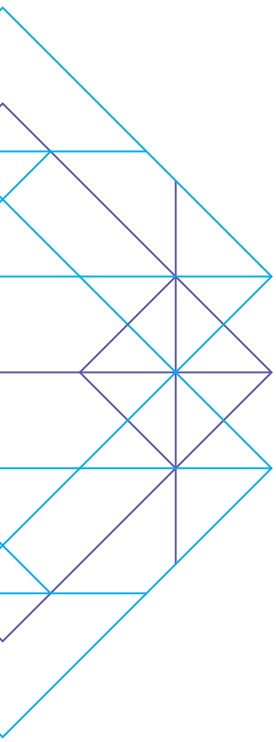


Fundamental Trends and Dislocated Markets

An Integrated Approach to Global Macro Investing

Executive Summary

We describe two approaches to global macro investing: a systematic strategy focused on identifying fundamental trends and an opportunistic strategy capitalizing on extreme dislocations between prices and fundamentals. We explore the potential benefits of combining these approaches into a single integrated macro strategy. We present evidence that this integrated strategy may offer attractive risk-adjusted returns that are consistent across economic environments and are diversifying to traditional asset classes. Finally, we show that these simulated strategy returns are diversifying to other alternative investments, including both the universe of global macro managers and market-neutral multi-asset style premia portfolios.

We thank Jordan Brooks, David Kupersmith, Thomas Maloney, Christopher Palazzolo, and Ashwin Thapar for helpful comments. We thank Maxi Deng, Rafael Schwalb, and Alice Zhao for outstanding research assistance.

Paras Bakrania, CFA
Associate

Chris Doheny, CFA
Managing Director

Jonathan Fader
Vice President

Caroline Heinrichs
Associate

Contents

Introduction

Global macro strategies have been a mainstay of the alternative investment universe for several decades. Institutions and individuals have been attracted to these strategies by a number of appealing features: strong risk-adjusted returns across varied economic environments, low correlations with both traditional portfolios and other hedge fund strategies, and scalability due to the deep liquidity of many macro markets.[1]

The popular conception of macro has often centered around individual portfolio managers making large bets based on insightful predictions of rare events. While we do not wish to minimize the successes of this concentrated discretionary style of global macro,[2] both today and historically, our research has identified profitable approaches to macro investing that may be more repeatable in the long run. Specifically, prior white papers have explored two such approaches: a Systematic Macro strategy focused on rigorously measuring changes in economic fundamentals and using this information to position across and within asset classes, and an Opportunistic Macro strategy that aims to capitalize on occasional extreme dislocations between prices and fundamentals. This paper explores the potential benefits of combining the two approaches to create a comprehensive global macro strategy.

The paper is organized as follows: We start by highlighting the economic intuition behind an integrated global macro approach combining systematic and opportunistic elements. Afterward, we present quantitative evidence over a quarter of a century for the potential benefits of combining these approaches. Finally, we show how the integrated strategy may be a valuable diversifier not only to a traditional portfolio but also within an alternatives portfolio.

Economic Intuition

Our investment philosophy is based on two insights:

1) Typically, financial markets tend to underreact to macroeconomic news and only slowly adjust to changes in fundamentals, and,

2) Occasionally, asset prices become extremely dislocated from their fundamental value.

Both observations may derive from common behavioral causes, such as anchoring and herding, which give rise to patterns of underreaction and overreaction in markets. Investors whose views on an asset's fair value are too anchored to current pricing (or who are simply not paying sufficient attention) may initially be slow to adjust their assessments in the face of unexpected fundamental news.

However, when clear and sustained trends in fundamentals and prices do emerge, investors may, in fact, overreact to these trends, taking for granted that fundamentals will continue to move in the same direction. Overextrapolation

1 Macro strategies will typically focus on liquid instruments across currencies, commodities, fixed income, and equities. Equity exposures tend to be at the index or sector level rather than focusing on individual companies.
2 In fact in AQR's Alternative Thinking Systematic vs. Discretionary, our colleagues argue that neither is necessarily better than the other.

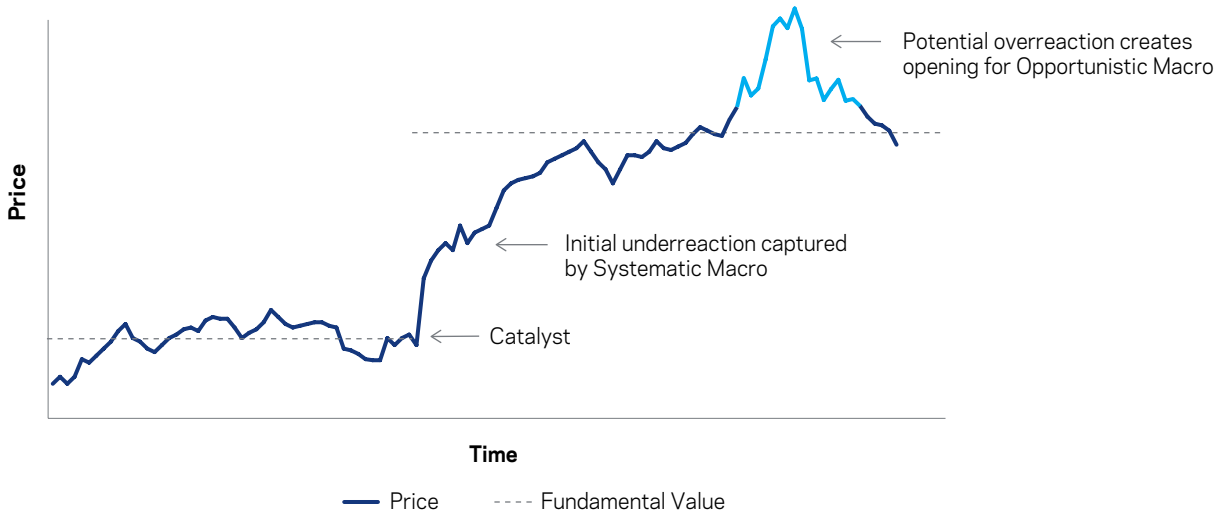
of fundamental trends may lead to herding behavior and an overshoot in prices.[3] Episodes of particularly positive or negative market sentiment may lead to dislocations between prices and fundamentals as well.

Exhibit 1 presents a stylized view of one potential market cycle featuring both phenomena in order to highlight the points in the cycle at which different approaches may thrive. A Systematic Macro strategy seeks to identify fundamental shifts in a comprehensive and timely fashion, profiting as prices eventually follow fundamentals. An Opportunistic Macro strategy may focus instead on the latter part of this cycle, identifying times when prices have grown detached from fundamentals.[4] We next describe the two approaches in more detail.

Systematic Macro

In *Building a Better Global Macro Portfolio* (Brooks, Frieda, Kupersmith, Nielsen, 2014), our colleagues at AQR explore the tendency of macro assets to *underreact* to news about changes in economic fundamentals, giving rise to exploitable trends in asset prices. This tendency opens the door to the kinds of macro trades that have caught the attention of the investing public over the decades: short positions in the British pound ahead of the 1992 devaluation, bets against risky assets such as equities and mortgage credit ahead of the Global Financial Crisis, and more recently, shorts in oil amid the energy price collapse of 2014–16. These episodes all featured large shifts in economic fundamentals[5] that were incorporated into market prices slowly enough to provide opportunities for macro investors.

Exhibit 1
Illustrative Market Cycle



Source: AQR. For illustrative purposes only.

3 Moskowitz, Ooi, and Pedersen (2012), "Time Series Momentum."
4 Of course, extreme dislocations between prices and fair value can occur at other points in a market cycle as well. For example, prices could fail to react at all to a significant shift in fundamentals, potentially creating an extreme deviation from fair value. In this example, both systematic and opportunistic approaches might take the same view on the asset at the same time.
5 Respectively, fundamental catalysts for these trades included weak U.K. growth and an urgent need for more accommodative monetary policy in 1992, a clear deterioration of U.S. (and eventually global) growth in 2007–08, and adverse shifts in both oil supply and oil demand in 2014–16.

Brooks et al. describe a "Macro Momentum" investment strategy organized around systematically measuring different dimensions of economic news and positioning accordingly across markets, seeking to capitalize on this tendency for underreaction.

The authors sort key fundamental macro variables into four broad themes: business cycle, monetary policy, international trade, and macro sentiment. They simulate the returns to a strategy of systematically buying assets with improving fundamentals and selling assets with deteriorating fundamentals. Positions may be either directional (buying or selling a single asset based on the direction of fundamental trends) or long-short (holding a market-neutral portfolio where long positions in the assets with more favorable fundamental trends are balanced by shorts in assets with less favorable trends). This systematic strategy is applied to equity indexes, government bonds, short-term interest rates, and currencies. Brooks et al. find strong risk-adjusted returns from each theme of Macro Momentum and in each asset class, and returns are lowly correlated among themes and asset classes.[6] Because the efficacy of Macro Momentum is so widespread, a broad application across themes and asset classes generates even more attractive performance. **Exhibit 2** provides an overview of these macro themes as well as examples for Macro Momentum signals.

In *A Half Century of Macro Momentum* (Brooks 2017), the analysis of Macro Momentum–based investing is extended significantly further back in time, providing additional evidence of the strategy's effectiveness through different economic and market environments.

Exhibit 2
Macro Momentum Themes

Theme	Description	Example Signals
Business Cycle	News about Changes in Growth and Inflation	GDP Forecast Revisions, Inflation Surprises
Monetary Policy	Central Bank Policy Changes	Changes in Short-Term Interest Rates, Taylor Rules
International Trade	Shifts in a Country's Export Prospects	Exchange Rate Movements, Terms of Trade
Macro Sentiment	Changes in Risk Sentiment	Options Sentiment, Equity Performance

Source: AQR. For illustrative purposes only.

