



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

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KEY FINDINGS

- When it comes to drawdowns, many investors focus on depth, but length matters, too. Empirically, strategies that protect against longer-lasting tail events are more helpful to long-term wealth creation than strategies that protect against shorter-lived ones.
- Options-based hedging strategies have been highly effective at delivering value over short-term bad outcomes for traditional portfolios, but their efficacy wanes at longer horizons—eventually underperforming 60/40 even in bad outcomes for 60/40.
- In contrast, the authors present a range of alternative diversifying strategies that can provide more consistent and higher relative returns during longer-term bad outcomes, thus potentially benefitting investors when they need it the most.

ABSTRACT

Investors have a natural urge to protect their portfolios from sudden crashes. The authors argue that investors should instead focus on bad outcomes that unfold over longer periods because those tend to be more detrimental to the long-term goal of wealth accumulation. The authors show that options-based hedging can be effective over shorter periods but tends to weaken over time. Worse still, returns tend to be very punitive during prolonged bull markets. In contrast, risk-mitigating and diversifying strategies such as defensive equities, risk parity, alternative risk premiums, and trend-following have more consistently added value in the longer-lasting market drawdowns that matter most to investors—and, unlike puts, can profit in up as well as down markets. This latter point suggests a crucial advantage for these strategies: that unlike options-based hedging, it is never too late to consider diversifying into them.

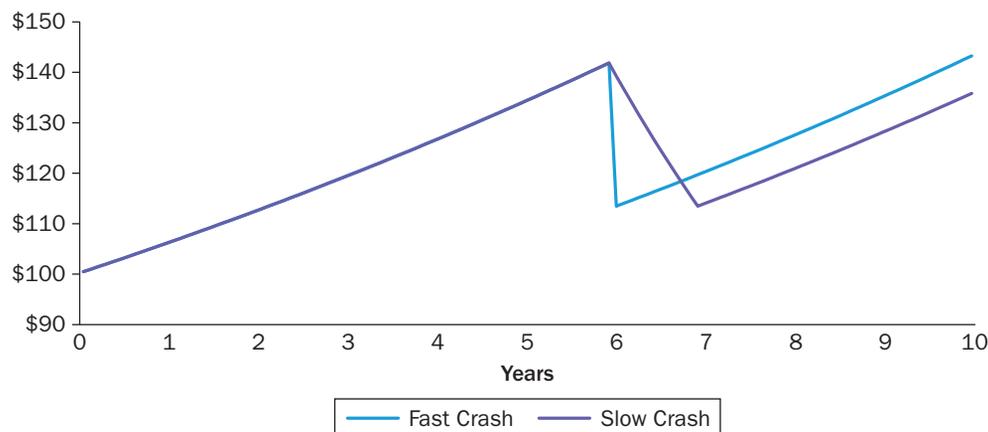
TOPICS

*[Portfolio construction](#), [tail risks](#), [options](#)**

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 is 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?

*All articles are now categorized by topics and subtopics. [View at PM-Research.com](#).

EXHIBIT 1**Even for the Same Magnitude Loss, Slower Losses May Be Worse—Two Hypothetical 20% Losses**

NOTES: Both series have 6% annual return, except for the fast crash, which loses 20% in one month, and the slow crash, 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 (but could start at the beginning of any year shown). For illustrative purposes only. Hypothetical data have inherent limitations, some of which are disclosed in the Appendix.

Most investors cannot 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 because of the opportunity cost of not making money for a longer time.

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

¹Again, let's restate our assumptions: 6% annual returns except for the period in which 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).

²This 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.

A REAL-WORLD EXAMPLE: TECH BUST VERSUS GLOBAL FINANCIAL CRISIS

Take two 60/40 investors, each starting with \$100. One invests 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, whereas the Tech Bust investor grinds even lower. 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 article 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 fifth 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. The pattern stops there, however; cumulative losses seem to flatten out for long-term bad outcomes, which we define here as ones that last more than a year (the right half of Panel A).⁵ In fact, a casual glance at this chart might lead someone to think that longer-term drawdowns are not as damaging as those that last only a year—but that is 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).

