# Crisis Logic

## Investing Amidst Uncertainty

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# Overview and Current Macroeconomic Environment

# Topics

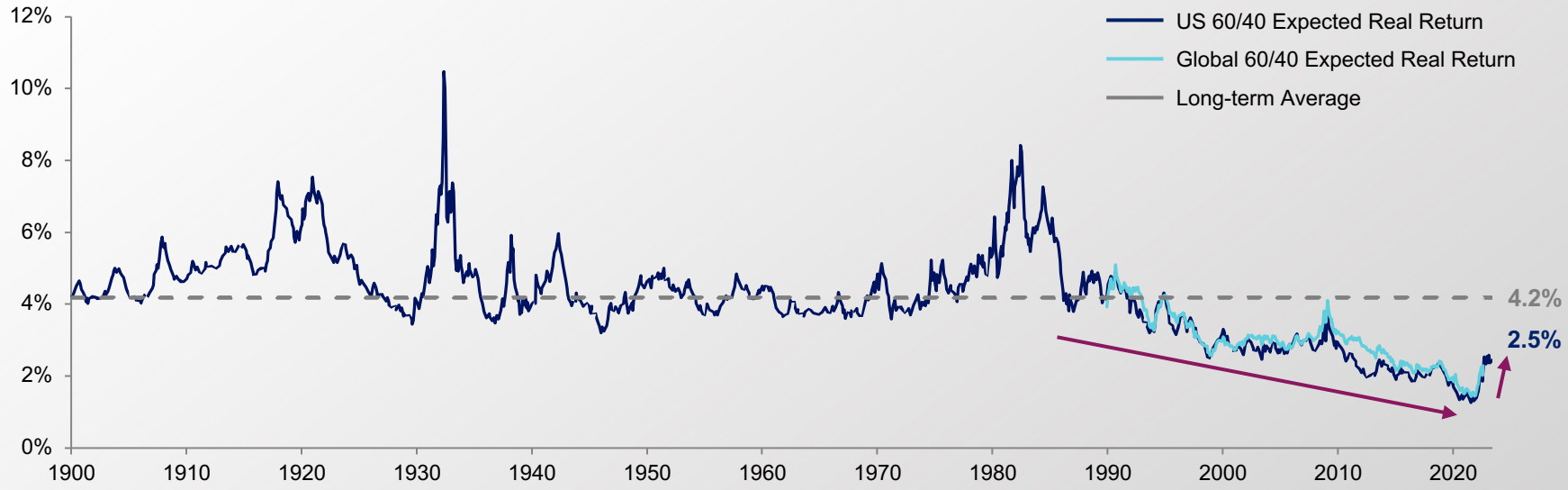
1. Current environment
2. What could go wrong
3. What helps when things turn ugly

# Current Environment

## Still a world of low expected returns

**Simple Expected Real Return of U.S. and Global 60/40 Stock/Bond Portfolios**

January 1, 1900 – June 30, 2023



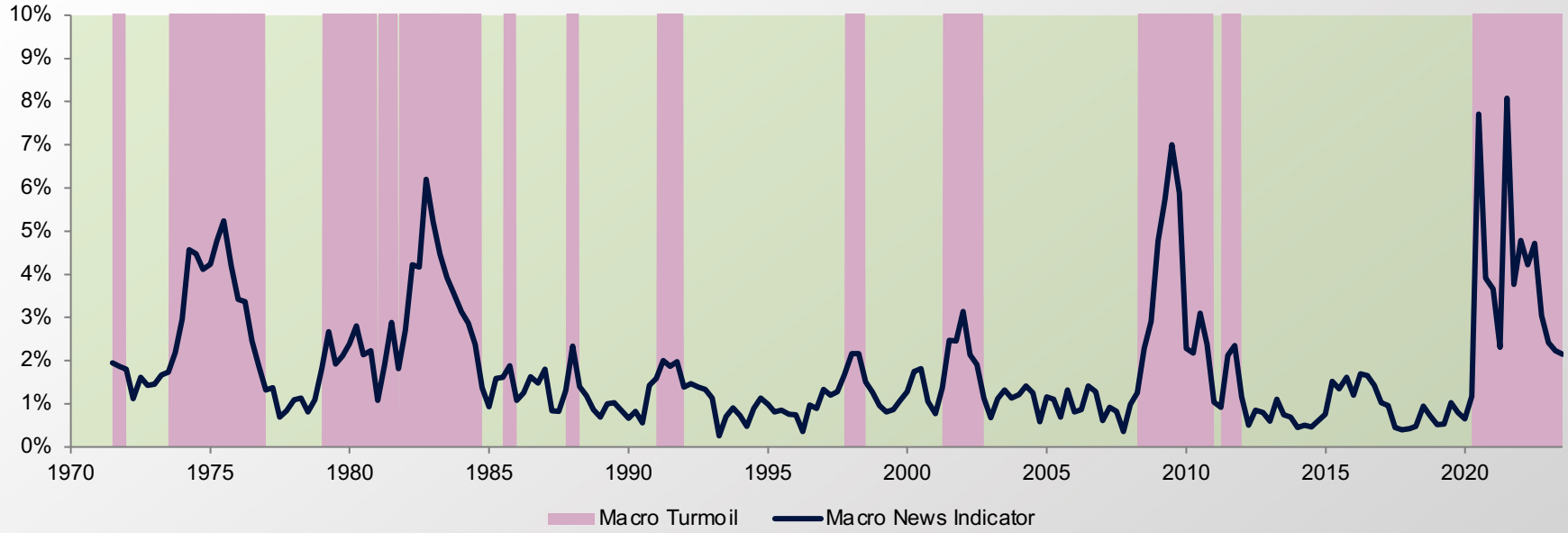

Source: AQR, Bloomberg, Robert Shiller's Data Library, Ibbotson Associates (Morningstar), Kozicki-Tinsley (2006), Federal Reserve Bank of Philadelphia, Blue Chip Economic Indicators, Consensus Economics. Earnings data through 6/30/2023. U.S. 60/40 portfolio is 60% U.S. equities and 40% long-dated Treasuries; Global 60/40 portfolio is 60% MSCI World and 40% GDP-weighted long-dated government bonds from countries in MSCI World universe. Real equity yield is simple average of two measures: (0.5 * Shiller E/P * 1.075) + 1.5% and Dividend/Price + 1.5%. The 1.5% term is assumed long term real earnings per share (EPS) growth. The 0.5 multiplier reflects the long-term payout ratio; the 1.075 multiplier accounts for EPS growth during 10-year earnings window. U.S. stock universe is S&P 500. Real bond yield is yield on long-term government bonds minus long-term expected inflation based on Blue Chip Economic Indicators, Consensus Economics and the Federal Reserve Bank of Philadelphia. Before survey data became available in 1978, expected long-term inflation is based on statistical estimates and on 1-year ahead Livingston inflation forecasts. This is one set of estimates of ex-ante real yields for equities and bonds, but other reasonable specifications should tell broadly the same story. Chart is for illustrative purposes only. Past performance is not a guarantee of future performance. Please read important disclosures in the Appendix.

# Current Environment

## We're in a period of macroeconomic uncertainty

**U.S. Growth and Inflation News and a Macro Turmoil Regime Indicator**

January 1, 1972 – June 30, 2023



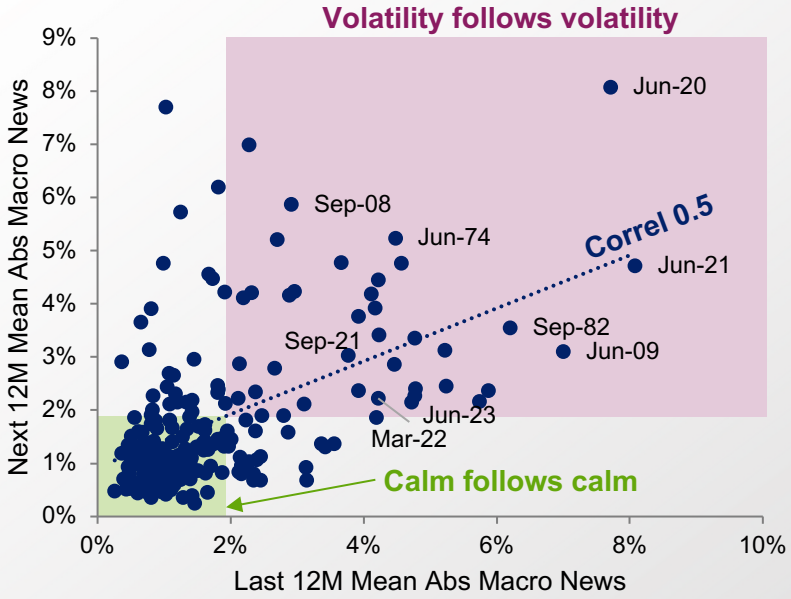

Sources: AQR, U.S. Bureau of Labor Statistics, Federal Reserve, Bloomberg. Macro Turmoil is defined as 12-month period for which macro news magnitude exceeds full sample mean. Based on 12-month returns at quarterly frequency. Macro news magnitude measure is based on changes in RGDP growth, changes in inflation, inflation surprises, RGDP growth surprises and industrial production (IP) 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 forecast 12 months earlier from Fed Survey of Professional Forecasters.

# Current Environment

## Macroeconomic volatility has tended to persist

### Macro News Indicator

January 1, 1972 – June 30, 2023



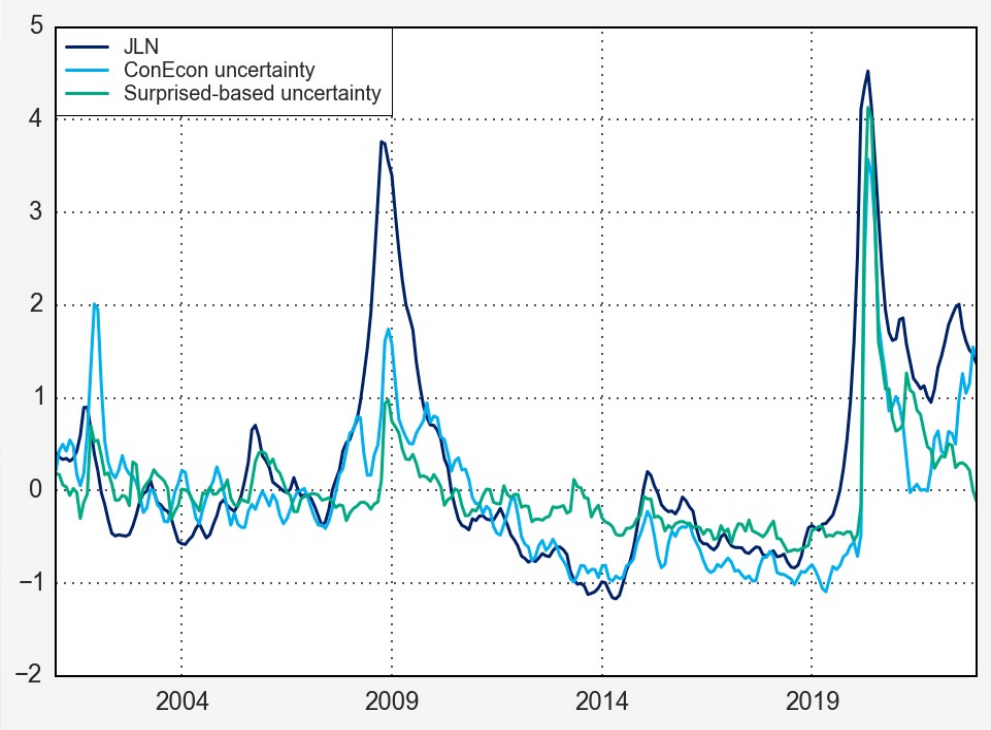

### Major Unresolved Macro Questions

- **Monetary policy lags:** the impact of tight policy has yet to be fully realized
- **Central bank tradeoffs:** central banks are hiking into an inflation shock for first time in decades
- **Disagreement:** material dispersion between market-implied and policymaker/economist forecasts, as well as across markets

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.