6 Over the sample period 1990–2013, the Sharpe Ratios for the individual macro themes range from 0.5 to 0.7 and for each asset class from 0.4 to 1.0. Moreover, pairwise correlations across themes and asset classes range from -0.15 to 0.44.

Opportunistic Macro

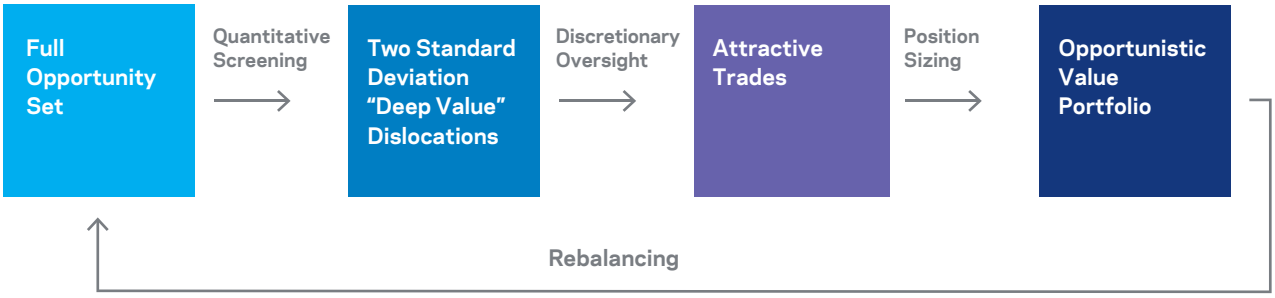
Building a Better Deep Value Portfolio (Kupersmith, Ross, Thapar, 2017) examines a different type of market inefficiency, in which asset prices may become extremely dislocated from plausible estimates of fair value. Extreme overvaluation of technology stocks during the dot-com bubble and undervaluation of convertible bonds during the Global Financial Crisis are noteworthy recent examples of what has been a recurring pattern through the history of financial markets. Various factors can drive these large deviations from fundamental value,[7] ranging from overreactions to long-term fundamental trends (internet and technology stocks did have an extremely bright future at the beginning of the millennium) to short-term fire sales due to leverage and a limited access to financing (in 2008 many convertible bond arbitrageurs were forced to liquidate holdings at whatever price they could obtain). These dislocations may look obvious in hindsight and on occasion are well remarked in real time as well. However, there are several obstacles to investors looking to take advantage.

Kupersmith et al. explore these obstacles in detail and lay out a structured process for overcoming them in order to identify and capitalize on deep value opportunities.

The first step of this structured process (illustrated in **Exhibit 3**) is an initial systematic screening for deep value opportunities across regions and asset classes. This quantitative screening is followed by a discretionary analysis of each identified opportunity with the intention of avoiding misleading valuation signals. Some investments may look attractive under a pure quantitative screening due to a distortion affecting a particular metric. For example, a country's banking sector may look cheap based on a quantitative measure such as book-to-price. However, if the banks' balance sheets include a large number of nonperforming loans and write-downs are expected, the price may already reflect the lower expected book value.

After truly attractive trades have been identified, it is important to size positions prudently to preserve the ability to hold them (or even add to them) if conditions get more extreme. By maintaining liquid reserves

Exhibit 3
Building an Opportunistic Macro (or "Deep Value") Portfolio



Source: AQR. For illustrative purposes only.

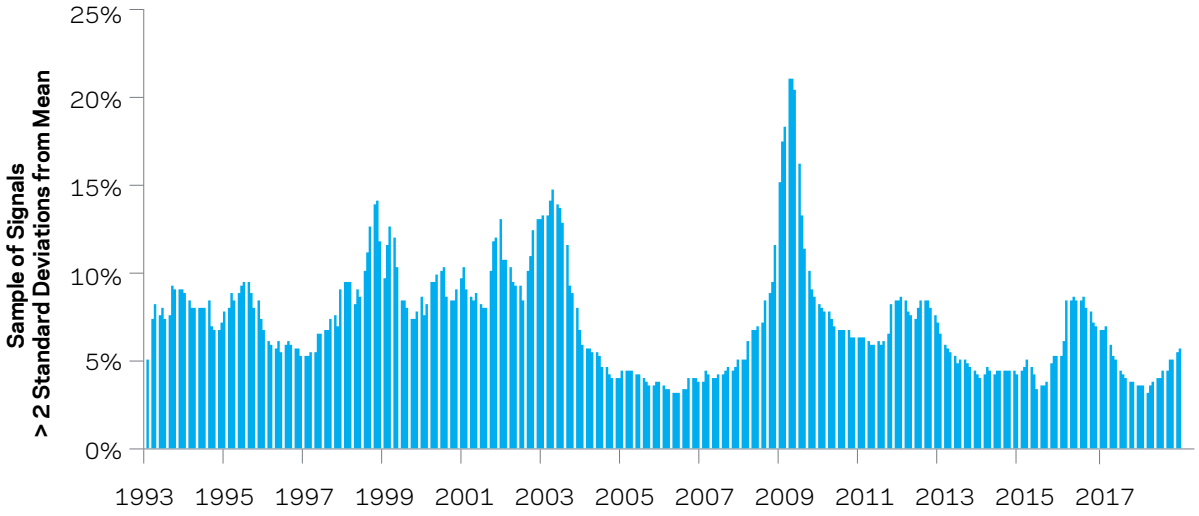
7 See Kupersmith, Ross and Thapar (2017), "Building a Better Deep Value Portfolio" for a more extensive list.

("dry powder"), a deep value strategy is more likely to be able to take advantage of additional opportunities as they emerge.

Exhibit 4 shows how the number of deep-value opportunities[8] varies through time. Even when monitoring a broad universe of macro assets and dozens of valuation metrics, there appear to be times when the opportunity set is quite constrained. In these environments, which have sometimes lasted for several years, an opportunistic manager may face a difficult choice between operating indefinitely at low levels of risk (and correspondingly low expected returns) or levering up the few available trades and potentially losing the ability to capitalize when the environment shifts.[9] Managers may also be tempted to drift toward other styles during these sparse periods, again compromising their readiness to take advantage of opportunities as they arise. These challenges may help to explain a result we will show later: we find little evidence that hedge funds are tapping into an opportunistic approach.

Exhibit 4

Hypothetical Deep Value Opportunities Through Time, 1993–2018



Source: Data from 1/1993 to 12/2018. For illustrative purposes only and not representative of an actual portfolio AQR manages. This graph tracks a selection of value signals in the Opportunistic Macro Sub-Strategy of the hypothetical Integrated Macro Strategy. Signals are classified as extreme when magnitudes are more than two standard deviations above their historical mean. These are elements of the models and do not indicate the possibility of profits or losses within a portfolio. Investment process is subject to change at any time without notice. Please see Appendix A for Opportunistic Macro universe description. Hypothetical performance results have certain inherent limitations, some of which are disclosed in the back.

8 Identified here as instances when a valuation metric for an asset or group of assets is more than two standard deviations from its historical mean.

9 In addition, a deep value portfolio in a low-opportunity set environment would be less diversified, and basic theory would indicate that Sharpe Ratio expectations should be lower as a result. Levering up such a portfolio is not doing anyone any favors.

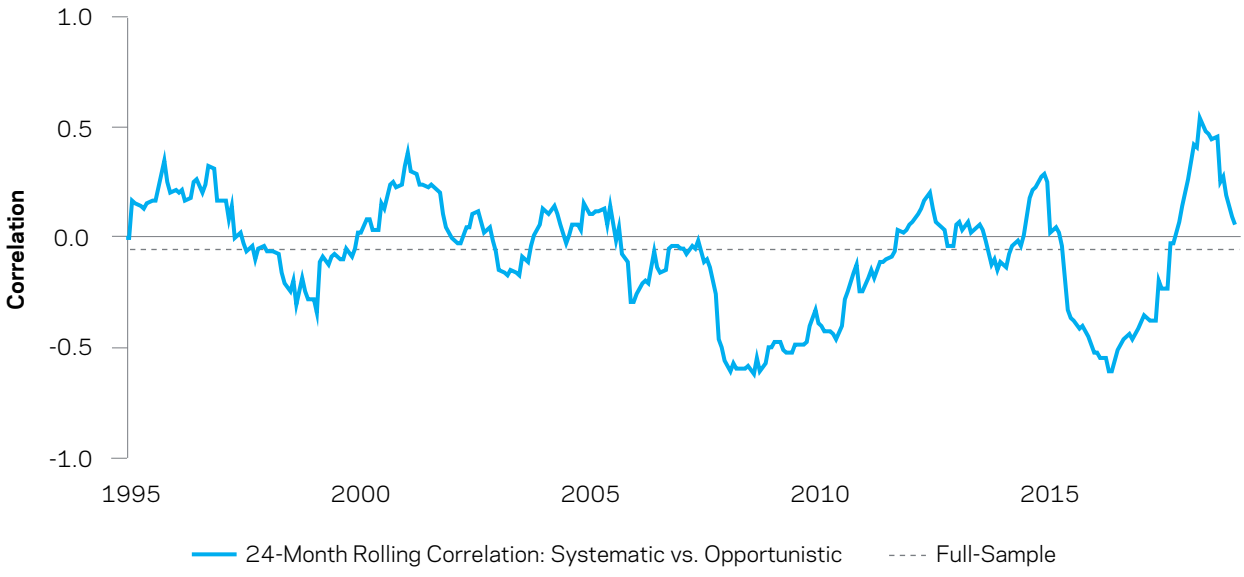
Combining Systematic and Opportunistic Macro

For the remainder of this paper, we will explore a hypothetical Integrated Macro strategy that incorporates both of the approaches discussed above: a Systematic Macro process focusing on Macro Momentum and an Opportunistic Macro process oriented around identifying extreme misvaluations. We introduce a backtest of this strategy with simulated returns stretching back to 1993, a sufficient time horizon to examine performance across a range of economic and market environments. For further detail on the construction of the backtest, see Appendix A.