Shorter-term bad outcomes for 60/40—although painful—have not had much impact on hitting 5% annual returns over the next 10 years because there were still plenty of years left to realize positive returns. The story changes for longer-term bad outcomes (the right half of the exhibit). In other words, the longer the bad outcome, the worse off the investor is in achieving his or her goal.

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

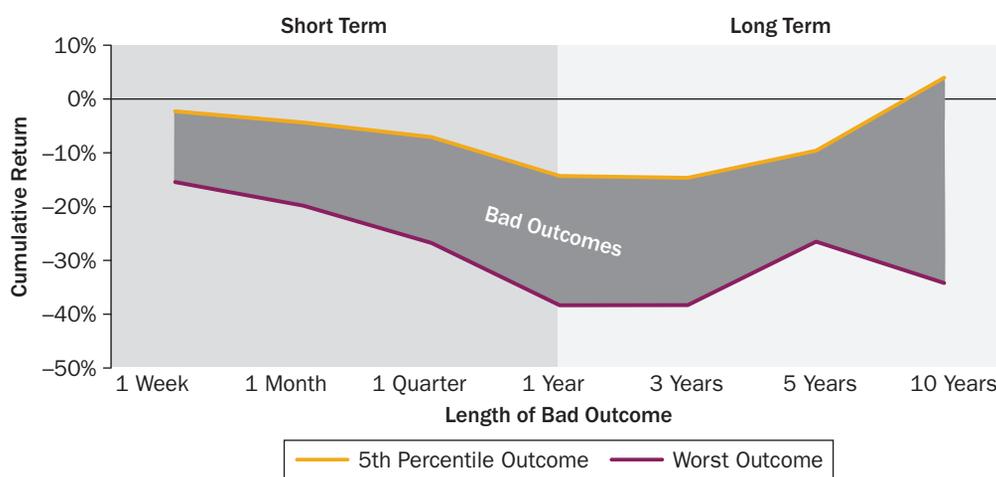
⁴We use overlapping observations throughout this analysis to take full advantage of the data, although that does mean the longer-horizon bad outcomes become more overlapping (i.e., only a handful of events may dominate long-horizon bad outcomes). Throughout this article, we use the longest time series available in each exhibit, except 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).

⁵The intuition for the (somewhat) U shape in Exhibit 2, Panel A, is that although loss potential increases with horizon, it is tempered (and eventually overwhelmed) by positive long-term equity and bond premiums and, in some cases, multiyear mean reversion.

EXHIBIT 2

Excess-of-Cash Performance of US 60/40 Portfolio (August 17, 1971–March 31, 2020)

Panel A: Absolute Worst through Fifth Percentile Worst Outcomes Over Various Horizons



Panel B: 10-Year Average Returns Starting with a Zero to Fifth Percentile Bad Outcome (labels are percentage of time the 10-year return exceeds 5%)



NOTES: *The 60/40 portfolio over this period generated a cash + 5% ten-year annual return 65% of the time. US 60/40 refers to a 60%/40% combination of US market-cap-weighted equities and US 10-year Treasuries. Panel A plots the worst returns (red line) and fifth percentile (orange line) worst returns over each horizon. Panel B shows 10-year returns starting with (i.e., including) the initial drawdowns from Panel A (i.e., what have 10-year returns been, starting with a bad outcome). Mechanically, each of the points along the line increasingly overlaps with the bad outcome events in Panel A, up to the 10-year horizon where the bad outcome is the entire evaluation period. The data are described in greater detail in the Appendix. All data are from August 17, 1971 to March 31, 2020. Time period is based on availability of data. All returns are excess of cash and gross of fees. Cash here and throughout refers to US Treasury bills. All underlying calculations use arithmetic returns. For illustrative purposes only.

SOURCES: Prepared by the authors from AQR, Federal Reserve, and Bloomberg data.

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 10 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 is 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 is 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 the investor is protected by the specified amount.

