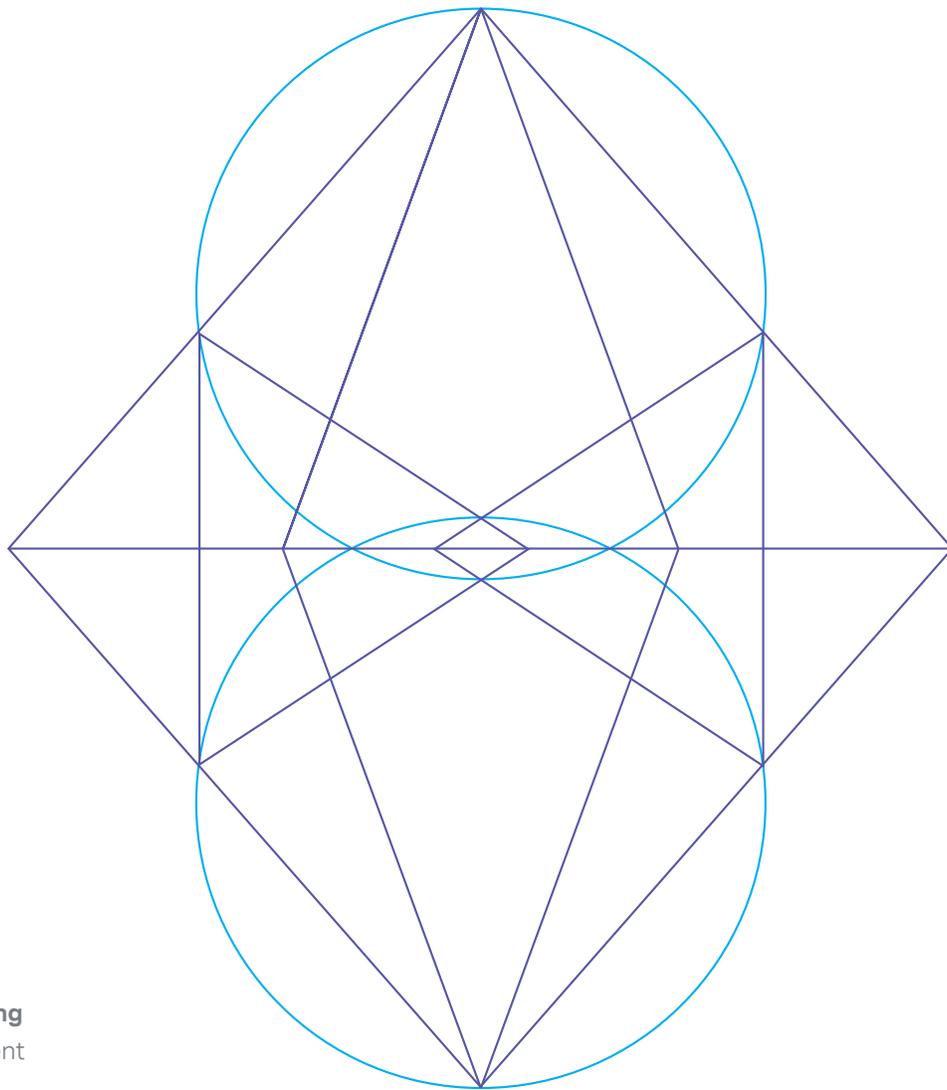




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Understanding Alternative Risk Premia



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Introduction

Most portfolios, including a traditional global 60% stocks/40% bonds allocation, are dominated by equity market risk. Though this has been beneficial in recent years, the global financial crisis highlighted the risk of over-relying on equity market return sources, as a 60/40 portfolio suffered a loss of almost -30% in 2008.¹ As such, we believe investors would be well-served to consider incorporating market-neutral alternative sources of return into their portfolios.

