

Portfolio Defense and Low Bond Yields

Authored by:
Invesco Global Asset
Allocation team

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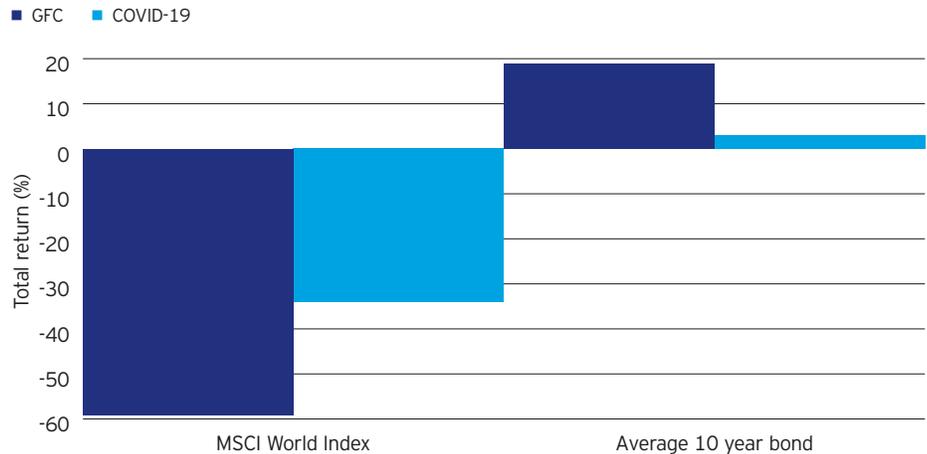
The role of government bonds within multi-asset portfolios is coming under increased scrutiny. Again. We have written before about the potential downside of owning sovereign debt (see *When Yields Rise* (2012) and *The Trouble with Bonds* (2015)). The insights of these earlier papers have not changed, but yields have continued to drift lower. The search for a replacement of the defensive qualities bonds bring to a portfolio has become even more critical. Over the course of many decades, bonds have demonstrated their ability to provide both a positive offset during periods of weakness in global equity markets and an incremental return to a portfolio. In other words, they have offered a unique insurance-like payoff without the drag of premium payments.

Non-inflationary growth regimes favor every type of equity investment. Inflationary growth environments have historically benefitted investments in commodities (particularly energy and precious metals). Deflationary, or crisis, scenarios have seen long-term, developed-market sovereign bonds provide strong defensive returns. The economic regime framework is both simple and intuitive in that it has, at least so far, associated a single asset class, each with its own long-term risk premium and correlation benefit, to a specific economic outcome without predicting which outcome is most likely. Bonds have fulfilled their role of defensive assets, and the benefits of the economic framework have been proven.

However, a review of our annual research agendas over the last decade reveals our mounting skepticism about the future of government bonds as the defensive asset of choice. On September 30, 2008, the average 10-year government bond yield across six countries (US, Canada, UK, Germany, Japan, and Australia) was 3.8%. Fast forward to July 31, 2020, and the average yield stands at a paltry 23 basis points. If low average yields weren't enough to worry about, both German and Japanese yields have been below zero for much of the last one and a half years. Furthermore, the scope for maneuvering among the universe of government bonds is becoming steadily more problematic as the range of yields across markets becomes increasingly compressed. Figure 1 on the following page shows that bonds are not mitigating risk as much as before. During the equity market sell-off during the 2020 COVID-19 crisis (~-30%), the average bond return was just over +2%. By comparison, during the global financial crisis of 2008, bond returns averaged nearly +20%. Clearly, low yields have reduced the ability of bonds to provide defense during significant equity market selloffs.

Figure 1: Bonds are not protecting as much as before

Performance during peak-to-trough equity decline



Source: Invesco analysis. For illustrative purposes only. Avg. 10-Year Bond represented by equally-weighted average of benchmark 10-Year government bonds from US, Canada, UK, Germany, Japan, and Australia. GFC drawdown period = 10/31/07 - 03/09/09. COVID-19 drawdown period from 02/12/20 to 03/23/20. **Past performance is not a guarantee of future results. An investment cannot be made directly into an index.**

While we have examined a larger set of alternative defensive assets¹, our focus is on the two assets we find to be most promising: Long put option exposure and equity factor strategies. Our research goal is not to improve on already impressive simulations. As we have already stated, bonds have been the near-perfect asset to hedge equity risk. Instead, we hope to merely match historical results where bonds were the sole contributor to portfolio defense. Furthermore, our intention is not to remove interest rate exposure from a strategy entirely. Instead, we intend to systematically reduce bond exposure in favor of a combination of exposures that exhibit similar return and correlation characteristics to bonds and improve the diversification characteristics of our existing framework. Specifically, we intend to introduce two new pillars to the strategy:

- 1 A long put exposure, and
- 2 An exposure to equity factors.