In this article, we evaluate two simple passive strategies that buy unhedged puts (10% and 20% out of the money [OTM]) and rebalance quarterly. There are, of course, many varieties of option-based hedging. Among passive strategies, one can vary the frequency of rebalancing, maturity of options, moneyness, and delta hedging. In addition, one could use a more active, or alpha-oriented, approach that attempts to enhance either the average return or convexity profile. Although the potential impact of manager alpha is by definition idiosyncratic,⁷ the main takeaways that we present are relatively consistent across a broad range of passive approaches, suggesting our findings can help investors form a reasonable baseline for what to expect from many put-based hedging strategies.

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).⁸ The format of Exhibit 3 is repeated throughout the article, so it is worth detailing here. The lines show the average cumulative outperformance of the portfolio in question (in this case, put options) compared with 60/40 during the various bad outcomes, which we define here as the absolute worst through fifth percentile worst return outcomes for 60/40. For example, “On average, what was the cumulative return of this portfolio compared with 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 outperformed a 60/40 portfolio over bad outcomes lasting up to three years. This result is driven by both sides of the performance comparison: (1) Equity options tend to realize positive returns during

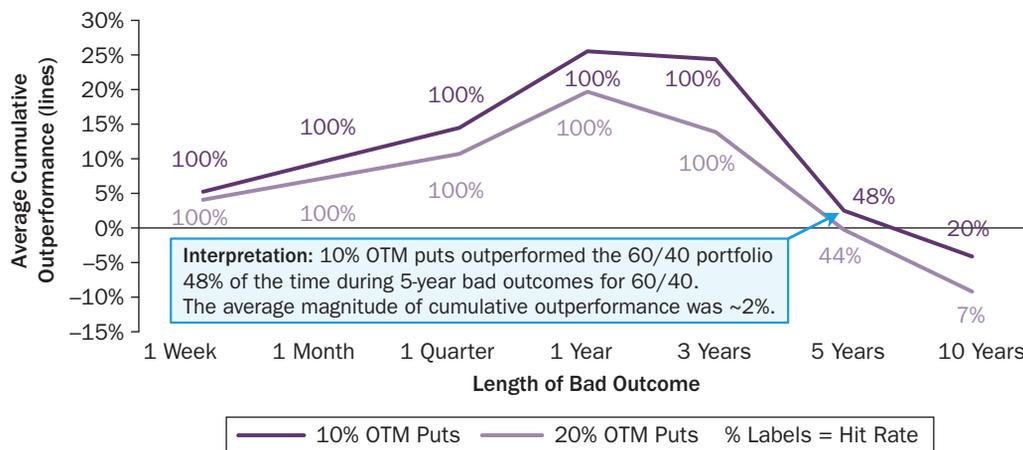
⁶That said, the claim of 10% protection only holds when the return horizon exactly aligns with option maturity. Path dependency will come into play when this is not the case, as shown by Israelov (2017, pp. 6–33). To illustrate, consider an investor who purchases quarterly 10% OTM puts. If the market is down exactly 10% every quarter, then for the selected hedging strategy, the puts would offer no relief.

⁷It is of course possible that with enough alpha, a manager’s put strategy may have a very different return profile from what we show here. Investors may therefore see better results if they are able to identify a manager with particular skill in option-based hedging. However, for investors seeking those approaches, the typical challenges of identifying manager skill are particularly pronounced because of the relatively few observations of tail events (by definition) with which to evaluate managers.

⁸For simplicity, we show the results for quarterly options—one with a 10% OTM strike and the other with a 20% OTM strike. Results are directionally similar for different strikes and maturities (we also considered monthly and annual rebalance frequencies, as well as 5% OTM variants). 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.

EXHIBIT 3

Options-Based Protection Tends to Weaken Over Longer Horizons—Outperformance of Hypothetical Options during Bad Outcomes for US 60/40 (January 5, 1996–March 31, 2020)



NOTES: The unconditional hit rates for the two options are 15% for 10% OTM puts and 12% for 20% OTM puts. US 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 with 60/40 portfolio during the worst 5% outcomes for 60/40 over each horizon shown on the x-axis. The data are described in greater detail in the Appendix. All data are from January 5, 1996 to March 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 have inherent limitations, some of which are disclosed in the Appendix.

SOURCES: Prepared by the authors from AQR, OptionMetrics, Federal Reserve, and Bloomberg data.

bad outcomes, and (2) we are comparing options' returns to 60/40 when 60/40 had very poor performance.

