



Portfolio Protection? It's a Long (Term) Story...

Executive Summary

Recent headlines focus on option-buying strategies and their extraordinary performance in March, usually leaving out their generally high long-term cost. The tail insurance strategies with the largest wins in crash months are likely ones that in good times lose all or most capital allocated to them, perhaps many times over.

Investors have a natural urge to protect their portfolios from sudden crashes like the one we've seen recently. We argue that they should instead focus on bad outcomes that unfold over longer periods, as those tend to be more detrimental to the long-term goal of wealth accumulation.

We show that options-based hedging can be effective over shorter periods but tends to weaken over time. In contrast, risk-mitigating and diversifying strategies such as defensive equities, risk parity, alternative risk premia, and trend-following have more consistently added value over the horizons that matter most—as well as on average. This latter point suggests a crucial advantage for these strategies: that unlike options-based hedging, it's never “too late” to consider diversifying into them.

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About the Portfolio Solutions Group

The Portfolio Solutions Group (PSG) provides thought leadership to the broader investment community and custom analyses to help AQR clients achieve better portfolio outcomes.

We thank Nick McQuinn, Ashwin Thapar and Dan Villalon for their work on this paper. We also thank Gregor Andrade, Cliff Asness, Matt Chilewich, Jeff Dunn, Jeremy Getson, Antti Ilmanen, Pete Hecht, Kelvin Lee, Thom Maloney, Toby Moskowitz, and Harsha Tummala for their helpful comments, and Rachel Lee, Sarah Schroeder, Nitin Krishna, and Derek Jansma for their excellent research assistance.

Why the Length of a Drawdown Matters

Take a highly simplified example: Suppose you manage a portfolio with an investment horizon of 10 years. This imaginary portfolio has a perfectly steady 6% annual return. But, there's a catch: at some point in those 10 years, the portfolio stops making money and instead suffers a 20% loss. The silver lining, though, is that you get to choose how long that loss lasts: either A) over one month or B) over one year. For simplicity, assume that before and after the loss period, the portfolio goes right back to making 6% per year. Which do you choose?

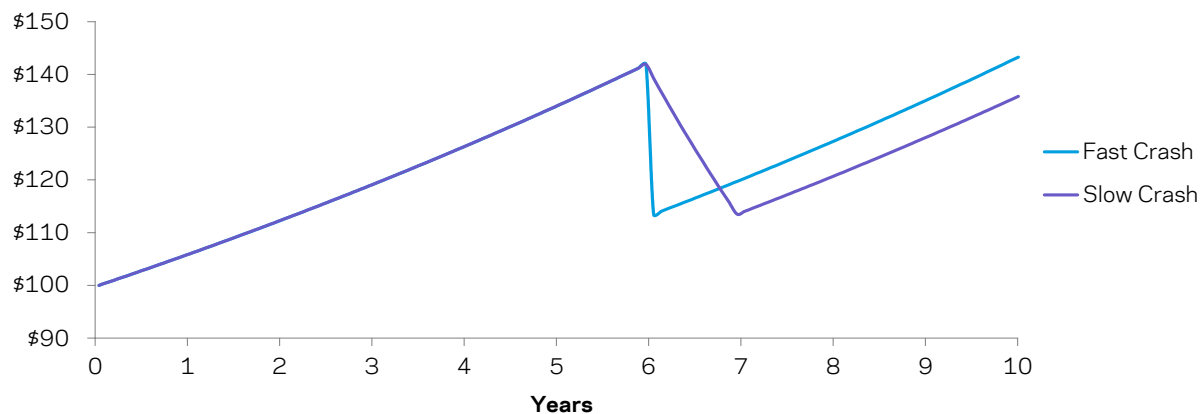
Most investors can't stomach the prospect of losing 20% in a single month. Admittedly, there are some valid reasons for that—governance issues, ability to stay invested, liquidity needs, and so on—but there is also a purely psychological element at play:

spreading the 20% loss out (e.g., losing 1.7% per month) over the course of a year may not even register as extreme and thus may be the more comfortable path for many investors.

However, in this article we argue that the faster, sharper drawdown of Option A may actually be the better choice for investors focused on long-term wealth accumulation.¹ Even though both choices suffer the same 20% economic loss in this simple example, **Exhibit 1** illustrates the key difference: the “slow loss” took away an entire year's worth of what was otherwise 6% annual returns, whereas the “fast crash” took out only a month's worth.² In other words, prolonged drawdowns may be worse due to the opportunity cost of not making money for a longer time.

Exhibit 1: Even for the Same Magnitude Loss, Slower Losses May Be Worse

Two Hypothetical 20% Losses



Source: AQR. Both series have 6% annual return, except for the “Fast Crash” which loses 20% in one month and the “Slow Loss” which loses 20% over one year (at all other points, the series each realize 6% annual returns). Both losses start at the beginning of Year 6 (though could start at the beginning of any year shown). For illustrative purposes only. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

- 1 Again, let's restate our assumptions: 6% annual returns except for the period where the portfolio is losing 20%, investors care most about cumulative wealth over the investment horizon of 10 years, and investors can survive the short-term crash. A different set of assumptions could produce different results (e.g., for many long/short or leveraged strategies, we believe short-term volatility very much needs to be actively addressed).
- 2 This example is highly simplified to make a point between two speeds of “bad outcomes.” The speed of recovery matters as well—for example, is it a “V” or “U”-shaped recovery? Our empirical analysis, which focuses on horizons up to 10 years, incorporates information about recovery magnitude and speeds. We may address recoveries more directly in a subsequent article.

Importantly, the conclusion of this stylized example holds with actual data. When it comes to drawdowns, depth isn't the only thing that investors should worry about. In general, the *longer* the bad outcome, the worse off the investor is. This result isn't just because longer lasting drawdowns tend to be deeper; it's also because longer periods of foregone positive returns tend to be more damaging to cumulative wealth.

A Real World Example: Tech Bust versus Global Financial Crisis

Take two 60/40 investors, each starting with \$100. One invests their \$100 at the start of September 2000, the other at the start of December 2007.³ Both are about to face major losses—the Tech Bust will cause losses of -22% over 24 months, the Global Financial Crisis (GFC) even more at -30%, but over a comparatively short 16 months.

One year in, both investors have lost money, but the one in the GFC has lost more. However, this changes by year 2. By this time, the GFC investor has already started to make money, while the Tech Bust investor grinds even lower. And this is the order that remains—the GFC investor better off than the Tech Bust investor—over the next year, two years, and so forth.

Even though the GFC eroded more wealth than the Tech Bust, it was over faster; and in this admittedly cherry-picked example, the GFC investor ended up better off in the years that

followed. Granted, this is merely one anecdote, but we observe a similar result in the data.

Turning to the Data

This paper focuses on the *length* of bad outcomes rather than the more typical perspective of *depth*. **Exhibit 2** illustrates why. In **Panel A**, we show what “bad outcomes” have actually looked like for traditional investors, plotting the worst cumulative returns and 5th percentile worst cumulative returns for a 60/40 stock/bond portfolio over various horizons.⁴

Not surprisingly, a bad month has been worse than a bad week, and a bad year has been worse than a bad quarter. But the pattern stops there; cumulative losses seem to flatten out for “Long-Term” bad outcomes, which we define here as ones that last more than a year (right-half of Panel A).⁵ In fact, a casual glance at this chart might lead someone to think that longer-term drawdowns aren't as damaging as those that last only a year—but that's where our earlier examples come into play.