In this article, we extend our colleagues' article, "Understanding Style Premia" (Israel and Maloney, 2014), which describes an approach to constructing market-neutral portfolios based on a set of return sources we call **Alternative Risk Premia (ARP)** or "**Styles.**" ARP are disciplined, systematic methods of investing that have the ability to produce long-term positive returns across markets and asset groups.

We will be focusing on intuitive, well-researched ARP such as Value, Momentum, Carry, Defensive, Trend-following and Volatility and show how each of these ARP, individually, has demonstrated strong historical performance. We then demonstrate how combining the various ARP across multiple asset groups into a single, multi-style portfolio may further enhance risk-adjusted returns. Additionally, because such an ARP portfolio has generally low-to-no correlation to a traditional 60/40 or hedge fund portfolio, it has the potential to improve risk-adjusted returns when combined with either. Thus, we believe investors can benefit from using a well-diversified multi-style ARP strategy as a core alternative solution.

1 Source: AQR. The returns for a 60% MSCI World / 40% Barclays Global Aggregate (Hedged) were -27% for the full year 2008.

What are Alternative Risk Premia?

In order to define ARP, we should first discuss traditional risk premia. Traditional risk premia are returns that can be harvested passively from directional long exposures in asset classes such as stocks, bonds, commodities and so forth. By contrast, ARP are dynamic and systematic sources of return that behave differently from those in traditional markets. ARP tend to be best harvested by going long securities with attractive characteristics *and* shorting securities that score poorly — providing investors with not only relative value but also tactical directional exposures (i.e. through trend-following, which we will describe in greater detail later).

Each of the six classic ARP described below has demonstrated, through extensive academic and practitioner research, the ability to offer attractive risk-adjusted returns across multiple, unrelated asset groups, and across various geographies.² Below, we describe each ARP and the fundamental basis for their existence:

Value, one of the best-known ARP, refers to the tendency for relatively cheap assets to outperform relatively expensive ones.³ These securities can outperform as some investors either overlook cheap securities in favor of growth/glamor securities or are averse to bearing the greater risk associated with distressed assets. Examples of value measures include book-to-price of stocks or real yield of government bonds.

Momentum is the tendency for investments that have recently performed well (or poorly) relative to other investments to continue performing well (or poorly) over the near term. It may be explained by investors' initial under-reaction to news, subsequent overreaction, and behavioral biases like the disposition effect (i.e. investors' tendency to prematurely sell winners and hold on to losers for too long). These biases extend price continuation, or trends, rather than prices "jumping" to fair value immediately. An example of a momentum measure is the trailing one-year price return of an asset relative to the market.

Carry is the tendency for higher-yielding assets to provide higher returns than lower-yielding assets. Carry is usually applied to currency and fixed income markets, and may arise in the presence of capital supply/demand imbalances or central bank actions. An example of a carry measure for currencies is the nominal interest rate.

Defensive is the tendency for lower-risk and higher-quality assets to generate higher risk-adjusted returns.⁴ Its existence may be due to leverage aversion among investors which could lead them to seek out (and pay a premium for) riskier assets with the seeming potential to earn higher returns; that is, more "bang for the buck." An example of a defensive measure is an asset's beta to its underlying market.

2 For a more in-depth study of multi-ARP investing, see Asness, Moskowitz, and Pedersen (2012) and Asness, Iilmanen, Israel, and Moskowitz (2015). For reading on individual ARP, see Fama and French (1992), Jegadeesh and Titman (1993), Asness (1994), Asness, Frazzini, and Pedersen (2013), Frazzini and Pedersen (2013), Kojien, Moskowitz, Pedersen, and Vrugt (2016), Moskowitz, Ooi, and Pedersen (2012), and Fallon, Park, and Yu (2015).

3 The value premium was one of the first ARP ever discovered. Eugene Fama and Kenneth French demonstrated in 1992 that the cross-section of U.S. stock returns can be explained by not only the market risk premium, but also by value and size.