As we look at long-term horizons, however, the value and consistency of options deteriorates because the insurance premium (more specifically, the volatility risk premium) tends to eat away at the returns. The negative 10-year result is particularly notable. Even over their worst 10-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.⁹

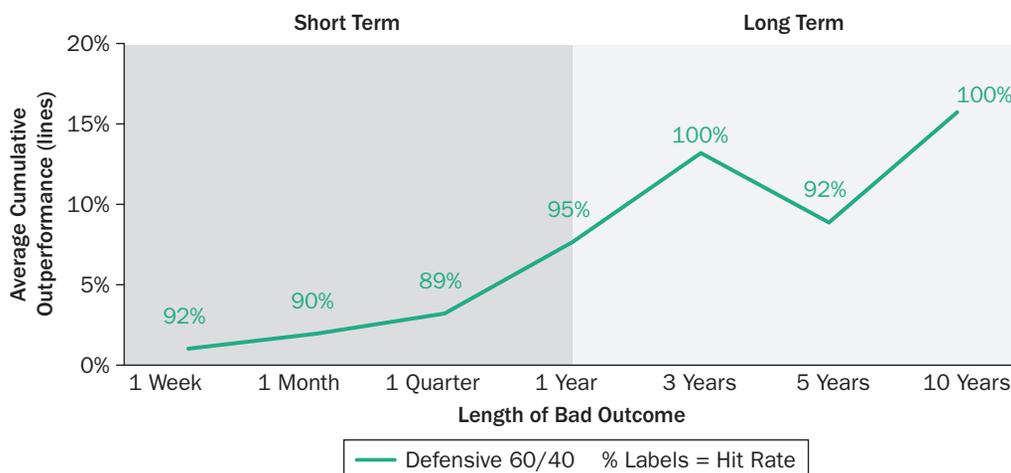
WHAT ACTUALLY HOLDS UP OVER THE LONG HAUL¹⁰

We have written in many places over the years that options markets offer an overpriced means of getting portfolio protection. Instead, we have argued for a range of risk-mitigating solutions that do not sacrifice a portfolio's expected return.¹¹ Here,

⁹For more on why options have not done as good a job as many investors have hoped, we refer readers to Israelov (2017, pp. 6–33), Israelov and Tummala (2017, 2018), Israelov and Nielsen (2015, pp. 108–120), and Robert Shiller's Yale Stock Market Crash Confidence Index (<http://www.econ.yale.edu/~shiller/data.htm>).

¹⁰We 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.

¹¹Regular readers will know we have been fans of the potential risk-mitigating roles of these strategies for a decade, with articles including those by Berger, Nielsen, and Villalon (2011), AQR Portfolio Solutions Group (2015, 2018), and most recently Nielsen, Thapar, and Villalon (2019). Our criticisms of options-based hedging have also been a theme over the past decade, as covered by Israelov (2017, pp. 6–33), Israelov, Nielsen, and Villalon (2017, pp. 59–67), Israelov, Klein, and Tummala (2017), and Israelov and Nielsen (2015, pp. 108–120).

EXHIBIT 4**Strong Defense—Outperformance of Hypothetical Defensive 60/40 during Bad Outcomes for US 60/40 (August 17, 1971–March 31, 2020)**

NOTES: US 60/40 is described in Exhibit 2. The hypothetical defensive US 60/40 is identical to US 60/40, except its equity portion is replaced by hypothetical defensive US equities. Hypothetical defensive US equities is a long-only US equity portfolio that overweights low-beta and high-quality stocks. This chart shows the average outperformance of the hypothetical defensive US 60/40 portfolio compared with 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 US 60/40 portfolio outperformed the 60/40 portfolio over this sample. The data are described in greater detail in the Appendix. All data are from August 17, 1971 to March 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 have inherent limitations, some of which are disclosed in the Appendix.

SOURCES: Prepared by the authors from AQR, Federal Reserve, and Bloomberg data.

we examine the evidence for three types of these solutions, following the same framework used earlier for options:

1. Within the equity allocation: defensive equities
2. Addressing the asset allocation: risk parity
3. Using liquid alternatives: alternative risk premiums and trend following

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 owing 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.