# Uncertainty Index

## We are in uncertain times



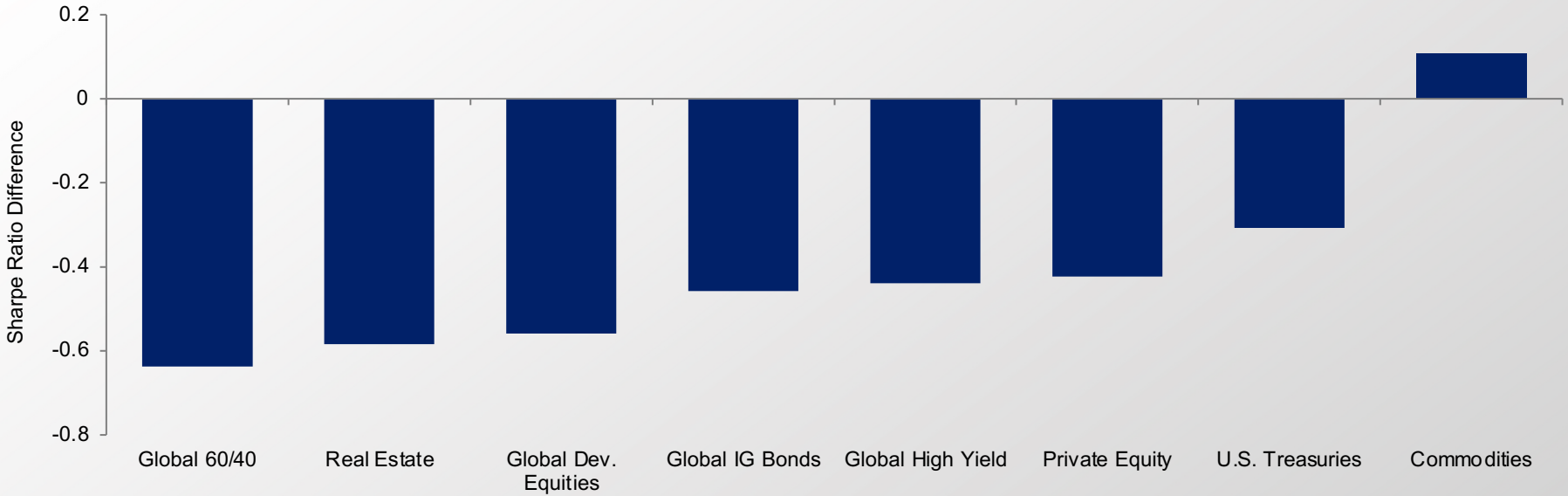

Source: AQR research from Consensus Economics and uncertainty index from Sydney Ludvigson's website using methodology in Jurado, Ludvigson, and Ng (2015), "Measuring Uncertainty† By Kyle Jurado, Sydney C. Ludvigson, and Serena Ng"

# Current Environment

## Macro uncertainty is bad news for most traditional assets

**Relative Performance of Asset Classes and Hypothetical Strategies During Macro Turmoil**

January 1, 1972 – June 30, 2023




Sources: AQR, U.S. Bureau of Labor Statistics, Federal Reserve, Bloomberg. Global 60/40 is 60% Global Dev. Equities and 40% Global IG Bonds. Macro Turmoil is defined as 12-month period for which macro news magnitude exceeds full sample mean. Based on 12-month returns at quarterly frequency. Macro news magnitude measure is based on changes in RGDP growth, changes in inflation, inflation surprises, RGDP growth surprises and industrial production (IP) 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 forecast 12 months earlier from Fed Survey of Professional Forecasters. Sharpe ratio is derived from the annualized net return excess of cash, which is the proxy index, over annualized volatility. Asset class proxies and construction of the hypothetical Price and Economic Trend strategies are defined in the Appendix.

# What Could Go Wrong?

# What Could Go Wrong?

## Consider three major risks for portfolios

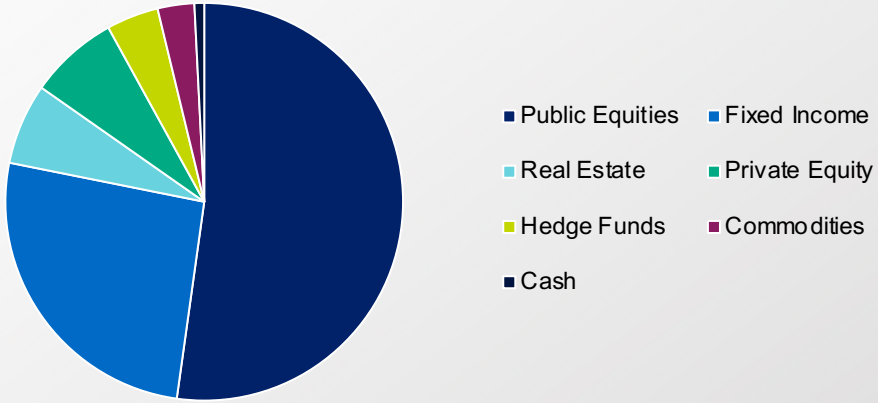
1. Recession
2. (Continued) inflation
3. Geopolitical tensions escalate further
4. Who knows what?!!

# What Could Go Wrong?

## Consider three major risks for portfolios

For each of these scenarios, we use history as a guide to simulate what the effect could be for a typical portfolio:

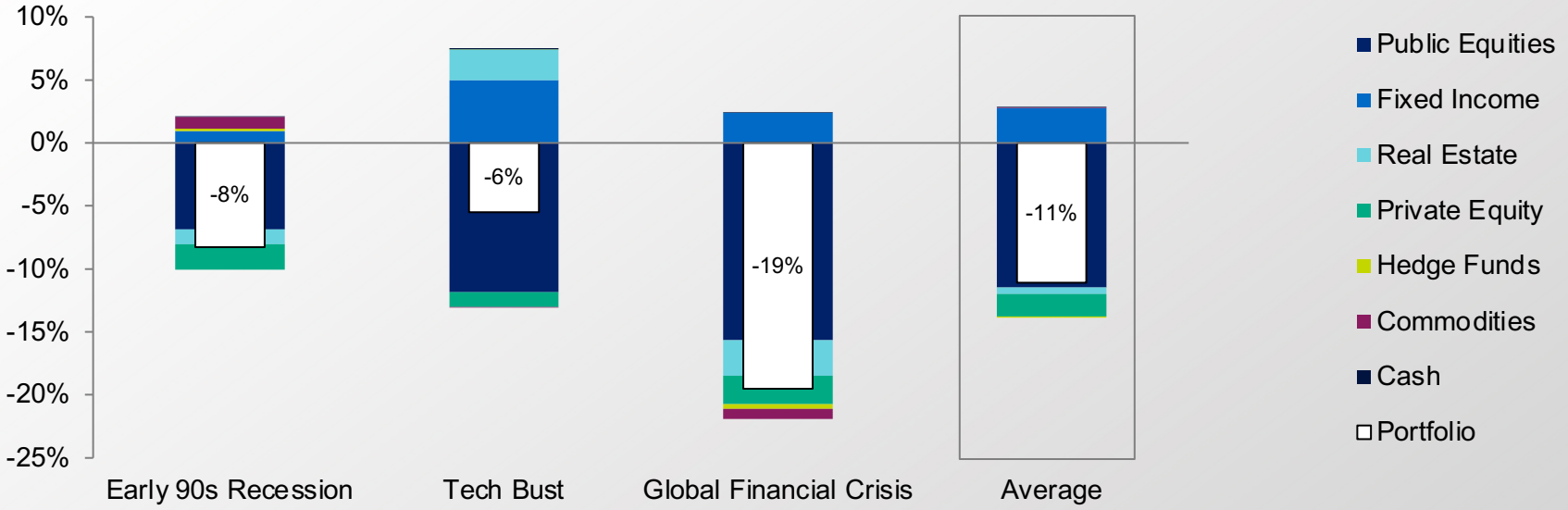
**Average Allocation of Typical Portfolio**
Fiscal Year 2022




Source: Public Plan Database. Typical portfolio average allocation determined by the 20 Largest U.S. Pension Funds via Public Plan Database. For illustrative purposes only.

# What Could Go Wrong?

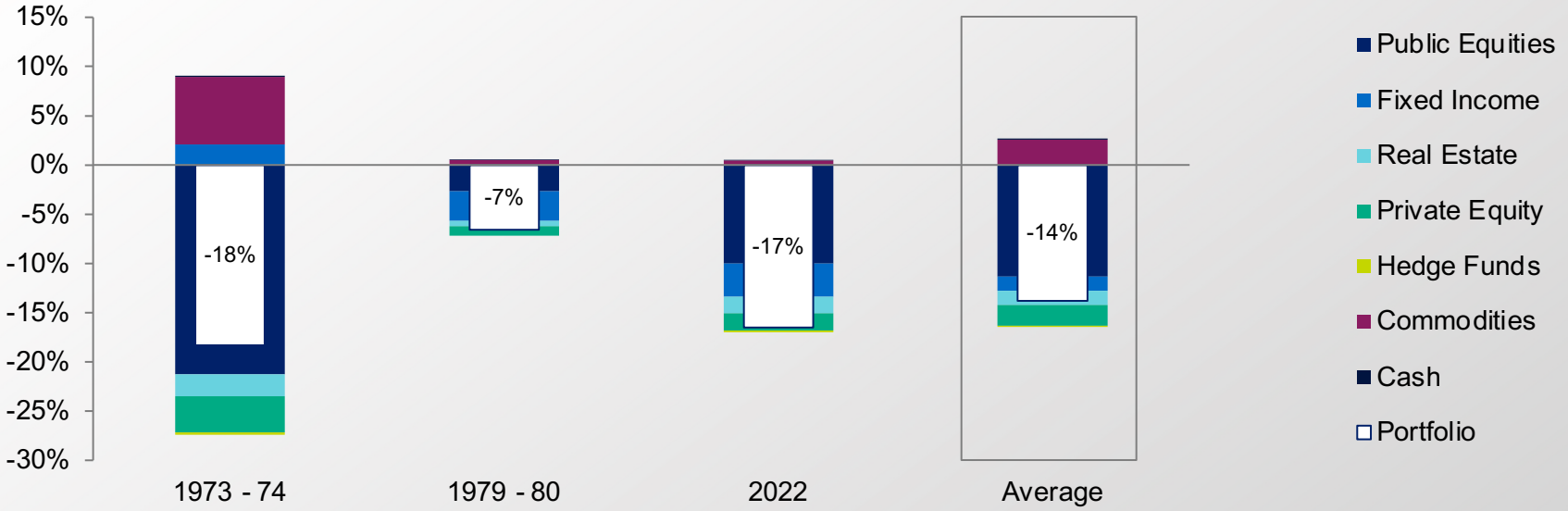
## 1. Recessionary shock




Source: AQR, Bloomberg. Early 90s Recession time period is defined as January 1, 1990 – September 30, 1990. Tech Bust time period is defined as March 1, 2001 – November 30, 2001. Global Financial Crisis time period is defined as December 1, 2007 – July 31, 2009. Please see appendix for asset class proxies used in this analysis.