4 Defensive is also commonly known as minimum volatility, low volatility or quality.

Trend-following, also known as time-series momentum, relates to the tendency for an asset's recent price trend, positive or negative, to continue in the near future. At first it might seem like this definition overlaps with Momentum (see above). However, there is a subtle but important difference. Trend-following considers only the recent "absolute" performance of the asset, i.e., it buys whatever is trending positive and sells/shorts whatever is trending negative. Momentum, meanwhile, considers only the "relative" performance, i.e., it buys the relative out-performers and sells/shorts the relative under-performers. One implication is that trend-following strategies can be net long (or short) any asset class over the short term, giving investors

tactical market exposures while momentum strategies are market neutral by design.

Volatility risk premia arise because financial instruments that allow investors to protect against downside or hedge extreme market events, primarily options, tend to trade at a premium — as with all insurance. The insurance risk premium embedded in options reflects investors' risk aversion and their tendency to overestimate the probability of significant losses. The strategy exploits these risk preferences and behavioral biases by systematically selling options to underwrite financial insurance for profit.

Exhibit 1: Summary of Alternative Risk Premia

ARP	Definition	Intuition: Who's on the Other Side?
Value	Cheap minus expensive	Cheap securities are "beaten-up," distressed, or otherwise less favored by some investors
Momentum	Relative outperformers minus underperformers	Initial underreaction (anchoring) and subsequent overreaction (herding) may lead to price move continuation
Carry	High yielders minus low yielders	High (or low) yields may indicate excess demand for (or supply of) capital
Defensive	Safe/high quality minus risky/low quality	Leverage-averse or constrained investors seek high-beta assets for more "bang for the buck"
Trend	Long (short) absolute positive (negative) performers	Initial underreaction (anchoring) and subsequent overreaction (herding) may lead to price move continuation
Volatility	Selling financial insurance	Investors overpay or are averse to tail losses

Source: AQR

Empirical Evidence for Alternative Risk Premia

ARP can sometimes be applied as style tilts on top of a traditional long-only portfolio. However, we focus on the long/short or market-neutral implementation of ARP across multiple asset classes.⁵ While Alternative Risk Premia exist broadly, each risk premium does not necessarily apply to every asset group. Some asset groups may not have the liquidity required (e.g. volatility selling in individual stocks, which is limited by the thin market for single-stock options), or ARP may be overlapping within an asset group (e.g. Carry and Value in stocks and equity indices).

In Exhibit 2, we document the historical evidence of six Alternative Risk Premia applied to four liquid asset groups. The evidence covers a period spanning more than 25 years starting in 1990. In some cases, this is a period that is fully out-of-sample relative to their original academic studies. As can be seen, all asset group ARP components generate positive Sharpe ratios over the sample period, ranging from around 0.3 to 1.2.⁶ The key point here is that ARP appear to be pervasive across styles and asset groups.

Exhibit 2: Evidence across Asset Groups and Alternative Risk Premia

Jan 1990 - Dec 2016

Sharpe Ratios	Value	Momentum	Carry	Defensive	Trend	Volatility
Stocks & Industries	1.02	1.05		1.68		
Equity Indices	0.37	0.30		0.39	0.74	1.06
Fixed Income	0.29	0.03	0.52	0.73	0.94	1.22
Currencies	0.35	0.67	0.63		0.78	

Source: AQR. The above analysis reflects a backtest of theoretical long/short alternative premia components based on AQR definitions across identified asset groups, and is for illustrative purposes only and not based on an actual portfolio AQR manages. The results shown do not include advisory fees or transaction costs; if such fees and expenses were deducted the Sharpe ratios would be lower; returns are excess of cash. All series start in 1990, with the following exceptions: Fixed Income Value, Momentum, Carry, and Defensive start in Jan 1991, Equity Indices Volatility starts in Jun 1996. Please read performance disclosures in the Appendix for a description of the investment universe. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

5 For a more in-depth discussion on the various ways to access ARP, from long-only to long/short implementations, see Asness and Liew (2014).

6 These risk-adjusted returns are optimistic relative to returns in practice, as they do not embed any implementation costs. More on this when we discuss the "Adjusted Composite" in the next section.