Say you are a 60/40 investor with a 10-year horizon and a return objective of 5% over cash. What impact have “Short-Term” bad outcomes had on your ability to achieve that objective? Not much, as shown in **Panel B**, which shows the average 10-year return (the lines) starting *with* the “bad outcomes” from Panel A, and the percentage of times those returns exceeded 5% (the labels).

3 Start dates were chosen to correspond to the pre-drawdown peaks. The 60/40 portfolio is 60% market-cap weighted U.S. equities, 40% U.S. 10 Year Treasuries, as defined in Exhibit 2 and in the Appendix. Returns are gross of fees.

4 We use overlapping observations throughout this analysis to take full advantage of the data, though that does mean the longer-horizon bad outcomes become more overlapping (i.e., only a handful of events may dominate long-horizon “bad outcomes”). Throughout this paper, we use the longest time series available in each exhibit, except for when we make comparisons across multiple strategies, in which case we use common periods (regardless, the general conclusions hold if we instead had shown the “common period” throughout).

5 The intuition for the (somewhat) U-shape in Exhibit 2A is that while loss potential increases with horizon, it's tempered (and eventually overwhelmed) by positive long-term equity and bond premia, and in some cases multi-year mean reversion.

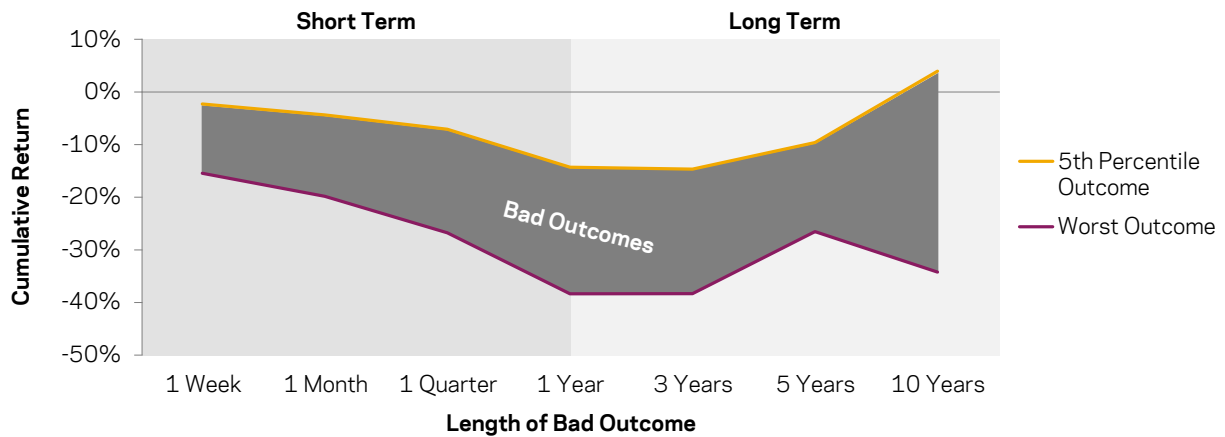
Shorter-term bad outcomes for 60/40—while painful—haven't had much impact on hitting 5% annual returns over the next 10 years, as there were still plenty of years left to realize

positive returns. The story changes for longer-term bad outcomes (right half of the exhibit). In other words, the *longer* the “bad outcome,” the worse off the investor is in achieving their goal.

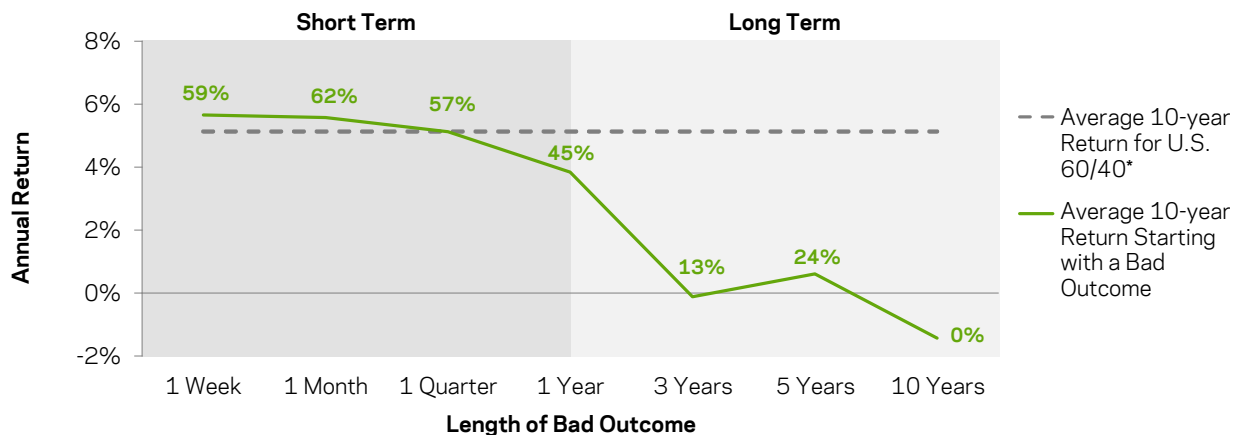
Exhibit 2: Excess-of-Cash Performance of U.S. 60/40 Portfolio

August 17, 1971 - March 31, 2020

Panel A: Absolute Worst through 5th Percentile Worst Outcomes Over Various Horizons



Panel B: 10-Year Average Returns Starting with a 0-5th Percentile Bad Outcome, (Labels are Percentage of Time the 10-Year Return Exceeds 5%)



*Note: The 60/40 portfolio over this period generated a cash+5% ten-year annual return 65% of the time.

Sources: AQR, Federal Reserve, Bloomberg. U.S. 60/40 refers to a 60%/40% combination of U.S. market-cap-weighted equities and U.S. 10 Year Treasuries. Panel A plots the worst returns (burgundy line) and 5th percentile (orange line) worst returns over each horizon. Panel B shows ten-year returns starting with (i.e., including) the initial drawdowns from Panel A (i.e. “what have ten-year returns been, starting with a bad outcome”). Mechanically, each of the points along the line becomes increasingly overlapping with the “bad outcome” events in Panel A, up to the 10-year horizon where the bad outcome is the entire evaluation period. This data is described in greater detail in the Appendix. Time period is based on availability of data. All returns are excess of cash and gross of fees. Cash here and throughout refers to U.S. Treasury bills. All underlying calculations use arithmetic returns. For illustrative purposes only.

The magnitudes of the results in Panel B are economically meaningful. Investors experiencing bad quarters have seen almost no detriment to reaching their longer-term return objectives, suggesting institutions that view themselves as long-horizon should not care much about fast, temporary drawdowns—even if the media often focuses on such episodes (e.g., October 1987). In contrast, Panel B shows that a bad 3-year period can mean no wealth accumulation for *ten years*.