# What Could Go Wrong?

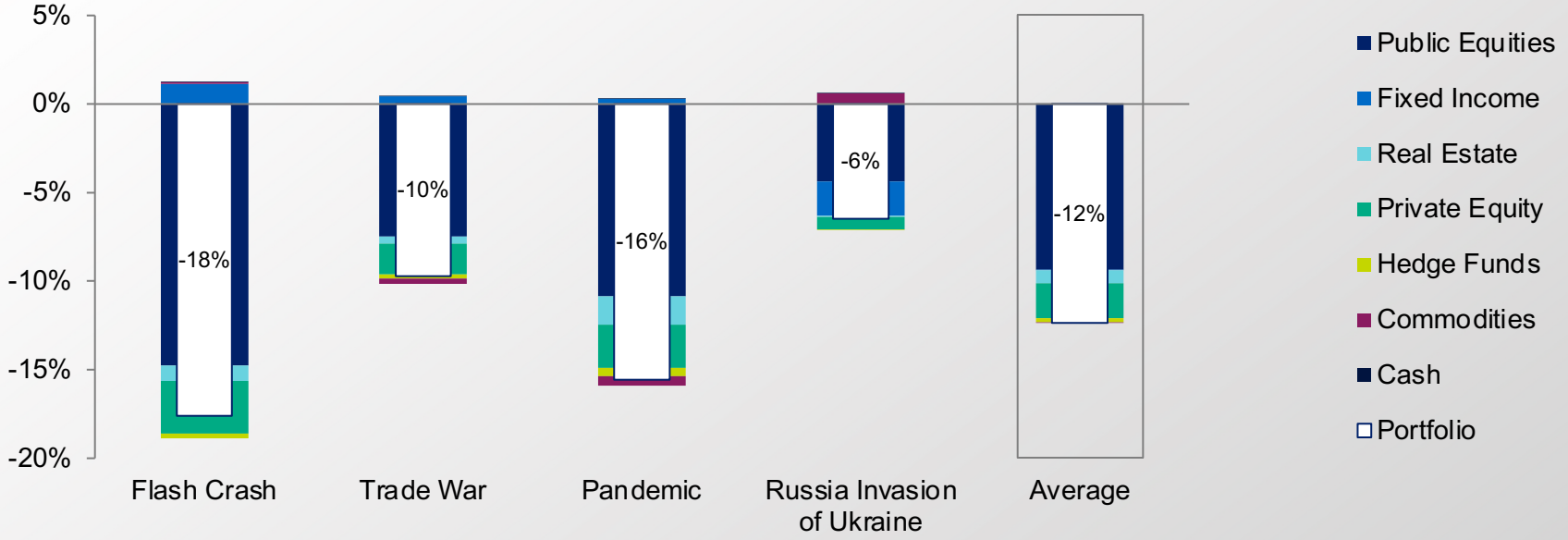
## 2. Inflationary shock




Source: AQR, Bloomberg. 1973 – 74 time period is defined as January 1, 1973 – December 31, 1974. 1979 – 80 time period is defined as October 1, 1979 – March 31, 1980. 2022 time period is defined as January 1, 2022 – December 31, 2022. Please see appendix for asset class proxies used in this analysis.

# What Could Go Wrong?

## 3. Other Crises




Source: AQR, Bloomberg. Flash Crash time period is defined as October 1, 1987 – November 31, 1987. Trade War time period is defined as October 1, 2018 – December 31, 2018. Pandemic time period is defined as February 1, 2020 – March 31, 2020. Russia Invasion of Ukraine time period is defined as February 1, 2022 – April 31, 2022. Please see appendix for asset class proxies used in this analysis.

# What Could Go Wrong?

## Can crises be predicted?

Can the

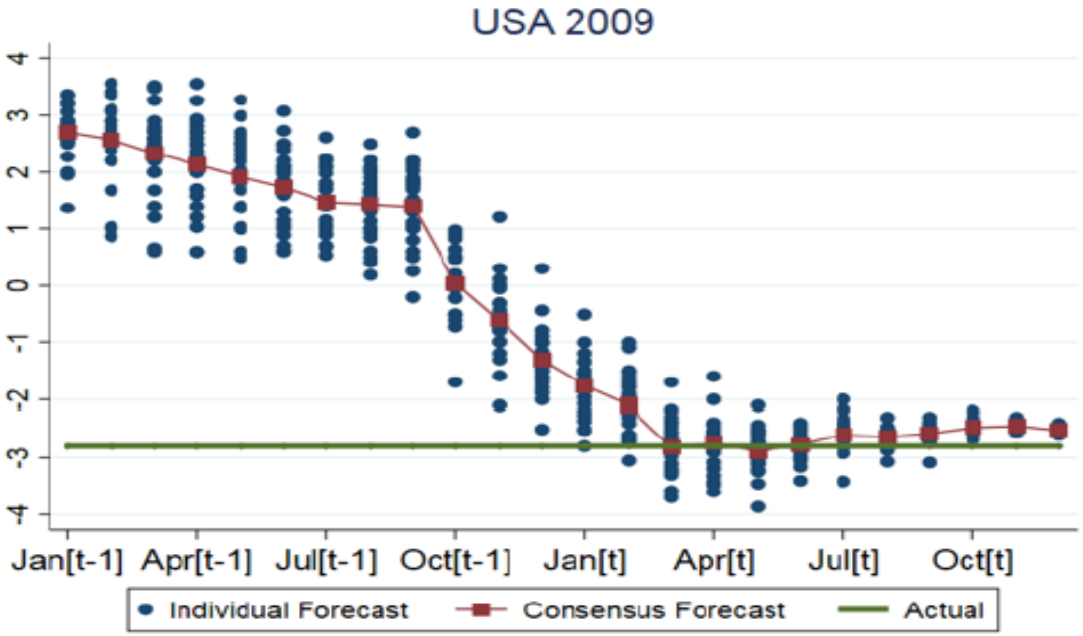
**No.**

At least

Why? B ***ks***.

Forecas

**Figure 2. Consensus Forecasts for USA (2009) and Argentina (2001)**




First chart source: An, Jalles, and Loungani (2018), "How Well Do Economists Forecast Recessions?" IMF working paper.
Second chart source: Drautzburg (2019), "Why Are Recessions So Hard to Predict? Random Shocks and Business Cycles," Federal Reserve Bank of Philadelphia and originally from Slutzky (1927, in English 1937).
For illustrative purposes only.

# Overconfidence

A common human bias

## 1998 NFL Draft: Two “Franchise” QBs


Source: Google Images. For illustrative purposes only. The use of the logos and pictures is for informational purposes only and is not authorized by, sponsored by or associated with the trademark owners.

# Where Are They Now?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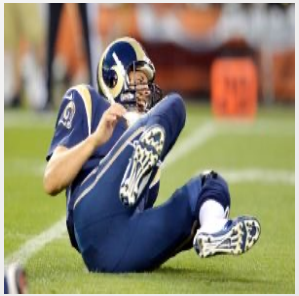
# 18 of last 23 #1 picks have been QBs





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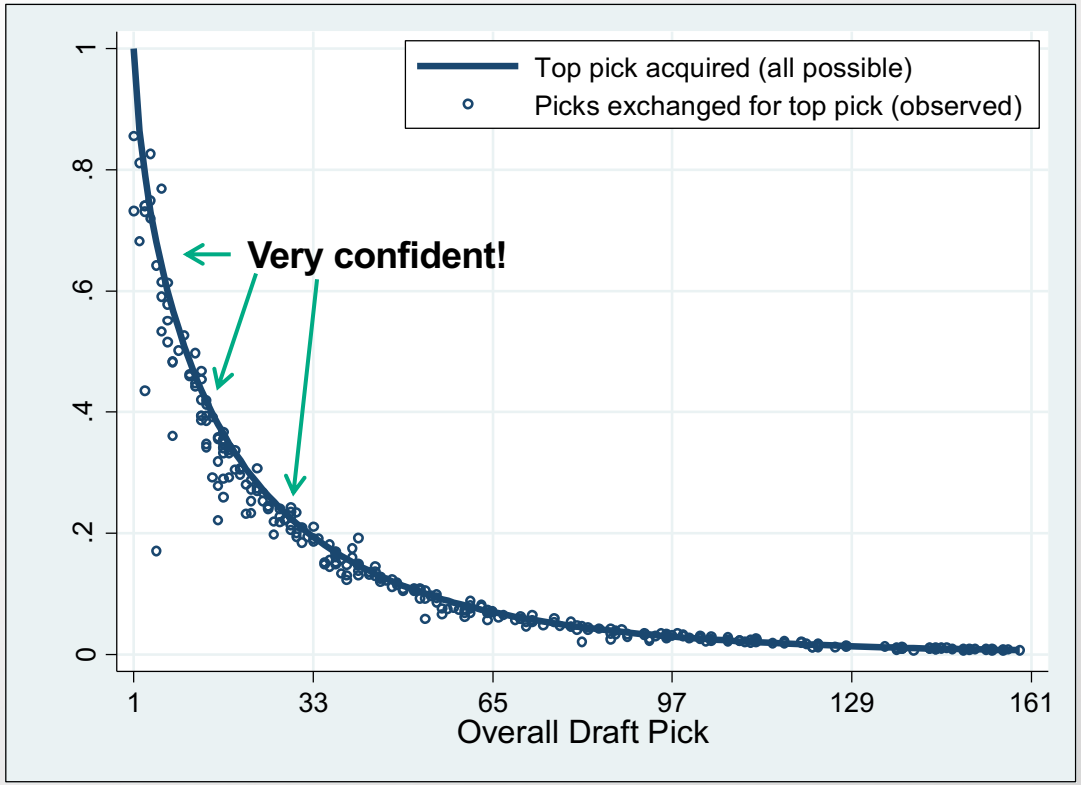
# Estimated Trade Value of Draft Picks




Source: Moskowitz and Wertheim (2011), "Scorecasting: The Hidden Influences Behind How Sports Are Played and Games Are Won" and Massey and Thaler (2004) "The Loser's Curse: Overconfidence vs. Market Efficiency in the NFL Draft." For illustrative purposes only.

# Estimated Trade Value of Draft Picks

## Draft Pick Value Chart

Used to Determine the Value of Traded Picks

| | Round 1 | | Round 2 | | Round 3 | | Round 4 | | Round 5 | | Round 6 | | Round 7 | | Additional Rounds | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3000 | 33 | 580 | 65 | 265 | 97 | 112 | 129 | 43 | 161 | 28 | 193 | 15.2 | 225 | 2.9 |
| 2 | 2600 | 34 | 560 | 66 | 260 | 98 | 108 | 130 | 42 | 162 | 27.6 | 194 | 14.8 | 226 | 2.8 |
| 3 | 2200 | 35 | 550 | 67 | 255 | 99 | 104 | 131 | 41 | 163 | 27.2 | 195 | 14.4 | 227 | 2.7 |
| 4 | 1800 | 36 | 540 | 68 | 250 | 100 | 100 | 132 | 40 | 164 | 26.8 | 196 | 14 | 228 | 2.6 |
| 5 | 1700 | 37 | 530 | 69 | 245 | 101 | 96 | 133 | 39.5 | 165 | 26.4 | 197 | 13.6 | 229 | 2.5 |
| 6 | 1600 | 38 | 520 | 70 | 240 | 102 | 92 | 134 | 39 | 166 | 26 | 198 | 13.2 | 230 | 2.4 |
| 7 | 1500 | 39 | 510 | 71 | 235 | 103 | 88 | 135 | 38.5 | 167 | 25.6 | 199 | 12.8 | 231 | 2.3 |
| 8 | 1400 | 40 | 500 | 72 | 230 | 104 | 86 | 136 | 38 | 168 | 25.2 | 200 | 12.4 | 232 | 2.2 |
| 9 | 1350 | 41 | 490 | 73 | 225 | 105 | 84 | 137 | 37.5 | 169 | 24.8 | 201 | 12 | 233 | 2.1 |
| 10 | 1300 | 42 | 480 | 74 | 220 | 106 | 82 | 138 | 37 | 170 | 24.4 | 202 | 11.6 | 234 | 2 |
| 11 | 1250 | 43 | 470 | 75 | 215 | 107 | 80 | 139 | 36.5 | 171 | 24 | 203 | 11.2 | 235 | 1.9 |
| 12 | 1200 | 44 | 460 | 76 | 210 | 108 | 78 | 140 | 36 | 172 | 23.6 | 204 | 10.8 | 236 | 1.8 |
| 13 | 1150 | 45 | 450 | 77 | 205 | 109 | 76 | 141 | 35.5 | 173 | 23.2 | 205 | 10.4 | 237 | 1.7 |
| 14 | 1100 | 46 | 440 | 78 | 200 | 110 | 74 | 142 | 35 | 174 | 22.8 | 206 | 10 | 238 | 1.6 |
| 15 | 1050 | 47 | 430 | 79 | 195 | 111 | 72 | 143 | 34.5 | 175 | 22.4 | 207 | 9.6 | 239 | 1.5 |
| 16 | 1000 | 48 | 420 | 80 | 190 | 112 | 70 | 144 | 34 | 176 | 22 | 208 | 9.2 | 240 | 1.4 |
| 17 | 950 | 49 | 410 | 81 | 185 | 113 | 68 | 145 | 33.5 | 177 | 21.6 | 209 | 8.8 | 241 | 1.3 |
| 18 | 900 | 50 | 400 | 82 | 180 | 114 | 66 | 146 | 33 | 178 | 21.2 | 210 | 8.4 | 242 | 1.2 |
| 19 | 875 | 51 | 390 | 83 | 175 | 115 | 64 | 147 | 32.6 | 179 | 20.8 | 211 | 8 | 243 | 1.1 |
| 20 | 850 | 52 | 380 | 84 | 170 | 116 | 62 | 148 | 32.2 | 180 | 20.4 | 212 | 7.6 | 244 | 1 |
| 21 | 800 | 53 | 370 | 85 | 165 | 117 | 60 | 149 | 31.8 | 181 | 20 | 213 | 7.2 | 245 | 0.95 |
| 22 | 780 | 54 | 360 | 86 | 160 | 118 | 58 | 150 | 31.4 | 182 | 19.6 | 214 | 6.8 | 246 | 0.9 |
| 23 | 760 | 55 | 350 | 87 | 155 | 119 | 56 | 151 | 31 | 183 | 19.2 | 215 | 6.4 | 247 | 0.85 |
| 24 | 740 | 56 | 340 | 88 | 150 | 120 | 54 | 152 | 31.6 | 184 | 18.8 | 216 | 6 | 248 | 0.8 |
| 25 | 720 | 57 | 330 | 89 | 145 | 121 | 52 | 153 | 31.2 | 185 | 18.4 | 217 | 5.6 | 249 | 0.75 |
| 26 | 700 | 58 | 320 | 90 | 140 | 122 | 50 | 154 | 30.8 | 186 | 18 | 218 | 5.2 | 250 | 0.7 |
| 27 | 680 | 59 | 310 | 91 | 136 | 123 | 49 | 155 | 30.4 | 187 | 17.6 | 219 | 4.8 | 251 | 0.65 |
| 28 | 660 | 60 | 300 | 92 | 132 | 124 | 48 | 156 | 30 | 188 | 17.2 | 220 | 4.4 | 252 | 0.6 |
| 29 | 640 | 61 | 292 | 93 | 128 | 125 | 47 | 157 | 29.6 | 189 | 16.8 | 221 | 4 | 253 | 0.55 |
| 30 | 620 | 62 | 284 | 94 | 124 | 126 | 46 | 158 | 29.2 | 190 | 16.4 | 222 | 3.6 | 254 | 0.5 |
| 31 | 600 | 63 | 276 | 95 | 120 | 127 | 45 | 159 | 28.8 | 191 | 16 | 223 | 3.3 | 255 | 0.45 |
| 32 | 590 | 64 | 270 | 96 | 116 | 128 | 44 | 160 | 28.4 | 192 | 15.6 | 224 | 3 | 256 | 0.4 |