Building a Diversified and Integrated ARP Portfolio

Knowing that all of these individual risk premia may offer positive risk-adjusted returns is encouraging. Equally important is that they generally do so in a manner with low correlations to one another. For a strategy that combines multiple risk premia, having low (and especially negative) correlation among the underlying components may create even more robust returns when putting them all together. Stated differently, each of these ARP can individually go through difficult periods, but the difficult periods don't tend to occur at the same time. Ultimately, combining lowly-correlated strategies may therefore lead to more consistent returns. In Exhibit 3, the top table shows the correlations among the six Alternative Risk Premia. Most ARP exhibit close to zero correlation with others, though there are some deviations: Momentum and Trend exhibit positive but low correlation at +0.3, while Value and Momentum are highly diversifying with correlations of -0.6. The impact of combining the various risk premia into one composite is shown in the bottom graph. The Raw Composite, a weighted-combination of the six ARP, as might be expected from combining lowly correlated ARP, achieves a higher return at the same level of risk (volatility) as the individual risk premia.

It is worth noting that the Raw Composite benefits from two layers of diversification: diversification across ARP (shown above), and diversification across multiple asset groups. For example, the Value strategy above buys cheap and sells expensive

assets across four asset groups: stocks, equity indices, fixed income, and currencies. It turns out that, much like the case for the correlations across styles shown in Exhibit 3, the correlations between styles implemented across assets are similarly low.⁷ In other words, a Value strategy in individual stocks has low correlation to a Value strategy implemented in Equity Indices, or a Carry strategy in currencies is lowly correlated to a Carry strategy in bonds.

The performance of the ARP Raw Composite, based off a simple simulation, is of course unrealistic, as it doesn't take into account real-world transaction costs or advisory fees, nor is it discounted for historical implementation concerns (could we really short stocks in 1990 at low cost?) and the possibility of some data mining, as much as we try to avoid it. To determine a more realistic composite performance, we apply a heavy discount to historical returns to account for these concerns.⁸ The result is an Adjusted Composite that achieves a more modest profile of 6.4% annualized excess return and 7.8% annualized volatility (or 0.8 Sharpe ratio). As a reference, the Sharpe ratios of stocks and bonds during the same period were 0.3 and 0.5, respectively (using MSCI World and Barclays Global Aggregate market indices). Our estimate is intended to provide a more realistic, albeit imprecise, guidance for future expectations — and investors would be well-served to accept it with some level of skepticism.

