



Alternative Thinking

Mapping Investable Return Sources to Macro Environments

In this issue, we study the sensitivity of major asset class premia and style premia to different macroeconomic environments (growth, inflation, real yields, volatility, illiquidity). Developing a better understanding of macro exposures can help investors design better-diversified portfolios.

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Executive Summary

- We explore the empirical relationships between investable strategies (asset classes and style premia) and macroeconomic environments.
- Identifying these relationships is not straightforward – results often depend on design choices as well as time periods – but this additional perspective may help investors to identify portfolio risks and potentially benefit from increased diversification.
- We find that *style premia have meaningfully less macro exposure than do asset classes*. Additionally, we provide further evidence on the benefits of diversification: namely, that a well-diversified portfolio (both for asset classes and style premia) may rely less on a specific macroeconomic outcome for success.
- We also identify environments that are most challenging for asset classes and style premia, such as ones marked by illiquid, unstable conditions.
- This analysis can help bridge macroeconomic forecasts to investment decisions, but the difficulty of forecasting and the potential instability of mapping relations limit the usefulness in tactical timing.

Introduction: Tools for Risk-based Investing

Investors have become increasingly aware that their portfolios are not only a collection of capital investments (for example, allocations to asset classes), but also a collection of exposures to various macro risk factors. “Risk-based investing” can refer to allocating risk across investable asset classes and strategies, or attempting to allocate risk across macro risk factors (such as economic growth and inflation, which are not directly investable). While investable assets and strategies are more practical for portfolio allocation decisions, investors should be aware of both approaches, and how they are

related. By viewing a portfolio through the lenses of both investable return sources and underlying risk factors, we believe investors can more effectively identify portfolio risks and potentially benefit from increased diversification. In this spirit, this issue of *Alternative Thinking* provides empirical evidence on how investable return sources (such as long-only asset class premia or long-short style premia¹) map to non-investable macro factors (such as exposure to economic growth or inflation).²

Before we review the results, we must stress the limitations of this type of analysis. Any empirical result is to some degree specific to the sample period (here 1972-2013), as well as dependent on design choices. Moreover, if investors want to use environmental analysis for tactical timing decisions, they need to be right in both their estimates of their investments’ sensitivities to the macro environment and their forecasts of the future macro environment.

Despite these caveats, we think the following key findings are robust and useful for building better-diversified portfolios:

- Major asset classes have different exposures to macro environments (such as economic growth, inflation, real yields, market volatility and liquidity). Among the most robust relations are the opposite exposures of stocks and bonds to growth, as well as the opposite exposures of commodities and bonds to inflation. We believe investors seeking effective diversification should

¹ Style premia are systematic strategies with long-term evidence of positive returns across a range of geographies and asset classes, including the Value premium and Momentum premium. See the blue box on page 3 for a description of the styles used in this analysis, and AQR White Paper “Investing with Style” for a more comprehensive review.

² Readers familiar with the cube in Ilmanen (Expected Returns, 2011) may recognize that the asset class premia correspond to the asset class perspective at the front of the cube, the style premia correspond to the strategy styles at the top, and the macro factors correspond to the underlying non-investable risk factors at the side. We have discussed the first two perspectives extensively in previous issues of *Alternative Thinking* (calling these investable return sources market risk premia and alternative risk/beta premia). Now we turn to the third side of the cube. To be clear, the third side (underlying risk factors) does not provide additional sources of diversification beyond those in the first two sides but, rather, it gives a more fundamental perspective on the portfolio.



try to balance these exposures in their long-only portfolios.

- Long-short style premia generally have smaller macro risk exposures, which can make them valuable diversifiers. Over the full period, all styles are observed to be profitable in both up and down environments for all five of our macro factors; this phenomenon is not observed in asset classes. Additionally, we find that diversification across styles further reduced macro sensitivities. Yet, style premia are not completely independent of macro risk factors; for example, most styles fared better in stable and liquid market environments.
- We also seek to identify environments that are most challenging for investors. Adverse growth conditions hurt many investments, but when slow growth coincides with high or rising inflation, real yields, volatility or illiquidity, it is difficult to find any asset class or strategy that is likely to perform well.

These descriptive results are hardly surprising, and we cannot be certain that they will continue to hold in the future. Still, awareness of historical patterns is a useful starting point, and any surprising results certainly increase our appetite for further study.

We begin by describing the key macroeconomic dimensions we study and the empirical indicators we use. We follow earlier research³ in focusing on growth and inflation dimensions and explore them with U.S. data, but later also analyze three other dimensions: real yield, volatility and liquidity. We study the performance of investable return sources – major asset class premia and style premia – through two different lenses (cumulative returns in ‘up’ and ‘down’ environments and correlation evidence), before turning to the three other dimensions. The Appendix provides further detail for interested readers, and a forthcoming white paper will give a more in-depth treatment of this topic.

³ See Katz and Palazzolo (2010a,b); Ilmanen (2011, chapters 16 and 26); Doskov, Pekkala and Ribeiro (2013), and references therein.

Identifying Growth and Inflation Environments

One can debate the most important macroeconomic dimensions to study, but conventional wisdom suggests that economic growth and inflation have the largest effects on investment returns. We agree and begin with these two.