#1

#10+#11

#29... #32

Source: www.footballcorner.bizland.com. For illustrative purposes only.

# Who Else Could You Have Had?

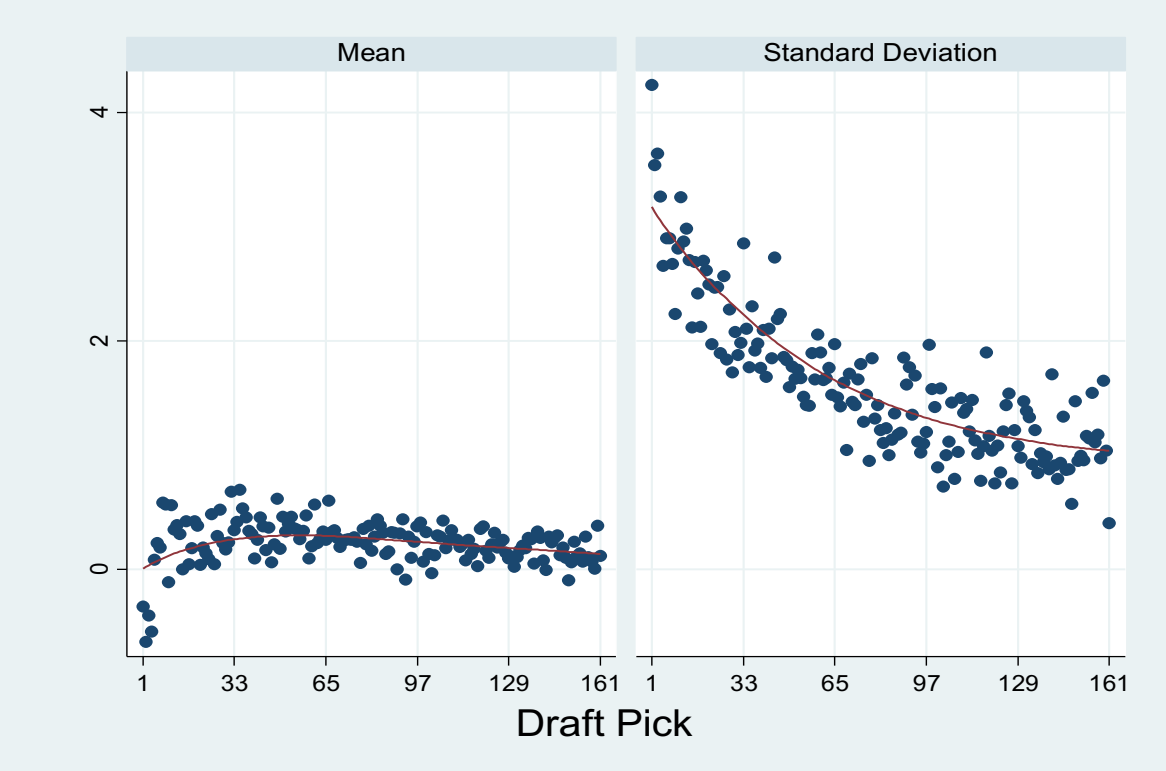
=

+ a 3rd round pick

=

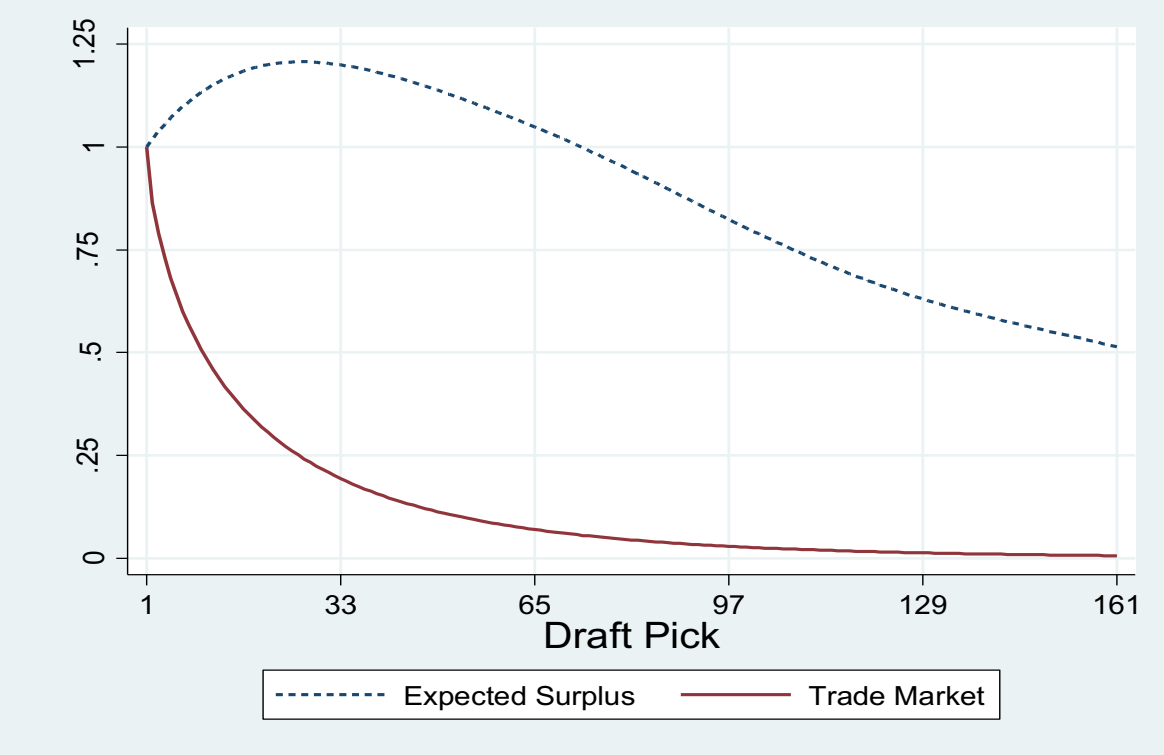
+

# High Picks: Low Mean, High Variance




Source: Moskowitz and Wertheim (2011), "Scorecasting: The Hidden Influences Behind How Sports Are Played and Games Are Won" and Massey and Thaler (2004) "The Loser's Curse: Overconfidence vs. Market Efficiency in the NFL Draft." For illustrative purposes only.

# Relative Pick Value

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# Diversification!

**Power of Diversification:**

- **You can pay a little less,**
- **You can lower the risk that your pick will be a bust,**

and

- **You have the potential to get better (dollar-adjusted) performance!**

**It won a Nobel Prize in Economic Sciences for investing!**

**(Markowitz, 1952, Sharpe, 1964)**

Source: AQR. Diversification does not eliminate the risk of experiencing investment losses.

# What Helps When Things Turn Ugly?

# What Helps When Things Turn Ugly?

## Seek diversifying strategies

A goal for an alternative portfolio is to diversify your risk – being less exposed to the next crisis, no matter what it is

Some strategies that we think are worth considering:

1. Liquid alternatives to diversify and reduce tail risk (example: style premia, trend-following)
2. Broadly diversify across asset-classes and investment strategies

Source: AQR. Diversification does not eliminate the risk of experiencing investment losses.

# What Helps (Generally) and When Things Turn Ugly

## Example of relative value strategies: Style Premia

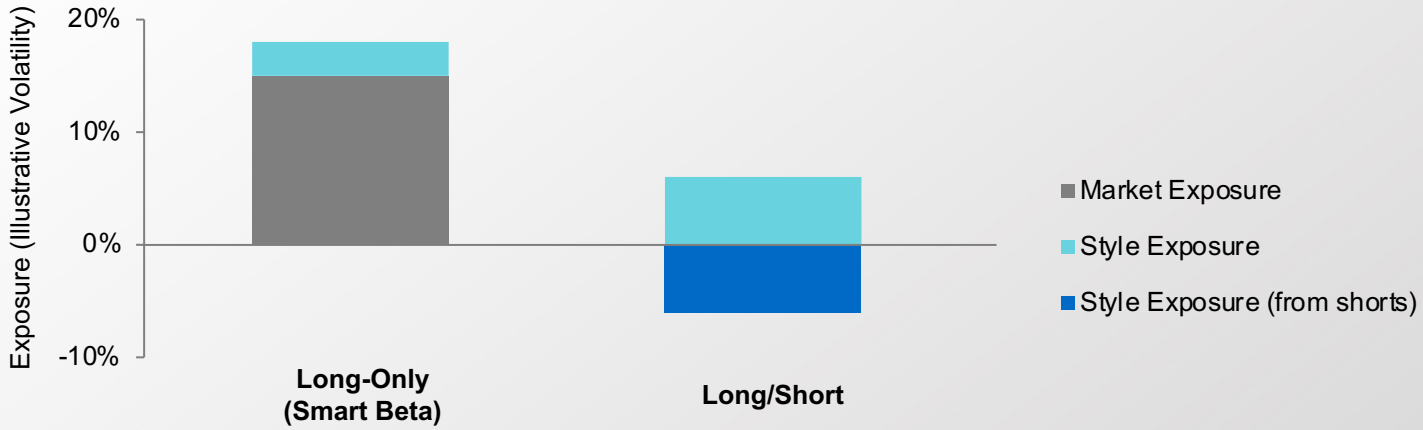
Some investment styles have decades of evidence in multiple regions and asset classes:

| | |
|---|---|
| **Value** | Relatively cheap assets tend to outperform relatively expensive ones |
| **Momentum** | An asset's recent relative performance tends to continue in the near future |
| **Carry** | Higher-yielding assets tend to provide higher returns than lower-yielding assets |
| **Defensive** | Lower-risk and higher-quality assets tend to generate higher risk-adjusted returns |

Source: AQR.