Our expectation is that the addition of these exposures can be a potential benefit for the strategy, particularly during more challenging environments when any downside mitigation from bonds may fail to materialize. The remainder of this paper describes these additions in greater detail.

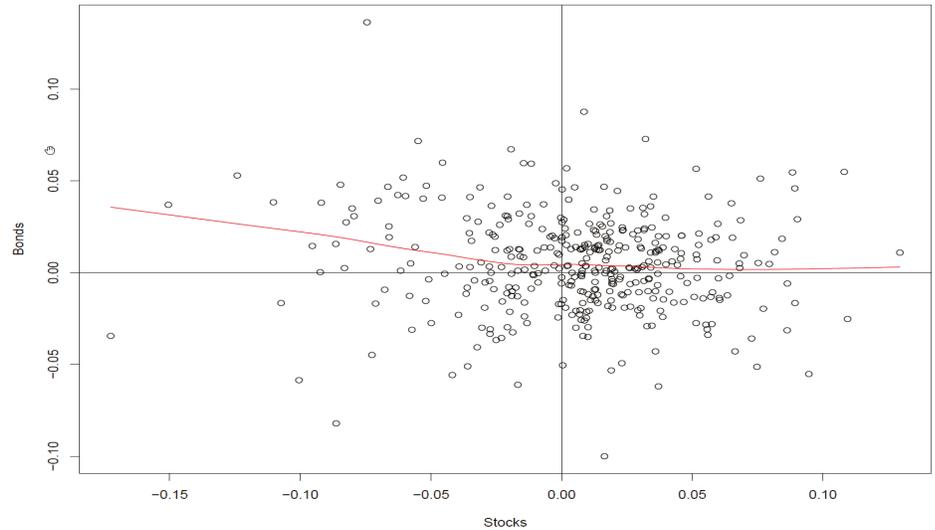
Long Put Options

Setting aside common criticisms for a moment, it is no accident that we find long put options to be a compelling addition to a strategy. A simple examination of the relationship between stock returns (S&P 500) and bond returns (10-year US Treasuries) since 1988 highlights the stylistically similar payoff structure of bonds relative to long put options. The red fitted line in Figure 2 has been estimated using a locally weighted polynomial regression and very clearly resembles the return profile of a long put option. Of course, there have been many times when both bond returns and stock returns have been negative (any observation in the lower left quadrant of Figure 2). Long put options can eliminate nearly all the simultaneously negative observations as a result of the contractual nature of long put returns. While bonds have been an effective indirect approach to reduce the impact of left-tailed equity events, put options have offered a more direct way to limit the risk of equity exposure. However, the main criticism of holding long put options is their explicit cost.

¹ Our defensive asset examination included a broad set of assets and included put options, macroeconomic equity factor exposures, Japanese Yen, Swiss Franc, and gold.

Figure 2: Return comparison: Stocks vs. bonds since Dec. 31, 1988

Bonds have been a near-perfect defensive asset



Source: Invesco analysis. Time period represented: 12/31/88 - 06/30/20. The scatter plot represents monthly returns of the S&P 500 versus the returns of the US Treasury Long Bond. The fitted line in red has been estimated using a locally-weighted polynomial regression. Cleveland, W. S. (1979) Robust locally weighted regression and smoothing scatterplots. *J. American Statistical Association* 74, 829-836. An investment cannot be made directly into an index.

The Costs of Reducing Equity Risk

As we examine the virtues of holding bonds as a means to reduce equity risk in a portfolio, it can be helpful to ask a simple question: Should a lower-risk portfolio of stocks and bonds be able to keep up with a higher-risk portfolio of only stocks during periods when stocks rise? Said another way, is there an implicit cost of reducing equity risk over the long term?

A central tenet of investing is that there is a positive relationship between risk and return. Investors should expect lower returns when they take less risk. This concept is demonstrated in all corners of finance but is perhaps most explicitly visible when we measure the costs of truncating downside risk with put options. Reducing equity risk by buying put options, which are a form of financial insurance, requires the payment of up-front cash premiums to the seller of the insurance. Watching premium payments move out of an investor's portfolio and into an insurance seller's pocket can trigger a painful recognition that lower returns (relative to the previously unprotected portfolio) are indeed to be expected as a result of contractually insuring against losses.

However, there is an often-overlooked benefit of reducing equity risk with put options - we can maintain (or even increase) our allocation to equities without having to reallocate into lower-risk assets, like bonds, for risk reduction. So, while the fixed and negative cost of options-based risk reduction is felt up front, the ability to retain or increase equity exposure can help offset that cost through the floating and positive expected equity returns of the future. Measuring the long-term impact of de-risking an equity portfolio with put options should require accounting for both the negative cost of holding insurance and the additional equity upside exposure that the insurance allows us to retain.