Defensive Equities¹²

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.

¹²There are many ways to build a long-only defensive equity portfolio—some incorporate statistical information such as volatility and beta, and others use fundamental data such as profitability, stability of earnings, and low leverage. In this article 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

EXHIBIT 5

Diversification When Most Needed—Outperformance of Hypothetical Risk Parity during Bad Outcomes for US 60/40 (August 17, 1971–March 31, 2020)



NOTES: US 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 with 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. The data are described in greater detail in the Appendix. All data are from August 17, 1971 to March 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 have inherent limitations, some of which are disclosed in the Appendix.

SOURCES: Prepared by the authors from AQR, Federal Reserve, and Bloomberg data.

This intuition is supported quite well by the data. Exhibit 4 shows the outperformance of a defensive 60/40 portfolio (i.e., the equity component is entirely defensive stocks). Because most bad outcomes for 60/40 have been driven by bad outcomes for equities, a defensive allocation almost mechanically makes these times less bad.¹³ Of course, it does not 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.

Risk Parity¹⁴

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.

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 should not necessarily be expected to outperform their long-term average returns in bad times.

¹³Of course, the flip side is that although defensive stocks do keep up on average, particularly strong bull markets may be instances in which they lag the market as a result of having a lower beta.

¹⁴Our 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.

EXHIBIT 6

Alternatives Can Be Remarkably Resilient When Traditional Portfolios Suffer—Outperformance of Hypothetical Styles and Trend during Bad Outcomes for US 60/40 (January 2, 1985–March 31, 2020)



NOTES: US 60/40 is described in Exhibit 2. Hypothetical styles represents a diversified, market-neutral portfolio that invests in four alternative risk premium themes (value, momentum, carry, and defensive) across four major asset groups (equity indexes, 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 indexes, government bond futures, commodity futures, and currency forwards. Hypothetical styles and trend-following are each scaled to 10% annual volatility. Hypothetical styles is discounted to realize a 0.8 Sharpe ratio, and hypothetical trend-following is discounted to realize a 0.6 Sharpe ratio. This chart shows the average outperformance of hypothetical styles and trend-following compared with 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-following outperformed the 60/40 portfolio over this sample. The data are described in greater detail in the Appendix. All data from January 2, 1985 to March 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 have inherent limitations, some of which are disclosed in the Appendix.

SOURCES: Prepared by the authors from AQR, Federal Reserve, and Bloomberg data.

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 because of its smaller equity allocation and better diversification (Exhibit 5).

Alternatives: Alternative Risk Premiums 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 premiums (value, momentum, carry, and defensive) and is applied across multiple liquid asset classes.
- **Trend (green line):** This hypothetical portfolio goes long or short different assets based on whether their trailing performance was positive or negative, respectively.¹⁵

¹⁵ 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 (Brooks 2017) and ones that follow trends in alternative markets (Babu et al. 2019).

The magnitudes of outperformance in Exhibit 6 are remarkable compared with 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 would expect the relative performance of the alternative portfolios to be.

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 for up to a year, whereas styles wins 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 owing to its ability to short markets as they are going down.^{16,17}

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 6¹⁸); note, however, that short, dramatic sell-offs and the corresponding deleveraging that often accompanies them may pose a short-term risk to any long-short portfolio (see our COVID-19 Pandemic Case Study later in this article).

PUTTING IT ALL TOGETHER

Portfolio theory tells us a collection of good strategies is better than just one. This may be especially important for risk-mitigating portfolios, a point we have argued going back at least to 2011 (Berger, Nielsen, and Villalon 2011).

Exhibit 7, Panel A, shows an equal-weighted combination of the four diversifying portfolios that we presented, 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).

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 eventually hits 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.¹⁹

¹⁶For example, Hurst, Ooi, and Pedersen (2017, pp. 15–29) documented outperformance in 8 of the 10 historically largest drawdowns for 60/40; most of these drawdowns were slow enough that trend-following was positioned to benefit from the risk-off environment.