# What Helps When Things Turn Ugly

## Going from factor tilts to true diversifiers




| | | |
|---|---|---|
| **Complexity** | Low | High |
| **Diversification Potential** | Low | High |
| **Style Exposure** | Low | High |

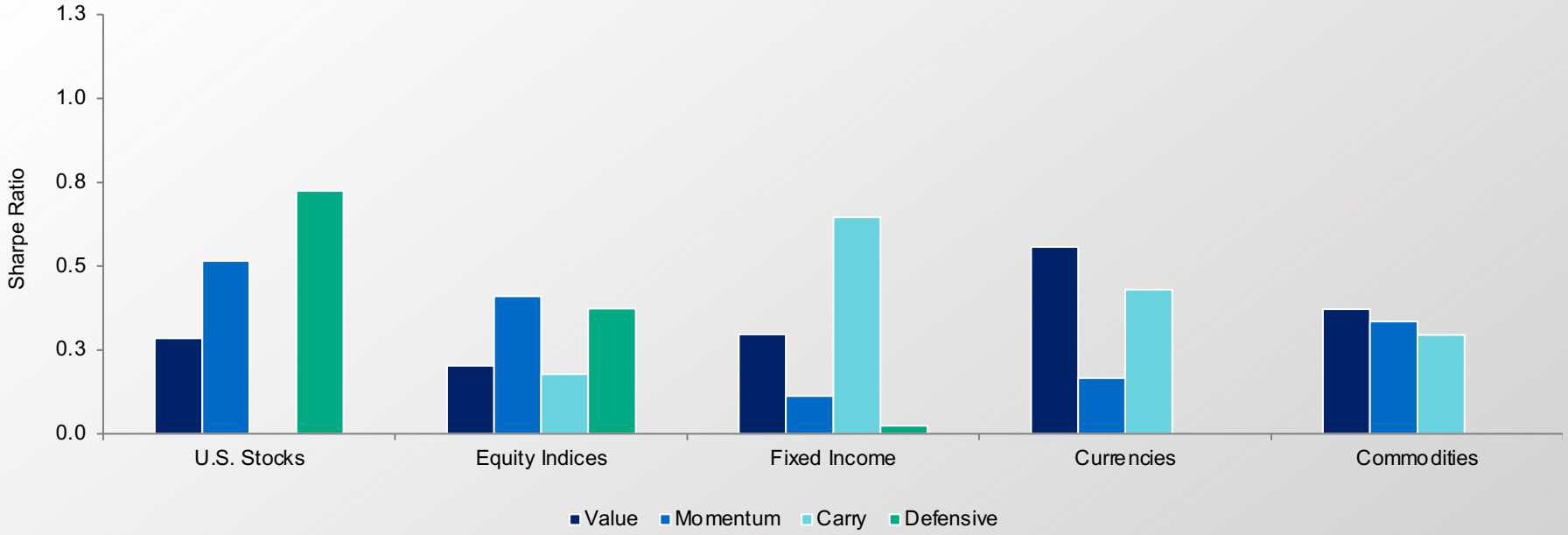
Source: AQR. For Illustrative purposes only. Diversification does not eliminate the risk of experiencing investment losses.

# Other Asset Classes

## Out of sample evidence (assets and time)

**Hypothetical Sharpe Ratios across Factor and Asset Classes (Full Sample)**

January 30, 1920 – August 31, 2022

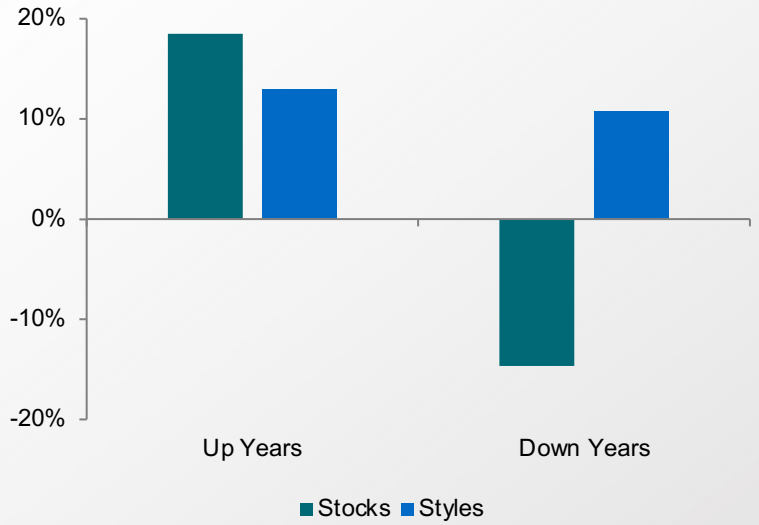



Source: AQR. "Fact, Fiction, and Factor Investing," Aghassi, Asness, Fattouche, Moskowitz (2022). Global Financial Data, Bloomberg, Datastream, Chicago Board of Trade, Commodity Systems Inc. The full sample period starts January 1, 1920 and ends August 31, 2022. Time periods for pre-sample, post-sample, and original sample can be found in the Appendix. All returns are excess of U.S. treasury bills but gross of trading costs and fees. The risk-free rate is the BofAML U.S. 3 month treasury bill. For illustrative purposes only and not representative of an actual portfolio that AQR currently manages. Hypothetical data has inherent limitations some of which are discussed in the Appendix. Please refer to the Appendix for descriptions of the data sources used and definitions for each style. Please read important disclosures in the Appendix

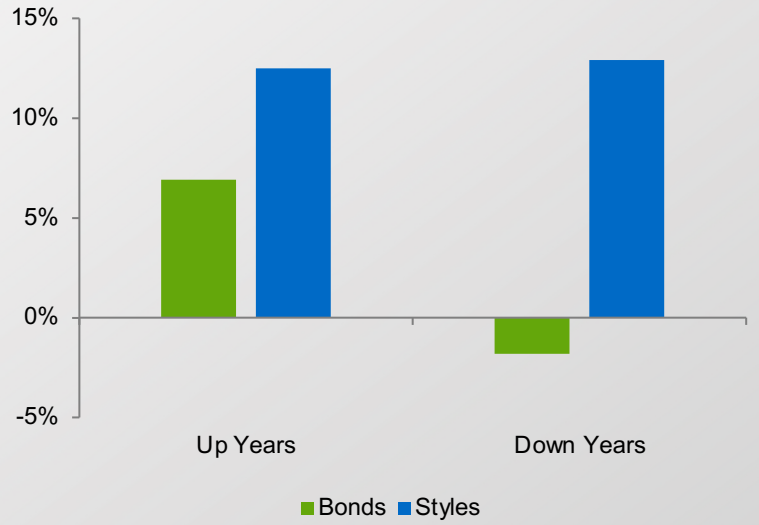
# What Helps When Things Turn Ugly

## Styles have tended to be resilient to risks in traditional markets

**Average Returns when Stock Markets are Positive and Negative**
January 1, 1990 – December 31, 2022




**Average Returns when Bond Markets are Positive and Negative**
January 1, 1990 – December 31, 2022

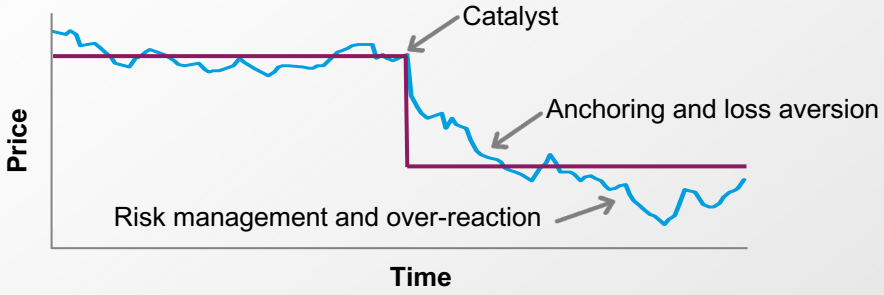


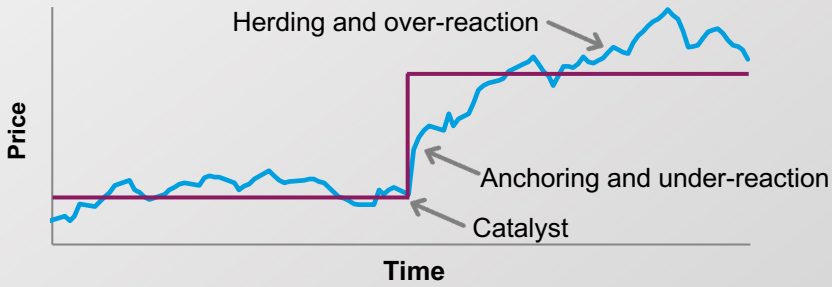

Source: AQR, Bloomberg. Stocks are represented by Russell 3000 Total Return Index. Bonds are represented by Bloomberg US Agg Total Return Index. Styles are represented Multi-Asset Style return series from Century of Factor Premia data scaled to 10 vol.

# Why Do Markets Trend?

## Prices tend to under-react to new information

Trends can result from behavioral biases and non-profit-seeking market participants (e.g., hedging, central banks).




Market Price  Fundamental Value

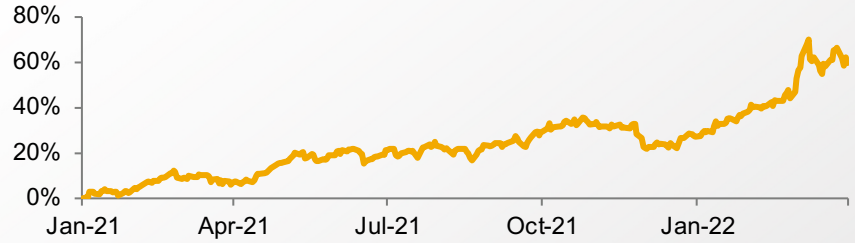
Source: AQR. The chart above is a hypothetical illustration and not representative of an actual investment. For illustrative purposes only. Please read important disclosures in the Appendix.

# What Helps When Things Turn Ugly

## Tends to profit when markets go from "good to great" and "bad to worse"

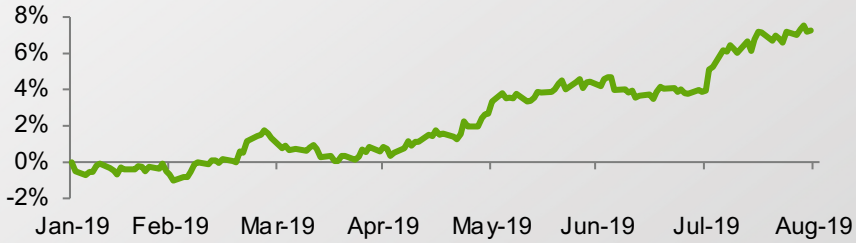
### Good to Great: Bloomberg Commodity Index