Before devoting ourselves to an examination of the behavior of the integrated strategy, we first highlight some of the potential benefits of pursuing Systematic and Opportunistic Macro in combination as opposed to separately. The Systematic Macro strategy takes positions to benefit from continuation of trends that have emerged in economic data and other macro indicators. In contrast, the Opportunistic Macro strategy is contrarian in nature, betting on convergence in instances when prices have moved far from fundamentals. It should not surprise us, therefore, that these strategies generate highly diversifying returns despite trading an overlapping universe of macro assets. **Exhibit 5** below shows that backtest returns for these two approaches have tended to have low or negative correlation at most points in the last quarter of a century.

Exhibit 5

Hypothetical Systematic and Opportunistic Approaches Are Diversifying

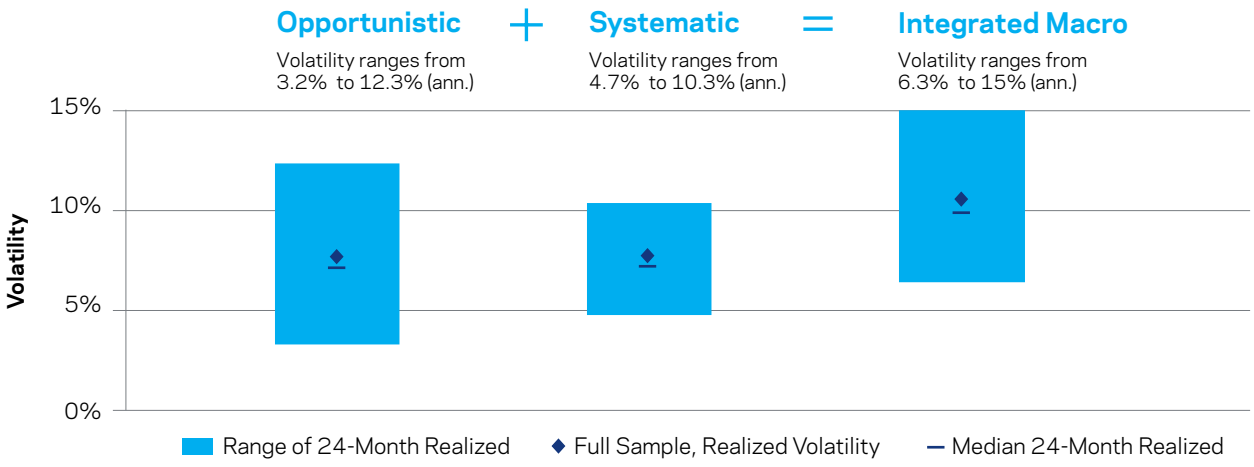


Source: AQR. Data from 01/1993 to 12/2018. For illustrative purposes only and not representative of an actual portfolio AQR manages. Hypothetical performance has inherent limitations, some of which are discussed in the disclosures at the end of this document. Please see Appendix A for description of backtest methodologies for simulated Opportunistic Macro, Systematic Macro and Integrated Macro strategies.

The uncorrelated nature of the two approaches provides several benefits. As the two return streams are diversifying to each other, the combined portfolio realizes lower volatility than the sum of the volatilities of the two components. **Exhibit 6** demonstrates, for the full sample, stand-alone volatility of nearly 8% in each of the two components results in combined volatility of only 10.5% for the integrated strategy. Furthermore, the combination smooths out some of the variations in the deep-value opportunity set. During periods with the fewest dislocations, such as 2004 to 2006, the Opportunistic Macro strategy takes around one third as much risk as during periods with the most dislocations. As discussed above, this poses significant challenges to managers. Combining Opportunistic Macro with the steadier risk budget of Systematic Macro may provide investors with smoother returns and fewer fluctuations in portfolio volatility, potentially enhancing staying power in the strategy. The smoother ride is seen in the narrower range of realized volatility for the integrated strategy.

Exhibit 6

Risk Benefits of Combining Hypothetical Opportunistic and Systematic Approaches 1993–2018

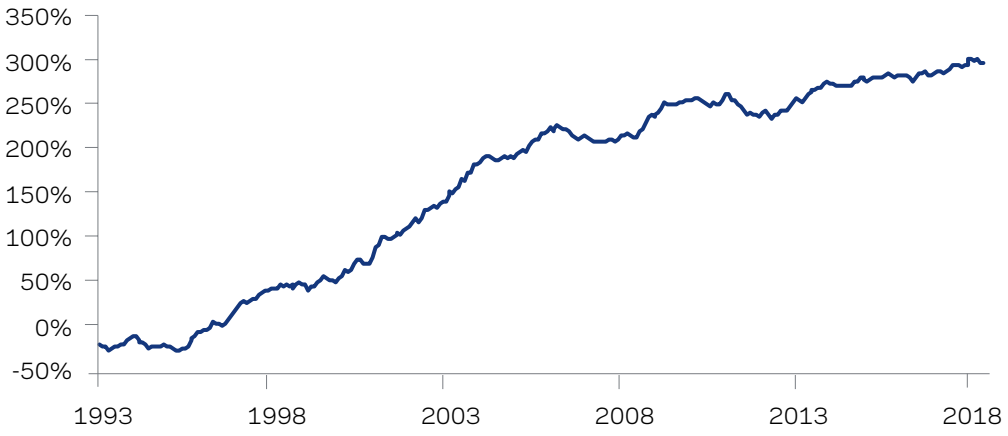


Source: AQR. Data from 01/1993 to 12/2018. For illustrative purposes only and not representative of an actual portfolio AQR manages. Hypothetical performance has inherent limitations, some of which are discussed in the disclosures at the end of this document. Please see Appendix for description of backtest methodologies for simulated Opportunistic Macro, Systematic Macro and Integrated Macro strategies.

Cumulative backtest returns of the Integrated Macro strategy are shown in **Exhibit 7** (Panel A), covering the period from the start of 1993 through December 2018. The strategy produces average annual excess-of-cash returns of 12% with an annualized standard deviation of 10.5% for a gross Sharpe ratio of 1.2.[10] Further, this performance has been consistent across macroeconomic environments. In Panel B we show the Sharpe Ratio of Integrated Macro during different growth and inflation regimes, relative to its full sample average. As the exhibit illustrates, Integrated Macro has demonstrated resilient risk-adjusted performance across macroeconomic environments. For comparison, we also show three traditional asset classes; these have tended to exhibit large sensitivities demonstrated by the large variation around the full sample Sharpe Ratio.

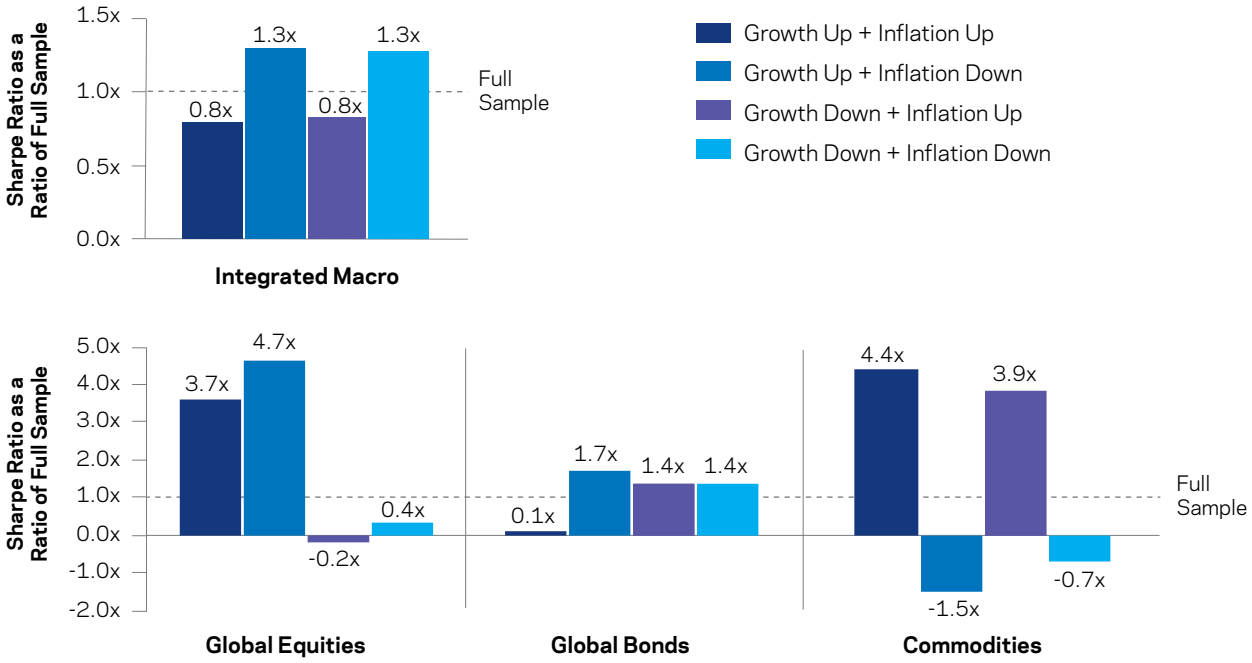
10 The backtest incorporates discounting, particularly in earlier periods. For more information, please refer to the Appendix.