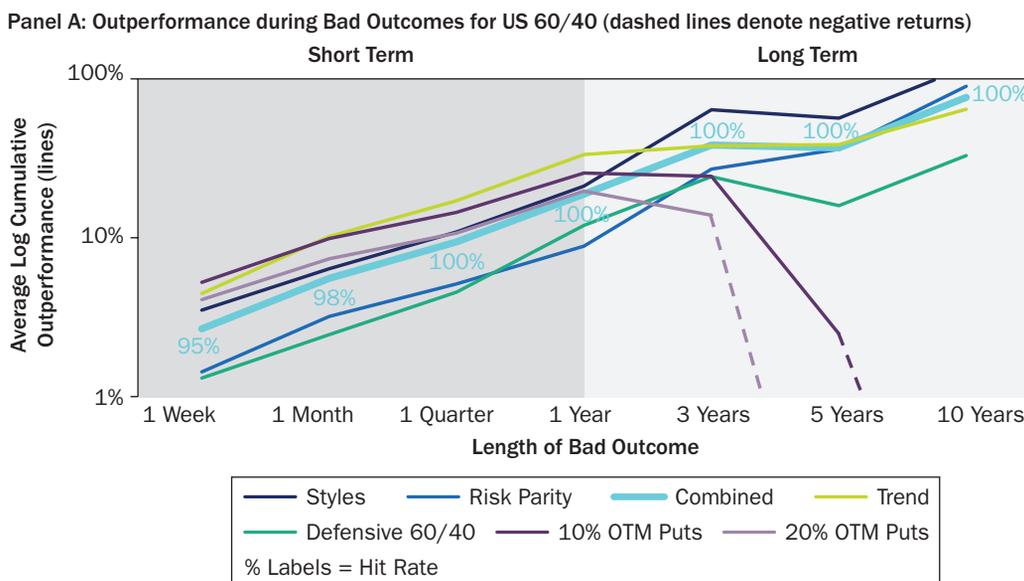
¹⁷Beyond liquid asset classes, trend-following has also offered especially consistent tail protection from drawdowns in illiquid asset classes, such as private equity. See AQR Portfolio Solutions Group (2015) and Nielsen, Thapar, and Villalon (2019) for data and intuition relating to trend's ability to hedge bad outcomes in private equity.

¹⁸Which in this case is by construction, because we have discounted these series to have 0.6 and 0.8 Sharpe ratios at 10% volatility (for trend and styles, respectively).

¹⁹As previously mentioned, this result holds for the passive put strategies that we present here, as well as for others that we have studied. It is possible that an option-buying strategy may have positive returns on average given enough manager skill, although investors would face the challenge of identifying those managers. Even if such a manager did produce positive returns over a full cycle, the episodic nature of those returns (with long periods of drag in between) may make it challenging to stick to this type of allocation.

EXHIBIT 7

Putting It All Together (January 5, 1996–March 31, 2020)



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	-0.3

NOTES: Using each series’ full history does not alter the conclusions of this chart. US 60/40, hypothetical puts, hypothetical defensive US 60/40, hypothetical risk parity, hypothetical styles, and hypothetical trend-following are described in previous exhibits. The hypothetical combined portfolio consists of a 25% capital weight each to hypothetical risk parity, defensive US 60/40, styles, and trend-following. This chart shows the average outperformance of the hypothetical portfolios compared with 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 time hypothetical portfolios outperformed the 60/40 portfolio over this sample. Average return versus 60/40 is the unconditional average outperformance over the period. Equity beta is the unconditional beta to US equities over the sample period. The data are described in greater detail in the Appendix. Each series is compared with 60/40 over the common overlapping period from January 5, 1996 to March 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 have inherent limitations, some of which are disclosed in the Appendix.

SOURCES: Prepared by the authors from AQR, Federal Reserve, OptionMetrics, and Bloomberg data.

The other portfolios show a more favorable pattern of outperformance that tends to grow with horizon (Panel A), as well as 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 because these two portfolios tend to have very low equity beta (the second line of Panel B) and so should tend to look good when markets do poorly. In comparison, strategies such as risk parity and defensive 60/40 have positive equity betas but still earn much 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 lengthen. The opposite is true for the risk-mitigating portfolios we have considered—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%

NOTES: Using each series' full history does not alter the conclusions of this chart. All series are described in previous exhibits. This chart ranks each of the hypothetical portfolios based on 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. The data are described in greater detail in the Appendix. Each series is compared with 60/40 over the common overlapping period from January 5, 1996 to March 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 have inherent limitations, some of which are disclosed in the Appendix.