January 2021 – March 2022



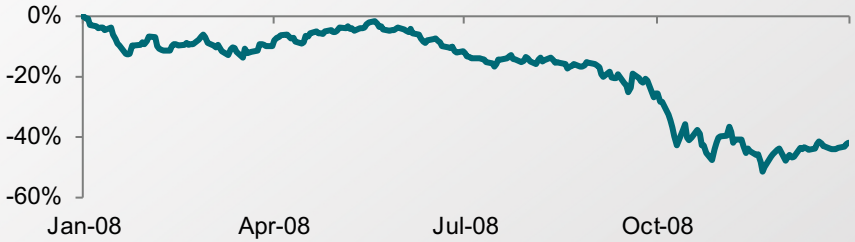

### Good to Great: U.S. 10-Year Bonds

January 2019 – August 2019



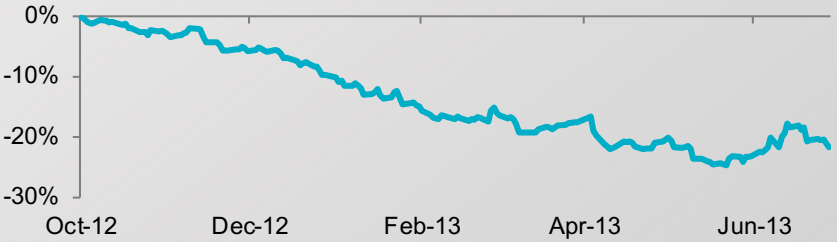

### Bad to Worse: MSCI World Index

January 2008 – December 2008




### Bad to Worse: Japanese Yen versus U.S. Dollar

October 2012 – June 2013



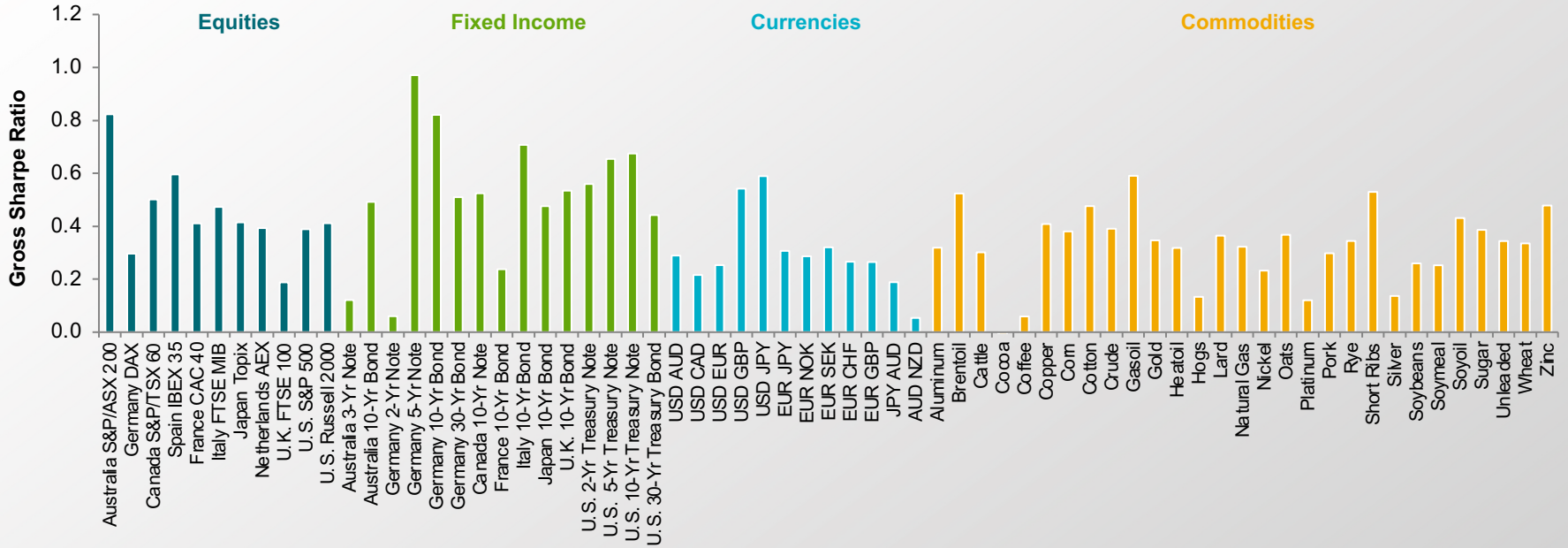

Source: Bloomberg. The charts above are for illustrative purposes only. See Appendix for description of indices

# Long-Term Evidence for Trend Following

## Trends are pervasive across markets and asset classes

**Hypothetical Trend-Following Sharpe Ratio for Individual Assets and Asset Classes**

January 1880 – June 2022



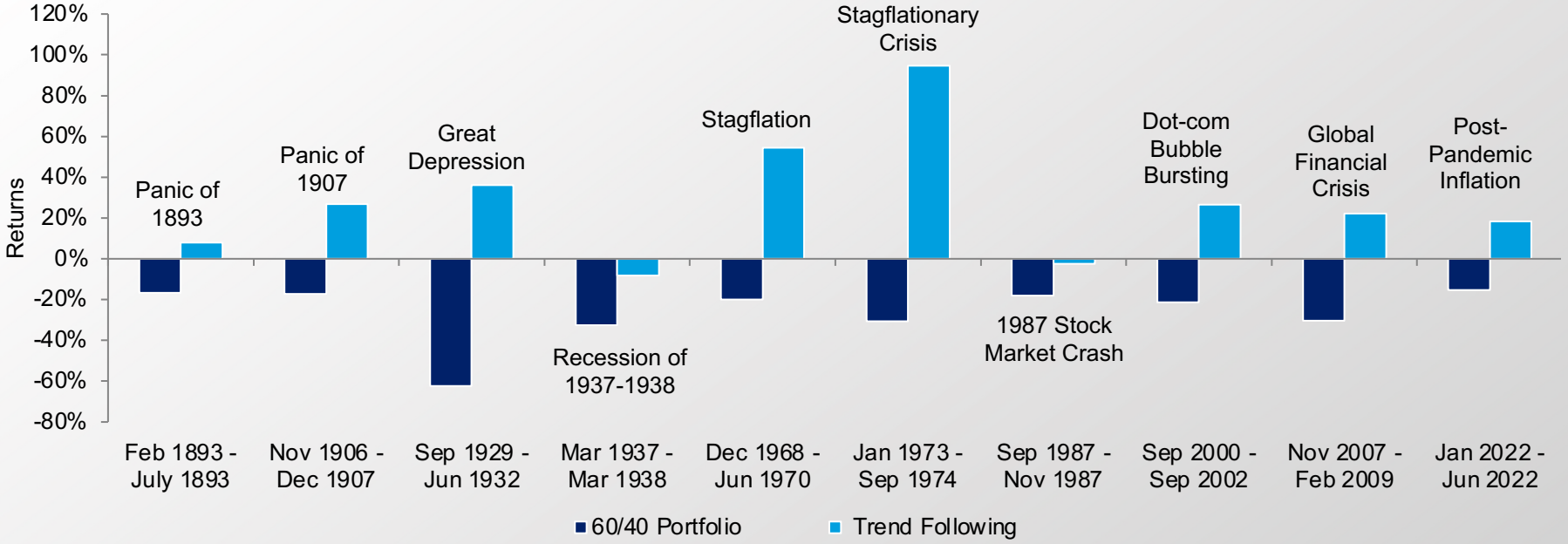

Source: AQR. The Sharpe ratios are based on the Hypothetical Trend-Following Strategy. The results are based on a backtest, net of 2/20 fees and estimated transaction costs. The 3-Month T-Bill is the risk-free rate used to derive the Sharpe ratio. This analysis is provided for illustrative purposes only and is not based on an actual portfolio AQR manages. Not all markets have return data going back to 1880, calculations are based on the longest time period available for each asset. Please read performance disclosures in the Appendix for a description of the investment universe and the allocation methodology used to construct the Trend-Following Strategy. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix..

# Why Invest in Trend Following?

## Performed well in severe market downturns

**Hypothetical Performance During the 10 Largest Drawdowns for a 60/40 Portfolio**

January 1880 – June 2022



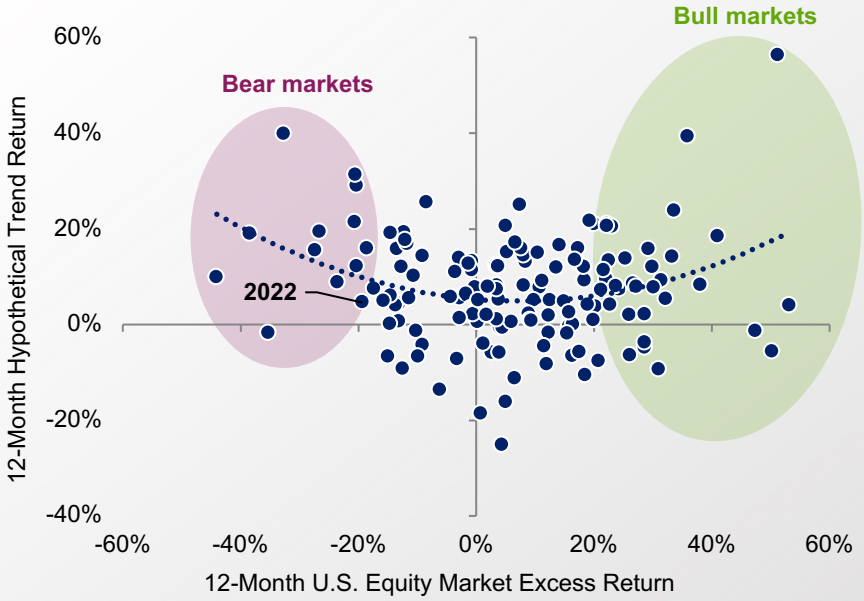

Source: AQR. The Hypothetical Trend-Following Strategy performance is a backtest, net of 2/20 fees and estimated transaction costs. The 60/40 portfolio has 60% invested in S&P 500 and 40% invested in U.S. 10-year bonds. The portfolio is rebalanced monthly, and no fees or transaction costs are subtracted from the returns. Please read performance disclosures in the Appendix for a description of the investment universe and the allocation methodology used to construct the Trend-Following Strategy and for details on the construction of the S&P 500 series. 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.

# What Helps When Things Turn Ugly

## Directional strategies

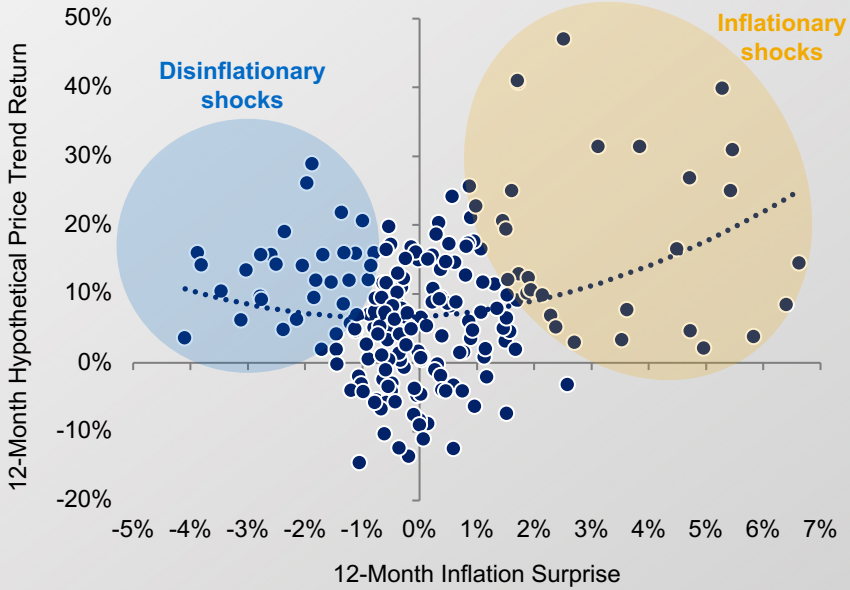
### Hypothetical Price Trend vs. Equity Returns

January 1880 – December 2022




### Hypothetical Price Trend vs. Inflation Surprises

January 1972 – December 2022




Source: AQR. Hypothetical price trend following strategy as described in A Century of Evidence on Trend Following (Hurst, Ooi and Pedersen, 2017), net of transaction costs and 1.25 & 20 fees – for more details see appendix. 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. Returns are excess of cash proxied by the carry on 3-Month T-Bills. Inflation surprise is realization minus forecast from Fed Survey of Professional Forecasters. Chart shows 12-month returns and surprises and quarterly frequency. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

# Thoughts on Managed Futures (aka Trend-Following)

## Some diversifiers might even help, especially when most needed

### 10 Worst 6-Month Periods for Private Equity

January 1, 1990 – March 31, 2023

| 6M Ending | Private Equity | Hypothetical Price Trend | Hypothetical Economic Trend | Hypothetical Combined Trend |
|---|---|---|---|---|
| Dec-2008 | -22.0% | 18.4% | 35.7% | 27.0% |
| Mar-2001 | -12.5% | 15.7% | 3.3% | 9.5% |
| Dec-2001 | -9.0% | 4.4% | 14.8% | 9.5% |
| Sep-2002 | -7.6% | 15.1% | 24.5% | 19.8% |
| Jun-2022 | -5.3% | 20.6% | 35.2% | 27.7% |
| Mar-2020 | -5.1% | 2.5% | -3.2% | -0.1% |
| Sep-1998 | -2.2% | 12.6% | 20.4% | 16.5% |
| Jun-2008 | -2.1% | 2.5% | 4.6% | 3.7% |
| Sep-2000 | -1.5% | 5.3% | -4.6% | 0.2% |
| Dec-1986 | -1.0% | 3.4% | 5.5% | 4.5% |
| Average | -6.8% | 10.0% | 13.6% | 11.8% |

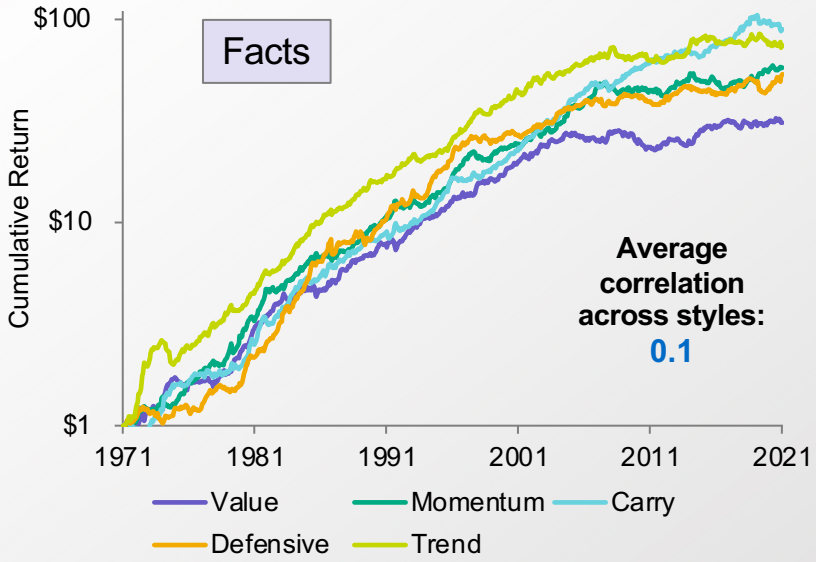
Sources: AQR, Cambridge Associates. Private equity is Cambridge Associates U.S. Private Equity Index. Price Trend and Economic Trend are hypothetical strategies targeting 10% volatility, net of transaction costs and 1.25&20 fees, as described in the appendix. Combined Trend is a simple average of Price and Economic Trend. Worst non-overlapping 6-month cumulative returns based on quarterly data. Hypothetical data has inherent limitations, some of which are disclosed in the appendix. Diversification does not eliminate the risk of experiencing investment losses.