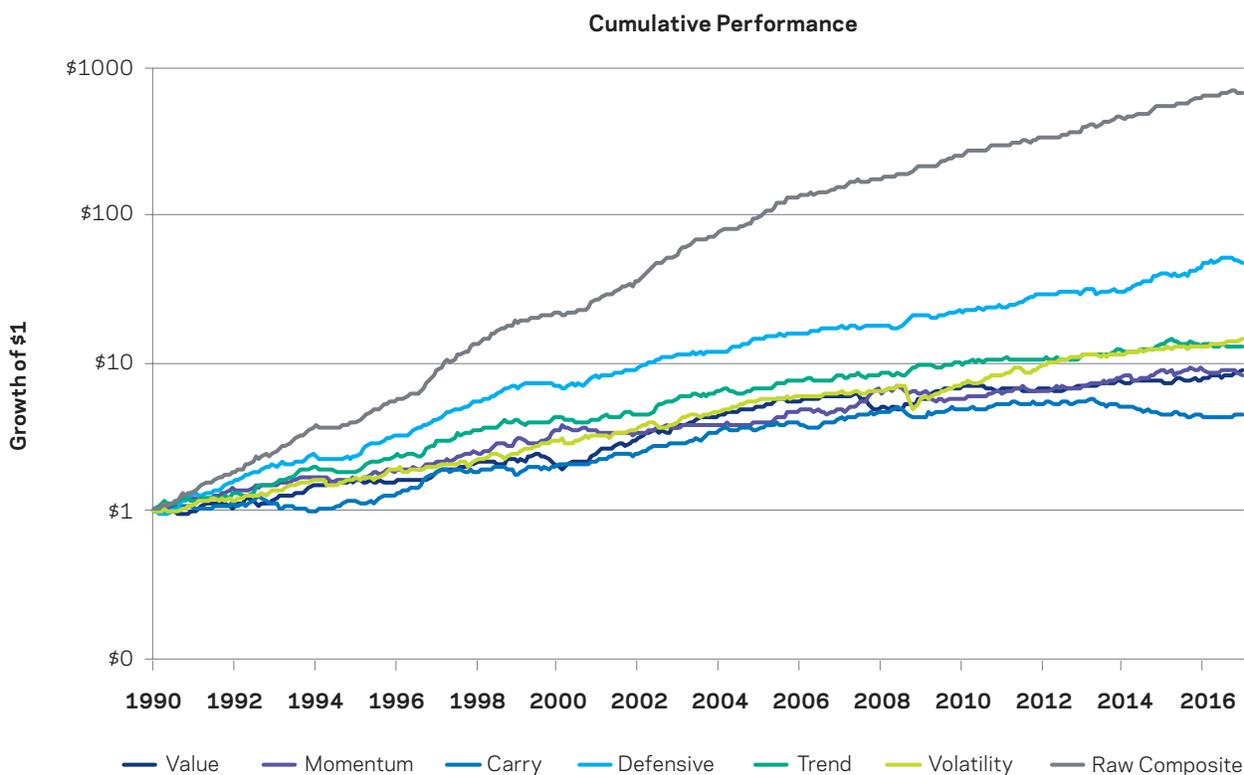
⁷ The average pairwise correlation between multi-style asset groups components is roughly 0.1.

⁸ The Adjusted Composite is constructed by subtracting a specified return from the Raw Composite each month to account for transaction costs, implementation issues and possibility of data mining. We assumed the discount to be 75% of the average monthly return for the following periods: 1990-1999, 2000-2009 and 2010-2017. As the average monthly returns are higher in earlier periods, this mechanism has the effect of discounting earlier years more to reflect greater concerns around stated issues.

Exhibit 3: Diversification across Alternative Risk Premia

Jan 1990 - Dec 2016

Correlations	Value	Momentum	Carry	Defensive	Trend	Volatility
Value						
Momentum	-0.6					
Carry	-0.1	0.1				
Defensive	0.0	0.1	-0.1			
Trend	-0.1	0.3	0.1	0.2		
Volatility	0.1	0.0	0.1	-0.1	-0.1	



Source: AQR. The above analysis reflects a backtest of theoretical long/short alternative premia components based on AQR definitions across identified asset groups, and is for illustrative purposes only and not based on an actual portfolio AQR manages. Each raw series is formed by combining the ARP applied to asset groups using the following risk (volatility) weighting: 30% stocks, 23% equity indices, 23% fixed income, and 24% currencies.⁹ When an asset group is missing, the rest are scaled up pro-rata; each of the six raw series is then scaled to 8% volatility. The Raw Composite is formed by combining roughly 32% Value, 28% Momentum, 10% Carry, 15% Defensive, 12% Trend, 3% Volatility components, in relative risk (volatility) space, then scaling the composite itself to 8% volatility. The results shown do not include advisory fees or transaction costs; if such fees and expenses were deducted the Sharpe ratios would be lower; returns are excess of the 3-Month T-Bill. Please read performance disclosures in the Appendix for a description of the investment universe. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