Referring back to the big picture question (should a lower-risk portfolio of stocks and bonds be able to keep up with a higher-risk portfolio of only stocks during periods when stocks rise?), the central tenets of finance suggest that a resounding "No!" is the appropriate answer in the long-run. De-risking a portion of an equity portfolio by selling equities and replacing them with bonds can also be thought of as a form of financial insurance. But, unlike options-based insurance, bond-based insurance has no explicit fixed cost, no observable seller posting ask prices to account for the unfavorably asymmetric volatility risk they are willing to take.² Instead, the costs of de-risking with bonds can only be known ex-post since the cost of bond-based risk reduction floats through time. Because many investors fail to conduct a thorough post-mortem of the costs of bond-based risk reduction, they may not realize that those implicit costs can be every bit as painful as the explicit upfront costs of de-risking with options.

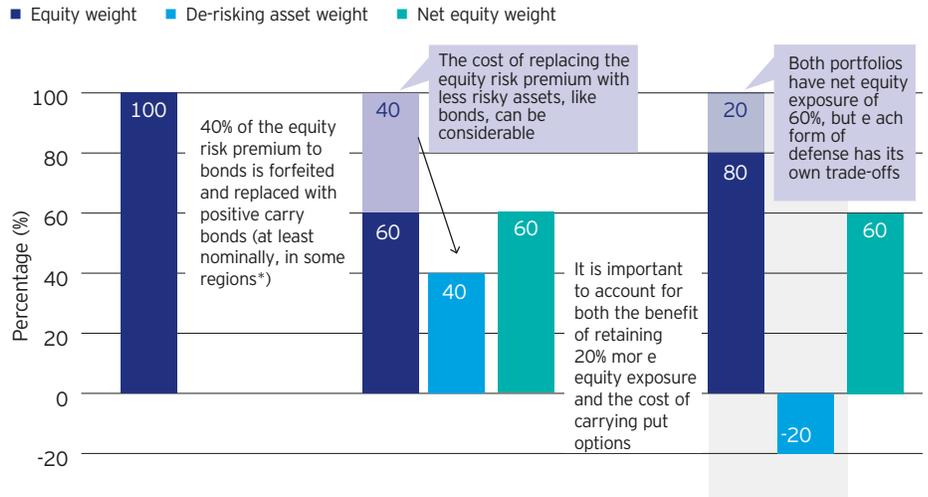
Figure 3 on the following page illustrates the differences between de-risking with bonds (10-year Treasuries) and put options, which can help us compare each technique more directly. In this example, we compare two portfolios: A traditional "60/40" portfolio that sells 40% of its equity exposure and replaces it with 10-year Treasury bonds, and an alternative portfolio which holds an 80% weight to equities and buys put options such that its net downside equity exposure is 60%, like the 60/40 portfolio.³

2 Option buyers enjoy favorably asymmetric payoff profiles where losses are limited to premiums paid and gains are unlimited. Since option sellers must contend with the opposite payoff profile, they rationally demand premiums for enduring unfavorable asymmetry and tail risk. The excess premium is generally referred to as the volatility risk premium (VRP) and is a primary source of the negative expected return to holding a long option position. We take no position on the appropriateness of buying or selling options since each can have its place in delivering beneficial properties to a well-diversified portfolio.

3 The put option strategy shown here, and throughout this discussion, is a simulation derived from OptionMetrics data, not an actual investment strategy. It consists of 12 overlapping series¹ of global equity (S&P 500, Nikkei, EuroStoxx 50, Russell 2000, and FTSE 100) index options, each with an expiration tenor of approximately 12 months and strike prices equal to approximately 90% of the index spot price, rolled and rebalanced on a monthly basis. The put option strategy is sized such that it approximates 60% net downside equity exposure, similar to the 60/40 global equity/bond portfolio. This simulated put option strategy is for illustration purposes only.

Figure 3: Measuring the cost of reducing equity risk

There are multiple ways to reduce equity risk - each with an expected cost relative to unhedged equity exposure



Sources: OptionMetrics and Invesco analysis. Put strategy consists of twelve overlapping series of global equity (S&P 500, Nikkei, EuroStoxx 50, Russell 2000, and FTSE 100) index options, each with an expiration tenor of approximately 12 months and strike prices equal to approximately 90% of the index spot price, rolled and rebalanced on a monthly basis. The put option strategy is sized such that it approximates 60% net downside equity exposure, similar to the 60/40 global equity/bond portfolio. This simulated put option strategy is for illustration purposes only.

This leads us back to our simpler question above (Is there an expected cost of reducing equity risk over the long term?). Figure 3 clearly shows that whether investors look to reduce portfolio risk implicitly with bonds or explicitly with put options, the answer is clearly yes. These two types of risk reduction both had costs relative to a pure equity portfolio historically.