# Living With Diversification

## Make sure your diversifiers are themselves… diversified

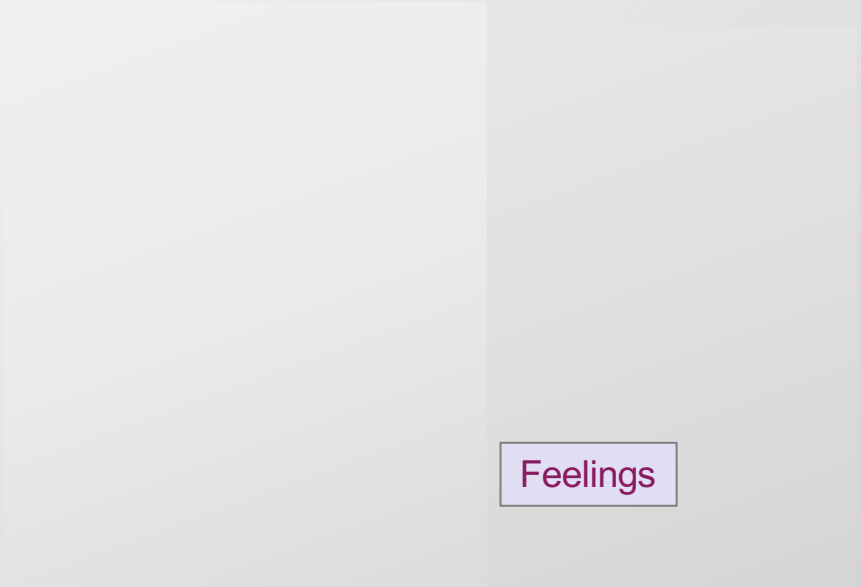
### Different Strategies Pay Off at Different Times

Cumulative Return, January 1, 1972 – December 31, 2021




### Hypothetical Range of Outcomes

January 1, 1972 – December 31, 2021




Source: AQR. Diversification does not eliminate the risk of experiencing investment losses. Value, Momentum, Carry, Defensive and Trend are heavily discounted backtests of alternative risk premia as described in the appendix. Five Styles is a simple average of the five styles depicted here. Please see Appendix for more details on the construction of the return series. Performance data quoted does not reflect the deduction of fees. If reflected, the fees would reduce the performance quoted. For illustrative purposes, does not represent strategies that AQR currently manages. No representation is being made that any investment will achieve performance similar to those shown. Hypothetical data has inherent limitations of which some are disclosed in the appendix. Please read important disclosures in the Appendix.

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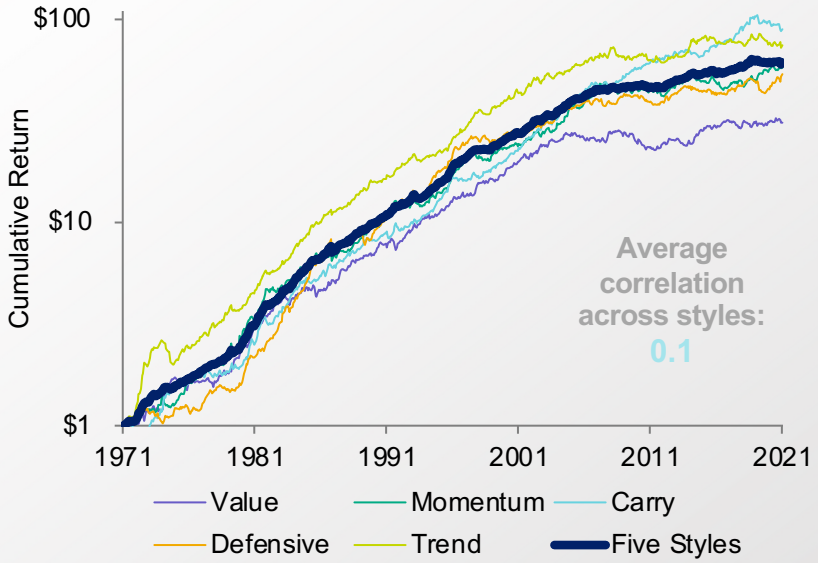


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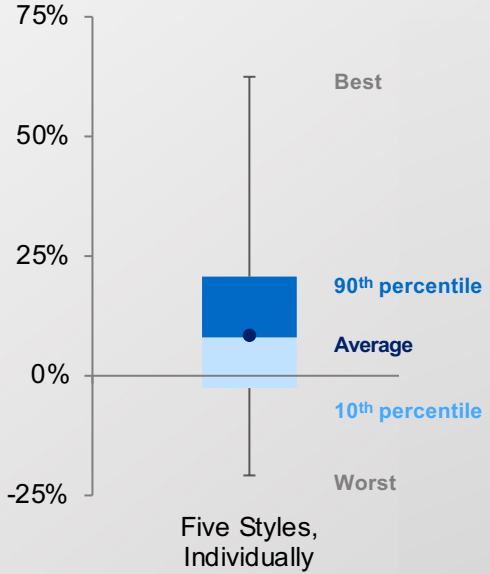
January 1, 1972 – December 31, 2021

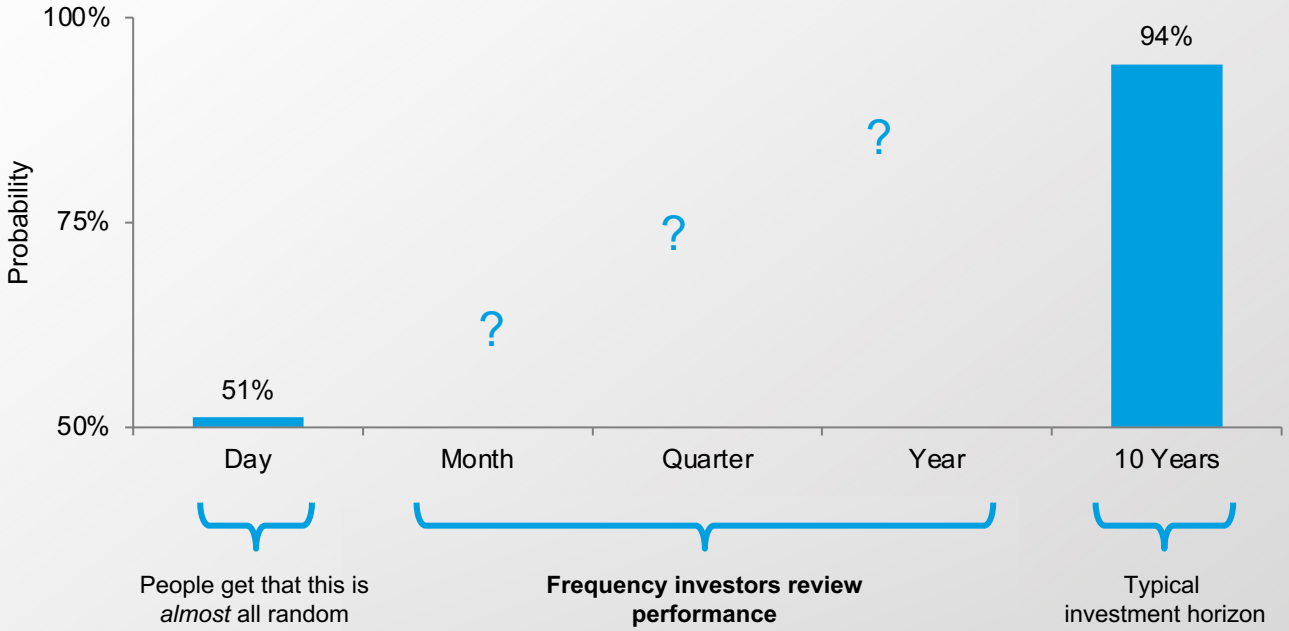



Source: AQR. Diversification does not eliminate the risk of experiencing investment losses. Value, Momentum, Carry, Defensive and Trend are heavily discounted backtests of alternative risk premia as described in the appendix. Five Styles is a simple average of the five styles depicted here. Please see Appendix for more details on the construction of the return series. Performance data quoted does not reflect the deduction of fees. If reflected, the fees would reduce the performance quoted. For illustrative purposes, does not represent strategies that AQR currently manages. No representation is being made that any investment will achieve performance similar to those shown. Hypothetical data has inherent limitations of which some are disclosed in the appendix. Please read important disclosures in the Appendix.

# Setting Expectations

## Sharpe ratios — though not perfect — can be useful

**Probability of a 0.5 Sharpe Ratio Strategy Outperforming Cash**




Source: AQR. Past performance is not a guarantee of future performance. Sharpe ratio is calculated as the difference in annualized arithmetic mean of monthly portfolio excess return over cash divided by annualized volatility of monthly excess returns over cash. See Appendix for important information.

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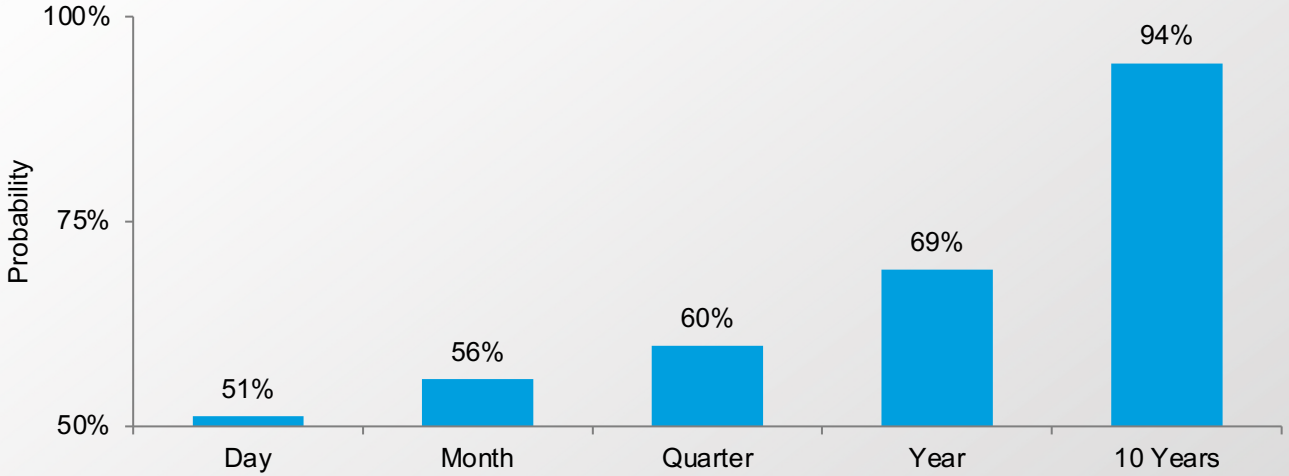


Source: AQR. Past performance is not a guarantee of future performance. Sharpe ratio is calculated as the difference in annualized arithmetic mean of monthly portfolio excess return over cash divided by annualized volatility of monthly excess returns over cash. See Appendix for important information.