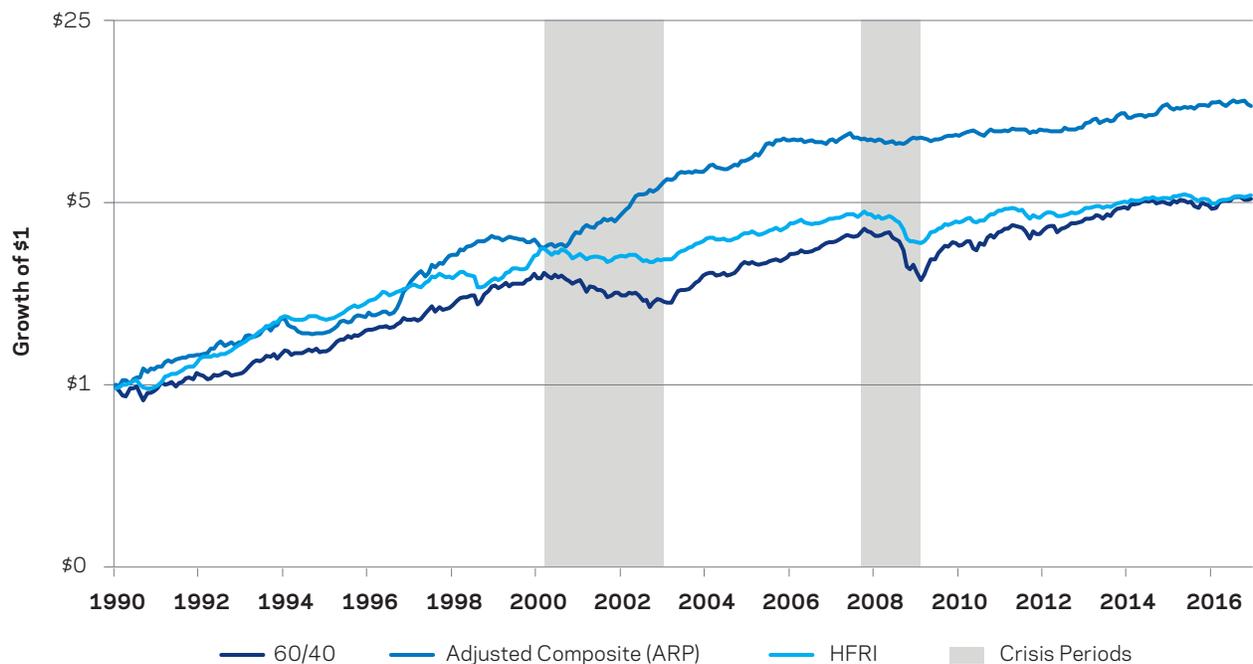
9 These asset group relative weights were chosen to take into account considerations like volatility, breadth, and liquidity.

ARP Composite as a Portfolio Diversifier

We think a diversified ARP strategy that captures multiple risk premia across liquid asset classes can function as a core alternative solution and provide important diversification benefits to investors’ portfolios. Not only is the portfolio diversifying within itself, as discussed above, but it is also diversifying to sources of return commonly found in an investor’s portfolio. The key is that ARP’s building blocks are strategies that go long and short markets, i.e. they are built to be market-neutral.

To illustrate this point, Exhibit 4 compares the cumulative returns of the Adjusted Composite (discussed above), to a traditional 60/40 stock/bond portfolio and a broad hedge fund index (HFRI Asset Weighted Composite Index, or “HFRI”). We also highlight, in gray, two difficult performance periods for traditional markets, the bursting of the Technology Bubble (Mar 2000 - Oct 2002) and the Global Financial Crisis (Jul 2007 - Mar 2009). Notice that during these periods, the Adjusted

Exhibit 4: Cumulative Returns of the Adjusted Composite and Indices



Source: AQR; The 60/40 is represented by 60% allocation to MSCI World and 40% to Barclays Global Aggregate. The hedge fund portfolio is represented by the HFRI Asset Weighted Composite. The above analysis reflects a backtest of theoretical long/short alternative premia components based on AQR definitions across identified asset groups, and is for illustrative purposes only and not based on an actual portfolio AQR manages. The results shown start with returns that do not include advisory fees or transaction costs, but are subject to a heavy discount as noted under footnote 8. The Crisis Periods are the bursting of the technology bubble from Mar 2000 - Oct 2002 and the global financial crisis from Jul 2007 - Mar 2009. Returns here are gross of the 3-Month T-Bill. Please read performance disclosures in the Appendix for a description of the investment universe. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

