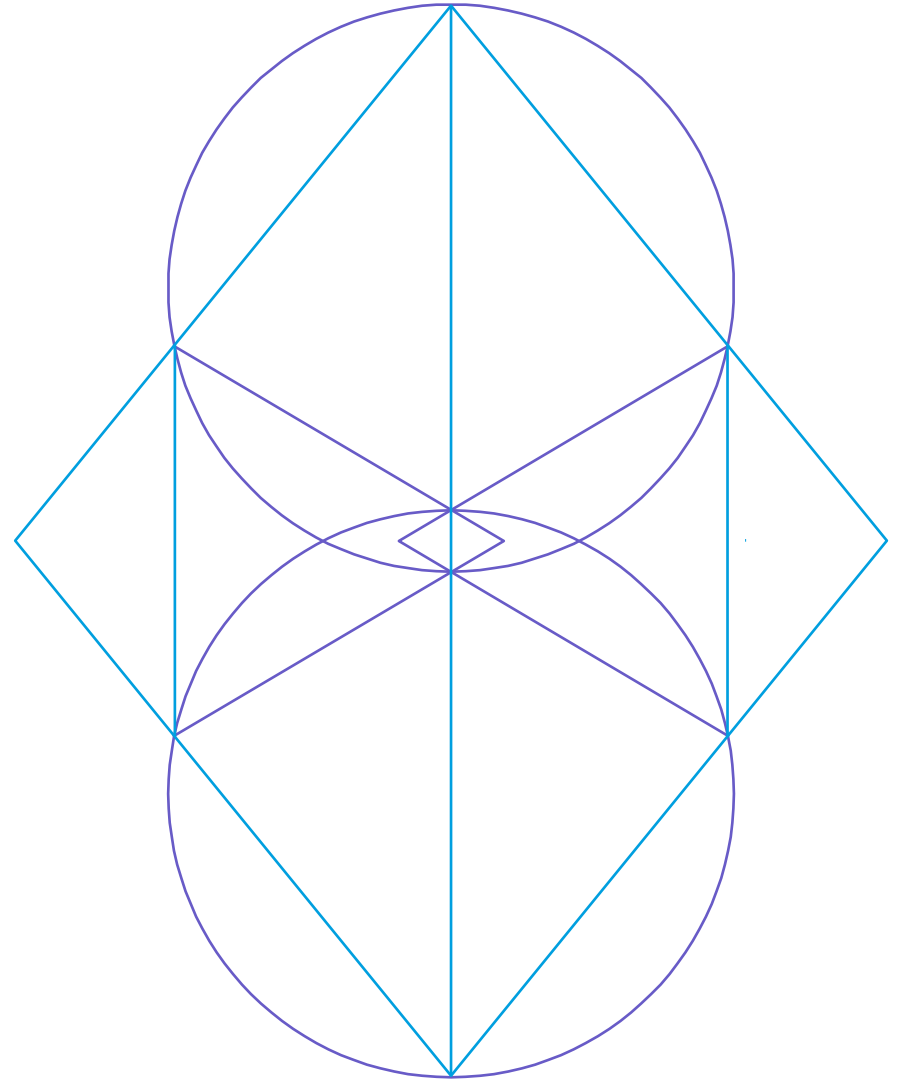
The "Serenity Prayer"
And its lessons for long-term investors

God, grant me the serenity to accept the things I cannot change,

the courage to change the things I can,

and the wisdom to know the difference

Expected returns

- Few investors show the serenity to accept lower spending plans

- More of us display courage to raise risk taking

- Many follow St Augustine and pray: *Lord, make me chaste, but not yet.*

Realized returns

- Few investors serenely accept an extended period of disappointing performance

- Even when we know that short/medium-term returns are dominated by luck, we often overreact to them, instead of focusing on the process we can control

- Outcome bias refers to the all-too-common tendency to equate the quality of a decision with the quality of its outcome

Investing Amid Low Expected Returns

Making the Most When Markets Offer the Least

Antti Ilmanen

Foreword by Cliff Asness

WILEY

Performance Disclosures

Performance Disclosures

Broad-based securities indices are unmanaged and are not subject to fees and expenses typically associated with managed accounts or investment funds. Investments cannot be made directly in an index.

The S&P 500 Index is a market-capitalization-weighted index of 500 leading publicly traded companies in the U.S.

The Bloomberg Barclays Global Aggregate Index is a market-weighted index of global government, government-related agencies, corporate and securitized fixed-income investments.