Exhibit 7A
Hypothetical Cumulative Excess-of-Cash Integrated Macro Returns, 1993–2018



Source: AQR. Data from 01/1993 to 12/2018. Returns gross-of-fees and in USD. For illustrative purposes only and not representative of an actual portfolio AQR manages. Hypothetical performance has inherent limitations, some of which are discussed in the disclosures at the end of this document. Please see Appendix A for description of backtest methodologies for simulated Opportunistic Macro, Systematic Macro and Integrated Macro strategies.

Exhibit 7B
Hypothetical Integrated Macro and Traditional Asset Classes Sharpe Ratios in Growth and Inflation Environments relative to full sample Sharpe Ratio average[11]



Source: AQR. Data from 01/1993 to 12/2018. For illustrative purposes only and not representative of an actual portfolio AQR manages. Hypothetical performance has inherent limitations, some of which are discussed in the disclosures at the end of this document. Please see Appendix A for description of backtest methodologies for simulated Opportunistic Macro, Systematic Macro and Integrated Macro strategies and construction of macroeconomic indicators. Commodities are proxied by the S&P GSCI Index. Please see important disclosures in the Appendix.

11 Global Equities is the MSCI World index. Global Bonds is a GDP weighted composite of Australian, European, Canadian, Japanese, U.K. and U.S. 10-year government bonds. Risk-free rate used in Sharpe Ratio calculation is U.S. three-month Treasury Bills. Please see Appendix for more details on the construction of the macroeconomic environmental indicators.

A Diversifier to Traditional Asset Classes

Long exposures to equities and fixed income form the backbone of most portfolios. As a result, a key question for many investors considering an alternative investment strategy is how it will behave in relation to these traditional asset classes.

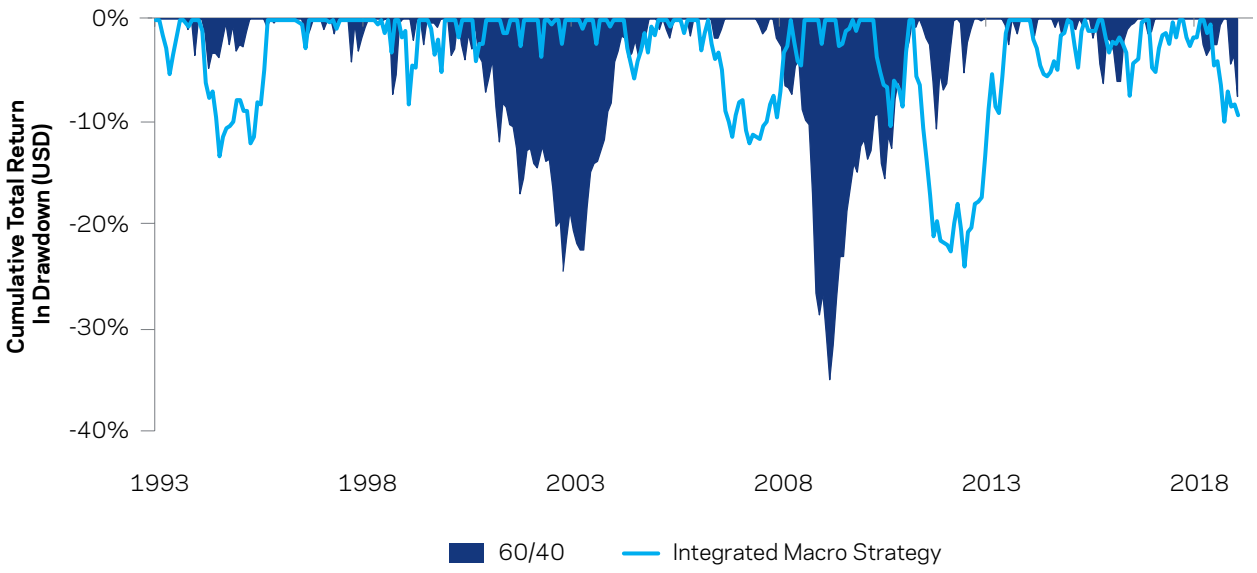
Integrated Macro takes much of its risk in long/short relative value positions that are designed to be market-neutral.[12] While the hypothetical strategy also takes directional positions in equity indexes and government bonds (among others), directional signals are calibrated to be neither long-biased nor short-biased over the course of an economic cycle.

It is therefore not surprising that, as intended, the strategy backtest exhibits near-zero correlations to both equities (MSCI World) and bonds (Global Aggregate) over the 1993–2018 sample (0.03 and 0.00 respectively).

As one would expect based on these low correlations, Integrated Macro and the 60/40 global equity/bond portfolio have tended to experience drawdowns at different times over the last 25 years. In other words, Integrated Macro returns have been diversifying at the times when traditional portfolios have been most in need of a boost.

Exhibit 8

Drawdowns of Global 60/40 and Hypothetical Integrated Macro Strategy 1993–2018



Source: AQR. Data from 01/1993 to 12/2018. For illustrative purposes only and not representative of an actual portfolio AQR manages. Hypothetical performance has inherent limitations, some of which are discussed in the disclosures at the end of this document. Please see Appendix A for description of backtest methodologies for simulated Opportunistic Macro, Systematic Macro and Integrated Macro strategies.

12 Relative value sub-strategies, which seek to identify which assets in a cross-section will outperform or underperform, allow for a wider breadth of opportunities compared to directional sub-strategies that seek to time individual assets. As a result, we expect these sub-strategies to offer higher Sharpe Ratios and accordingly allocate more risk in these areas.

A Distinct Source of Alpha

"We try to catch new trends early, and in later stages we try to catch trend reversals. Therefore, we tend to stabilize rather than destabilize the market. We are not doing this as a public service. It is our style of making money." —George Soros[13]

As the quote above indicates, the goal of identifying both incipient trends and eventual overreactions has been in the minds of macro investors through time. The hypothetical Integrated Macro strategy seeks to pursue these objectives in a diversified and systematic manner.

To assess the degree to which the wider global macro universe is pursuing a similar strategy, we analyze the historical factor exposures of the Credit Suisse (CS) Global Macro Index (**Exhibit 9**, Panel A). First, the macro index exhibits substantial beta to traditional asset classes,[14] in stark contrast to the market-neutrality of Integrated Macro shown above. Second, the index loads positively on the returns of our systematic sleeve[15] but somewhat *negatively* on opportunistic, suggesting that few macro managers are pursuing a deep value approach.[16] It is also worth noting that the macro index returns offer statistically insignificant alpha after controlling for exposures to stocks, bonds, and the two sleeves of Integrated Macro. Collectively, these four return streams explain a fairly large proportion of the variation in CS Macro Index returns, with an adjusted $\mathbf{R^2}$ of 24%.[17]

The reverse exercise yields strikingly different results. When the Integrated Macro strategy is regressed against stocks, bonds, and the CS Macro Index (Panel B), we see insignificant loadings on traditional assets, a statistically significant but economically small loading on the macro index, and alpha that is both statistically and economically significant. Indeed, alpha over these investments represents almost the entirety of Integrated Macro's returns. Traditional asset returns and macro index returns explain almost none of the variation in the Integrated Macro strategy's returns, with an adjusted $\mathbf{R^2}$ of just 3%. These results indicate that, in aggregate, macro hedge funds capture only a small subset of the opportunities exploited by the Integrated Macro strategy.

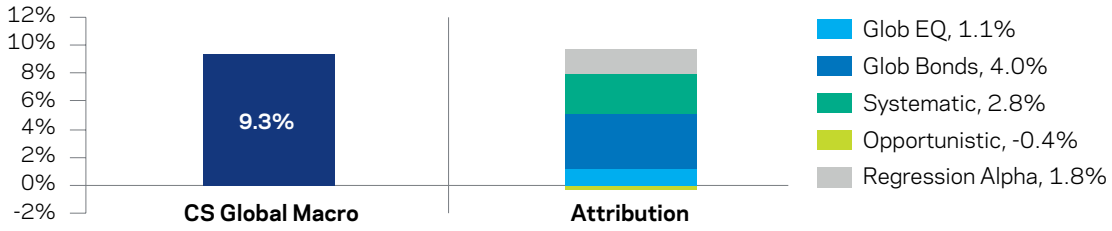
13 As quoted in Bass, (1999) *The Predictors*, Henry Holt & Company.
14 Asness, Krail and Liew (2001), "Do Hedge Funds Hedge?" is one of the earliest diatribes on this. The paper found that the broad index of hedge funds and most hedge fund subcategories had not added value over what would be expected given their average market exposure. In other words, aggregate hedge fund returns over this period might have been due to equity market exposure rather than to alpha or manager skill. The authors study the CSFB/Tremont index of hedge funds over 1994–2000.
15 Consistent with Brooks (2017), which finds that global macro funds load significantly on monetary policy themes but do not load on international trade and risk sentiment themes. Brooks studies developed market equity indices, currencies, government bonds and interest rates over the period 1970–2016 (date range can vary for individual assets).
16 While the negative loading on Opportunistic Macro is not quite statistically significant, it does motivate the question of whether the strategy may indeed profit to some extent by positioning in a contrarian fashion with respect to the broader community of macro managers.
17 $\mathbf{R^2}$ measures the percentage of variation explained by the factors included in a regression. Twenty-four percent is a reasonably high figure, akin to what one might find regressing returns from one stock on returns from another stock in the same industry.