Figure 4: Option-based defense

The cost of reducing equity risk with bonds or put options



Source: Invesco analysis. Data as of 06/30/20. Past performance is not a guarantee of future results.

Our aim is not to suggest that one type of risk reduction is “better” - there are many variables and trade-offs between them. These trade-offs can be unique to each investor based on their own needs and utility preferences. Instead, our goals are 1) to compare the implicit and explicit costs and benefits of each risk reduction strategy in the context of the full portfolio, 2) to understand differences which may cause one strategy to outperform the other, and 3) to systematically apply a robust defensive asset toolkit that incorporates multiple forms of defense into a strategy.

Comparing the Costs of De-Risking with Put Options Relative to Bonds

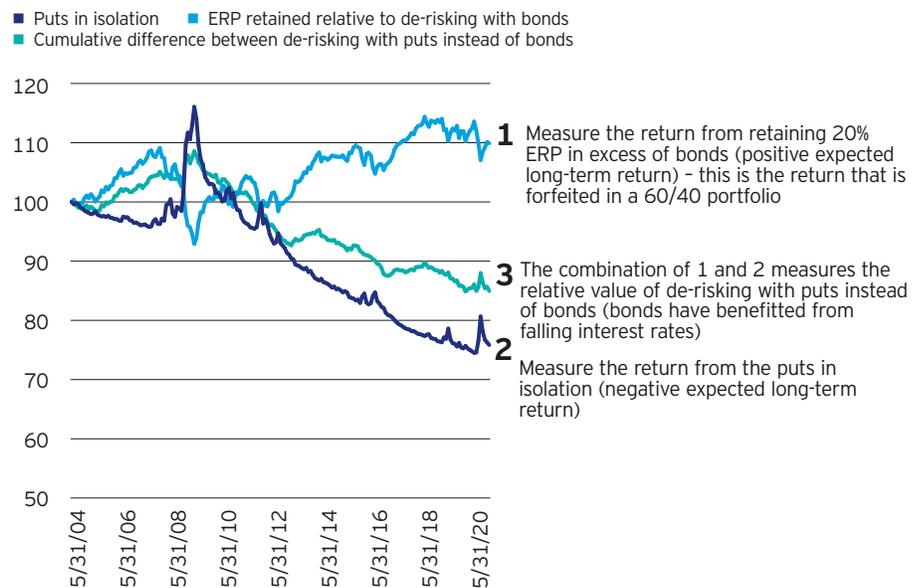
As shown in Figure 4, de-risking with bonds generally requires a partial forfeiting of the equity risk premium. In this case, we can define the equity risk premium as the equity return in excess of the bonds which replaced the equities. To be clear, this is the implicit cost of bond-based risk reduction.

If we instead buy put options and retain 100% of the equity risk premium (in other words, retain 40% more of the equity risk premium than the bond-based portfolio), then any positive equity risk premium is a net benefit of de-risking with puts relative to bonds. This benefit, of course, needs to be measured alongside the explicit costs of carrying the put options in isolation. The combination of the “extra” equity risk premium earned and the carry costs of the put options is the apples-to-apples value of de-risking with puts instead of bonds.

Figure 5 illustrates the historical performance of the components of the “De-Risk with Puts” portfolio relative to the “De-Risk with Bonds” portfolio.⁴

Figure 5: Measuring the costs of reducing equity risk

Making an apples-to-apples comparison of the costs of de-risking with put options relative to de-risking with bonds



Source: Invesco analysis. Time period represented: 03/31/04 - 06/30/20. Past performance, actual or simulated, is not a guarantee of future results. For illustrative purposes only.

⁴ Academics and industry practitioners sometimes ignore or de-emphasize the full portfolio effects of options-based risk reduction and instead focus almost entirely on the stand-alone carry costs of holding long option positions. This may be due to the inconveniences of combining non-linear options with linear assets like equities when applying the statistical analysis techniques commonly used in modern portfolio theory to option strategy return streams. For example, in Ilmanen, Thapar, et al. (July 2020) entitled “Tail Risk Hedging: Contrasting Put and Trend Strategies,” a lengthy discussion on the costs of passively managed put strategies (bolstered with startling cumulative wealth graphs of the stand-alone put strategies) concludes with only minimal recognition (no graphs) of the full portfolio effect - “Really countering investor impatience may require taking an integrated view: With a credible tail hedge in place, an investor can increase their equity allocation (say, from 60/40 to 70/30 - though excessive equity risk is typically the problem most hedgers are trying to address in the first place), and then judge the tail hedge performance together with this higher equity allocation and not stand-alone.” While a bit more complex, we believe an integrated view is the only way to appropriately assess the effectiveness of a portfolio that combines both risky and defensive assets.