The MSCI World Index is a free float-adjusted market capitalization weighted index that is designed to measure the equity market performance of developed markets.

The SG Trend Index is designed to track the largest 10 (by AUM) CTAs and be representative of the managed futures trend-following space. The AQR Funds - AQR Managed Futures Strategy Fund is a constituent of the SG Trend Index.

The Bloomberg Commodity Index is made up of 23 exchange-traded futures on physical commodities, representing 21 commodities which are weighted to account for economic significance and market liquidity.

The Bloomberg Dollar Spot Index tracks the performance of a basket of 10 leading global currencies versus the U.S. Dollar. It has a dynamically updated composition and represents a diverse set of currencies that are important from trade and liquidity perspectives.

The Bloomberg USD High-Yield Corporate Bond Index is a rules-based, market-value-weighted index engineered to measure publicly issued non-investment grade USD fixed-rate, taxable and corporate bonds.

The FTSE World Government Bond Index (WGBI) measures the performance of fixed-rate, local currency, investment-grade sovereign bonds from over 20 countries, denominated in a variety of currencies, and has more than 30 years of history available. The WGBI is a broad benchmark providing coverage of the global sovereign fixed income market.

The CBOE S&P 500 5% Put Protection IndexSM (PPUT) tracks the value of a hypothetical portfolio of securities (PPUT portfolio) designed to protect an investor from negative S&P 500 returns. The PPUT portfolio is composed of S&P 500® stocks and of a long position in a one-month 5% out-of-the-money put option on the S&P 500 (SPX put).

The CBOE Eurekahedge Tail Risk Index is an equally weighted index of 13 constituent funds. The index is designed to provide a broad measure of the performance of underlying hedge fund managers that specifically seek to achieve capital appreciation during periods of extreme market stress.

The Bloomberg Barclays Global Treasury Index tracks fixed-rate local currency government debt of investment grade countries.

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

The FTSE 100 Index is an index composed of the 100 largest companies by market capitalization listed on the London Stock Exchange.

The MSCI Emerging Markets Index is a free float-adjusted market capitalization index that is designed to measure equity market performance of emerging markets.

The TOPIX Index is a free-float adjusted market capitalization-weighted index that is calculated based on all the domestic common stocks listed on the TSE First Section.

The KBW Bank Index is designed to track the performance of a selection of leading banks and thrifts that are publicly traded in the U.S.

The NASDAQ 100 Index is a market capitalization-weighted index that tracks the 100 largest, most actively traded companies listed on the Nasdaq stock exchange.

Performance Disclosures

The Cliffwater Direct Lending Index is an asset weighted index of 12,000 + directly originated middle market loans.

The NCREIF Property Index is a quarterly, unleveraged composite total return for private commercial real estate properties held for investment purposes.

The Cambridge US Private Equity Index is calculated based on data compiled from over 1,000 US private equity and venture capital funds.

The Credit Suisse Hedge Fund Index is an asset-weighted hedge fund index that provides a rules-based measure of an investable portfolio

The FTSE NAREIT Equity REITs Index is a free-float adjusted, market capitalization-weighted index of U.S. equity REITs.

The HFRI Fund Weighted Composite Index is a global, equal-weighted index of single-manager funds that report to HFR database.

The HFRI RV: Fixed Income Asset-Backed Index includes strategies in which the investment thesis is predicated on realization of a spread between related instruments.

The HFRI Credit Index is a composite index of various strategies trading primarily in credit markets.

The HFRI ED: Distressed/Restructuring Index includes strategies which employ an investment process focused on credit instruments trading at significant discounts to their value at issuance because of either formal bankruptcy proceeding or financial market perception of near-term proceedings.

The HFRI ED: Special Situations Index includes strategies which employ an investment process focused on instruments in companies currently engaged in a corporate transaction.

Credit Suisse Distressed Index is designed to measure the aggregate performance of event driven funds that focus on distressed situations.

Performance Disclosures

Simple Yield-Based Forecasts of Expected Returns

Sources for historical equity and bond expected returns are AQR, Robert Shiller's data library, Kozicki-Tinsley (2006), Federal Reserve Bank of Philadelphia, Blue Chip Economic Indicators, Consensus Economics and Morningstar. Prior to 1926, stocks are represented by a reconstruction of the S&P 500 available on Robert Shiller's website which uses dividends and earnings data from Cowles and associates, interpolated from annual data. After that, stocks are the S&P 500. Bonds are represented by long-dated Treasuries. The equity yield is a 50/50 mix of two measures: 50% Shiller E/P * 1.075 and 50% Dividend/Price + 1.5%. Scalars are used to account for long term real Earnings Per Share (EPS) Growth. Bond yield is 10-year real Treasury yield minus 10-year inflation forecast as in *Expected Returns* (Ilmanen, 2011), with no rolldown added.