Exhibit 9

Factor Exposures of Global Macro Industry and Hypothetical Integrated Strategy 1994–2018

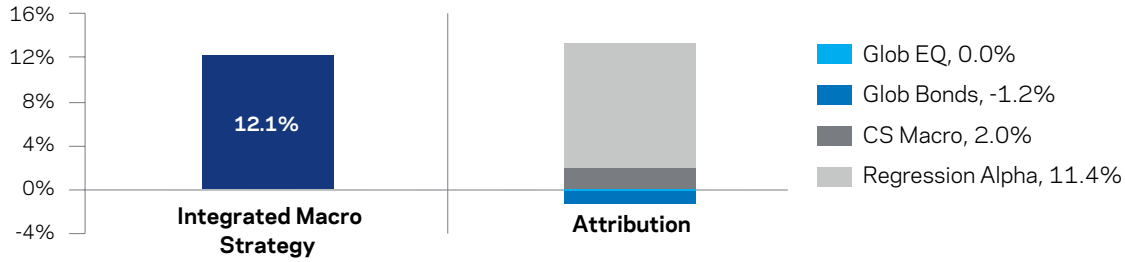
A. Credit Suisse Global Macro Index

	MSCI World	Global Agg	Systematic Macro	Opportunistic Macro	Intercept	R^2
Beta	**0.15**	**0.78**	**0.34**	-0.09	1.8%	24%
T-Stat	**5.00**	**5.10**	**5.95**	-1.66	0.98	



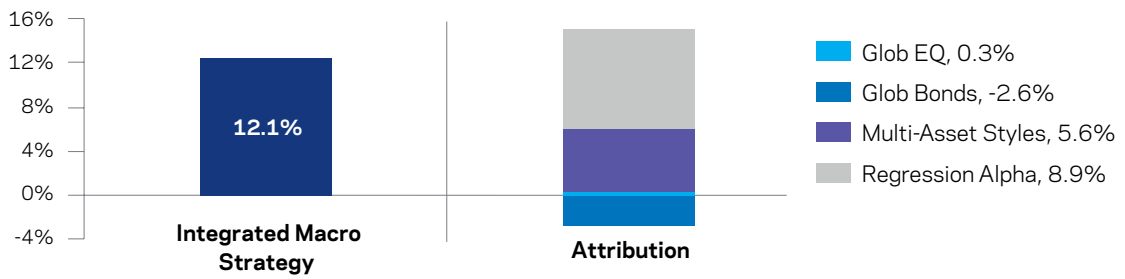
B. Hypothetical Integrated Macro Strategy

	MSCI World	Global Agg	CS Macro	Intercept	R^2
Beta	0.00	-0.24	**0.21**	**11.4%**	3%
T-Stat	-0.05	-1.08	**2.77**	**4.72**	



C. Hypothetical Integrated Macro Strategy (market factors and multi-asset styles)

	MSCI World	Global Agg	Multi-Asset Styles	Intercept	R^2
Beta	0.03	**-0.51**	**0.40**	**8.9%**	12%
T-Stat	0.86	**-2.41**	**6.34**	**3.80**	



Source: AQR, Credit Suisse. Data from 01/1994 to 12/2018. For illustrative purposes only and not representative of an actual portfolio AQR manages. Hypothetical performance has inherent limitations, some of which are discussed in the disclosures at the end of this document. Please see Appendix A for description of backtest methodologies for simulated Opportunistic Macro, Systematic Macro and Integrated Macro strategies. Global Equities are proxied by MSCI World Index and Global Bonds by Bloomberg Barclays Global Aggregate Bond Index. Please read important disclosures at the end of this document.

While the Integrated Macro strategy clearly adds value relative to the CS Macro index, there are perhaps more appropriate (and challenging) benchmarks within the alternative space. Specifically, we would like to examine the relationship between Integrated Macro and several of the major alternative sources of return documented in the academic literature. To this end, in Panel C we compare Integrated Macro returns with a simple market-neutral multi-asset style premia portfolio (consisting of value, momentum, carry, defensive and trend).[18] For more detail on the construction of this "Multi-Asset Styles" return stream, please see Appendix B.

Integrated Macro appears to bear a closer relationship to hypothetical Multi-Asset Styles, an unsurprising result given that measures of value, momentum, carry, etc., are given some weight with the strategy's systematic sleeve. However, Integrated Macro alpha remains large and significant, and this combination of factors still explains only a quarter of Integrated Macro returns.

These results suggest that Integrated Macro may add value to a portfolio with existing exposures to rigorously implemented alternative premia such as Multi-Asset Styles. **Exhibit 10** displays the performance of Integrated Macro, Multi-Asset Styles, and a 50/50 combination of the strategies. Integrated Macro exhibits a low correlation to the diversified-style premia portfolio (0.3). The combination produces a Sharpe ratio in excess of 1.4 and realizes a max drawdown of -12.4%, far smaller than the maximum drawdowns of Integrated Macro or Multi-Asset Styles stand-alone. Over the past 25 years, Integrated Macro has been highly complementary to broader hedge fund portfolios, be it global macro managers or diversified style premia portfolios.

Exhibit 10

Hypothetical Integrated Macro Is Complementary to Diversified Multi-Asset Style Premia, 1993-2018

	Integrated Macro	Multi-Asset Styles	50/50 Combination
Average Excess Return	12.0%	12.5%	12.3%
Volatility	10.5%	9.9%	8.3%
Sharpe Ratio	1.1	1.3	1.5
Max Drawdown	-23.9%	-20.5%	-12.4%

Source: AQR, Credit Suisse. Data from 01/1993 to 12/2018. For illustrative purposes only and not representative of an actual portfolio AQR manages. Hypothetical performance has inherent limitations, some of which are discussed in the disclosures at the end of this document. Please see Appendix for description of backtest methodologies for simulated Integrated Macro and Multi-Asset Styles strategies.

18 Israel, Maloney (2013), "Understanding Style Premia" is a comprehensive discussion of these investment themes.

Conclusion

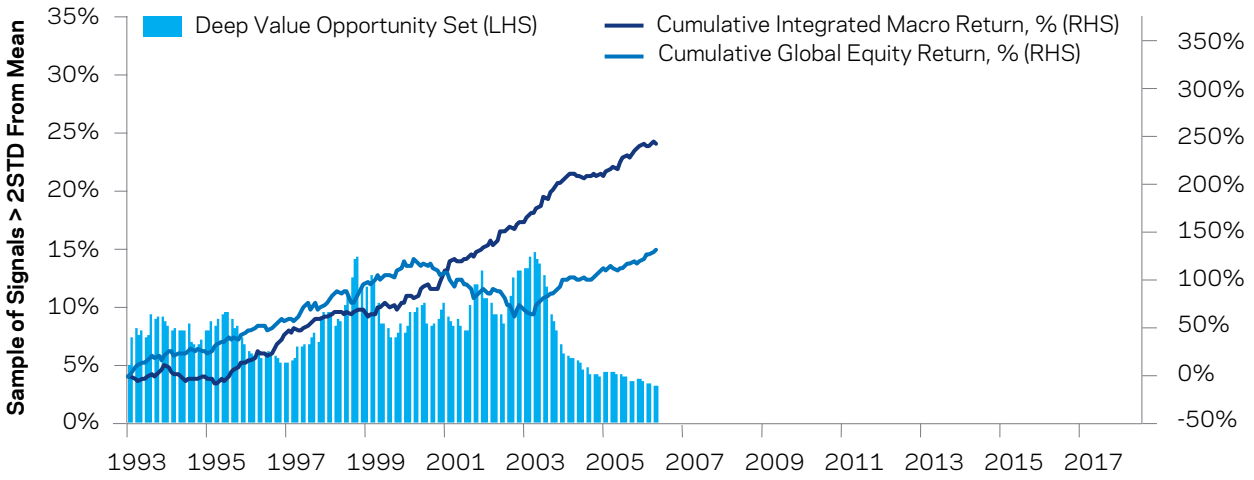
We have presented the framework for an integrated approach to global macro investing, marrying the ability to capitalize on both fundamental macroeconomic trends and extreme deviations from fair value, and applying the strategy across equity, fixed income, currency and commodity markets. This hypothetical Integrated Macro strategy provides cash-efficient exposure to a largely unexploited return stream in the macro space, capitalizing on dislocations in markets that investors may have difficulty in accessing due to the variable opportunity set over time. By integrating these highly complementary approaches, investors may gain access to a source of alpha that is diversifying to both traditional and alternative investments.

Portfolio Exhibits

To illustrate how the Integrated Macro strategy might have positioned at different points in time, below we present highlights of the hypothetical backtest portfolio in three different market environments. Specifically, we present a sample of key positions for both the Opportunistic Macro and Systematic Macro sleeves in a "low opportunity set" environment for the opportunistic sleeve (i.e., a period in which unusually few value signals were at extremes), a "high opportunity set" environment (many value signals at extremes), and a "moderate opportunity set environment" (a typical proportion of signals at extremes). For Opportunistic Macro positions, we list the value metrics which were at extremes for these assets. For Systematic Macro positions, we highlight some of the key fundamental signals driving these backtest views.