Differentiating Between De-Risking with Puts Relative to Bonds

The green line in Figure 5 shows and is consistent with our view that bonds have been a nearly perfect defensive asset over the past 30+ years. Investors have been better off de-risking with bonds than with puts since 1996. So why should investors consider expanding the defensive asset toolkit to include options-based protection at this stage? An examination of the key attributes and drivers of success for each defensive asset is important to answer this question. We believe there are five primary differentiators that will determine the future effectiveness of incorporating puts and bonds in a defensive asset framework.

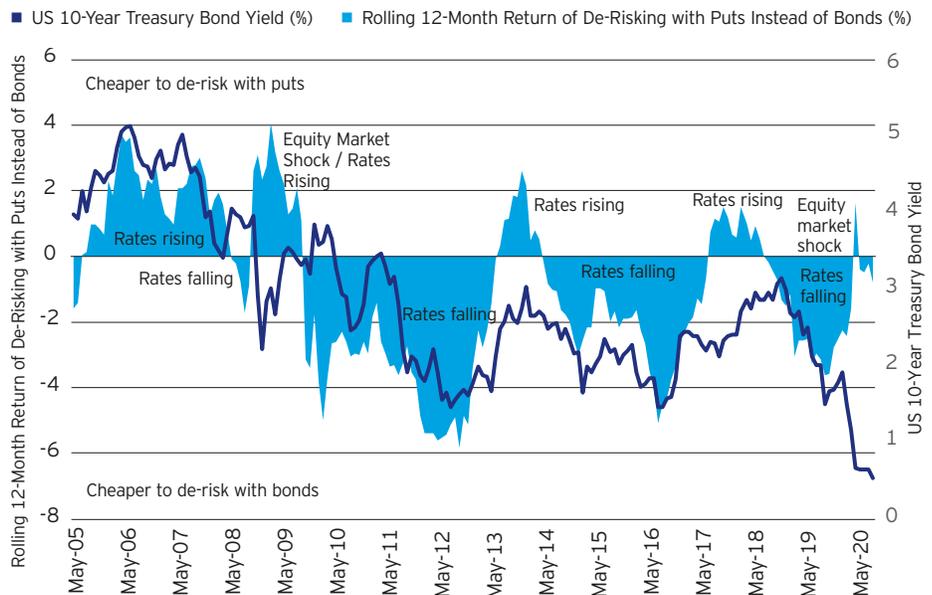
- 1 The direction of interest rates** - Rising rates may favor puts over bonds and vice versa.
- 2 Equity returns in excess of bonds** - Higher equity risk premium over bonds may favor puts over bonds (this is the blue line in Figure 5 and can be driven by the level and direction of interest rates).
- 3 The future correlation of stocks and bonds** - Options-based protection is contractually reliable and not impacted by future correlation assumptions. If bonds become more correlated with stocks than they have been in the last 30 years, puts may be more effective defensive assets than bonds.
- 4 The severity of equity market shocks** - Because put options are more convex than bonds (they gain more rapidly as markets fall further), put options may outperform bonds during more severe selloffs.

5 The cost of carrying put options - All else equal, a higher cost of carrying puts clearly favors bonds relative to puts. The implementation details of the put protection strategy can impact carry costs greatly.

The level and direction of interest rates are related to 1, 2, and 3 above, and when rates are at extreme levels, as they are now, the risk of a change in direction may be more likely. As we seek to bolster the defensive asset toolkit, the heightened risk of rising rates and equity market shocks, illustrated in Figure 6, is the primary evidence supporting the case for including puts alongside bonds for a more holistic approach to defense.

Figure 6: De-risking with puts can be less costly than bonds when rates rise

Outcomes of de-risking with puts or bonds are tied to the direction of interest rates and the severity of market shocks



Source: Invesco analysis. Time period represented: 04/30/05 - 06/30/20. **Past performance is not a guarantee of future results. For illustrative purposes only.**

Regarding the fourth differentiator (the severity of equity market shocks), we expect the cost of reducing equity risk with put options to remain negative over the long term. This will almost certainly be true for the puts in isolation (purple line in Figure 5). If interest rates stop falling and/or begin a long-term trend of rising, we would expect options-based defense to outperform bond-based defense (light blue line in Figure 6 may begin to rise).

The degree of outperformance of puts relative to bonds will be impacted by our implementation of the put option strategy. If we are able to thoughtfully implement a systematic put protection strategy that accounts for the trade-offs of carry costs and performance during equity sell-offs, we may be able to improve the long-term effectiveness of including options-based protection.

Our framework for assessing the effectiveness of options-based protection strategies, and defensive assets more broadly, centers around five criteria⁵:

- 1 **Reactivity** - How much do the options return when equities fall?
- 2 **Convexity** - How much more do the options return when equities fall further?
- 3 **Reliability** - What is the hit rate of positive returns for the options when equities fall?
- 4 **Carry costs** - What is the performance of the options when equities are rising?
- 5 **Path dependency** - How much does our defensive exposure vary based on our implementation schedule and the path of market returns?