A Century of Multi-Asset Factor Premia
Simple factor definitions; pre- and post-sample data

Style Premia Definitions by Asset Class

	U.S. Stocks	Equity Indices	Global Bonds	Currencies	Commodities
Value	B/P	Cyclically-Adjusted PE (CAPE)	Real Bond Yield	Purchasing Power Parity	5-Year Reversal
Momentum	Past 12-Month Price Return (excluding Most Recent Month)				
Carry	—	Dividend Yield	Yield Curve Slope	Short-Term Interest Rate	Futures Curve Rolldown
Defensive	Beta			—	—

An Extended Dataset
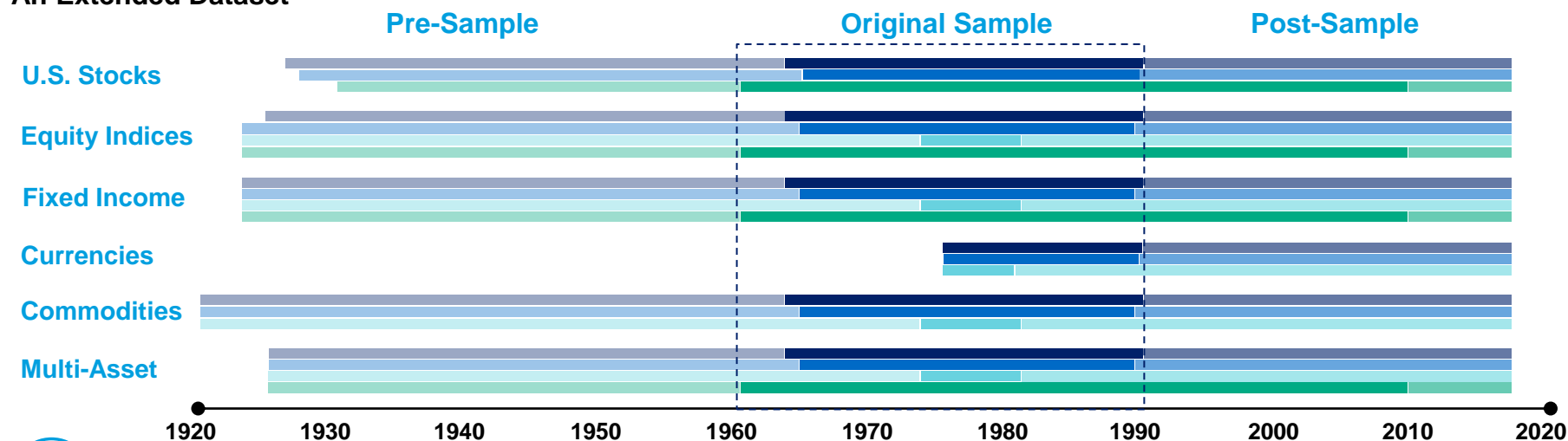
Source: AQR. For illustrative purposes only. Asset Class Data is subject to change at any time without notice. The full sample period starts 1/1920 and ends 9/2018. Time periods for pre-sample, post-sample, and original sample can be found in the Appendix. Darker shaded region of each horizontal bar represents original sample period. Please refer to the Appendix for descriptions of the data sources used and definitions for each style. Note that multi-asset composite is volatility-weighted combination of strategies in all asset classes, and also includes International Stocks for a shorter available history since 7/1984. Please refer to the Appendix for descriptions of the data sources used and definitions for each style in the Century of Factor Premia section.