Portfolio Exhibit 1

March 2006 – Hypothetical Low-Opportunity Set Environment

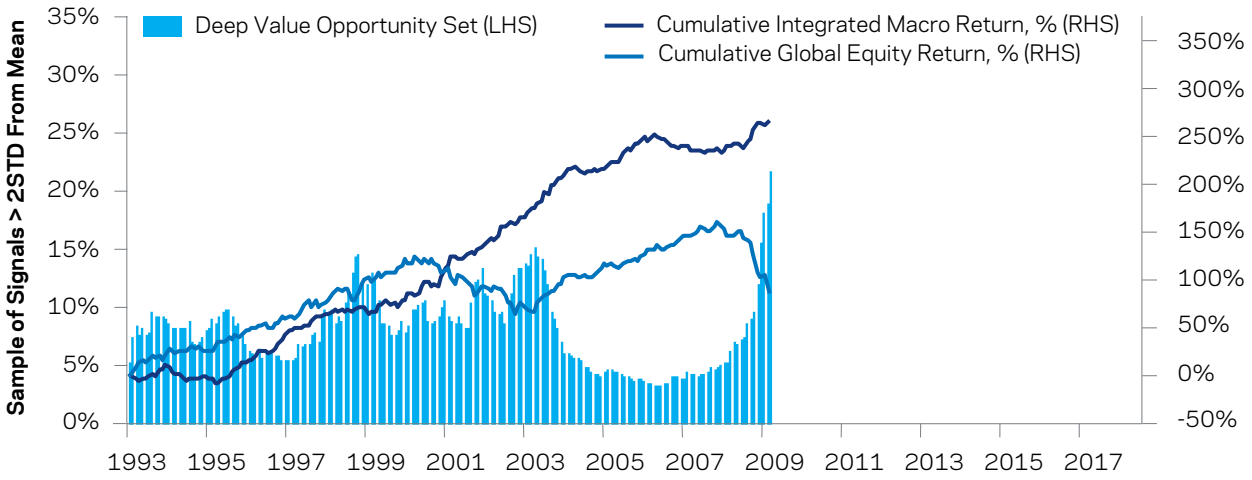


Source: AQR. Data from 01/1993 to 12/2018. For illustrative purposes only and not representative of an actual portfolio AQR manages. Hypothetical performance has inherent limitations, some of which are discussed in the disclosures at the end of this document. Please see Appendix for description of backtest methodologies for simulated Opportunistic Macro, Systematic Macro and Integrated Macro strategies. Global Equities are proxied by MSCI World Index. Please read important disclosures at the end of this document.

Opportunistic Macro Highlights	Value Signals Motivating View
Long Eurozone Equities against Short Australian Equities	Forward Earnings / Price, Adjusted Cash Flow/Price
Short Nasdaq against S&P 500	Cash Flow / Price
Short Euro against Swiss franc	Real Exchange Rate Mispricing, Long-Term Reversal
Short New Zealand dollar against Japanese yen	Real Exchange Rate Mispricing, Long-Term Reversal

Systematic Macro Highlights	Fundamental Signals Motivating View
Long Equities in Australia and Canada	Downside Inflation Surprises, Positive Earnings Forecast Revisions
Short 2-year Interest Rate Swaps in Japan, the Eurozone, and the U.S.	Hawkish Monetary Policy Trends, Bullish Equity Sentiment
Short 10-year Government Bonds Futures across Developed Economies	Hawkish Monetary Policy Trends, Bullish Equity Sentiment
Short the New Zealand dollar against U.S. Dollar and euro	Weakening Terms of Trade, Negative Growth Surprises/ Revisions, Bearish Equity Sentiment

Portfolio Exhibit 2
February 2009 – Hypothetical High-Opportunity Set Environment



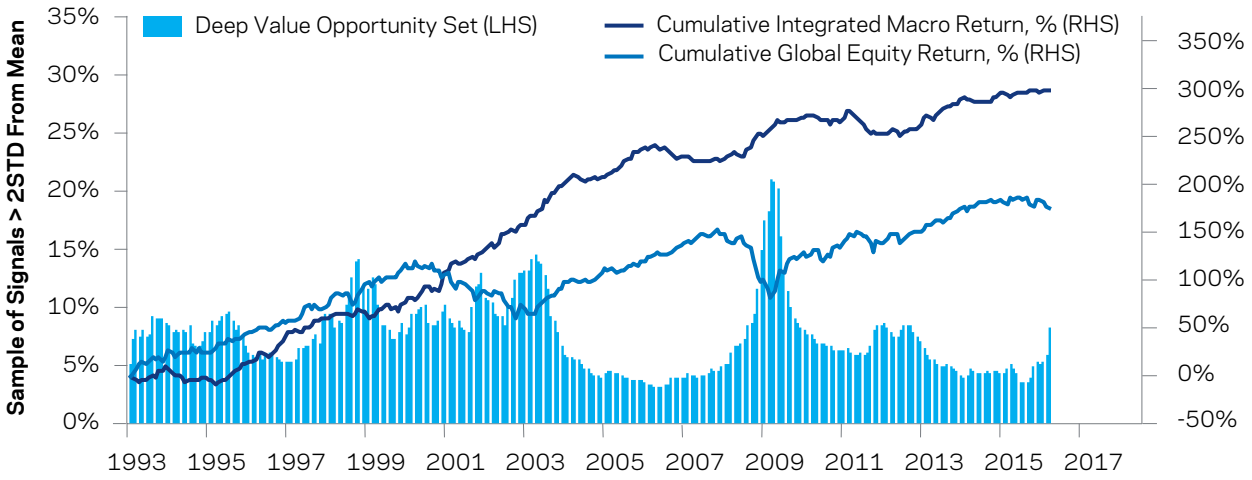
Source: AQR. Data from 01/1993 to 12/2018. For illustrative purposes only and not representative of an actual portfolio AQR manages. Hypothetical performance has inherent limitations, some of which are discussed in the disclosures at the end of this document. Please see Appendix for description of backtest methodologies for simulated Opportunistic Macro, Systematic Macro and Integrated Macro strategies. Global Equities are proxied by MSCI World Index. Please read important disclosures at the end of this document.

Opportunistic Macro Highlights	Value Signals Motivating View
Long Banks, Insurance, Diversified Financials in the U.S., Europe, and Japan (Beta-Hedged)	Book/Price, Earnings/Price, Cash Flow/Price
Long Auto Makers in the U.S., Europe, and Japan (Beta-Hedged)	Book/Price, Earnings/Price
Long Retailers and Consumer Goods in the U.S. and Japan (Beta-Hedged)	Earnings/Price, Forward Earnings/Price, Book/Price
Long Real Estate Sector in Europe (Beta-Hedged)	Book/Price
Long Energy Equipment/Services in the U.S. (Beta-Hedged)	Earnings/Price, Forward Earnings/Price
Long Equity Indexes in the U.S. and other Developed Markets (Canada, Italy, Switzerland, EAFE)	Short-Term Price Reversal
Long Crude Oil and Short Gold	Short-Term Price Reversal
Long Euro Stoxx against other Developed Markets	Industry-Adjusted Book/Price, Earnings Price
Long South African Rand against other EM Currencies	Long-Term Reversal
Long Turkish Equities against other EM Equities	Cash Flow/Price, Earnings/Price

Systematic Macro Highlights	Fundamental Signals Motivating View
Long Equities in Australia and Switzerland	Dovish Monetary Policy Trends, Falling Long-Term Yields
High Conviction Long Positions in 10-year Government Bonds	Negative Equity Sentiment, Downward Inflation Surprises/ Revisions
Long 2-Year Interest Rate Swaps in the U.S., the Eurozone, and Japan	Dovish Monetary Policy Trends, Bearish Equity Sentiment, Negative Growth Surprises/Revisions
Long Australian Dollar against Canadian Dollar	Positive Growth Surprises/Revisions, Upward Inflation Surprises/Revisions
Long U.S. Dollar against Euro	Improving Terms of Trade, Improving Export Partner Growth, Positive Growth Surprises

Portfolio Exhibit 3

February 2016 – Hypothetical Moderate-Opportunity Set Environment



Source: AQR. Data from 01/1993 to 12/2018. For illustrative purposes only and not representative of an actual portfolio AQR manages. Hypothetical performance has inherent limitations, some of which are discussed in the disclosures at the end of this document. Please see Appendix for description of backtest methodologies for simulated Opportunistic Macro, Systematic Macro and Integrated Macro strategies. Global Equities are proxied by MSCI World Index. Please read important disclosures at the end of this document.

Opportunistic Macro Highlights	Value Signals Motivating View
Long U.S. Oil Sector and U.S. Energy Equipment/Services Sector (Beta-Hedged)	Book/Price
Long Japanese Banks (Beta-Hedged)	Book/Price, Forward Earnings / Price
Short German 30-Year Bonds	Short-Term Price Reversal
Long Equities in U.S., Europe, and Japan	Short-Term Price Reversal
Long Euro against Developed Basket	Real Exchange Rate

Systematic Macro Highlights	Fundamental Signals Motivating View
Short U.S. and Canadian Equities	Negative Growth Surprises/Revisions, Hawkish Monetary Policy Trends
Long Japanese yen and Short Norwegian krone	Improving Terms of Trade, Positive Earnings Forecast Revisions
Long 2-year Interest Rate Swaps in the U.K. and the U.S.	Negative Growth Surprises/Revisions, Downward Inflation Revisions, Bearish Equity Sentiment
Long 10-year Government Bonds in Japan and Germany	Downward Inflation Revisions, Dovish Monetary Policy Trends, Bearish Equity Sentiment
Short Mexican Peso and Brazilian Real vs. Long Hungarian Forint and Singapore Dollar	Weakening Terms of Trade, Worsening Credit Risk, Bearish Options Sentiment
Short Bloomberg Commodity Index	Strengthening Dollar, Negative Growth Forecast Revisions in Commodity Consuming Economies

Appendix

A. Integrated Macro Backtest Description

The Integrated Macro backtest represents the combination of simulated returns for an Opportunistic Macro strategy and Systematic Macro strategy, each scaled to target 8% annualized volatility over a full market cycle.

As discussed, we believe an Opportunistic Macro strategy benefits from some degree of discretionary oversight. However, for the purposes of simulating historical returns, it is necessary to define the strategy in purely quantitative terms. The Opportunistic Macro strategy is comprised of relative value and directional substrategies encompassing developed and emerging equity indexes, developed equity sectors, developed and emerging currencies, developed and emerging interest rates, developed government bonds, and commodities. Each substrategy utilizes multiple quantitative value metrics. In relative value substrategies, for each value factor we define a value spread between a pair or group of assets as the absolute value of the differentials of asset factor values. In directional substrategies, value signals for each asset are compared with their own history. Value spreads are standardized on an expanding basis. The opportunistic strategy enters a trade (buying the cheap asset[s] and/or selling the expensive asset[s]) when a value signal reaches two standard deviations and exits when it falls back below one standard deviation. To approximate discretionary screening for "false positives," trades are not entered if other available value metrics are in sufficiently strong disagreement with the value signal that is flagging. Risk levels are capped at the asset and substrategy levels.