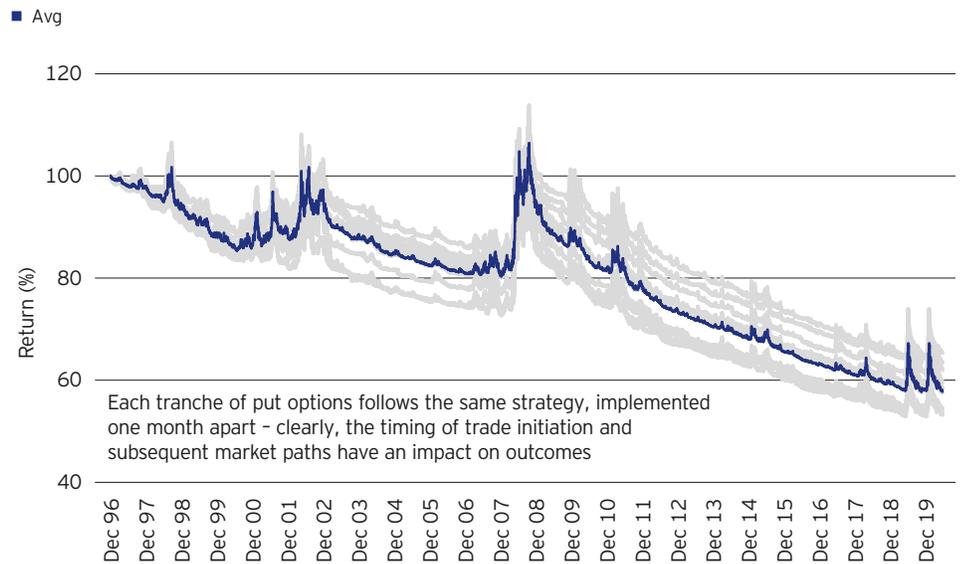
In general, any option strategy that seeks to reduce carry costs will also reduce the hedging effectiveness as measured by 1, 2, and 3. Our research is continuously focused on systematically balancing these trade-offs. We are also highly focused on path dependency to ensure that simulated results are not simply based on chance.

Figure 7 on the following page illustrates the importance of careful implementation of options-based protection with a focus on reducing path dependency in order to increase the stability of expected outcomes.

⁵ We borrow these terms from Baltas et al. (2020) of Goldman Sachs, "Systematic Downside Protection." See also Bank of America Merrill Lynch Global Research, "Allocation Alchemy: Hedges for the tail, defensives if bonds fail," 2020; UBS "Systematic Hedging, 2020" - Meketa Investment Group, "Risk Mitigating Strategies," 2019.

Figure 7: Long put strategy - managing path dependency

Diversifying option hedges across both strike prices and expiration dates can reduce path dependency



Source: Invesco analysis. Time period represented: 12/31/96 - 06/30/20. For illustrative purposes only.

Equity Factor Exposures

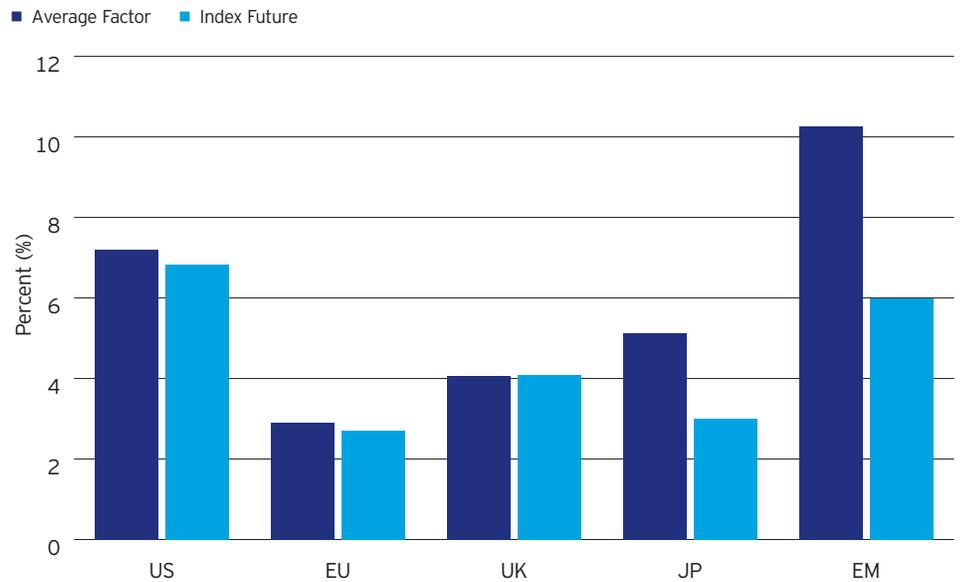
We now shift our focus to the second addition to the defensive toolkit, namely taking equity factor exposures into account. The recent decade has seen a significant rise in factor-based investment strategies, most often focusing on style factor strategies such as value or momentum. Style factors follow a clear investment rationale and are thought of as a meaningful approach to diversifying more traditional capitalization-weighted equity exposures. In this context, investors are typically very much concerned with managing shocks that ultimately result in significant equity drawdowns.