Asset Descriptions for Macro Analyses
Asset class proxies and hypothetical strategy methodology

Asset Class	Proxy 1	Start Date	Proxy 2	Start Date	Proxy 3	Start Date
Domestic Equity	MSCI US Net TR Index	1/1/1972				
International Dev. Equity	MSCI World ex US Net TR Unhedged Index	1/1/1972				
Emerging Equity	MSCI Emerging Markets Net TR Unhedged Index	1/1/1988	MSCI EAFE Net TR Unhedged Index	1/1/1972		
Domestic Govt Bonds	U.S. 10-year Treasury	1/1/1972				
Global IG Bonds	Bloomberg Barclays Global Agg Bond Index Hedged	2/1/1990	AQR Global Bond Series (vol adjusted)	1/1/1972		
High Yield Bonds	Bloomberg Barclays US High Yield Index	8/1/1983	Barclays US Corporate Bond Index	2/1/1973	AQR US Bond Series	1/1/1972
Inflation-Linked Bonds	U.S. 10-Year TIPS	3/1/1997	Synthetic returns based on nominal Treasury yields and survey-based expected inflation	1/1/1972		
Private Equity	50% Russell 2000 x 1.2 (levered listed small cap index), 50% Cambridge U.S. Buyout (unlisted)	4/1/1986	70% Russell 2000 x 1.2 (levered listed small cap index), 30% Cash	1/1/1972		
Real Estate	50% FTSE NAREIT All REITs Index (listed), 50% NCREIF Index (unlisted)	12/1/1977	60% FTSE NAREIT All REITs Index (listed), 40% Cash	1/1/1972		
Commodities	Bloomberg Commodities Index	1/1/1972				
Gold	S&P GSCI Gold Total Return Index	1/1/1972				
B/E Inflation	Long 10-year U.S. TIPS as defined above, short 10-year U.S. Treasury	1/1/1972				
Long/Short Equity Factors	Value is U.S. HML Devil factor based on B/P (Asness and Frazzini, 2013), constructed to be industry neutral. Momentum is U.S. 'Up Minus Down' factor based on 12M return excluding most recent month, constructed to be industry neutral. Low Beta is U.S. 'Betting Against Beta' factor (Frazzini and Pedersen, 2014), constructed to be industry neutral. Quality is U.S. 'Quality Minus Junk' factor (Asness, Frazzini and Pedersen, 2014), constructed to be industry neutral. All factors are cap-weighted long the 1/3 best stocks and short the 1/3 worst stocks following the methodology of Fama and French (1993), rebalanced annually every January. All factors except Low Beta are dollar long and short. For Low Beta the long side is levered to make the portfolio ex-ante beta-neutral as described in Frazzini and Pedersen (2014). Multi-factor Portfolio is equal-weighted combination of Value, Momentum and Defensive, where Defensive is 50% Low Beta and 50% Quality. Returns are gross of costs and fees.					
Trend Following	Please see the Hypothetical Price-Based Trend-Following Strategy description on the Trend Following Backtest Descriptions slides.					
Macro Momentum	Hypothetical long/short and directional strategies applied to 15 equity indices, 9 government bond markets, and 9 currencies, with signals based on the following macro momentum themes as described in A Half Century of Macro Momentum by Brooks (2017): Business Cycle, International Trade, Monetary Policy, Risk Sentiment. The strategy goes long assets for which fundamental momentum is favorable and short assets for which it is unfavorable. Returns are net of estimated transaction costs and 2 & 20 fees.					
Cash	Carry on 3m T-Bills	1/1/1972				

A Century of Multi-Asset Factor Premia
Data sources and definitions

Factor Premia Asset Data

U.S. Stocks: Individual stock-level data from the CRSP database from July 1926 for Value, July 1927 for Momentum, and July 1931 for Defensive strategies.

Equity Indices: Returns on equity indices from 23 equity markets international which include all countries in the MSCI World Index as of 10/31/2016. Since most countries have multiple equity indices, we use the index that is investable, has the most coverage of the total stock market of that country, and has the longest history. We source monthly total returns from Global Financial Data and futures returns from Bloomberg and Datastream.

Fixed Income: Nominal yield and total returns data of 10-year local currency government bonds as well as 3-month interest rates for 13 countries covering North America, Northern Europe, Japan, and Australia/New Zealand, sourced from Global Financial Data, Bloomberg, and Datastream.

Currencies: Spot and 1-, 2-, 3-, and 6-month forward exchange rates from AQR's production data base and interpolate the forward exchange rate for the next quarterly IMM date. This simulates a strategy of buying and holding the forward contract maturing at the near IMM date and rolling to the far contract 5 days before the maturity date. Before 1990, we use changes in spot exchange rates plus the carry of the currency for the total return. This includes data from 20 developed market currencies (Australia, Eurozone, Canada, Japan, Norway, New Zealand, Sweden, Switzerland, United Kingdom, and the U.S., and Belgium, Spain, Finland, France, Germany, Ireland, Italy, Netherlands, Austria, and Portugal).