In addition to trades based on relatively slow-moving fundamental value metrics, the opportunistic backtest also incorporates a short-term reversal signal applied across asset classes. When positive (or negative) one-month returns for an asset exceed 2 (or -2) standard deviations relative to historical one-month returns, the strategy positions for reversal, exiting once the trailing one-month return moves back below 1 (above -1) standard deviation. Risk is capped at the asset class level. Rebalancing frequency is monthly for value signals and daily for reversal signals.

The Systematic Macro strategy is similarly comprised of relative value and directional substrategies encompassing developed and emerging equity indexes, developed and emerging currencies, developed interest rates, developed government bonds, developed yield curves, and commodities. The strategy positions in these assets primarily on the basis of Macro Momentum signals, which measure trends in economic fundamentals. These signals are grouped into four major themes: business cycle (representing changes in growth and inflation), international trade, monetary policy, and macro sentiment. While Macro Momentum signals are given the largest weight, consideration is also given to other signals, including measures of price momentum, value, and carry. Because returns are simulated gross of trading costs and further may be subject to data mining, results have been discounted. A heavier discount has been applied to the earlier portions of the backtest, as both concerns may be more material for those periods.

Investment universe of the hypothetical backtest discussed above

Stocks

Sectors

Automobiles & Components
Banks
Biotechnology
Capital Goods
Commercial & Professional Services
Consumer Durables & Apparel
Consumer Services
Diversified Financials
Energy
Food & Staples Retailing
Food Beverage & Tobacco
Health Care Equipment & Services
Household & Personal Products
Insurance
Materials
Media
Pharmaceuticals
Real Estate
Retailing
Semiconductors & Semiconductor Equipment
Software & Services
Technology Hardware & Equipment
Telecommunication Services
Transportation
Utilities

Equity Indices

Developed

Australia
Canada
Eurostoxx
France
Germany
Hong Kong
Italy
Japan
Netherlands
Sweden
Switzerland
Spain
United Kingdom
United States

Emerging

Brazil
China
India
Israel
Malaysia
Mexico
Poland
Russia
Singapore
South Korea
South Africa
Taiwan

Fixed Income

Bond Futures

Australia
Canada
Germany
Japan
United Kingdom
United States

Interest Rate Futures

Australia
Canada
Eurozone
New Zealand
Switzerland
United Kingdom
United States

Interest Rate Swaps

Australia
Canada
Czech Republic
Germany
Hong Kong
Hungary
Israel
Japan
Mexico
New Zealand
Norway
Poland
Singapore
South Africa
South Korea
Sweden
Switzerland
United Kingdom
United States

Currencies

Developed Currencies

Australia
Canada
Euro
Japan
New Zealand
Norway
Sweden
Switzerland
United Kingdom
United States

Emerging Currencies

Brazil
Chile
Colombia
Czech Republic
Hungary
India
Indonesia
Israel
Korea
Mexico
Philippines
Poland
Russia
Singapore
South Africa
Taiwan
Turkey

Other

Commodities

Aluminium
Brentoil
Live Cattle
Cocoa
Coffee
Copper
Corn
Cotton
Crude
Feeder Cattle
Gasoline
Gold
Heating oil
Hogs
Natgas
Nickel
Palladium
Platinum
Silver
Soybeans
Soymeal
Soyoil
Sugar
Unleaded
Wheat
Zinc

Bloomberg Commodity Index

Credit Indices

Europe
United States

Source: AQR.

B. Multi-Asset Styles Description

Our style premia are long/short returns scaled to target or realize 10% annual volatility. We subtract no trading costs or fees.

The market-neutral style premia (Value, Momentum, Carry and Defensive) are hypothetical long/short strategies applied in multiple asset classes: stock selection, industry allocation, country allocation in equity, fixed income and currency markets, and commodities. Value goes long relatively cheap assets and short relatively expensive ones. Momentum goes long recent relative outperforming assets and short relative underperforming assets. Carry goes long higher-yielding assets and short lower-yielding assets. Defensive goes long lower-risk and higher-quality assets and short higher-risk and lower-quality assets.

Each style premia strategy allocates 50/50 risk weights to stock and industry selection (SS) and asset allocation (AA) strategies. The SS and AA strategies are designed to target 10% volatility, so the aggregate style strategies have volatilities around 8%. For SS we use 50/50 risk weights between stock selection within industries and across industries (to be in line with the common but arguably inefficient practice of letting across-industry positions matter as much as within-industry positions). For AA we use the same relative risk weights for asset classes as "Investing With Style" (AQR white paper, 2012, available upon request): 33% equity country allocation, 25% fixed income, 25% currencies, 17% commodities.

We combine several data sources to produce a dataset long enough to capture many different macroeconomic environments. We use value, momentum, carry and defensive style premia strategies as described in "Investing With Style" (AQR white paper, 2012, available upon request), except for SS carry, for which we use the dividend yield strategy returns in Ken French's data library.

In addition to the four market-neutral style premia, we include the market-directional Trend style, which applies 12-month trend-following strategies in four major asset classes: equities, fixed income, currency and commodities. While the style is nearly uncorrelated with equity markets in the long run, at any point in time it can be directionally long or short. For data since 1993, we source trend style premia from "Time Series Momentum" (*Journal of Financial Economics*, 2012).

Note that two of the style premia — Momentum and Trend — are related to each other but different in construction. Momentum strategies go long assets that have done relatively well versus their peers and short the laggards, while trend-following strategies consider each asset independently. Thus, trend-following strategies can at times take highly market-directional positions.

"Multi-Asset Styles" is an equal-weighted composite of the five style premia, scaled to 10% volatility.

C. Construction of Macroeconomic Indicators

We construct macroeconomic indicators in the spirit of *Ilmanen, Maloney and Ross (2014)*, using data since 1993.

Each of our macro indicators combines two series, which are first normalized to Z-scores: that is, we subtract a historical mean from each observation and divide by a historical volatility. When we classify our quarterly 12-month periods into, say, "growth up" and "growth down" periods, we compare actual observations to the median so as to have an equal number of up and down observations (because we are not trying to create an investable strategy where data should be available for investors in real time, we use the full sample median).

The underlying series for our growth indicator are the Chicago Fed National Activity Index (CFNAI) and the "surprise" in industrial production growth over the past year. Since there is no uniquely correct proxy way to capture "growth"; averaging may make the results more robust and signals appropriate humility. CFNAI takes this averaging idea to extremes as it combines 85 monthly indicators of U.S. economic activity. The other series — the difference between actual annual growth in industrial production and the consensus economist forecast a year earlier — is narrower but more directly captures the surprise effect in economic developments. We use median forecasts from the Survey of Professional Forecasters data as published by the Philadelphia Fed. While data surprises a priori have a zero mean, this series has exhibited a downward trend in recent decades, reflecting the (partly unexpected) relative decline of the U.S. manufacturing sector.

Our inflation indicator is also an average of two normalized series. One series measures the de-trended level of inflation (CPIYOY minus its mean, divided by volatility), while the other measures the surprise element in realized inflation (CPIYOY minus consensus economist forecast a year earlier).

References

Asness, C., Ilmanen, A., Israel, R., Moskowitz, T. (2015) "Investing with Style," *Journal of Investment Management*, Vol. 13, No. 1, pp. 27–63.

Asness, C., Liew, J., Pedersen, L., Thapar A. (2014), "Deep Value."

Asness, C., Krail, R., Liew J. (2001), "Do Hedge Funds Hedge?"

AQR Capital Management (2017) "Alternative Thinking Q3 2017 — Systematic vs. Discretionary."

Brooks, J. (2017), "A Half Century of Macro Momentum."

Brooks, J., Frieda, A., Kupersmith, D., Nielsen L. (2014), "Building a Better Global Macro Portfolio."

Ilmanen, A., Maloney, T., Ross, A. (2014), "Exploring Macroeconomic Sensitivities," *Journal of Portfolio Management*, Vol. 40, Issue 3.

Israel, R., Maloney T. (2013), "Understanding Style Premia."

Kupersmith, D., Ross, A., Thapar, A. (2017), "Building a Better Deep Value Portfolio."

Moskowitz, T., Ooi, Y., Pedersen L. (2012), "Time Series Momentum," *Journal of Financial Economics*, Vol. 104, Issue 2, pp. 228–250.

Disclosures

This document has been provided to you solely for information purposes and does not constitute an offer or solicitation of an offer or any advice or recommendation to purchase any securities or other financial instruments and may not be construed as such. The factual information set forth herein has been obtained or derived from sources believed by the author and AQR Capital Management, LLC ("AQR") to be reliable but it is not necessarily all-inclusive and is not guaranteed as to its accuracy and is not to be regarded as a representation or warranty, express or implied, as to the information's accuracy or completeness, nor should the attached information serve as the basis of any investment decision. This document is intended exclusively for the use of the person to whom it has been delivered by AQR, and it is not to be reproduced or redistributed to any other person. The information set forth herein has been provided to you as secondary information and should not be the primary source for any investment or allocation decision. Past performance is not a guarantee of future performance.

This material is not research and should not be treated as research. This paper does not represent valuation judgments with respect to any financial instrument, issuer, security or sector that may be described or referenced herein and does not represent a formal or official view of AQR. The views expressed reflect the current views as of the date hereof and neither the author nor AQR undertakes to advise you of any changes in the views expressed herein.