A harder question is how to measure a particular economic environment, since each choice has its pros and cons. For example, economic growth can be measured by asset market data such as the relative performance of procyclic industries or commodities, or even just by using equity market returns as the growth indicator. However, when doing so, the resulting high correlations and explanatory power reflect the closeness of the dependent and explanatory variables. (Is it interesting to explain U.S. stock market performance by a factor based on Canadian equity returns?) As a result, in efforts to capture more fundamental relations between financial markets and underlying macro conditions, we elect to use macroeconomic data. This choice has its own problems, notably timing challenges as macroeconomic data are backward-looking, published with lags and subject to data revisions, while asset prices are clearly forward-looking.⁴

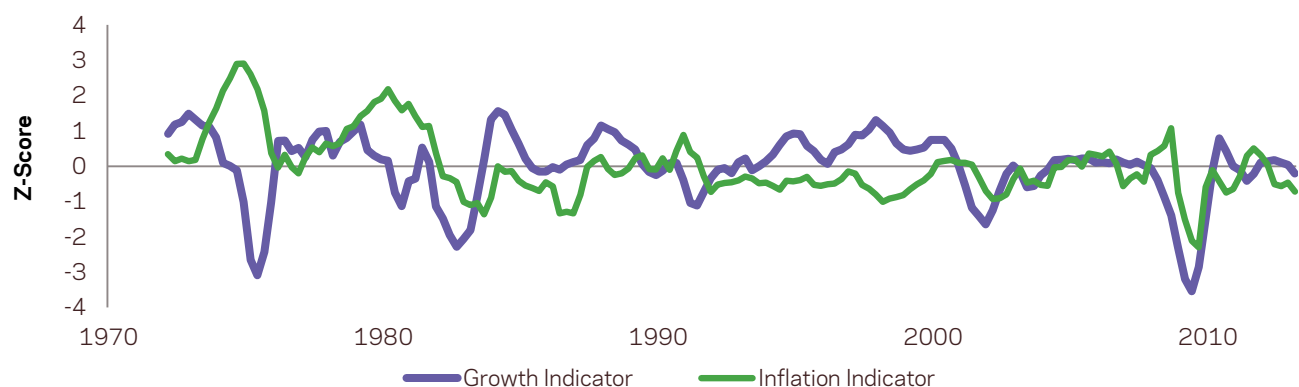
Each of our macro indicators,⁵ or macro factors, is a composite of two series. Our growth and inflation indicators are based on the following sources:

- Growth: Chicago Fed National Activity Index and ‘surprise’ in Industrial Production growth
- Inflation: Year-on-year inflation rate and ‘surprise’ in Consumer Price Inflation

⁴ Would you expect this quarter’s equity returns to be most affected by the past quarter’s economic growth (published this quarter), by the current quarter’s growth (on which markets get useful contemporaneous information), or by future growth (because markets have some ability to predict - and influence - economic growth)? Empirically, the last one is the correct answer. Longer data windows mitigate these problems. Thus, we study contemporaneous annual returns and macroeconomic developments (sampled quarterly).

⁵ The Appendix provides details on the construction of all five of our macro indicators and the rationale for our design choices.



Exhibit 1 | Growth and Inflation Indicators, 1972–2013

Source: AQR. See Appendix for details of indicator construction.

We then normalize the measures so that we can make comparisons across all macro dimensions. The indicators are shown in **Exhibit 1**.

Even when we normalize the growth indicator to have a zero mean, positive environments are more frequent, punctuated by sharp negative spikes corresponding to recessions (1974, 1980, 1981, 1990, 2001, and 2008). In contrast, the inflation indicator is more often negative and occasionally spikes up, often reflecting rising oil prices (1974, 1980, 1990, and 2008). We therefore classify ‘up’ and ‘down’ environments for each macro indicator by comparing the estimated value to the median – this ensures an equal number of observations in the two environments, and hence a fairer comparison when we look at cumulative returns.

How Do Investments Perform Across Growth and Inflation Environments?

Investors have a range of portfolio building blocks to choose from. We focus here on eight: three major asset class premia – U.S. stocks and government bonds, and commodities (S&P GSCI) – and five AQR-calculated hypothetical long-short style premia composites – market-neutral Value, Momentum, Carry and Defensive styles, and a market-directional Trend-following strategy.⁶ Because many

institutional portfolios are dominated by equity market risk, they are likely to exhibit sensitivities similar to those reported for equities.

While long-short styles have a long history in academia, they are rarely explicitly represented in institutional portfolios. The styles⁷ we investigate are applied in several asset classes and include:

Value: buy assets that are “cheap” relative to their fundamental value and sell “expensive” assets

Momentum: buy assets that recently outperformed their peers and sell recent underperformers

Carry: buy high-yielding assets and sell low-yielding assets

Defensive: buy low-risk, high-quality assets and sell more speculative assets

Trend-following: go long assets that have performed well over the recent past, and go short assets that have performed poorly over the recent past

Strategies” (2012), as well as references in the Appendix. These are returns of simulated strategies, without subtracting trading costs or fees. See disclosures in the Appendix.

⁷ Two style premia – Momentum and Trend-following – 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. Further details of all return premia are given in the Appendix.