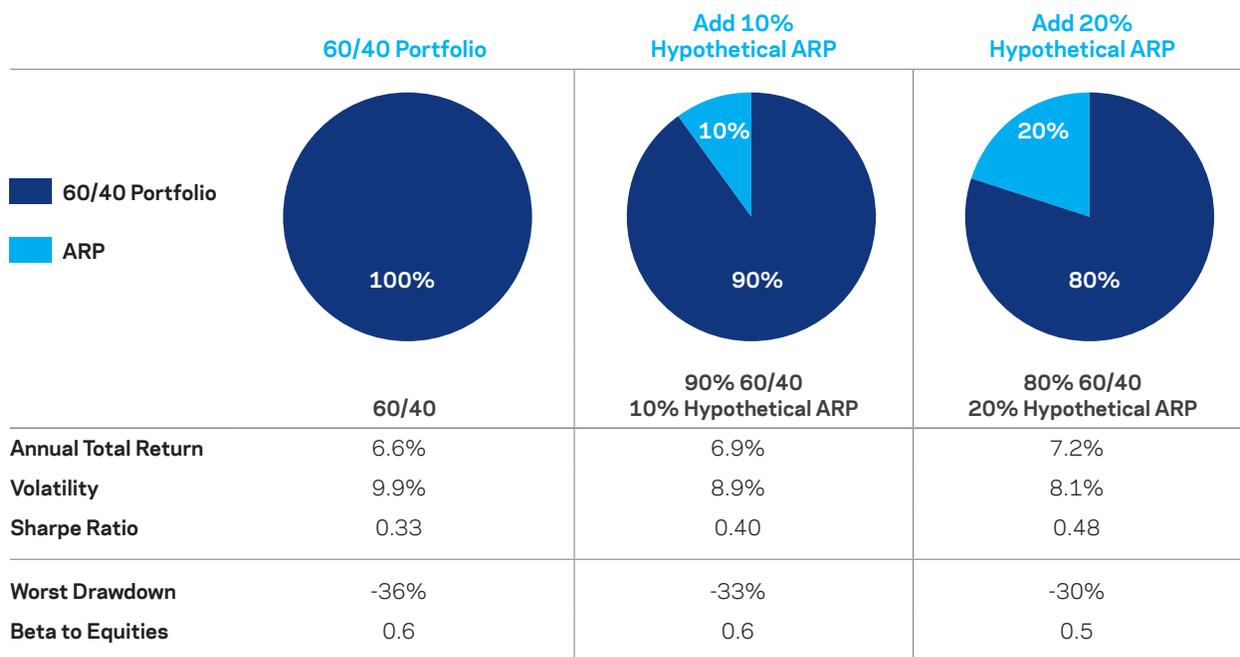
Composite provided valuable diversification to the 60/40 portfolio, unlike the HFRI.¹⁰ As can be seen from the graph, ARP suffered most *during* the rise of the Technology Bubble, prior to the burst, when expensive, higher risk and lower quality stocks outperformed their peers, resulting in poor performance in both the Value and Defensive ARP. The important takeaway is that the Adjusted Composite is lowly correlated to both the 60/40 and HFRI across market environments, suggesting

it may be complementary to both traditional and alternative portfolios.

In Exhibit 5, we show what re-allocating 10% and 20% of a 60/40 portfolio to the Adjusted Composite achieves. The resulting portfolios have higher returns, lower risk, and therefore higher risk-adjusted performance (the power of diversification!). Importantly, the combination portfolios also experience less severe drawdowns.