Investors are right to look for ways to mitigate losses in their portfolios. That said, not all losses are equally important. History suggests it's the longer-term losses that matter more; and thus, the “best” solutions are ones that are effective over those longer-term horizons. In this article we study bad outcomes for 60/40 portfolios over short- and long-term horizons and distinguish which strategies are best at protecting “fast” and which are best at protecting “slow.”

Options-based hedging strategies tend to weaken over time

The most direct way to mitigate bad outcomes is via the options market, in which investors can specify a level of desired protection (e.g., 10% maximum loss) and a duration for that protection (e.g., one year).⁶ However, as with any form of insurance, such a service comes at a cost: the insurance premium. If financial markets do better than what's specified in the options contract, the option expires worthless and the paid premium registers as a negative return. If, on the other hand, markets do worse, then you're protected by the specified amount.

Empirically, put options have done a consistent job at protecting investors from short, sharp crashes—but their ability to add value diminishes over longer horizons (**Exhibit 3**).⁷ The format of this exhibit is repeated throughout the article, so it's worth

detailing here. The lines show the average cumulative outperformance of the portfolio in question (in this case, put options) compared to 60/40, during the various “bad outcomes,” which we define here as the absolute worst through 5th percentile worst return outcomes for 60/40. E.g., “on average, what was the cumulative return of this portfolio compared to 60/40, when 60/40 had a bad outcome.” The labels show the hit rate, or how often that outperformance was positive.

As shown in Exhibit 3, options consistently out-performed a 60/40 portfolio over bad outcomes lasting up to 3 years. This result is driven by both sides of the performance comparison: 1) equity options tend to realize positive returns during bad outcomes, and 2) we are comparing options' returns to 60/40 when 60/40 had very poor performance.

6 That said, the claim of 10% protection only holds when the return horizon exactly aligns with option maturity. Path dependency will come into play when this is not the case, as shown in [Israelov \(2017\)](#). To illustrate, consider an investor who purchases quarterly 10% OTM puts. If the market is down exactly 10% every quarter, then for the selected hedging strategy, the puts would offer no relief.

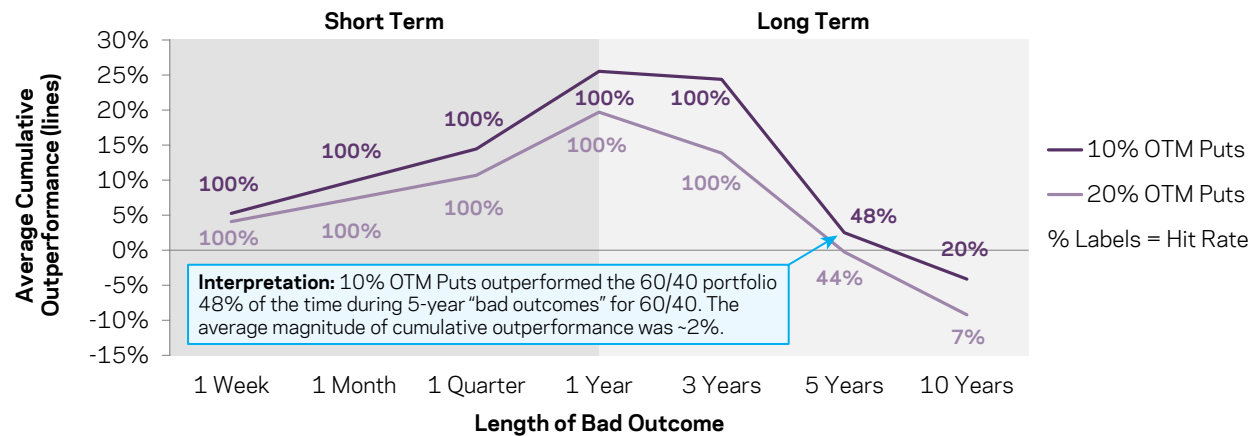
7 For simplicity, we're showing the results for quarterly options—one with a 10% out-of-the-money strike and the other with a 20% out-of-the-money strike. Results are directionally similar for different strikes and maturities. Additionally, the put-buying portfolios we analyze are unlevered (i.e., 100% notional exposure); but given the cash efficiency of puts, these portfolios could easily be levered 10+ times (as we believe they are in some extreme implementations) and would have lost most or all capital in many instances throughout the sample we study.

But as we look at “Long-Term” horizons, the value and consistency of options deteriorates, as the insurance premium (more specifically, the volatility risk premium) tends to eat away the returns. The negative ten-year result is particularly notable. Even over

their *worst* ten-year periods, 60/40 portfolios outperformed options. Options-based portfolios, typically pursued with the objective of providing support to a portfolio when most needed, have eaten away at portfolio returns over the horizons that matter most.⁸

Exhibit 3: Options-Based Protection Tends to Weaken Over Longer Horizons*

Outperformance of Hypothetical Options during Bad Outcomes for U.S. 60/40
January 5, 1996 - March 31, 2020



*Note: The unconditional hit rates for the two options over all 3 year periods are 15% for 10% OTM puts and 12% for 20% OTM puts.

Source: AQR, OptionMetrics, Federal Reserve, Bloomberg. U.S. 60/40 is described in Exhibit 2. Puts are a 10% or 20% OTM put option with quarterly expiry/rebalance. This chart shows the average cumulative outperformance of puts compared to 60/40 during the worst 5% outcomes for 60/40 over each horizon shown on the x-axis. This data is described in greater detail in the Appendix. Time period is based on availability of data. All returns are excess of cash and gross of fees. All underlying calculations use arithmetic returns. For illustrative purposes only. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

What Holds Up Over the Long Haul⁹

We’ve written in many places over the years that options markets offer an overpriced means of getting portfolio protection. Instead, we’ve argued for a range of risk-mitigating solutions that don’t sacrifice a portfolio’s expected return.¹⁰ Here, we examine the evidence for three types of these solutions, following the same framework used above for options:

1. Within the equity allocation: Defensive Equities
2. Addressing the asset allocation: Risk Parity
3. Using liquid alternatives: Alternative Risk Premia and Trend Following

⁸ For more on why options have not done as good a job as many investors have hoped, we refer readers to [Israelov \(2017\)](#), [Israelov and Tummala \(2017\)](#), [Israelov and Nielsen \(2015\)](#), [Israelov and Tummala \(2018\)](#), and [Robert Shiller’s Yale Stock Market Crash Confidence Index](#).

⁹ We focus here on broad strategies, using simple implementations of each. Various managers (AQR obviously included!) may implement these in such a way to enhance diversification and/or risk-mitigating characteristics.

¹⁰ Regular readers will know we’ve been fans of the potential risk-mitigating roles of these strategies for a decade, with papers including: [Berger, Nielsen and Villalon \(2011\)](#), [AQR Alternative Thinking 3Q2015](#), [AQR Alternative Thinking 3Q2018](#) and most recently, [Nielsen, Thapar and Villalon \(2019\)](#). Our criticisms of options-based hedging has also been a theme over the past decade, as covered in [Israelov \(2017\)](#), [Israelov, Nielsen and Villalon \(2017\)](#), [Israelov, Klein and Tummala \(2017\)](#), and [Israelov and Nielsen \(2015\)](#).