It is also important to recognize that the universe of equity factors is quite large and that not all factors offer a defensive profile. Factors should help investors better understand portfolio exposures. However, since the universe is large and there is inconsistent usage of terms, two simple questions will guide our factor choices: 1) Should investors expect to be compensated for having exposure to a given factor, and 2) what sort of environment should be most beneficial for a particular factor exposure? The factor exposures that we believe offer the best return and defensive characteristics are quality, low volatility, and momentum. Each of these factors can offer a well-documented rationale for positive risk premiums in the long-run and negatively correlated excess returns (relative to the traditional capitalization-weighted index). Positive correlation to bond returns also provides some evidence of the factors' defensive characteristics.

As you might have already guessed, we focus on factors where there is an expectation of a positive risk premium and those that perform best during periods of economic stress or crisis. In fact, positive return premiums are what makes equity factor exposures a natural complement to put options in so far as they can help to defray the explicit costs of holding long put options. Figure 8 on the following page represents the comparison of the annualized return of the equally weighted average of momentum, quality, and low volatility versus the active index futures contract for each available market.⁶ Figure 9 on the following page illustrates the defensive profile of the excess factor returns. Here, of course, negative correlations suggest that factors tend to outperform when market returns are below zero.

It is important to mention, however, that reasonable factor indices are not available for the Hong Kong equity market. Furthermore, liquidity presents an issue for implementing the put option strategy on the Hang Seng market exposure. To ensure that we are able to improve the diversification framework across all equity holdings in the portfolio, it makes sense that we should include markets that have both liquid options and available factor indices. Emerging market exposure satisfies these twin desires. Hence, we will replace Hong Kong with emerging market exposure to fully implement a more defensive equity structure.

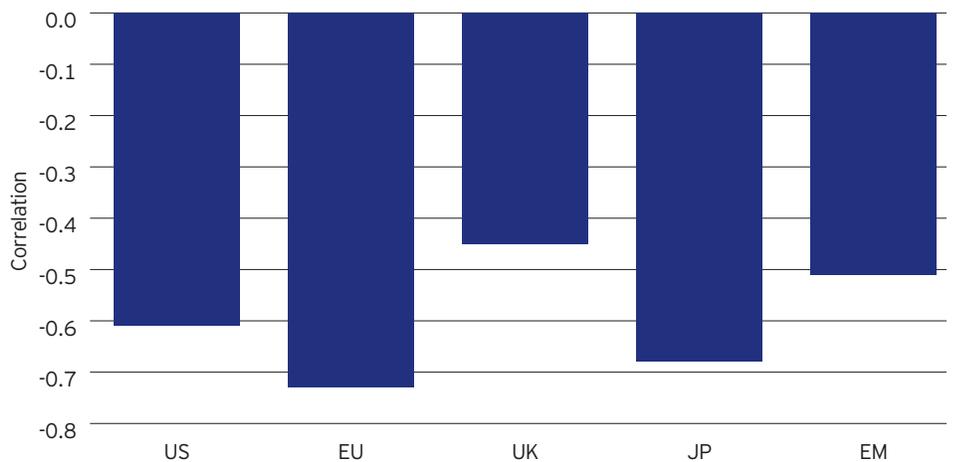
⁶ Sources: MSCI via Refinitiv, Invesco analysis. Time period represented: 12/31/00 - 09/30/20. Past performance is not a guarantee of future results. An investment cannot be made directly into an index.

Figure 8: Annualized return comparison 12/31/01 - 09/30/20

Sources: MSCI via Refinitiv, Invesco analysis. Time period represented: 12/31/01 - 09/30/20. **Past performance is not a guarantee of future results. An investment cannot be made directly into an index.**