⁶ See “Investing with Style (2012)” and “A Century of Trend-Following

We first study the impact of growth and inflation separately. **Exhibit 2** shows the cumulative returns for each investment (in excess of cash) when the macro indicator is “up” (dark shading) and when it is “down” (light shading); in other words, one return series is always flat while the other one is moving. An advantage of showing the data this way is that at a glance one can see whether long-term results are consistent over time: for example, whether equities’ tendency to perform well during growth-up environments came evenly or mainly from the early or the later part of the 1972-2013 window (answer: the latter).⁸

The asset class “wedge” in cumulative returns

The left half of Exhibit 2 shows performance for asset class premia. The first row shows that equity performance was mildly positively related to the growth environment but distinctly negatively related to the inflation environment: a large and consistent gap, or wedge, appears in the inflation graph between equities’ down and up performances – but the wedge is not as prominent in the growth graph. This weak relation between equities and growth reflects the forward-looking nature of equity returns, as noted in footnote 4. If we relate equity returns with next year’s growth, as discussed earlier, the “wedge” is much wider.⁹

The second row shows that government bonds earned most of their excess returns since 1972 at times when growth and inflation indicators were down. The third row shows virtually the reverse pattern for commodities: the S&P GSCI index flourished in growth-up and inflation-up

environments. Nothing surprising here, but the results are pleasingly consistent over time.

More consistency among long-short strategies

The right half of Exhibit 2 shows the performance of various long-short style premia in different growth and inflation environments. There are some variations but the most noteworthy pattern is that all style premia were positive in both up and down environments. While for asset classes, a large “wedge” develops over time between the up and down returns, this is less evident for style premia. This pattern seems indicative of lower macroeconomic sensitivities in these premia and arguably more “alpha-like” behavior.¹⁰

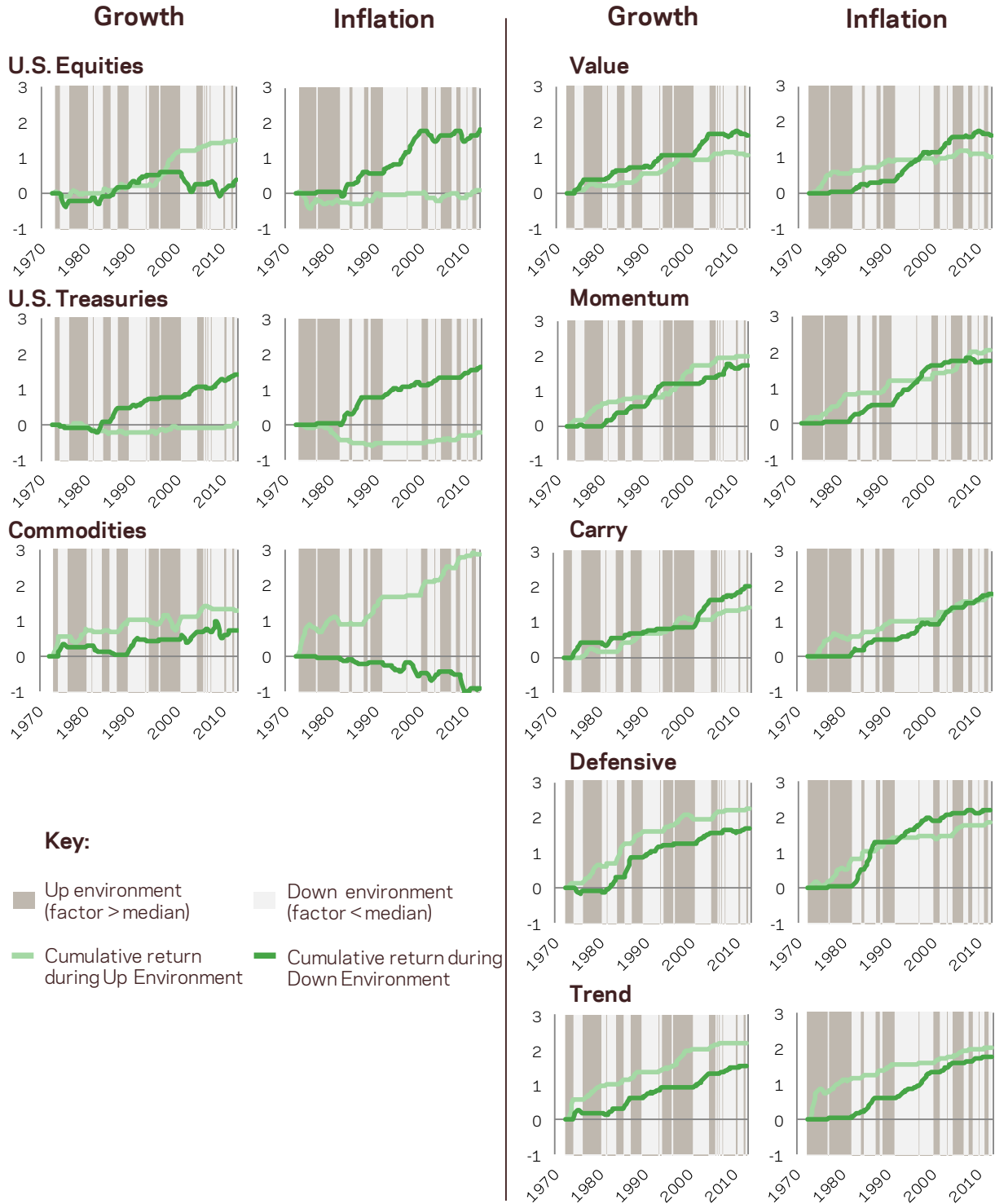
⁸ Cumulative return charts in Exhibit 2 capture only the binary distinction between “up” and “down” periods for each macro indicator. The correlations in later exhibits reflect the linear relation between all observations of the macro indicators and the investment return series. Note that because we use quarterly sampled annual data, the graphs effectively depict combined returns of four staggered investment strategies, each rebalancing annually at different quarters.