These three categories represent a spectrum of diversification to 60/40 and, correspondingly, how they should perform when 60/40 suffers. The first solution has the same allocation to equities, though with lower beta; the second diversifies across additional asset classes; and the third should be the least correlated due to portfolio construction that seeks to remove market exposure altogether. This range of diversification is relevant context for understanding their efficacy during bad outcomes for traditional portfolios.

1. Defensive Equities¹¹

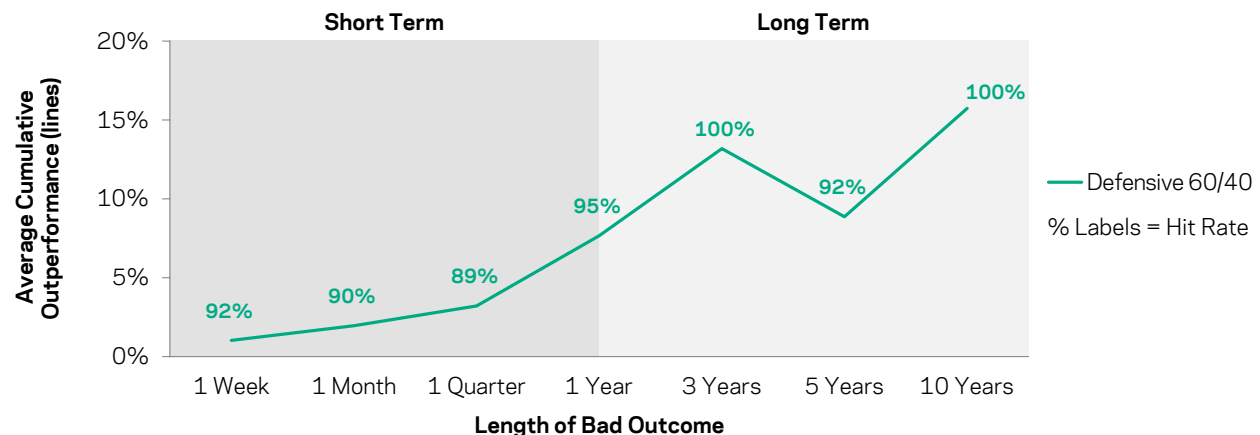
Defensive stocks have historically offered returns in line with broader equity markets but with less risk. This makes them a particularly

intuitive choice for investors looking to mitigate the worst outcomes for their equity allocation.

This intuition is supported quite well in the data. **Exhibit 4** shows the outperformance of a “Defensive 60/40” portfolio (i.e., where the equity component is entirely defensive stocks). Since most bad outcomes for 60/40 have been driven by bad outcomes for equities, a defensive allocation almost mechanically makes these times “less bad.”¹² Of course, it doesn’t always work that way—for example, in sharp crashes, if all stocks are sold indiscriminately, defensive stocks can face losses similar to the overall stock market. That said, looking at the long-term evidence, defensive investing has been very consistent at adding value over the horizons that matter.

Exhibit 4: Strong Defense

Outperformance of Hypothetical Defensive 60/40 during Bad Outcomes for U.S. 60/40
August 17, 1971 - March 31, 2020



Source: AQR, Federal Reserve, Bloomberg. U.S. 60/40 is described in Exhibit 2. Hypothetical Defensive U.S. 60/40 is identical to U.S. 60/40, except its equity portion is replaced with Hypothetical Defensive U.S. Equities. Hypothetical Defensive U.S. Equities is a long-only U.S. equity portfolio that overweights low-beta and high-quality stocks. This chart shows the average outperformance of the Hypothetical Defensive U.S. 60/40 portfolio compared to the regular 60/40 portfolio during the worst 5% outcomes for 60/40 over each horizon shown on the x-axis. The percentage labels show the “hit rate,” or the percentage of the time the Hypothetical Defensive U.S. 60/40 portfolio outperformed the 60/40 portfolio over this sample. This data is described in greater detail in the Appendix. Time period is based on availability of data. All returns are excess of cash and gross of fees. All underlying calculations use arithmetic returns. For illustrative purposes only. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

11 There are many ways to build a long-only defensive equity portfolio—some incorporate statistical information such as volatility and beta; others use fundamental data such as profitability, stability of earnings, low leverage, etc. In this paper, we use both types of signals (albeit simplified versions of them). Some long/short strategies, such as “betting-against-beta” (BAB) favor more defensive stocks but apply leverage on these to give both the long and short sides equal market risk (BAB is one component of the “Styles” strategy evaluated later). Such strategies are market-neutral rather than defensive, and thus shouldn’t necessarily be expected to outperform their long-term average returns in bad times.

12 Of course, the flip side is that while defensive stocks do keep up on average, particularly strong bull markets may be instances in which they lag the market due to having a lower beta.

2. Risk Parity¹³

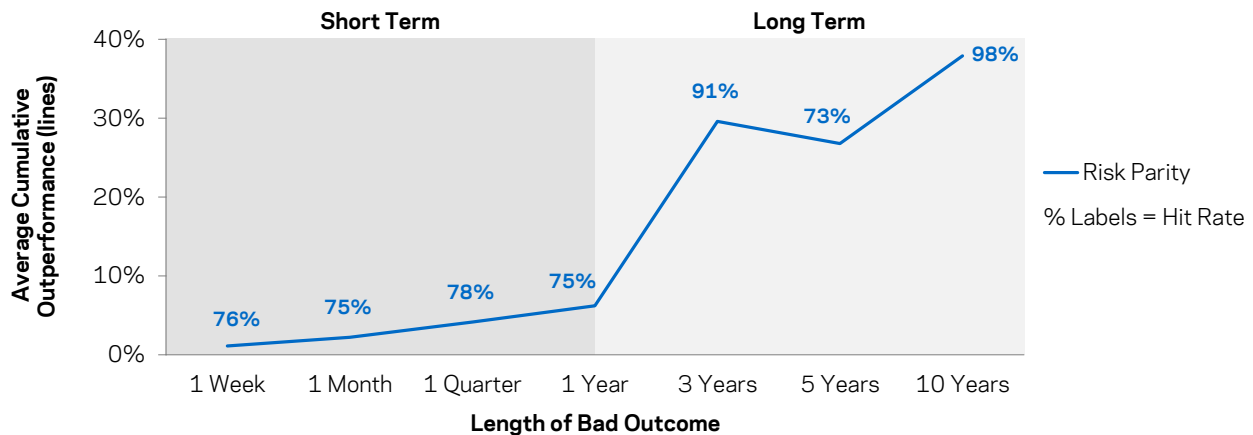
The two fundamental ways in which risk parity may address the worst outcomes for traditional investors are 1) by reducing a portfolio's exposure to equity risk and 2) by increasing the exposure to other sources of returns. These other sources of returns can run the gamut from commodities to currencies to emerging debt, but for this example we use a simple hypothetical

portfolio of only three asset classes: developed stocks and bonds and commodities.