Commodities: Monthly futures prices of 40 commodities starting in 1877, sourced from the Annual Report of the Trade and Commerce of the Chicago Board of Trade, Commodity Systems Inc., and Bloomberg. For base metals and platinum, rolled return series from the S&P, Goldman Sachs, and Bloomberg are used.

U.S. Equity Market Data: Prior to 1926, the U.S. Equity series is constructed by adding price-weighted capital appreciation returns of NYSE stocks collected by Goetzmann, Ibbotson, and Peng to U.S. equity dividend returns recorded by the Cowles commission. The series consists of returns of the S&P 90 from 1926 to 1957 and returns of the S&P 500 from 1957 onwards.

Global Equities: GDP-weighted return of equity index futures of 11 developed countries.

Global Fixed Income: GDP-weighted return of 15 government bond indices of 8 developed countries scaled to a constant duration of 4 years.

Factor Premia Definitions

U.S. Stocks: Value: Book-to-Price Ratio; Momentum: Past 12 Month Return, Excluding Last Month; Defensive: Beta

Equity Indices: Value: Cyclically-Adjusted Earnings-to-Price Ratio; Momentum: Past 12 Month Return, Excluding Last Month; Carry: Dividend Yield; Defensive: Beta

Fixed Income: Value: Real Bond Yield; Momentum: Past 12 Month Return, Excluding Last Month; Carry: Term Premium; Defensive: Beta

Currencies: Value: Purchasing Power Parity; Momentum: Past 12 Month Return, Excluding Last Month; Carry: Short Term Interest Rate

Commodities: Value: 5 Year Reversal; Momentum: Past 12 Month Return, Excluding Last Month; Carry: Futures Curve Rolldown; Defensive: Beta

Multi-style is an equal weighted portfolio of the factor premia within each asset class.

The **multi-asset multi-style composite** is based on equal risk weights across asset classes, using long-run volatilities; it also includes a shorter history of International Stocks.

A Century of Multi-Asset Factor Premia
Methodology for macroeconomic sensitivity analysis and factor timing

Macroeconomic Indicator Definitions

Inflation: Average of the past 12 month change in CPI in the U.S. and the rate of change of the past 12 month CPI in the U.S

Growth: Average of the past 12 month change in real GDP in the U.S. and the rate of change of the past 12 month real GDP in the U.S

Volatility: Past 24 month realized volatility of developed equities

Macroeconomic Sensitivity Analysis Methodology

First, we form the Inflation, Growth, and Volatility indicators by capping extreme values at the 95th and 5th percentiles for each indicator and then normalizing. The full sample is then split into two categories for each indicator. If the indicator is above its median for that period, it is classified as a "high" period (if it is less than or equal to its median, it is classified as a "low" period). This ensures there is an equal number of "high" and low" periods in the analysis. Next, the style and market returns are converted to rolling annual returns. The returns are separated into two buckets for each indicator— returns in the "high" environments and returns in the "low" environments. We then calculate Sharpe ratios as the simple average of the rolling returns divided by the volatility of the rolling returns. We calculate Sharpe ratios in the full sample, the "high" and "low" inflation environments, the "high" and "low" growth environments, and finally the "high" and "low" volatility environments. We then compare these Sharpe ratios.

Factor Timing Methodology

The timing backtest is based on an expanding panel regression of factor returns on four standalone timing variables: value spread, past 12-month returns, business cycle proxy *based on U.S. real GDP growth level and change), and inverse volatility. The regression betas are used to compute predicted factor returns. The timing multiplier is based on the expanding z-score of predicted factor returns. The timing is applied to each style and asset class separately and these timed returns are then aggregated into a portfolio. The sign-constrained regressions impose non-negative sign for value spread, factor momentum and inverse volatility, thus implying no position if the regression shows a negative beta. The full model approach uses all of the above timing variables, while the other approaches use each signal standalone.

