A Defensive Allocation in Broad Portfolios: How Much Is Enough?

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Executive Summary

- For investors whose portfolios have a significant equity exposure, equity-risk-mitigation strategies may be used to alleviate the impact of severe equity market drawdowns.
- Incorporating risk mitigation strategies optimally can potentially enhance portfolio defensiveness against market declines without sacrificing too much return.
- Defensive alternative risk premia strategies are a natural candidate for risk mitigation, as they provide attractive return potential and have negative equity beta. Combining them with an equity-heavy portfolio may lead to lower equity beta with attractive returns.

As the stock market hits record highs, it is prudent for investors with high equity exposure to consider equity-risk-mitigation strategies that could provide positive returns in a large market correction.[1] There is, however, no free lunch, as strategies with higher defensiveness typically come at a cost of lower return. Therefore, the question of how to optimally allocate among these strategies to achieve desired defensiveness while maintaining high return potential is crucial.

In practice, investors who do not want to sacrifice too much return but still wish to avoid suffering large losses in their portfolios during an equity drawdown could consider defensive alternative risk premia (DARP) strategies. Designed to improve defensiveness, these strategies build on alternative risk premia (ARP) strategies, which typically have low to zero beta, to target a negative equity beta.

In our earlier work, “A Theoretical Framework for Equity-Defensive Strategies,”[2] we characterize an asset or strategy’s defensiveness as its equity beta conditional on a large equity drawdown (conditional beta). In general, an asset or strategy is considered to be more defensive if it has a lower conditional beta, as it is expected to perform well when equity delivers large negative returns. Formally, if an investor wishes to maximize overall portfolio return while achieving a certain level of defensiveness:[3]

$$\max_{w} w'\mu \text{ subject to } w'\Sigma w \leq \sigma_p^2 \text{ and } w'\beta \leq \beta_c, \quad (1)$$

1 Some examples of risk mitigation strategies include tail risk hedging, Treasuries, trend-following and alternative risk premia strategies.

2 Baz, Jamil, Josh Davis, Steve Sapra, Jerry Tsai and Normane Gillmann. "A Theoretical Framework for Equity-Defensive Strategies." PIMCO Quantitative Research, 2019.

3 Defensiveness is defined as targeting a conditional beta below some threshold β_c.μ and Σ are the unconditional mean and variance-covariance matrix of the available assets’ excess returns, and β is these assets’ conditional beta. σ_p^2 is the target volatility of the portfolio.

then the asset allocation is given by[4]

$$w = \beta_c w^B + c(w^{MVO} - \beta^{MVO} w^B). \quad (2)$$

That is, the optimal portfolio can be decomposed into two parts. The first is a hedging component that provides the desired downside defensiveness (conditional beta) using the least amount of the investor's risk budget; the second is a diversification component that increases return potential without affecting the beta. The return of the portfolio can be decomposed similarly:

Portfolio return = -insurance premium + (risk budget × efficiency) (3)

The key to an attractive defensive portfolio is one that does not overpay on the "insurance premium" and still leaves a risk budget sufficient to generate returns.

In this piece, we use this framework to show hypothetically how to optimally combine a portfolio with high equity exposure (a 60/40 portfolio that allocates 60% to equities and 40% to bonds) with a DARP strategy so that the overall portfolio can achieve better defensiveness while maintaining attractive expected returns. Each of the two strategies has 10% volatility, the Sharpe ratio of the 60/40 portfolio is 0.45 (4.5% excess return), and that of the DARP strategy is slightly lower at 0.40 (4.0% excess return). The equity beta, both unconditionally and conditionally, is 0.6 for the 60/40 portfolio and -0.2 for the DARP strategy, and the correlation between the two strategies is -0.3 (or a covariance of -0.003):[5]

$$\mu = \begin{bmatrix} 0.045 \\ 0.040 \end{bmatrix}, \Sigma = \begin{bmatrix} 0.010 & -0.003 \\ -0.003 & 0.010 \end{bmatrix}, \beta_c = \begin{bmatrix} 0.60 \\ -0.20 \end{bmatrix}. \quad (4)$$

ALLOCATION WITH LEVERAGE

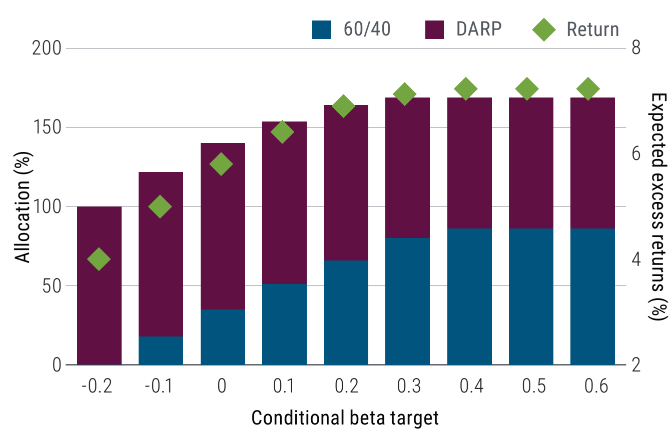
To form a 10% volatility portfolio that we believe can achieve the highest possible return using these two strategies, an investor would allocate 86% to the 60/40 portfolio and 83% to the DARP strategy (this is the mean-variance optimal (MVO) portfolio). The conditional beta of this portfolio is 0.35, and the expected excess return is 7.2% (or a Sharpe ratio of 0.72). Compared with the original 60/40 portfolio, introducing the DARP strategy leads to a higher Sharpe ratio as well as a lower conditional beta.