SOURCES: Prepared by the authors from AQR, Federal Reserve, OptionMetrics, and Bloomberg data.

CASE STUDY: THE COVID-19 PANDEMIC

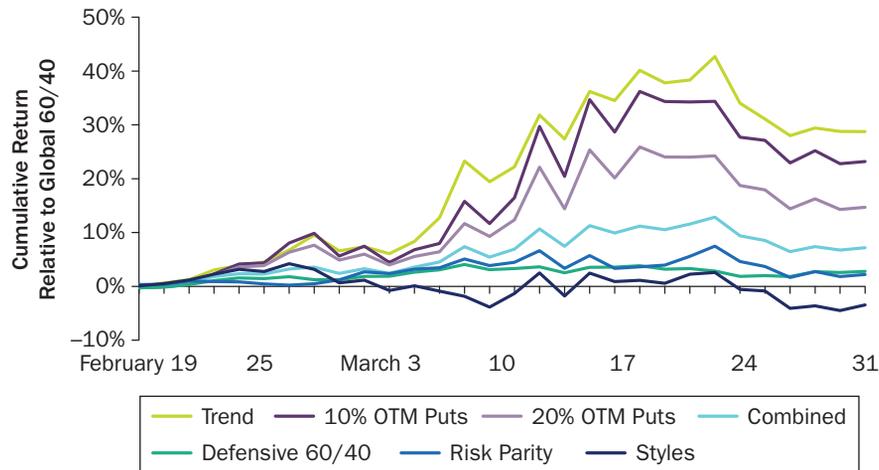
The first quarter of 2020 brought a swift end to one of the longest expansions in history. The COVID-19 pandemic wreaked havoc on markets, causing dramatic losses for many asset classes—particularly equities and credit. Although the magnitude and recency of this event certainly make it a relevant data point for our study, it ultimately qualified as a short-term bad outcome (one of the shortest ever, in fact, given its magnitude) and thus ex post did not meaningfully impair long-term returns for traditional portfolios, supporting Exhibit 2's conclusion. Nonetheless, Exhibit 9 shows how each of the portfolios we have analyzed performed during this crisis.

During this bad outcome, put options offered good protection (exactly as expected, given the speed of the market crash). Defensive also added some value over the period, mitigating losses to an extent in line with history (see, e.g., Exhibit 4's 1-month horizon).²⁰

Risk parity also outperformed, though more narrowly than some investors may have expected; not only did equities struggle, but so did commodities.²¹

²⁰Notably, despite a common refrain in the industry of defensive stocks being overvalued or otherwise expensive. See IImanen, Nielsen, and Chandra (2015) for more on why measures of expensiveness for defensive stocks can be a misleading indicator of future returns.

²¹Versions of risk parity with an allocation to credit-sensitive assets likely had performance more in line with, or below, traditional portfolios.

EXHIBIT 9**The COVID-19 Drawdown—Cumulative Returns Relative to Global 60/40 (February 19, 2020–March 31, 2020)**

NOTES: 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 19, when global 60/40's drawdown began. The data are 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 have inherent limitations, some of which are disclosed in the Appendix.

SOURCES: AQR, OptionMetrics, Bloomberg.

Bond markets—despite having low yields going into the year—generated meaningfully positive returns. Compared with 60/40, where only one of the two asset classes did poorly, risk parity still outperformed in line with its history (see Exhibit 5).

Alternative risk premiums 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 because 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 US dollar.

Finally, the diversified approach—the combined portfolio—outperformed 60/40 by about as much as it normally has during a bad outcome of this length (see Exhibit 7).

CONCLUSION

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 (Nielsen, Thapar, and Villalon 2019). This is in stark contrast to options, which have meaningfully underperformed in the periods following equity tail events—a true case of closing the door too late.

In this article, we have shown that the protection offered by 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 is 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.