Risk parity is not necessarily expected to make money in equity drawdowns—after all, equities are a component of the portfolio—but in bad outcomes for traditional investors, risk parity has tended to outperform due to its smaller equity allocation and better diversification (**Exhibit 5**).

Exhibit 5: Diversification When Most Needed

Outperformance of Hypothetical Risk Parity during Bad Outcomes for U.S. 60/40
August 17, 1971 - March 31, 2020



Source: AQR, Federal Reserve, Bloomberg. U.S. 60/40 is described in Exhibit 2. Hypothetical Risk Parity is a risk-balanced portfolio of global developed stocks, global developed government bonds, and commodity futures. Hypothetical Risk Parity is scaled to 10% annual volatility. This chart shows the average outperformance of Hypothetical Risk Parity compared to the 60/40 portfolio during the worst 5% outcomes for 60/40 over each horizon shown on the x-axis. The percentage labels show the "hit rate," or the percentage of the time Hypothetical Risk Parity outperformed the 60/40 portfolio over this sample. This data is described in greater detail in the Appendix. Time period is based on availability of data. All returns are excess of cash and gross of fees. All underlying calculations use arithmetic returns. For illustrative purposes only. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

3. Alternatives: Alternative Risk Premia and Trend Following

Alternatives—especially those that are managed to have little sensitivity to stock and bond markets—can be especially valuable during bad outcomes for traditional assets. In **Exhibit 6** we test two widely-known alternative strategies:

- **Styles (blue line):** this hypothetical portfolio focuses on four long/short alternative risk premia (value, momentum, carry, and defensive) and is applied across multiple liquid asset classes.
- **Trend (green line):** this hypothetical portfolio goes long or short different asset classes based on whether their trailing performance was positive or negative, respectively.¹⁴

¹³ Our example here seeks a strategic risk exposure to three asset classes. Other, more "risk-mitigation"-oriented implementations may incorporate dynamic signals to tactically reduce exposures when risks are perceived to be high.

¹⁴ For simplicity, this hypothetical strategy follows only price trends in major, liquid markets. Other versions of trend-following that exhibit similar performance characteristics include ones that incorporate fundamental/macro signals (see [Brooks \[2017\]](#)) and ones that follow trends in alternative markets (see [Babu, et al \[2019\]](#)).

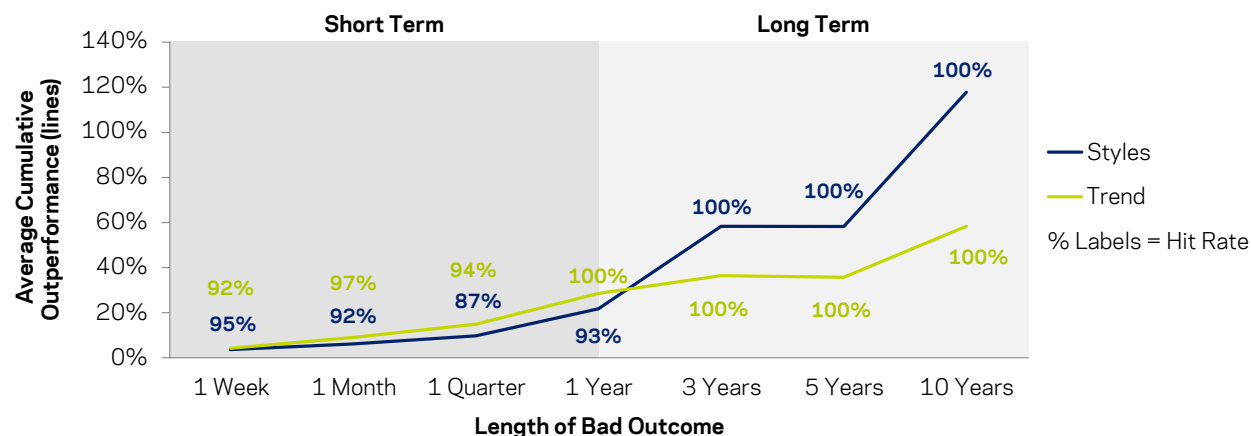
The magnitudes of outperformance in Exhibit 6 are remarkable compared to those in the previous exhibits but can be explained simply. Because these alternative portfolios have (on average) no exposure to stock and bond markets, their performance during market drawdowns tends to resemble their long-term average performance. This means their *relative* performance will largely be driven by the 60/40 side of the ledger: the more severe the drawdown for 60/40, the stronger we'd expect the relative performance of the alternative portfolios.

An interesting exercise is to compare the performance of Trend and Styles in bad outcomes of different lengths. In the left half of Exhibit 6, we see that Trend tends to have

the upper hand up to a year, while Styles win out when bad outcomes persist for very long time. Earlier research has shown that Trend can go “beyond” diversification in certain market downturns; it can act as a *hedge* due to the ability to short markets as they are going down.^{15, 16}

When it comes to Styles, we expect that the diversification of the underlying portfolios should help achieve higher average returns over the long term (as reflected in the 10-year horizon in Exhibit 6¹⁷); but note that short, dramatic sell-offs and the accompanying deleveraging that may accompany them may pose a short-term risk to any long/short portfolio (see our COVID-19 Pandemic Case Study on page 13).

Exhibit 6: Alternatives Can Be Remarkably Resilient When Traditional Portfolios Suffer
 Outperformance of Hypothetical Styles and Trend during Bad Outcomes for U.S. 60/40
 January 2, 1985 - March 31, 2020



Source: AQR, Federal Reserve, Bloomberg. U.S. 60/40 is described in Exhibit 2. Hypothetical Styles represents a diversified, market neutral portfolio which invests in four alternative risk premia themes (value, momentum, carry, and defensive) across four major asset groups (equity indices, stocks and industries, global government bonds, and commodities). Hypothetical Trend is a trend-following portfolio that uses 1m, 3m, and 12m price momentum signals to invest across equity indices, government bond futures, commodity futures, and currency forwards. Hypothetical Styles and Trend are each scaled to 10% annual volatility. Hypothetical Styles is discounted to realize a 0.8 Sharpe ratio and Hypothetical Trend is discounted to realize a 0.6 Sharpe ratio. This chart shows the average outperformance of Hypothetical Styles and Trend compared to the 60/40 portfolio during the worst 5% outcomes for 60/40 over each horizon shown on the x-axis. The percentage labels show the “hit rate,” or the percentage of the time Hypothetical Styles and Trend outperformed the 60/40 portfolio over this sample. This data is described in greater detail in the Appendix. Time period is based on availability of data. All returns are excess of cash and gross of fees. All underlying calculations use arithmetic returns. For illustrative purposes only. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

15 For example, [Hurst, Ooi and Pedersen \(2017\)](#) document outperformance in eight of the ten historically largest drawdowns for 60/40, as most of these drawdowns were “slow enough” that trend following was positioned to benefit from the risk-off environment.
 16 Beyond liquid asset classes, trend-following has also offered especially consistent tail protection from drawdowns in *illiquid* asset classes, such as private equity. See [AQR Alternative Thinking 3Q2015](#), and [Nielsen, Thapar and Villalon \(2019\)](#) for data and intuition relating to trend’s ability to hedge bad outcomes in private equity.
 17 Which in this case is by construction, since we’ve discounted these series to have 0.6 and 0.8 Sharpe ratios at 10% volatility (for Trend and Styles, respectively).