Timing Strategies from Century Study

We use the following timing methodologies: z-score, out-of-sample regression with no sign restrictions, out-of-sample regression with the restriction that a given factor have the same sign across all asset classes for a given timing variable, out-of-sample regression with both an economic sign and factor restriction (e.g., value spreads should have a positive coefficient and be the same for a given factor across all asset classes), and finally a full sample regression (in-sample) that places no restrictions on any coefficients. The timing variables are the value spread, past 12-month return on each factor (factor momentum), average characteristic of the factor itself (factor spread), which is the value spread for value portfolios, the momentum for momentum portfolios, the average carry for the carry portfolios, and the average negative beta for the defensive portfolios, five-year reversals (negative of past five year return on the factor), inverse volatility (where volatility is estimated over the prior 36 months of returns), inverse variance, business cycle (an ex ante measure that seeks to identify stages of the business cycle – contraction, recovery, slowdown, expansion – where we use both the level and change of GDP growth, compute a rolling 10-year z-score of level and changes in GDP growth, and identify the turning point of a business cycle as whether the z-score breaks +/-1.0 to identify each of the four periods), growth momentum (moving average of annual GDP growth), inflation momentum (moving average of inflation growth), CAPE, and "VIX" (realized volatility of the market over the last 36 months). We also report a simple average of all the timing strategies as well as a timing strategy based on the "full model" that incorporates all timing variables into one model, under each methodology, to time the factors.

Century of Factor Premia
Dates of pre-, original, and post-sample periods

Asset Class	Style	Pre-Sample Period	Original Sample Period	Post-Sample Period
Multi-Asset	Value	Mar-1926 - Dec-1963	Jan-1963 - Dec-1990	Jan-1990 - Dec-2019
Multi-Asset	Momentum	Feb-1926 - Dec-1964	Jan-1964 - Dec-1989	Jan-1989 - Dec-2019
Multi-Asset	Carry	Feb-1926 - Dec-1973	Jan-1973 - Dec-1981	Jan-1981 - Dec-2019
Multi-Asset	Defensive	Feb-1926 - Dec-1960	Jan-1960 - Dec-2009	Jan-2009 - Dec-2019
Multi-Asset	Multi-style	Feb-1926 - Dec-1960	Jan-1960 - Dec-1990	Jan-1990 - Dec-2019
U.S. Stocks	Value	Jul-1927 - Dec-1963	Jan-1963 - Dec-1990	Jan-1990 - Dec-2019
U.S. Stocks	Momentum	Feb-1928 - Dec-1964	Jan-1964 - Dec-1989	Jan-1989 - Dec-2019
U.S. Stocks	Defensive	Mar-1928 - Dec-1960	Jan-1960 - Dec-2009	Jan-2009 - Dec-2019
U.S. Stocks	Multi-style	Jul-1927 - Dec-1960	Jan-1960 - Dec-1990	Jan-1990 - Dec-2019
Commodities	Value	Jan-1920 - Dec-1963	Jan-1963 - Dec-1990	Jan-1990 - Dec-2019
Commodities	Momentum	Jan-1920 - Dec-1964	Jan-1964 - Dec-1989	Jan-1989 - Dec-2019
Commodities	Carry	Jan-1920 - Dec-1973	Jan-1973 - Dec-1981	Jan-1981 - Dec-2019
Commodities	Defensive	Jan-1920 - Dec-1960	Jan-1960 - Dec-2009	Jan-2009 - Dec-2019
Commodities	Multi-style	Jan-1920 - Dec-1960	Jan-1960 - Dec-1990	Jan-1990 - Dec-2019
Equity Indices	Value	Feb-1925 - Dec-1963	Jan-1963 - Dec-1990	Jan-1990 - Dec-2019
Equity Indices	Momentum	Feb-1923 - Dec-1964	Jan-1964 - Dec-1989	Jan-1989 - Dec-2019
Equity Indices	Carry	Feb-1923 - Dec-1973	Jan-1973 - Dec-1981	Jan-1981 - Dec-2019
Equity Indices	Defensive	Feb-1923 - Dec-1960	Jan-1960 - Dec-2009	Jan-2009 - Dec-2019
Equity Indices	Multi-style	Feb-1923 - Dec-1960	Jan-1960 - Dec-1990	Jan-1990 - Dec-2019
Fixed Income	Value	Mar-1923 - Dec-1963	Jan-1963 - Dec-1990	Jan-1990 - Dec-2019
Fixed Income	Momentum	Feb-1923 - Dec-1964	Jan-1964 - Dec-1989	Jan-1989 - Dec-2019
Fixed Income	Carry	Feb-1923 - Dec-1973	Jan-1973 - Dec-1981	Jan-1981 - Dec-2019
Fixed Income	Defensive	Feb-1923 - Dec-1960	Jan-1960 - Dec-2009	Jan-2009 - Dec-2019
Fixed Income	Multi-style	Feb-1923 - Dec-1960	Jan-1960 - Dec-1990	Jan-1990 - Dec-2019

Asset Class	Style	Original Sample Period	Post-Sample Period
Currencies	Value	Jan-1974 - Dec-1990	Jan-1990 - Dec-2019
Currencies	Momentum	Jan-1974 - Dec-1989	Jan-1989 - Dec-2019
Currencies	Carry	Jan-1974 - Dec-1981	Jan-1981 - Dec-2019
Currencies	Multi-style	Jan-1974 - Dec-1990	Jan-1990 - Dec-2019

Historical Long Run Risk Premia
Data Sources and Definitions

Data Sources

Equities: GDP-weighted return of equity index futures of 11 developed countries

Bonds: GDP-weighted return of 15 government bond indices of 8 developed countries scaled to a constant duration of 4 years.