APPENDIX

DATA DESCRIPTIONS

Throughout this article, *bad outcomes* refers to the fifth percentile to worst returns for the US 60/40 portfolio. Percentile calculations are our own, calculated on the US 60/40 data described in this appendix.

US 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 August 17, 1971 to January 4, 1988. US equities is the S&P 500 Index from January 5, 1988 to March 31, 2020.

US Treasuries are the estimated return on US 10-year Treasuries from August 17, 1971 to May 26, 1982. These estimates use daily Federal Reserve Treasury par yield data, incorporating yield income, rolldown, duration effects, and convexity effects. US Treasuries are the Merrill Lynch (ML) 10-Year Treasury Futures TR Index from May 27, 1982 to March 31, 2020. Because the ML futures index reflects the price of the cheapest-to-deliver bond, which often has a 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 $1.1 \times$ scalar).

US 60/40 is 60% US equities and 40% US Treasuries, using the data described earlier.

The 10% and 20% OTM quarterly options are hypothetical backtested options portfolios that hold front-quarter S&P 500 put options, selected to be 10% (20%) OTM, 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 third-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 US equities is a hypothetical backtest of a portfolio that holds 90% long low-beta US stocks and 10% high-quality US stocks. The universe is all US stocks in the CRSP database. The low-beta stocks represent the unlevered long side of the BAB factor as described by Frazzini and Pedersen (2014). The high-quality stocks represent the long side of the quality minus junk (QMJ) factor as described by Asness, Frazzini, and Pedersen (2019). Returns are gross of fees and of trading costs.

Defensive US 60/40 is a hypothetical portfolio invested 60% in defensive US equities and 40% in US 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 United Kingdom, and the United States. Developed bonds include the G6 countries. Inflation-linked bonds include France, Germany, the United Kingdom, and the United States. Commodities include agriculturals, energies, and metals. The portfolio is constructed with a dynamic risk model that 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 time point, 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 that invests in four market-neutral style premiums (value, momentum, carry, and defensive) across developed assets (stocks, equity indexes, currencies, nominal bonds, and commodities). Stock and industry selection include approximately 2,000 stocks across Europe, Japan, and United States. Country equity indexes for developed markets include Australia, Canada, Eurozone, Hong Kong, Japan, Sweden, Switzerland, the United Kingdom, and United States. Within Europe, this includes Italy, France, Germany, Netherlands, and Spain. Emerging markets include Brazil, China, India, Israel, Malaysia, Mexico, Poland, Singapore, South Africa, South Korea, Taiwan, Thailand, and Turkey. Bond futures include Australia, Canada, Germany, Japan, the United Kingdom, and the United States. The yield curve includes Australia, Germany, and the United States. Interest rate futures include Australia, Canada, Europe (Euribor), the United Kingdom and the United States (Eurodollar). Currencies for developed markets include Australia, Canada, Euro, Japan, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States. Emerging markets include Brazil, Hungary, India, Israel, Mexico, Poland, Singapore, South Africa, South Korea, Taiwan, and Turkey. Commodity selection includes silver, copper, gold, crude, Brent oil, natural gas, corn, and 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 indexes, 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 deseasonalized carry. Defensive: BAB, BAB, n/a, BAB, and n/a. Asset-signal pairs listed as n/a 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 January 5, 1996 to March 31, 2020.

Trend is a hypothetical backtested trend-following portfolio that uses three time-series momentum signals' (trailing 1m, 3m, and 12m) performance to invest across four major asset classes: commodities including agriculturals, energies, and metals; global developed and emerging equity indexes; 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 January 5, 1996 to March 31, 2020.

Combined is a hypothetical portfolio combination of defensive US 60/40, risk parity, trend, and styles series described earlier 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 earlier.

Defensive global equities is a hypothetical backtest of a portfolio that 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 BAB factor as described by Frazzini and Pedersen (2014). The high-quality stocks represent the long side of the QMJ factor as described by Asness, Frazzini, and Pedersen (2019). 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 earlier.

US Treasury bills (cash) is the US One-Month Treasury bill rate from the AQR Data Library until March 31, 1992. US Treasury bills is then the BofA Merrill Lynch 3-Month Treasury Bill Index from April 1, 1992 to March 31, 2020.

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