The reason for using risk mitigation strategies is that the overall portfolio can achieve better defensiveness (that is, an upper bound on the portfolio's conditional beta). Given that the portfolio with maximum return has a conditional beta of 0.35, it would not make sense to target any value greater than this; after all, any portfolio with higher conditional beta would likely also have lower return. However, what if the investor wishes to have a lower beta of, say, 0.25? What would be the best way to achieve it? And perhaps more importantly, how much return would they need to forgo?

In this framework, the optimal portfolio with a beta of 0.25 allocates 73% to the 60/40 and 94% to the DARP strategy. That is, as we increase the defensiveness of the portfolio, we shift roughly 10% of the weighting from the 60/40 to the DARP strategy. The expected return of this portfolio is 7.0%. Compared with the previous case, we sacrifice about 20 basis points of return but decrease the unconditional beta by almost 30%.

More generally, Exhibit 1 shows the allocations to the two strategies, given various beta targets. Note that while the

Exhibit 1: Optimal portfolio allocation when leverage is allowed



Source: PIMCO. **Hypothetical example for illustrative purposes only.** There can be no assurance that the investment approach outlined above will produce the desired results or achieve any particular level of returns.

4 c is a constant that ensures the volatility target is met; w^B is the portfolio that achieves a beta of 1 with the lowest variance; and w^{MVO} and β^{MVO} are the portfolio weight and equity beta, respectively, of the mean-variance optimal portfolio.

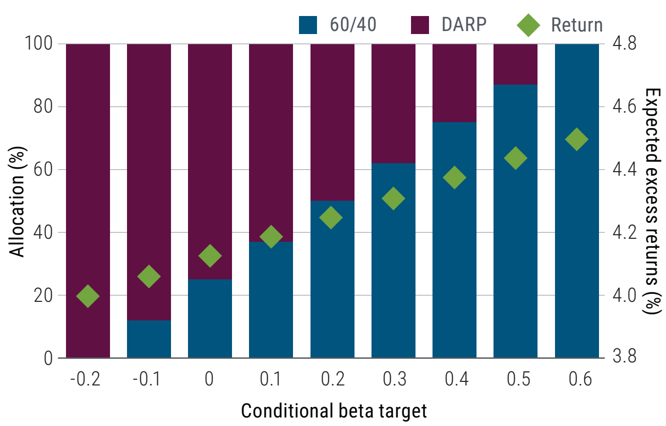
5 Assumes the return of the 60/40 portfolio to be $0.6r_e + 0.4r_b$ and the DARP return is $-0.2r_e + r_i$. If equity, bond and DARP idiosyncratic returns are uncorrelated, the covariance between 60/40 and DARP is $-0.12var_e(r_m)$, which equals -0.003 with 16% equity volatility.

investor does pay the cost of lower return as their allocation shifts toward the DARP strategy, these portfolios still offer competitive returns. For example, the portfolio with a -0.1 conditional beta has a Sharpe ratio around 0.5, which is higher than that of the 60/40 portfolio.

ALLOCATION WITHOUT LEVERAGE

In the previous example, the total allocation to these strategies can be above 100%, but many investors face leverage constraints. Recognizing this, here we further constrain the allocation so that the total weights should sum to 100%. In this case, the portfolio that achieves the highest return is one that allocates to only the 60/40 portfolio, which has a conditional beta of 0.6. With this new leverage constraint, the optimal portfolio with a 0.25 conditional beta allocates 56% to the 60/40 portfolio and 44% to the DARP strategy. This portfolio has an expected excess return of 4.3% and volatility of 6%. Compared with the 60/40 portfolio, while return decreases about 22 basis points, the Sharpe ratio rises significantly from 0.45 to 0.71.

Exhibit 2: Optimal portfolio allocation when leverage is not allowed



Source: PIMCO. **Hypothetical example for illustrative purposes only.** There can be no assurance that the investment approach outlined above will produce the desired results or achieve any particular level of returns.

More generally, Exhibit 2 shows the optimal allocation to the two strategies under various conditional beta targets.[6] As before, increasing portfolio defensiveness leads to lower returns; however, having a high octane DARP strategy limits the cost of higher defensiveness.

CONCLUSION

While here we focus on a 60/40 portfolio, the same framework can be applied to any portfolio with high equity exposure. Investors simply decide the level of defensiveness they desire to determine the optimal allocation. Having a high quality defensive alternative risk premia strategy is crucial in achieving an attractive portfolio, as it allows investors to enhance the defensiveness of their portfolios without sacrificing too much return.

6 Each of these optimal portfolios has a total weight of 100% as well as a 10% upper bound on volatility. Because the DARP strategy has lower expected return, and because of the weight constraint, we shift the minimum amount of weights from the benchmark to meet the beta target. In this case, because the two strategies are negatively correlated, the volatility constraint will not bind for lower-beta targets.

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