Putting It All Together

As perennial fans of diversification, we believe a collection of good strategies is better than just one. This may be especially important for risk-mitigating portfolios, a point we've argued going back at least to 2011.¹⁸

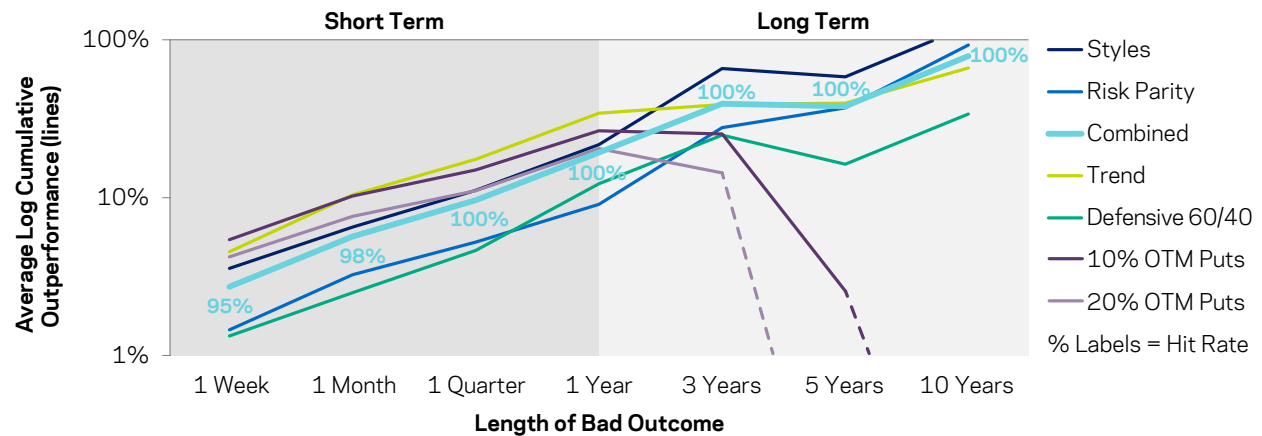
along with each one individually, and the two options portfolios. Given the dispersion in cumulative returns across them, we report log outperformance to get a clearer picture (for clarity, the hit rate labels are shown only for the "Combined" approach).

Exhibit 7, Panel A shows an equal-weighted combination of the four "good" portfolios,

Exhibit 7: Putting It All Together

January 5, 1996 - March 31, 2020

Panel A: Outperformance during Bad Outcomes for U.S. 60/40 (dashed lines denote negative returns*)



Panel B: Full-period Average Returns and Equity Beta (sorted by average returns)

	Risk Parity	Styles	Combined	Trend	Defensive 60/40	20% OTM Puts	10% OTM Puts
Average Return vs. 60/40	2.7%	1.6%	1.3%	0.4%	0.3%	-7.3%	-8.2%
Equity Beta	0.21	-0.11	0.08	-0.13	0.34	-0.15	-0.30

*Using each series' full history does not alter the conclusions of this chart.

Sources: AQR, Federal Reserve, OptionMetrics, Bloomberg. U.S. 60/40, Hypothetical Puts, Hypothetical Defensive U.S. 60/40, Hypothetical Risk Parity, Hypothetical Styles, and Hypothetical Trend are described in previous exhibits. The Hypothetical Combined portfolio consists of a 25% capital weight each to Hypothetical Risk Parity, Defensive U.S. 60/40, Styles, and Trend. This chart shows the average outperformance of the Hypothetical portfolios compared to the 60/40 portfolio during the worst 5% outcomes for 60/40 over each horizon shown on the x-axis. The percentage labels show the "hit rate," or the percentage of the time Hypothetical portfolios outperformed the 60/40 portfolio over this sample. Average Return vs. 60/40 is the unconditional average outperformance over the period. Equity Beta is the unconditional beta to U.S. Equities over the sample period. This data is described in greater detail in the Appendix. Each series is compared to 60/40 over the common overlapping period from 1/5/1996 to 3/31/2020. Time period is based on availability of data. All returns are excess of cash and gross of fees. All underlying calculations use arithmetic returns. For illustrative purposes only. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

18 Berger, Nielsen and Villalon (2011).

At the shortest horizons, put options are among the strongest and most consistent performers. This is not surprising, given that protecting against sharp crashes is their raison d'être. However, this outperformance starts to tail off past the one-year horizon. At the longest bad outcomes for 60/40, the outperformance tails off, eventually hitting negative territory. In other words, puts fail to help over the horizons that are most important to long-term cumulative returns. In addition, as shown in **Panel B**, puts lose money on average, making them an even less attractive proposition for long-term investors.

The other portfolios show a more favorable pattern of outperformance that tends to grow with horizon (Panel A), and positive returns on average (Panel B). Among these, Trend and Styles appear to offer the highest relative returns during most of the bad outcomes

for 60/40. This is unsurprising, as these two portfolios tend to have very low equity beta (second line of Panel B) and so should tend to look good when markets do poorly. In comparison, strategies like Risk Parity and Defensive 60/40 have positive equity betas but still earn a lot of their return from sources not meaningfully present in the 60/40 portfolio. This contributes to outperformance when 60/40 is suffering, regardless of the horizon.

In **Exhibit 8** we present each portfolio covered in this article ranked by hit rate over each horizon's bad outcomes. In general, the consistency of puts weakens as bad outcomes get longer. The opposite is true for the risk-mitigating portfolios we've looked at—over longer horizons, their efficacy improves (along with their cumulative returns, as shown in Exhibit 7), making them the more compelling choice for most investors.

Exhibit 8: A Periodic Table of Portfolio Protection
 Outperformance Over Various Horizons, Sorted by Hit Rate
 January 5, 1996 - March 31, 2020*

1 Week	1 Month	1 Quarter	1 Year	3 Years	5 Years	10 Years
10% OTM Puts 100%	10% OTM Puts 100%	10% OTM Puts 100%	Trend 100%	Styles 100%	Styles 100%	Styles 100%
20% OTM Puts 100%	20% OTM Puts 100%	20% OTM Puts 100%	10% OTM Puts 100%	Combined 100%	Trend 100%	Risk Parity 100%
Combined 95%	Combined 98%	Combined 100%	20% OTM Puts 100%	Trend 100%	Combined 100%	Combined 100%
Styles 95%	Trend 96%	Trend 98%	Combined 100%	Risk Parity 100%	Risk Parity 100%	Trend 100%
Defensive 60/40 92%	Styles 93%	Defensive 60/40 97%	Defensive 60/40 100%	10% OTM Puts 100%	Defensive 60/40 100%	Defensive 60/40 100%
Trend 91%	Defensive 60/40 93%	Risk Parity 90%	Risk Parity 100%	Defensive 60/40 100%	10% OTM Puts 48%	10% OTM Puts 20%
Risk Parity 82%	Risk Parity 87%	Styles 88%	Styles 92%	20% OTM Puts 100%	20% OTM Puts 44%	20% OTM Puts 7%

*Using each series' full history does not alter the conclusions of this chart.