# Concluding Thoughts

## Do you have sufficient diversification to face the unknown?

1. What are the primary risks your portfolio is exposed to?
   - For most investors, equity and equity-related risks are dominant
   - Followed by interest rate risk

2. What to look for in a diversifying strategy:
   - Returns that are truly diversifying
   - Delivering returns when most needed
   - A diverse set of diversifiers

Source: AQR. For illustrative purposes only. Diversification does not eliminate the risk of experiencing investment losses. Please read important disclosures in the Appendix.

# Appendix

# What Helps When Things Turn Ugly

## Relative value strategies can be pursued in many asset classes

| | Value | Momentum | Carry | Defensive |
|---|---|---|---|---|
| Stocks & Industries | ✓ | ✓ | | ✓ |
| Equity Indices | ✓ | ✓ | ✓ | ✓ |
| Fixed Income | ✓ | ✓ | ✓ | ✓ |
| Currencies | ✓ | ✓ | ✓ | |
| Commodities | ✓ | ✓ | ✓ | |

Source: AQR. Specific exposures are subject to change and not all styles are applicable in all contexts.

# Disclosures

# Performance Disclosures

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"Expected" or "Target" returns or characteristics refer to expectations based on the application of mathematical principles to portfolio attributes and/or historical data, and do not represent a guarantee. These statements are based on certain assumptions and analyses made by AQR in light of its experience and perception of historical trends, current conditions, expected future developments and other factors it believes are appropriate in the circumstances, many of which are detailed herein. Changes in the assumptions may have a material impact on the information presented.

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# 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 Russell 2000 Index** is a small-cap U.S. stock market index that makes up the smallest 2,000 stocks in the Russell 3000 Index**.**

**The Russell 3000 Index** is designed to track the performance of the 3,000 largest U.S. companies and represents approximately 96% of the investable U.S. equity market.

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

**Bloomberg Agg Total Return Index** is a broad base, market capitalization-weighted bond market index representing intermediate term investment grade bonds traded in the United States. Investors frequently use the index as a stand-in for measuring the performance of the US bond market

**The FTSE Nareit All Equity REITs Index** is a free-float adjusted, market capitalization-weighted index of U.S. equity REITs. Constituents of the index include all tax-qualified REITs with more than 50 percent of total assets in qualifying real estate assets other than mortgages secured by real property.

**The HFRI Fund Weighted Composite Index** is a global, equal-weighted index of the largest hedge funds that report to the HFR Database which are open to new investments and offer quarterly liquidity or better. The index constituents are classified into Equity Hedge, Event Driven, Macro or Relative Value strategies.

**MSCI USA Total Return Index** is designed to measure the performance of the large and mid cap segments of the US market. With 627 constituents, the index covers approximately 85% of the free float-adjusted market capitalization in the US.

Request ID: 383888

# Appendix: Current Environment

## Macro news indicators and hypothetical strategy descriptions

**Inflation and Growth Metrics:**

We combine two measures of the “information content” of realized U.S. inflation:

1. year-on-year CPI inflation minus CPI for previous 1-year period (“change”)

2. year-on-year CPI inflation minus 1-year forecast at start of period (“surprise”)

We combine the two metrics (standardized so they have equal influence) to reduce noise in either one. We use quarterly overlapping year-on-year periods, to avoid seasonal effects and mitigate the role of publication lags. We construct a corresponding metric for U.S. GDP growth, as a control variable.

# Appendix: What Could Go Wrong?

## Asset descriptions for scenario analysis

| Asset Class | Proxy 1 | Start Date | Proxy 2 | Start Date |
|---|---|---|---|---|
| Public Equities | Russell 3000 Total Return Index | 1/1/1979 | MSCI USA Total Return Index | 1/1/1972 |
| Fixed Income | Bloomberg US Agg Total Return Index | 2/1/1976 | AQR US Bond Series | 1/1/1972 |
| Real Estate | FTSE NAREIT All Equity REITs Index | 1/1/1972 | | |
| Private Equity | 1.2x Russell 2000 Total Return Index | 1/1/1979 | 1.3x MSCI USA Total Return Index | 1/1/1972 |
| Hedge Funds | HFRI Fund Weighted Composite Index | 1/1/1990 | HFRI Fund Weighted Composite Index | 1/1/1990 |
| Commodities | Bloomberg Commodity Index Total Return | 1/1/1972 | | |
| Cash | Carry on 3m T-Bills | 1/1/1972 | | |

Source: AQR

# Appendix: What Helps When Things Turn Ugly

## 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.

Source: AQR, Global Financial Data, Bloomberg, Datastream, Chicago Board of Trade, Commodity Systems Inc. The full sample period starts in 1/1920 (all assets become available in 1920s except for currencies in 1974). All factor premia reflect a backtest of theoretical long/short style components based on AQR definitions applied in several asset group contexts. The results shown do not include advisory fees or transaction costs but are in excess of cash (US treasury bills).

# Appendix: Hypothetical Trend following Strategies

**Hypothetical Price-Based Trend-Following Strategy Academic Backtest Construction**

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 gross of advisory fees and net of transaction costs, unless stated otherwise. 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. The transactions costs used in the strategy are based on proprietary 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.

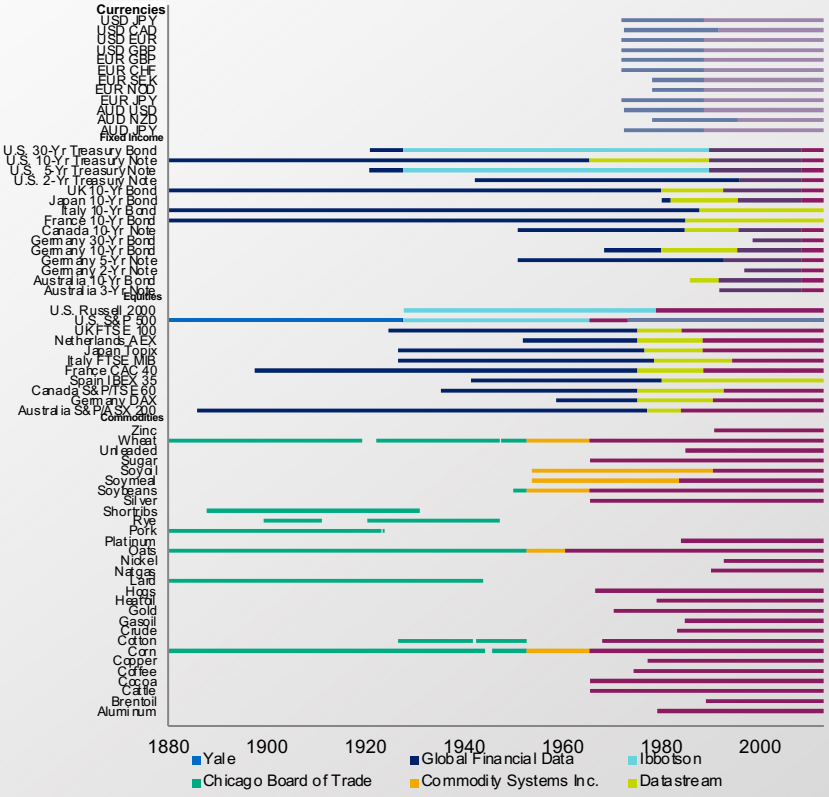
The benchmark and relevant cash rate is assumed to be ICE BofA 3-Month T-Bill. Prior to 1929 when 3-month Treasury bills became available, the benchmark and relevant cash rate is assumed to be the NYSE call money rates (the rates for collateralized loans) through 1920 and returns on short-term government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

# Appendix: Hypothetical Trend following Strategies

**Figure 2**



# Appendix: Hypothetical Trend following Strategies

**Hypothetical Economic Trend-Following Strategy Academic Backtest Construction**

The Hypothetical Economic Trend-Following Strategy uses data from January 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.

**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.

# Appendix: Hypothetical Trend following Strategies

**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

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# Performance Disclosures

**Hypothetical Alternative Risk Premia (ARP) Strategy Description:**

The strategy is an equal-weighted combination of five discounted multi-asset long/short factors – value, momentum, carry, defensive and trend – scaled to 8% volatility and net of 2% management fee.

The long/short factors are hypothetical strategies as described in Ilmanen, Maloney and Ross (2014), discounted to account for transaction costs and real-world constraints. Each series is scaled to realize 8% volatility.

The four market-neutral multi-asset factor premia (value, momentum, carry and defensive – as described below) are hypothetical long/short strategies applied in stock selection, industry allocation, country allocation in equity, fixed income and currency markets, and commodities. Each factor allocates 50/50 risk weights to stock and industry selection (SS) and asset allocation (AA) strategies. For AA we use the following risk weights: 33% equity country allocation, 25% fixed income, 25% currencies, 17% commodities. We combine several data sources to produce a sufficiently long dataset:

- Since 1990, we use factor premia strategies as described below, and with further detail in "Investing With Style" (2012). These series incorporate t-costs, constraints and discounting. For SS carry we use the dividend yield strategy returns in Ken French's data library.
- For 1972-1989, we source value and momentum factor returns from "Value and Momentum Everywhere" (Journal of Finance, 2013), defensive factor returns from "Betting Against Beta" (Journal of Financial Economics, 2013), and SS carry from the dividend yield strategy returns in Ken French's data library. AA carry factor premia before 1990 as well as some early histories of AA value, momentum and defensive factors are hypothetical strategies similar to those described above, but over a narrower universe. We discount returns by 50% to account for t-costs and real-world constraints.

The SS factor premia proxies we use since 1990 are beta-neutral. The value and momentum premia before 1990, and the SS carry premium throughout, are dollar-neutral. The defensive factor premia are beta-neutral throughout.

Additional details on the construction of the four market-neutral multi-asset factor premia:

- Value means buying assets that are "cheap" relative to their fundamental value and selling "expensive" assets. In stocks this is some measure of fundamental value relative to price e.g., B/P. For bonds we use a measure of real bond yields, and for currencies and commodities a measure of 5-year reversal in price, reflecting mean reversion. In all cases, a systematic process that first sorts assets by these measures, going long the cheap (relative to fundamentals) assets and short the expensive ones, is applied.
- Momentum involves buying assets that recently outperformed their peers and selling those that recently underperformed. The typical approach is to look at the past 12 months of returns for a universe of assets, going long the ones that have outperformed their peers and short the underperformers.
- Carry implies buying high-yielding assets and selling low-yielding assets. In currency markets we sort countries by their short term (say, 3-month) lending rate, and go long the countries with the highest rates and short the markets with the lowest. Likewise, in fixed income and commodity futures, where backwardation or contango are exploited across various commodities. For stocks, the carry earned is the expected dividend yield for which we use Ken French data as described above.
- Defensive consists of buying low-risk, high-quality assets and selling high-risk, low-quality assets. In the case of stocks, we sort by forecasted betas and go long the stocks with the lowest betas and short the ones with the highest betas. We also go beyond beta to include more fundamental measures of risk—or conversely "quality"—by seeking high profitability, low leverage, and stable earnings among stocks, or favoring short-duration assets in fixed income.

The fifth multi-asset factor is Trend. The multi-asset trend factor applies 12-month trend-following strategies in four asset classes: equities, fixed income, currencies and commodities. From 1985, we use "Time Series Momentum" (Journal of Financial Economics, 2012). For 1972-1984 trend is a hypothetical strategy based on the same asset classes, but including 1-, 3- and 12-month momentum, and starting with a smaller asset universe that grows during the period as more assets become available.

# Performance Disclosures

**Trend-Following Strategy**

The Hypothetical 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 gross of advisory fees and net of transaction costs, unless stated otherwise. 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. AQR's fees are available upon request and also may be found in Part 2A of its Form ADV. The transactions costs used in the strategy are based on AQR's 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 performance of the AQR Managed Futures Strategy may be greater or less than the performance of the Trend-Following Strategy due to, among other things, differences in the investment strategy pursued by the AQR Managed Futures Strategy and the number of the holdings in and composition of the AQR Managed Futures Strategy's portfolio.

The benchmark and relevant cash rate is assumed to be 3-month Treasury bills. 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% |


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