⁹ Viewed statistically, the correlation between annual equity returns and our contemporaneous growth indicator is 0.24, while the correlation using next-year’s growth indicator is 0.50. One example: the growth indicator only turned positive a year after equity markets bottomed in 2009Q1. Market-based macro indicators will tend to achieve higher correlations.

¹⁰ The largest wedges seen in the asset class charts are statistically significant at the 5% level, based on difference of means tests. None of the differences for the style premia – in either growth or inflation environments – are statistically significant. These different wedge patterns are not too surprising. Asset classes arguably earn their long-run premia mainly as a compensation for their exposures to macro factors such as growth and inflation. The long-short style premia likely earn long-run rewards partly for various behavioral reasons. While one can argue that the style premia have more upward-sloping cumulative returns due to overfitting, or to omitted trading costs, these arguments do not explain the balanced performance across environments.



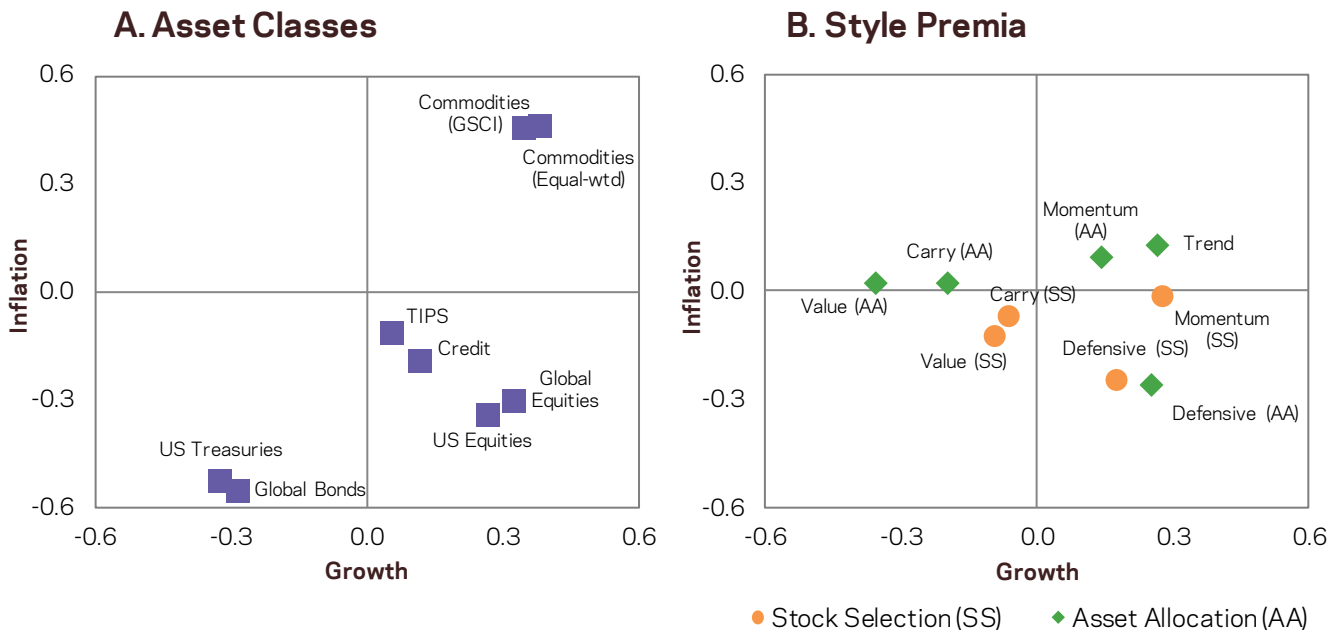
Exhibit 2 | Asset and Hypothetical Style Premia Cumulative Performance in Growth and Inflation “Up” and “Down” Environments, 1972–2013



Source: AQR. All returns are gross of transaction costs and fees. Past performance is not a guarantee of future performance. See Appendix for details of methodology. Hypothetical data has inherent limitations, some of which are disclosed at the end of this document.



Exhibit 3 | Partial Correlations of Asset Class Premia (left) and Hypothetical Style Premia (right) with Growth and Inflation, 1972–2013



Source: AQR. Please see Appendix for details of methodology. Hypothetical data has inherent limitations, some of which are disclosed at the end of this document.

Mapping Return Sources in Macro Risk Space

Turning to the joint impact of growth and inflation on investment returns, we now use partial correlations to plot these investments in macro risk space.¹¹ Exhibit 3A shows that Treasuries and commodities have particularly opposite growth-inflation exposures, while equities are in the bottom-right quadrant, as expected. As noted earlier, many institutional portfolios are dominated by equity market risk; thus, they too should perform best in the growth-up, inflation-down environment. A more balanced risk allocation across these three asset classes may provide more effective diversification across major economic exposures – an outcome that is sought by risk parity investors. However, no asset

class resides in the top-left quadrant; it is famously difficult to find an asset class or even a style premium that performs well in a stagflationary (growth-down, inflation-up) environment. Cash may be the least bad option.