Exhibit 5: Hypothetical Impact of Adding an ARP Portfolio (Adjusted Composite) to a Global 60/40 Allocation

Jan 1990 - Dec 2016



Source: AQR. The 60/40 is represented by 60% allocation to MSCI World and 40% to Barclays Global Aggregate. Above analysis reflects a backtest of theoretical long/short alternative premia components based on AQR definitions across identified asset groups, and is for illustrative purposes only and not based on an actual portfolio AQR manages. The results shown do not include advisory fees or transaction costs. Returns here are gross of the 3-Month T-Bill, but the Sharpe ratio is computed excess of this. Please read performance disclosures in the Appendix for a description of the investment universe. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

10 Hedge fund indices often exhibit sensitivity, or positive correlation, to equity markets. For an in-depth discussion, see Asness, Krail, and Liew (2001). It's also worth noting that the Adjusted Composite is not guaranteed to outperform during bad times for market portfolios. While we expect the composite and markets to be uncorrelated in the long-term, ARP can exhibit positive, zero, or negative correlations to markets in the short-term.

Conclusion

Although equity and bond returns are often viewed as among the most reliable sources of long-run returns, many investors perhaps over-rely on them. In addition to a simple 60/40 stock/bond portfolio, we believe that investors can benefit from diversifying to other reliable sources of return.

Alternative Risk Premia (ARP) refer to systematic sources of return that are diversifying to traditional markets. In this paper, we combine six well-known styles — Value, Momentum, Carry, Defensive, Trend and Volatility — to create a portfolio that has the potential to deliver attractive risk-adjusted return.

We illustrate that harvesting multiple alternative risk premia across multiple liquid asset groups has the potential to deliver even better risk-adjusted

returns than a single ARP applied to a single asset group. This is because we expect correlations across risk premia and asset groups to remain low, resulting in strong diversification benefits when combined in a single portfolio.

Finally, we demonstrated that a comprehensive, “pure” long/short ARP strategy has diversifying properties that may make it a valuable addition to an investor’s portfolio. It generally has low-to-no correlation to a traditional 60/40 or hedge fund portfolio and, when added to either, may improve risk-adjusted returns.

With the many benefits that an ARP strategy can bring, we believe it can function as a core alternative solution in investors’ portfolios.

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Appendix

Investment universe of each of the asset groups used to create hypothetical results in Exhibits 2 through 5.

Stocks & Industries	Currencies	Country Equities	Fixed Income
<p>Approximately 2,000 stocks across 60 industries in the following countries:</p> <ul style="list-style-type: none"> Belgium Denmark Finland France Germany Italy Japan Netherlands Norway Portugal Spain Sweden Switzerland United Kingdom United States 	<p>Developed Countries:</p> <ul style="list-style-type: none"> Australia Canada Euro Japan New Zealand Norway Sweden United Kingdom United States 	<p>Developed Country Indices:</p> <ul style="list-style-type: none"> Australia (ASX SPI 200) Canada (S&P/TSX 60) Europe (EuroStoxx 50) France (CAC 40) Hong Kong (Hang Seng) Germany (DAX) Italy (FTSE-MIB) Japan (TOPIX, Nikkei) MSCI EAFE Netherlands (AEX) Spain (IBEX 35) Sweden (OMX30) Switzerland (SMI) United Kingdom (FTSE 100) United States (S&P 500, S&P 400, NASDAQ 100, Russell 2000, DJIA) <p>Country Index Options:</p> <ul style="list-style-type: none"> S&P 500 Euro Stoxx 50 FTSE 100 Nikkei 	<p>Government Bond Futures:</p> <ul style="list-style-type: none"> 3-Yr Australia 10-Yr Australia 2-Yr Germany 5-Yr Germany 10-Yr Germany 30-Yr Germany 10-Yr U.K. 10-Yr Canada 10-Yr Japan 10-Yr Italy 2-Yr U.S. 5-Yr U.S. 10-Yr U.S. 20-Yr U.S. Ultra Long Bond U.S. 10-Yr France <p>Government Bond Options:</p> <ul style="list-style-type: none"> 10-Yr U.S.

Source: AQR.

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