Commodities: equal weighted return of a basket of 29 commodities

Credit Excess: excess return of US corporate bonds over duration-matched US treasury bonds

Value: equal risk weight of a value strategy (as described in later slides) in equity indices, stocks, fixed income, commodities, and currencies

Momentum: equal risk weight of a momentum strategy (as described in later slides) in equity indices, stocks, fixed income, commodities, and currencies

Carry: equal risk weight of a carry strategy (as described in later slides) in equity indices, stocks, fixed income, commodities, and currencies

Defensive: equal risk weight of a defensive strategy (as described in later slides) in equity indices, stocks, fixed income, commodities, and currencies

Trend: equal weighted combination of 12-month time series momentum strategies for 67 markets across four major asset classes – 29 commodities, 11 equity indices, 15 bond markets, and 12 currency pairs.

Descriptions of Style Premia in each asset class

U.S. Stocks: Value: Book-to-Price Ratio; Momentum: Past 12 Month Return, Excluding Last Month; Defensive: Beta

Equity Indices: Value: Cyclically-Adjusted Earnings-to-Price Ratio; Momentum: Past 12 Month Return, Excluding Last Month; Carry: Dividend Yield; Defensive: Beta

Fixed Income: Value: Real Bond Yield; Momentum: Past 12 Month Return, Excluding Last Month; Carry: Term Premium; Defensive: Beta

Commodities: Value: 5 Year Reversal; Momentum: Past 12 Month Return, Excluding Last Month; Carry: Futures Curve Rolldown; Defensive: Beta

Asset class data descriptions for Style Premia

U.S. Stocks: Individual stock-level data from the CRSP database from July 1926 for Value, July 1927 for Momentum, and July 1931 for Defensive strategies.

Equity Indices: Returns on equity indices from 23 equity markets international which include all countries in the MSCI World Index as of 10/31/2016. Since most countries have multiple equity indices, we use the index that is investable, has the most coverage of the total stock market of that country, and has the longest history. We source monthly total returns from Global Financial Data and futures returns from Bloomberg and Datastream.

Fixed Income: Nominal yield and total returns data of 10-year local currency government bonds as well as 3-month interest rates for 13 countries covering North America, Northern Europe, Japan, and Australia/New Zealand, sourced from Global Financial Data, Bloomberg, and Datastream.

Commodities: Monthly futures prices of 40 commodities starting in 1877, sourced from the Annual Report of the Trade and Commerce of the Chicago Board of Trade, Commodity Systems Inc., and Bloomberg. For base metals and platinum, rolled return series from the S&P, Goldman Sachs, and Bloomberg are used.

Hypothetical Value Factor Descriptions

Hypothetical AQR Global Style Premia Standalone Value Model:

This is an AQR Global Style Premia Standalone Value Model is a theoretical long/short style portfolio is based on monthly returns, undiscounted, net of transaction costs, net of 2% model mgmt. fee and 20% performance fee, excess of a cash rate proxied by the ICE BofAML U.S. 3 Mo. T-bill, and scaled to 7% annualized volatility. The strategy is designed to take long positions in the assets with the strongest style attributes and short positions in the assets with the weakest style attributes, while seeking to ensure the portfolio is market-neutral. The portfolio only uses Value signals that are considered to be well-known, and does not include the full suite of proprietary signals AQR may include in some portfolios. The universe is approximately 2,000 stocks across Europe, Japan, and U.S. The risk model used is the Barra Developed Equity Risk Model.