We include in Exhibit 3 more detail on asset classes and style premia than in other exhibits. We display another series for each of the major asset classes to suggest that the patterns are also robust to using more diversified indices. We also show credit and TIPS (with a synthetic series starting in 1980) returns, both of which show up closer to the origin. Because credit is more like a hybrid between stocks and bonds, it shows up as a less-important diversifier for any portfolio from a macro perspective. TIPS could be especially important in duration-hedged spread positions with nominal bonds to protect against rising inflation.

Exhibit 3B turns to style premia, here split into stock selection (SS) and macro asset allocation (AA)

¹¹ Partial correlation gives the “pure” impact of each factor after accounting for the impact of the other factor. The distinction between simple and partial correlations is the same as that between slope coefficients in simple and multiple regressions. However, because our growth and inflation indicators are almost uncorrelated (correlation 0.04), partial correlations do not differ much from simple correlations. The difference is larger when we later study the joint impact of growth and volatility (correlation -0.49).



strategies. Our priors suggest that these long-short style premia should have lower macro exposures and therefore be located closer to the origin. This is generally true, but a few correlations are as large for styles as for asset classes (e.g., Defensives in the inflation dimension, and Momentum (SS) and Value (AA) at opposite ends of the growth dimension). Interestingly, for each style, the two different asset contexts (SS and AA) have similar (mild) macro exposures even though they can be quite heterogeneous. Momentum strategies reside in the top-right quadrant (with commodities), Defensive strategies in the bottom-right quadrant (with equities), and Value and Carry strategies in or near the bottom-left quadrant (with bonds).

It bears repeating that these results might be specific to this sample or our specifications of these style premia and macro environments. For example, macro-factor sensitivities could be more significant in long-only style-tilted portfolios which can be highly market-directional. Even long-short style premia can be more market-directional in certain asset classes than in the broadly diversified style composites we analyze here; currency carry (within the Carry style premium) is a prominent example.

Beyond Growth and Inflation

While growth and inflation may be the most important macro dimensions, they are not the only ones. We now turn to the three other dimensions: real yield, volatility and liquidity conditions. In each case, our environmental indicator averages two reasonable measures and tries to capture both their “level” and “change” perspectives.

- Real Yield: Real long-term bond yield and real short-term rate
- Volatility: Stock and bond market volatility based on daily returns of the S&P500 and 10-year Treasuries over the past year
- Illiquidity: “TED” spread in money markets and a well-established price impact measure in equity markets (see Appendix for details)

Exhibit 4 extends the macro risk space mapping results shown in Exhibit 3, now plotting partial correlations to growth against partial correlations to each of the other four macro indicators. Treasuries show by far the strongest relation to real yields but this link is partly mechanical. The equity market correlation to real yields is near zero over the full sample (though this relationship has become clearly positive since the mid-1990s). Among style premia, Defensive and Momentum styles appear to provide some diversification benefits as they have a mild positive relation to high/rising real yields.