Sources: AQR, Federal Reserve, OptionMetrics, Bloomberg. All series are described in previous exhibits. This chart ranks each of the Hypothetical portfolios based on their hit rate versus 60/40 over the various horizons. If two portfolios have the same hit rate, we give priority to the portfolio with the larger magnitude of outperformance over that period. This data is described in greater detail in the Appendix. Each series is compared to 60/40 over the common overlapping period from 1/5/1996 to 3/31/2020. Time period is based on availability of data. All returns are excess of cash and gross of fees. All underlying calculations use arithmetic returns. For illustrative purposes only. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

Case Study: The COVID-19 Pandemic

The first quarter of 2020 brought a swift end to one of the longest expansions in history. The COVID-19 virus wreaked havoc on markets, causing dramatic losses for many asset classes—particularly equities and credit. The magnitude and recency of this event provide a salient and unfolding case study for how each of the portfolios we've analyzed has performed (**Exhibit 9**).

Six weeks in, put options have offered good protection (exactly as expected given the speed of the market crash). Defensive has also added some value so far over this period, mitigating

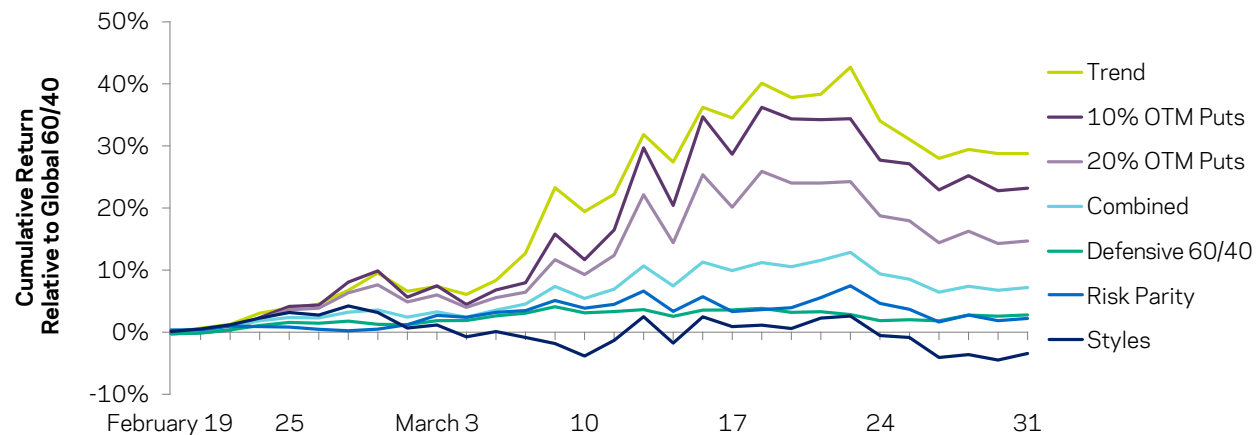
losses to an extent in line with history (cf. Exhibit 4's 1-month horizon).¹⁹

Risk Parity also outperformed, though more narrowly than some investors may have expected, as not only did equities struggle but so did commodities.²⁰ Fortunately, bond markets—despite having low yields going into the year—generated meaningfully positive returns. Compared to 60/40, where “only” one of the two asset classes did poorly, Risk Parity still outperformed in line with its history (cf. Exhibit 5).

Exhibit 9: The COVID-19 Drawdown

Cumulative Returns *Relative to Global 60/40*

February 19, 2020 - March 31, 2020



Source: AQR, OptionMetrics, Bloomberg. Global 60/40 is 60% MSCI World and 40% Barclays Global Treasury Hedged USD Index. Hypothetical Risk Parity, Puts, Styles, and Trend are described in previous exhibits. Defensive Global 60/40 is identical to Global 60/40 except its equity portion is replaced with Hypothetical Defensive Global Equities. Hypothetical Defensive Global Equities is a long-only global developed equity portfolio that overweights low-beta and high-quality stocks. The Hypothetical Global Combined portfolio consists of a 25% capital weight each to Hypothetical Risk Parity, Defensive Global 60/40, Styles, and Trend. This chart shows the difference in cumulative total return each day between the hypothetical portfolios and Global 60/40 starting February 19th, when Global 60/40's drawdown began. This data is described in greater detail in the Appendix. Unlike previous exhibits, returns here are gross of cash, and calculations are geometric. For illustrative purposes only. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix.

19 Notably, despite a common refrain in the industry of defensive stocks being overvalued or otherwise expensive. See [Ilmanen, Nielsen and Chandra \(2015\)](#) for more on why measures of expensiveness for defensive stocks can be a misleading indicator of future returns.

20 Versions of risk parity with an allocation to credit-sensitive assets likely had performance more in line with, or below, traditional portfolios.

Alternative risk premia diverged meaningfully. Styles over this period were a mixed bag—for instance, value struggled and carry in currencies underperformed (as it generally does in risk-off environments), but momentum and defensive were more in line with historical averages. Trend was a notable bright spot, as it was positioned short many of the assets that continued to deteriorate (such as commodities)

and generally long fixed income and currencies such as the U.S. Dollar.

While we don't know today if this drawdown will end up as a "Short-Term" or a "Long-Term" bad outcome, the early evidence is very much in line with history, notably with the "Combined" portfolio outperforming 60/40 by about as much as it normally has during a bad outcome of this length (cf. Exhibit 7).

Conclusion: It's Never "Too Late" to Think About Good Strategies for Bad Times

A common refrain after a major drawdown is that building a more resilient portfolio is like "closing the stable door after the horse has bolted."

During the bull market that followed the Global Financial Crisis, the long-term diversifying portfolios we analyzed here generally kept up with traditional portfolios—which may be surprising given it was a period marked by higher-than-usual returns for stocks and bonds, and lower-than-usual risk.²¹ This is in stark contrast to options, which generally would have "closed the door too late," causing option-protected portfolios to meaningfully underperform.

In this paper we've shown that protection from options tends to decrease the longer you hold them. What this means for options investors is that successful timing matters—a lot. This is far less of an issue for the other risk-mitigating portfolios we analyzed. Their long-term protection characteristics have been stronger than options, and their returns on average have been positive, suggesting it's never too late to think about diversifying into them. Additionally, given equity and bond yields that even today are more expensive than their long-term averages, the case for diversification very much remains stronger than usual.

21 Nielsen, Thapar and Villalon (2019).

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Appendix

Data Descriptions

Note: Throughout this article, “bad outcomes” refer to the 5th percentile to worst returns for the U.S. 60/40 portfolio. Percentile calculations are our own, calculated on the U.S. 60/40 data described below.

U.S. Equities is the US MKT factor from the AQR Data Library, which represents the market-cap-weighted return on all stocks in the NASDAQ, AMEX, and NYSE, from 8/17/1971 to 1/4/1988. U.S. Equities is the S&P 500 Index from 1/5/1988 to 3/31/2020.