Hypothetical AQR Developed and Emerging Global Value Factor Portfolio Description:

The Hypothetical AQR Developed and Emerging Global Value Factor Portfolio utilizes the subset of underlying signals that compose the Valuation theme within AQR's Style Premia Equity strategies to evaluate stocks and create long-short, market-neutral equity portfolios based exclusively on these signals. The Valuation theme is designed to capture the tendency for relatively cheap assets to outperform relatively expensive ones. Factor returns are gross of advisory fees and net of transaction costs. Global factor returns start January 1, 1990 and emerging factor returns start January 1, 1996. The combined portfolio utilizes a monthly rebalancing schedule and targets an average annualized volatility of 16% over the long-term. The investment universe includes a broad subset of liquid tradeable large cap stocks within the Global and Emerging universes. The risk model used is the Barra Global Equity Risk Model (GEM2L) from January 1996 – March 2020, BIMe_noCURR_301L from April 2020 – September 2022 and AQR's proprietary risk models thereafter.

Trend Following Backtest Descriptions

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 1.25% 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%

Trend Following Backtest Descriptions

Figure 2
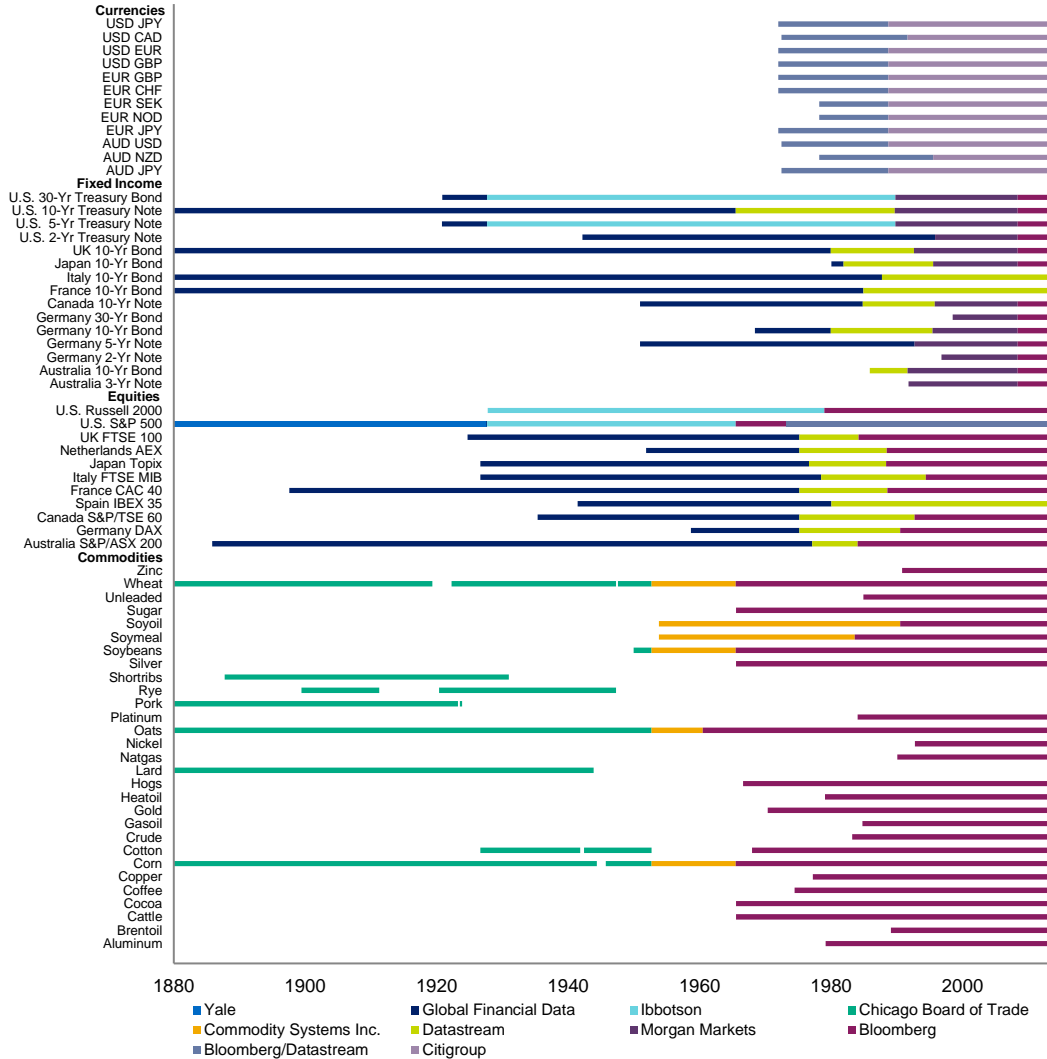
Trend Following Backtest Descriptions

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

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.

Trend Following Backtest Descriptions

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

Trend Following Backtest Descriptions

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 1.25% 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.

Regional Disclosures