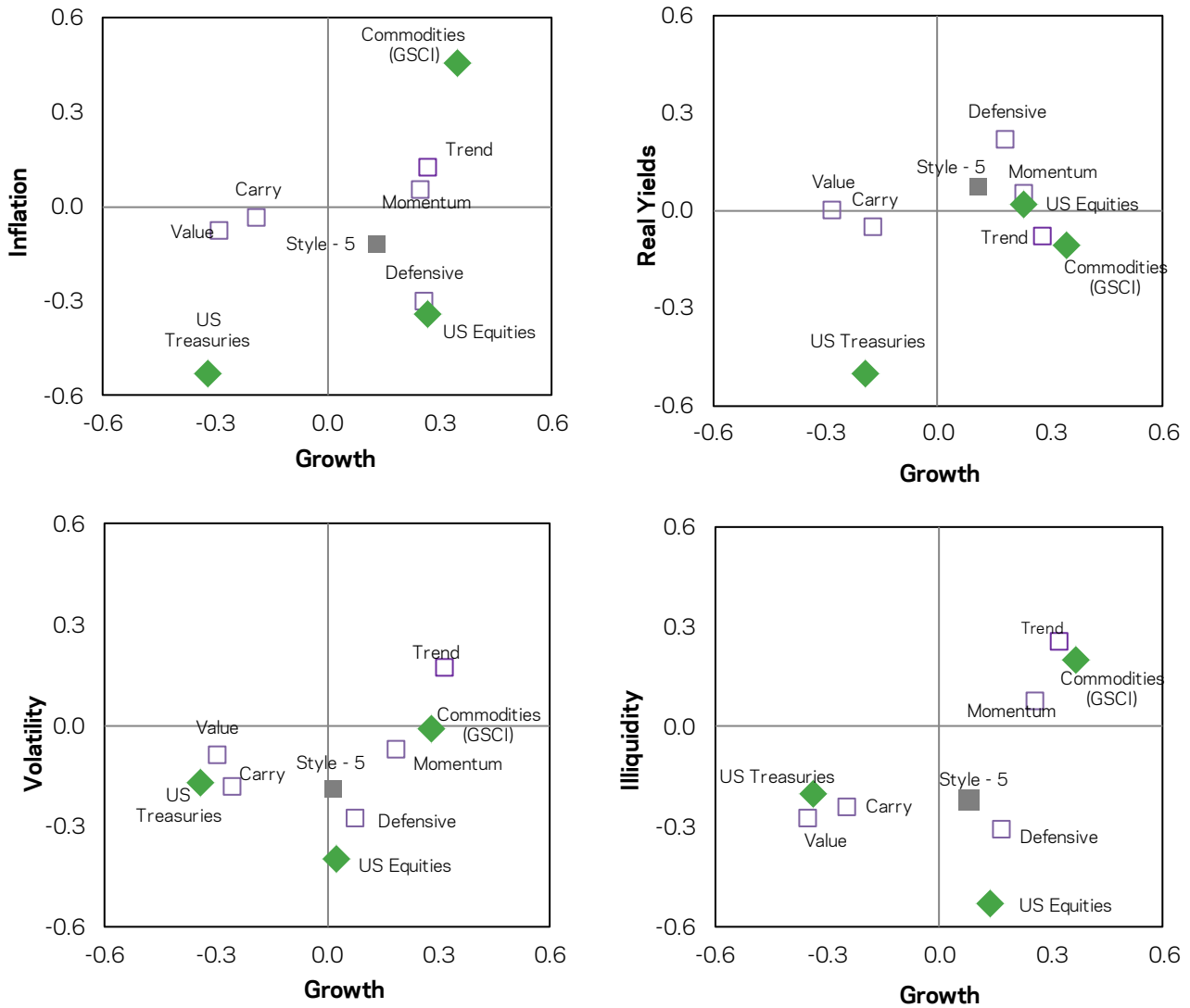
Generally, equities display a stronger sensitivity to volatility and illiquidity than to growth. Synchronicity explains this more than anything else, as the growth indicator uses no market data. However, it is interesting that stocks and bonds have the same signs here - despite opposite experiences in 2008. Both assets preferred good liquidity conditions until the mid-2000s and earned their main long-run gains in that environment.

Most of the market-neutral style premia - Value, Carry and Defensive - fared better in stable and liquid market conditions, while Momentum was near neutral. Conversely, trend-following appears in the top right quadrant of the lower two graphs, indicating potentially attractive diversifying properties in volatile and illiquid market environments.

Just as it is difficult to populate the upper left ‘stagflationary’ quadrant on the growth/inflation graph, it is difficult to populate this quadrant on the other three risk graphs as well, with rising real yields, volatility and illiquidity all posing a challenging investment environment - all compounded by negative growth. As expected, the style premia tend to be closer to the origin in all four graphs, suggesting more consistent returns in different environments (though a preference for liquid and stable environments can be seen in the lower two graphs).



Exhibit 4 | Partial Correlations of Asset Class Premia and Hypothetical Style Premia with Macro Indicators (Growth and Inflation, Real Yields, Volatility, Illiquidity), 1972–2013



Source: AQR. Please see Appendix for details of methodology. Hypothetical data has inherent limitations, some of which are disclosed at the end of this document.

Applications for Portfolio Construction

Our results imply that a portfolio dominated by a single asset or strategy is more likely to be susceptible to macro conditions (i.e., to reside toward the *edges* of the charts in Exhibits 3 and 4), and that combining investments may be an effective way to mitigate macro risk exposures (or to be closer to the *center* of the charts).

With that in mind, we include in Exhibit 4 a simple equal-volatility style composite of long-short Value, Momentum, Carry, Defensive and Trend-following strategies ("Style-5"). This style premia portfolio is closer to the origin than most of its components, illustrating possible benefits of diversification. On the growth-inflation scatterplot (top left graph), the style portfolio resides in the same quadrant as equities, but again much closer to the origin. On the real yield dimension, the same portfolio has a mild



positive tilt, while on the volatility and illiquidity dimensions, it has clearer negative tilts. The results are consistent with our intuition, and it makes sense that even a well-diversified portfolio would favor stable liquid market conditions and remain vulnerable to liquidation environments.

Concluding Remarks

We believe that a better understanding of how investable return premia relate to different macro risks can provide a valuable edge in building better long-term portfolios. However, the relationships we document here are not predictive, and thus less useful for tactical decisions than strategic ones. For example, while our analysis may help investors build diversified portfolios that are less prone to underperformance in different macro-economic environments, predicting those environments remains a challenge.

When it comes to strategic asset allocation, we may speculate why investors are so comfortable with their equity-centric portfolios. One reason might be the fact that equities and equity-dominated portfolios tend to flourish in growth-up, inflation-

down environments. As the post-WWII history is characterized by broadly benign growth and inflation developments (despite several hiccups), investors may have grown to consider such equity-friendly conditions too complacently as the medium-term base scenario. Yet, given all the exceptional fundamental developments and economic policies in recent years, one can hardly count on any single scenario going forward, making it that much more essential to construct portfolios that are also robust across macro environments.