U.S. Treasuries are the estimated return on U.S. 10 Year Treasuries from 8/17/1971 to 5/26/1982. These estimates use daily Federal Reserve Treasury par yield data, incorporating yield income, rolldown, duration effects, and convexity effects. U.S. Treasuries are the Merrill Lynch 10 Year Treasury Futures TR Index from 5/27/1982 to 3/31/2020. Since the ML futures index reflects the price of the “cheapest-to-deliver” bond, which often has maturity shorter than 10 years, we scale the volatility of the futures index returns to match that of our Fed Treasury returns data over their common period (this results in a 1.1x scalar).

U.S. 60/40 is 60% U.S. Equities and 40% U.S. Treasuries, using the data described above.

10% and 20% OTM Quarterly Options are hypothetical backtested options-portfolios holds front-quarter S&P 500 put options, selected to be 10% (20%) out-of-the-money, sized to unit leverage, held to expiration, and rebalanced at expiration. The backtests hold only one option at a time and use standard March, June, September, and December 3rd Friday quarterly expiries. Returns are gross of estimated transaction costs, gross of fees, and excess of cash (US 3-month LIBOR). These are not the returns to an actual portfolio AQR manages and are for illustrative purposes only.

Defensive U.S. Equities is a hypothetical backtest of a portfolio which holds 90% long low beta U.S. stocks and 10% high quality U.S. stocks. Universe is all U.S. stocks in the CRSP database. The low beta stocks represent the unlevered long side of the “Betting Against Beta” (BAB) factor as described in Asness, Frazzini and Pedersen (2014). The high quality stocks represent the long side of the “Quality Minus Junk” (QMJ) factor as described in Asness, Frazzini and Pedersen (2013). Returns are gross of fees and of trading costs.

Defensive U.S. 60/40 is a hypothetical portfolio invested 60% in Defensive U.S. Equities and 40% in U.S. Treasuries.

Risk Parity is a hypothetical long-only model portfolio that allocates equal risk across three major asset classes (developed equities, developed nominal bonds, and inflation-sensitive assets). Developed equities include Australia, Eurostoxx, Canada, France, Germany, Hong Kong, Italy, Japan, Netherlands, Spain, Switzerland, the U.K., and the U.S. Developed Bonds include the G6 countries. Inflation-linked bonds include France, Germany, the U.K., and the U.S. Commodities include agriculturals, energies, and metals. The portfolio is constructed with a dynamic risk model which attempts to size positions so that each asset class contributes equally to marginal portfolio-level risk at each point in time. The dynamic risk model is composed of volatility and correlation forecasts for each asset class which will vary in response to changes in the risk environment. The portfolio targets an annualized volatility of 10%. The portfolio imposes exposure limits on individual asset classes. Each asset class is built with the most relevant instrument available at each point in time including: individual stocks, equity indexes, equity index futures, equity index swaps, developed bonds, developed bond futures, and commodity futures. The portfolio is gross of fees and net of transaction cost estimates.

Styles is a hypothetical backtested portfolio which invests in four market-neutral style premia (value, momentum, carry, and defensive) across developed assets (stocks, equity indices, currencies, nominal bonds, and commodities). Stock and Industry Selection: approximately 2,000 stocks across Europe, Japan, and U.S. Country Equity Indices: Developed Markets: Australia, Canada, Eurozone, Hong Kong, Japan, Sweden, Switzerland, U.K., U.S. Within Europe: Italy, France, Germany, Netherlands, Spain. Emerging Markets: Brazil, China, India, Israel, Malaysia, Mexico, Poland, Singapore, South Africa, South Korea, Taiwan, Thailand, Turkey. Bond Futures: Australia, Canada, Germany, Japan, U.K., U.S. Yield Curve: Australia Germany, United States. Interest Rate Futures: Australia, Canada, Europe (Euribor), U.K. and U.S. (Eurodollar). Currencies: Developed Markets: Australia, Canada, Euro, Japan, New Zealand, Norway, Sweden, Switzerland, U.K., U.S. Emerging Markets: Brazil, Hungary, India, Israel, Mexico, Poland, Singapore, South Africa, South Korea, Taiwan, Turkey. Commodity Selection: Silver, copper, gold, crude, Brent oil, natural gas, corn, soybeans. The portfolio rebalances monthly and targets 10% volatility annually. The styles are first combined at equal notional weights within each asset class; the asset class composites are then combined at equal notional weights to form the overall portfolio. The styles use the following signals for stocks, equity indices, currencies, bonds, and commodities, respectively. Value: HML Devil and non industry-neutral EP, EP, purchasing power parity, real bond yield, and 5-year reversal. Momentum: UMD, 12m momentum, 12m momentum, 12m momentum, and 12m momentum. Carry: n/a, n/a, 50/50 implied/real short rate, term spread (10y - 3m), and de-seasonalized carry. Defensive: BAB, BAB, n/a, BAB, and n/a. Asset-signal pairs listed as n/a above mean the style does not trade that asset class. The portfolio is gross of fees, net of transaction cost estimates, and discounted ex-post to a realized Sharpe ratio of 0.8 over the period 1/5/1996 to 3/31/2020.

Trend is a hypothetical backtested trend-following portfolio which uses three time series momentum signals (trailing 1m, 3m, and 12m performance to invest across 4 major asset classes: commodities including agriculturals, energies, and metals; global developed and emerging equity indices; developed bond futures and short-term interest rates; and developed and emerging currency pairs. All signals in aggregate determine the direction, long or short, and the size of each trade for each individual market in the model. The portfolio targets balanced risk exposures over time, and limits the amount of concentrated risk that can be taken in any one asset or asset class. The portfolio is scaled ex post to 10% annualized volatility. The portfolio is gross of fees, net of transaction cost estimates, and discounted ex-post to a realized Sharpe ratio of 0.6 over the period 1/5/1996 to 3/31/2020.

Combined is a hypothetical portfolio combination of Defensive U.S. 60/40, Risk Parity, Trend, and Styles series described above at 25% capital weights each

Global Equities is the MSCI World Index.

Global Treasuries is the Barclays Global Treasury Hedged USD index.

Global 60/40 is a 60%/40% combination of Global Equities and Global Treasuries series described above.

Defensive Global Equities is a hypothetical backtest of a portfolio which holds 90% long low beta global developed stocks and 10% high quality global developed stocks. The universe is roughly the same as the MSCI World. The low beta stocks represent the unlevered long side of the "Betting Against Beta" (BAB) factor as described in Asness, Frazzini and Pedersen (2014). The high quality stocks represent the long side of the "Quality Minus Junk" (QMJ) factor as described in Asness, Frazzini and Pedersen (2013). Returns are gross of fees and of trading costs.

Defensive Global 60/40 is a hypothetical portfolio invested 60% in the Defensive Global Equities series and 40% in the Global Treasuries series described above.

U.S. Treasury Bills (Cash) is the U.S. One Month Treasury Bill rate from the AQR Data Library until 3/31/1992. U.S. Treasury Bills is then the BofA Merrill Lynch 3-Month Treasury Bill Index from 4/1/1992 to 3/31/2020.

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