The information contained herein is only as current as of the date indicated, and may be superseded by subsequent market events or for other reasons. Charts and graphs provided herein are for illustrative purposes only. The information in this presentation has been developed internally and/or obtained from sources believed to be reliable; however, neither AQR nor the author guarantees the accuracy, adequacy or completeness of such information. Nothing contained herein constitutes investment, legal, tax or other advice nor is it to be relied on in making an investment or other decision. There can be no assurance that an investment strategy will be successful. Historic market trends are not reliable indicators of actual future market behavior or future performance of any particular investment which may differ materially, and should not be relied upon as such.

The information in this paper may contain projections or other forward-looking statements regarding future events, targets, forecasts or expectations regarding the strategies described herein, and is only current as of the date indicated. There is no assurance that such events or targets will be achieved, and may be significantly different from that shown here. The information in this document, including statements concerning financial market trends, is based on current market conditions, which will fluctuate and may be superseded by subsequent market events or for other reasons.

Gross performance results do not reflect the deduction of investment advisory fees and other expenses, which would reduce an investor's actual return. AQR's asset based fees may range up to 2.85% of assets under management, and are generally billed monthly or quarterly at the commencement of the calendar month or quarter during which AQR will perform the services to which the fees relate. Where applicable, performance fees are generally equal to 20% of net realized and unrealized profits each year, after restoration of any losses carried forward from prior years. In addition, AQR funds incur expenses (including start-up, legal, accounting, audit, administrative and regulatory expenses) and may have redemption or withdrawal charges up to 2% based on gross redemption or withdrawal proceeds. Please refer to AQR's ADV Part 2A for more information on fees. Consultants supplied with gross results are to use this data in accordance with SEC, CFTC, NFA or the applicable jurisdiction's guidelines.

HYPOTHETICAL PERFORMANCE RESULTS HAVE MANY INHERENT LIMITATIONS, SOME OF WHICH, BUT NOT ALL, ARE DESCRIBED HEREIN. NO REPRESENTATION IS BEING MADE THAT ANY FUND OR ACCOUNT WILL OR IS LIKELY TO ACHIEVE PROFITS OR LOSSES SIMILAR TO THOSE SHOWN HEREIN. IN FACT, THERE ARE FREQUENTLY SHARP DIFFERENCES BETWEEN HYPOTHETICAL PERFORMANCE RESULTS AND THE ACTUAL RESULTS SUBSEQUENTLY REALIZED BY ANY PARTICULAR TRADING PROGRAM. ONE OF THE LIMITATIONS OF HYPOTHETICAL PERFORMANCE RESULTS IS THAT THEY ARE GENERALLY PREPARED WITH THE BENEFIT OF HINDSIGHT. IN ADDITION, HYPOTHETICAL TRADING DOES NOT INVOLVE FINANCIAL RISK, AND NO HYPOTHETICAL TRADING RECORD CAN COMPLETELY ACCOUNT FOR THE IMPACT OF FINANCIAL RISK IN ACTUAL TRADING. FOR EXAMPLE, THE ABILITY TO WITHSTAND LOSSES OR TO ADHERE TO A PARTICULAR TRADING PROGRAM IN SPITE OF TRADING LOSSES ARE MATERIAL POINTS THAT CAN ADVERSELY AFFECT ACTUAL TRADING RESULTS. THERE ARE NUMEROUS OTHER FACTORS RELATED TO THE MARKETS IN GENERAL OR TO THE IMPLEMENTATION OF ANY SPECIFIC TRADING PROGRAM, WHICH CANNOT BE FULLY ACCOUNTED FOR IN THE PREPARATION OF HYPOTHETICAL PERFORMANCE RESULTS, ALL OF WHICH CAN ADVERSELY AFFECT ACTUAL TRADING RESULTS.

The hypothetical performance results contained herein represent the application of the quantitative models as currently in effect on the date first written above, and there can be no assurance that the models will remain the same in the future or that an application of the current models in the future will produce similar results because the relevant market and economic conditions that prevailed during the hypothetical performance period will not necessarily recur. Discounting factors may be applied to reduce suspected anomalies. This backtest's return, for this period, may vary depending on the date it is run. Hypothetical performance results are presented for illustrative purposes only. In addition, our transaction cost assumptions utilized in backtests, where noted, are based on AQR Capital Management, LLC's, ("AQR")'s historical realized transaction costs and market data. Certain of the assumptions have been made for modeling purposes and are unlikely to be realized. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions used in achieving the returns have been stated or fully considered. Changes in the assumptions may have a material impact on the hypothetical returns presented. Actual advisory fees for products offering this strategy may vary.

Note to readers in Australia: AQR Capital Management, LLC, is exempt from the requirement to hold an Australian Financial Services License under the Corporations Act 2001, pursuant to ASIC Class Order 03/1100 as continued by ASIC Legislative Instrument 2016/396, ASIC Corporations (Amendment) Instrument 2021/510 and ASIC Corporations (Amendment) Instrument 2022/623. AQR is regulated by the Securities and Exchange Commission ("SEC") under United States of America laws and those laws may differ from Australian laws. **Note to readers in Canada:** This material is being provided to you by AQR Capital Management, LLC, which provides investment advisory and management services in reliance on exemptions from adviser registration requirements to Canadian residents who qualify as "permitted clients" under applicable Canadian securities laws. No securities commission or similar authority in Canada has reviewed this presentation or has in any way passed upon the merits of any securities referenced in this presentation and any representation to the contrary is an offence. **Note to readers in Europe:** AQR in the European Economic Area is AQR Capital Management (Germany) GmbH, a German limited liability company (Gesellschaft mit beschränkter Haftung; "GmbH"), with registered offices at Maximilianstrasse 13, 80539 Munich, authorized and regulated by the German Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, „BaFin"), with offices at Marie-Curie-Str. 24-28, 60439, Frankfurt am Main und Graurheindorfer Str. 108, 53117 Bonn, to provide the services of investment advice (Anlageberatung) and investment broking (Anlagevermittlung) pursuant to the German Securities Institutions Act (Wertpapierinstitutsgesetz; "WpIG"). The Complaint Handling Procedure for clients and prospective clients of AQR in the European Economic Area can be found here: https://ucits.aqr.com/Legal-and-Regulatory. **Note to readers in Hong Kong:** The contents of this presentation have not been reviewed by any regulatory authority in Hong Kong .AQR Capital Management (Asia) Limited is licensed by the Securities and Futures Commission ("SFC") in the Hong Kong Special Administrative Region of the People's Republic of China ("Hong Kong") pursuant to the Securities and Futures Ordinance (Cap 571) (CE no: BHD676). **Note to readers in China:** This document does not constitute a public offer of any fund which AQR Capital Management, LLC ("AQR") manages, whether by sale or subscription, in the People's Republic of China (the "PRC"). Any fund that this document may relate to is not being offered or sold directly or indirectly in the PRC to or for the benefit of, legal or natural persons of the PRC. Further, no legal or natural persons of the PRC may directly or indirectly purchase any shares/units of any AQR managed fund without obtaining all prior PRC's governmental approvals that are required, whether statutorily or otherwise. Persons who come into possession of this document are required by the issuer and its representatives to observe these restrictions. **Note to readers in Singapore:** This document does not constitute an offer of any fund which AQR Capital Management, LLC ("AQR") manages. Any fund that this document may relate to and any fund related prospectus that this document may relate to has not been registered as a prospectus with the Monetary Authority of Singapore. Accordingly, this document and any other document or material in connection with the offer or sale, or invitation for subscription or purchase, of shares may not be circulated or distributed, nor may the shares be offered or sold, or be made the subject of an invitation for subscription or purchase, whether directly or indirectly, to persons in Singapore other than (i) to an institutional investor pursuant to Section 304 of the Securities and Futures Act, Chapter 289 of Singapore (the "SFA")) or (ii) otherwise pursuant to, and in accordance with the conditions of, any other applicable provision of the SFA .**Note to readers in Korea:** Neither AQR Capital Management (Asia) Limited or AQR Capital Management, LLC (collectively "AQR") is making any representation with respect to the eligibility of any recipients of this document to acquire any interest in a related AQR fund under the laws of Korea, including but without limitation the Foreign Exchange Transaction Act and Regulations thereunder. Any related AQR fund has not been registered under the Financial Investment Services and Capital Markets Act of Korea, and any related fund may not be offered, sold or delivered, or offered or sold to any person for re-offering or resale, directly or indirectly, in Korea or to any resident of Korea except pursuant to applicable laws and regulations of Korea. **Note to readers in Japan:** This document does not constitute an offer of any fund which AQR Capital Management, LLC ("AQR") manages. Any fund that this document may relate to has not been and will not be registered pursuant to Article 4, Paragraph 1 of the Financial Instruments and Exchange Law of Japan (Law no. 25 of 1948, as amended) and, accordingly, none of the fund shares nor any interest therein may be offered or sold, directly or indirectly, in Japan or to, or for the benefit, of any Japanese person or to others for re-offering or resale, directly or indirectly, in Japan or to any Japanese person except under circumstances which will result in compliance with all applicable laws, regulations and guidelines promulgated by the relevant Japanese governmental and regulatory authorities and in effect at the relevant time. For this purpose, a "Japanese person" means any person resident in Japan, including any corporation or other entity organised under the laws of Japan. **Note to readers in United Kingdom:** This material is being provided to you by AQR Capital Management (Europe) LLP, a UK limited liability partnership with its office at Charles House 5-11, Regent St., London, SW1Y 4LR, which is authorised and regulated by the UK Financial Conduct Authority ("FCA").

www.aqr.com

AQR Capital Management, LLC Two Greenwich Plaza, Greenwich, CT 06830 **P** +1.203.742.3600 **F** +1.203.742.3100