This analysis is neither the first nor the last word on this topic. We could make different decisions in the construction of the macro indicators, extend the analysis to other investments (e.g., beyond the U.S.), and drill into style premia within single asset classes. And naturally investors may want to customize the analysis to their portfolios and other design choices. The bottom line is that we are continuing to explore these dimensions; we will be publishing more detail on this analysis in the coming months. We look forward to the ongoing dialogue.



Appendix A | Construction of Macro Indicators and Investment Return Series

Macro Indicators

A study like ours requires a lot of data and numerous design decisions. Our first choice was to decide which macro dimensions we believe are most relevant. We chose economic growth, inflation, real yields, volatility, and illiquidity. Monetary policy was another candidate; it is closely related to real yields.

As noted in the main text, we choose to construct our macro indicators mainly from fundamental economic data, rather than asset market returns (which we consider “too close” to the patterns we try to explain).¹² This choice brings its own problems, notably timing challenges as macroeconomic data are backward-looking, published with lags and later revised, while asset prices are clearly forward-looking. The impact of publication lags and the mismatch between backward- and forward-looking perspectives can be mitigated by using longer windows. Thus, we use contemporaneous annual economic data and asset returns through our analysis (past-year data with quarterly overlapping observations).¹³ Each of our macro indicators combines two series, which are first normalized by subtracting a historical mean from each observation and dividing by a historical volatility. When we classify our quarterly 12-month periods into, say, “growth up” or “growth down,” we compare observations to the median so as to have an equal number of up and down observations.

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 way to capture any risk factor, averaging may make the results more robust and signals 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.¹⁴

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).

The three other macro indicators combine the level and change aspects of real yield, volatility and liquidity conditions. (This is a design decision; someone else could have chosen indicators based on changes only.) For example, both high and rising real yields can imply adverse conditions for many investors. We study real long-term bond yields (subtracting a survey-based forecast of long-term inflation from the 10-year Treasury yield) and real short yields (subtracting a survey-based forecast of next-year inflation from the three-month Treasury bill rate). We normalize both their levels and one-year changes, and then average these to give us a composite **Real Yield Indicator**. Likewise, we estimate the volatility of the S&P500 and 10-year Treasuries using a one-year window. We normalize both the level of volatility and its change from a year ago, and average these to give a composite **Volatility Indicator**. Finally, we proxy market illiquidity using the “TED”

¹² For example, potential market-based proxies of economic growth include equity market returns, the relative performance of cyclical and defensive industries, dividend swaps, and estimates from cross-sectional regressions of asset returns on growth surprises.

¹³ Arguably composite growth surprise indices are the best proxies of economic growth news, but such composites are available at best going back to 1990s. Forecast changes in economist surveys as well as business and consumer confidence surveys may be the next best choices because they are reasonably forward-looking and timely. In a globalized world, it is not clear whether we should focus only on domestic macro developments, but data constraints make us focus on U.S. data. Finally, it is not clear how real economic growth ties to expected corporate cash flow growth (e.g., earnings per share) that influence stock prices or to real yields that influence all asset prices but especially those of bonds.

¹⁴ We use median forecasts from the Survey of Professional Forecasters data 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.



spread of funding liquidity and Amihud's "ILLIQ" price impact measure in equity markets.¹⁵ We normalize both the levels and one-year changes, and average these to give a composite **Illiquidity Indicator**.

The last three indicators are closer to market data than our growth and inflation indicators above. The real yield indicator will have a partly mechanical negative correlation with U.S. Treasury return because 10-year yield changes dominate Treasury returns, although the link is loosened by us subtracting expected inflation, averaging with real short rates, and using level as well as change data for the indicator. The illiquidity indicator contains the TED spread which tends to spike during financial crises such as 2008 (as do equity market volatility and the other illiquidity measure), inducing a negative correlation with equity returns. It is thus not surprising if these more timely indicators "drive out" the growth indicator's mild positive relation with equity returns when we study joint effects.

Investment Return Series

Our asset class premia are long-only returns expressed as excess returns over the Treasury bill rate. Our style premia are long-short returns scaled to target or realize 10% annual volatility. We subtract no trading costs or fees, which makes a bigger difference for the long-short strategies. Our main **asset class premia** are US equities (S&P500 index), US Treasuries (constant-maturity 10-year return), and commodities (S&P GSCI index). For robustness, we also study global equities (MSCI World), global bonds (GDP-weighted average of 10-year government bonds in six countries), and an equal-weighted composite of 24 commodity futures. In addition, we study the credit excess returns of investment-grade corporates over duration-matched Treasuries (Barclays index data since 1973) and TIPS returns (using an in-house proxy for inflation-linked bond performance; this series begins in 1980, well before the first TIPS were issued in 1997).

Market-neutral style premia series are more difficult to compile, especially because we apply these premia in numerous asset classes: stock selection, industry allocation, country allocation in equity, fixed income and currency markets, and commodities. Besides the four broad style composites, we also construct separate stock selection (SS) and asset allocation (AA) premia for each style. Since 1990, we use value, momentum, carry and defensive style premia as described in "Investing with Style" (AQR white paper, 2012). For 1972-1989, we source value and momentum style returns from "Value and Momentum Everywhere" (Journal of Finance, 2013), defensive style returns from "Betting Against Beta" (forthcoming in the Journal of Financial Economics, 2013), and the SS carry style premium from dividend yield strategy returns in Ken French's data library. For AA carry before 1990, as well as early histories of AA value, momentum and defensive styles, we use AQR in-house backtests.¹⁶

In addition to four market-neutral style premia, we include the market-directional **trend style**, which applies 12-month trend-following strategies in four major asset classes (AA). 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. We source trend style premia from "Time Series Momentum" (Journal of Financial Economics, 2012) and in-house backtests.