Figure 9: Excess factor return correlation

Excess factor returns are negatively correlated with equity beta



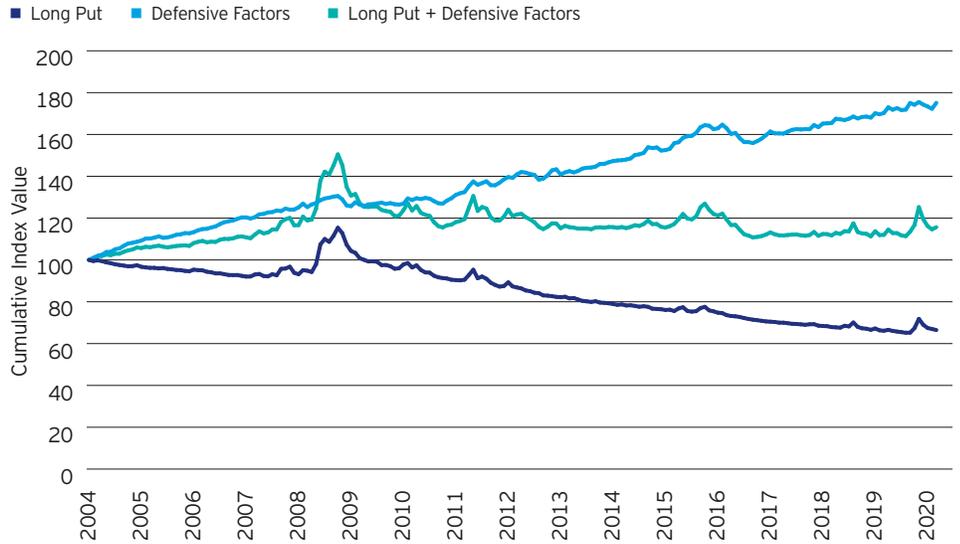
Source: Invesco analysis. Time period represented: 12/31/00 - 09/30/20. **Past performance is not a guarantee of future results. An investment cannot be made directly into an index.**

In a similar fashion as bonds, positive equity factor premiums during periods of significant market stress are less than certain (see Figure 2). Figure 10 on the following page highlights that combining the excess factor returns with long put options has created a diversified defensive asset with strong negative correlation (-0.86) to equity beta exposure.⁷

⁷ Sources: Refinitiv, MSCI, OptionMetrics, and Invesco analysis. Data covers the period May 31, 2004 through September 30, 2020.

Figure 10: Long-run defensive asset returns

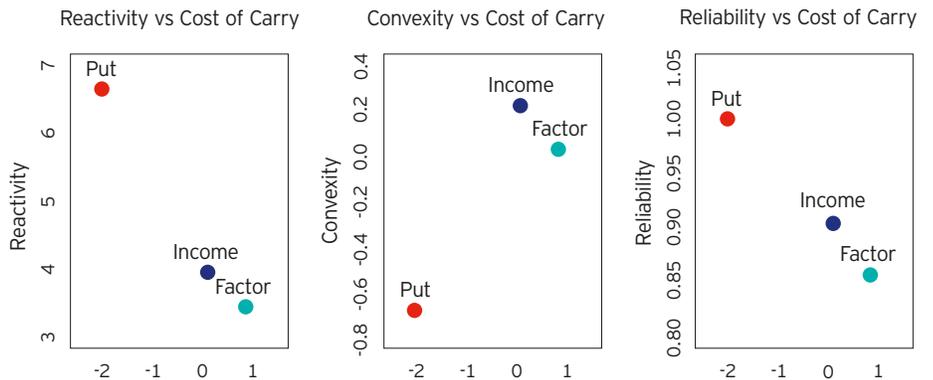
Managing the costs of long puts



Sources: MSCI via Refinitiv, Invesco analysis. Time period represented: 12/31/00 - 09/30/20. **Past performance is not a guarantee of future results. An investment cannot be made directly into an index.**

In the context of several of the metrics we have already highlighted to assess the effectiveness of defensive assets, we show in Figure 11 that the average of quality, momentum, and low volatility has been nearly as good as bonds with somewhat more positive carry. While timing which factor might provide the best defensive profile may be possible, we have intentionally removed this degree of freedom in an effort to make this enhancement straightforward and easy to implement through the use of total return swaps.

Figure 11: Average of quality, momentum and low volatility has been nearly as good as bonds



Source: Invesco analysis. Time period represented: 05/31/04 - 09/30/20. For illustrative purposes only.

In keeping with our model research goal, the simulated portfolio returns, including both long puts and defensive equity factor exposures, have resulted in model portfolio returns with similar characteristics to one that relies solely on bonds. Importantly, the model portfolio using puts and factor exposures has significantly less explicit interest rate exposure.

Conclusion

Incorporating both long put options and defensive factor exposures into the equity component of a strategy offers an opportunity to bolster the defensiveness of the strategy and simultaneously reduce the explicit interest rate exposure of the portfolio. At its core, the risk parity construct underpinning a strategy is nothing more than a portfolio construction technique. Whether or not the technique results in an acceptable outcome will almost entirely be a function of the ingredients (e.g., the assets used to represent the economic outcomes) rather than the technique itself. The prevailing view is that interest rates have finally reached a level where they will be unable to offer the same benefits they have provided in the past. Adding new exposures to remove the defensive burden from bonds is a reasonable update since the next decade will almost certainly look very different than the last.

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