¹⁵ The TED spread is the yield difference between Eurodollar and Treasury bill rates (we use the 3-month maturity). This spread tends to widen when market concerns on banking sector credit risk rise or funding liquidity conditions deteriorate. The ILLIQ measure of a stock's market impact costs, developed by Amihud (2002) and often used in empirical studies, is the ratio of absolute return over volume. Intuitively, the price change induced by a given dollar volume is higher for less liquid stocks. The aggregate measure widens when overall market liquidity worsens.

¹⁶ While the SS style premia proxies we use since 1990 are market (beta) neutral, the value and momentum premia before 1990, and the carry premium throughout, are 'only' dollar-neutral and may contain moderate empirical beta exposures. The defensive style premia are beta-neutral through the whole sample (we buy larger amounts of low-risk investments than we sell high-risk investments. (The general lesson is that we need to be precise in understanding strategy designs. Just as corporate bond positions will have very different market exposures depending on whether they are duration-hedged with Treasuries, market exposures of style premia will depend on the degree of hedging.)



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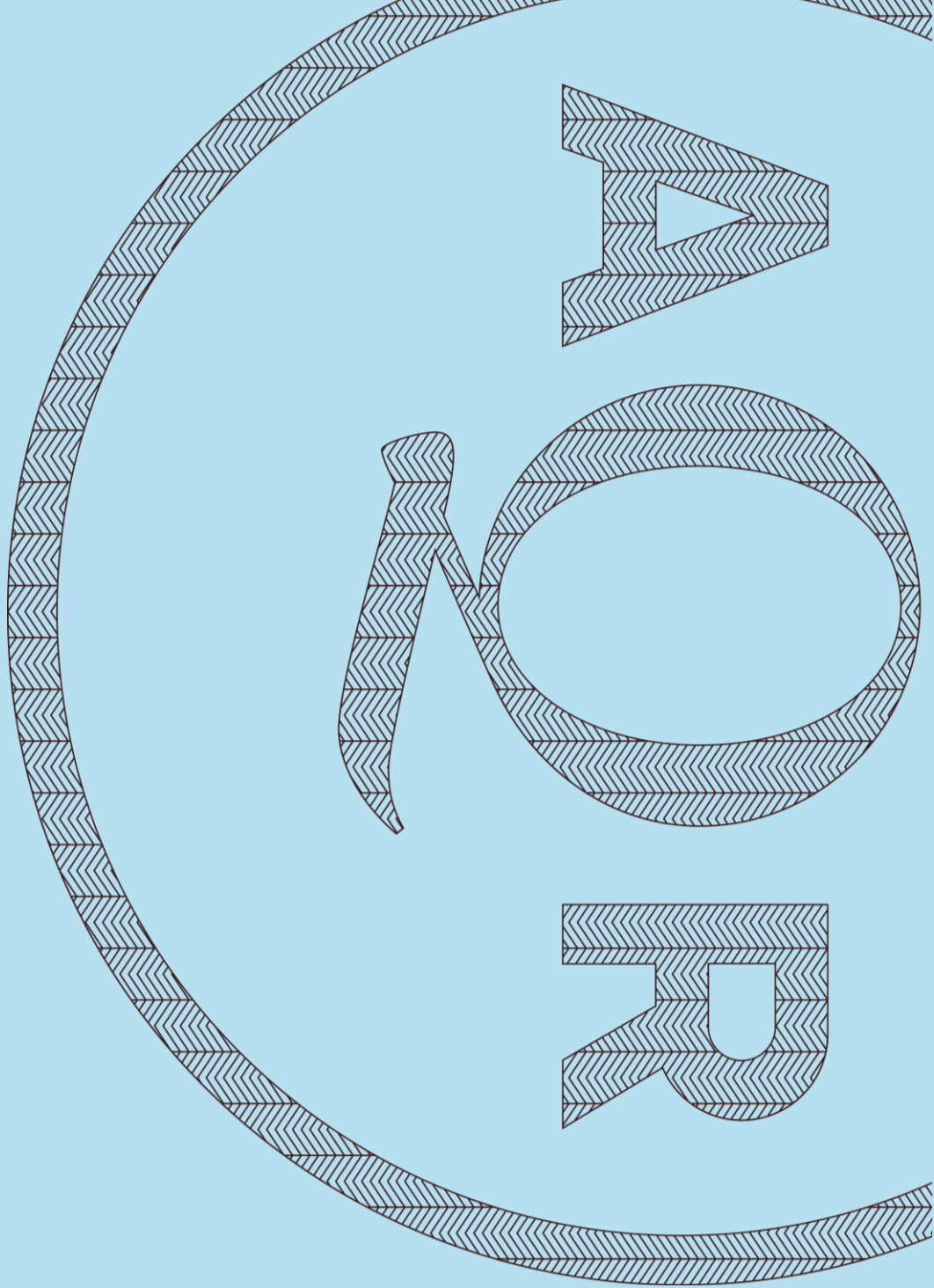
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