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ADAPTIVE RISK ALLOCATION AND THE FUTURE OF PORTFOLIO CONSTRUCTION

While the future will always remain an undiscovered country, risk parity is no longer an undiscovered solution for investors. In the years leading up to the 2008 financial crisis, many practitioners had already become converts to the key tenets of risk parity and used them to develop new strategies. Ideas such as using leverage to harness the higher risk-adjusted returns of fixed-income markets, investing according to risk instead of capital and the diversification benefits of multiple risk premia beyond equity have become common for sophisticated investors. However, one area of risk allocation that has not been explored as commonly is the idea of *adaptive* rather than static risk allocation. In this paper, we make the case for adaptive risk allocation approaches and explore their potential benefits for investors.

Risk parity review

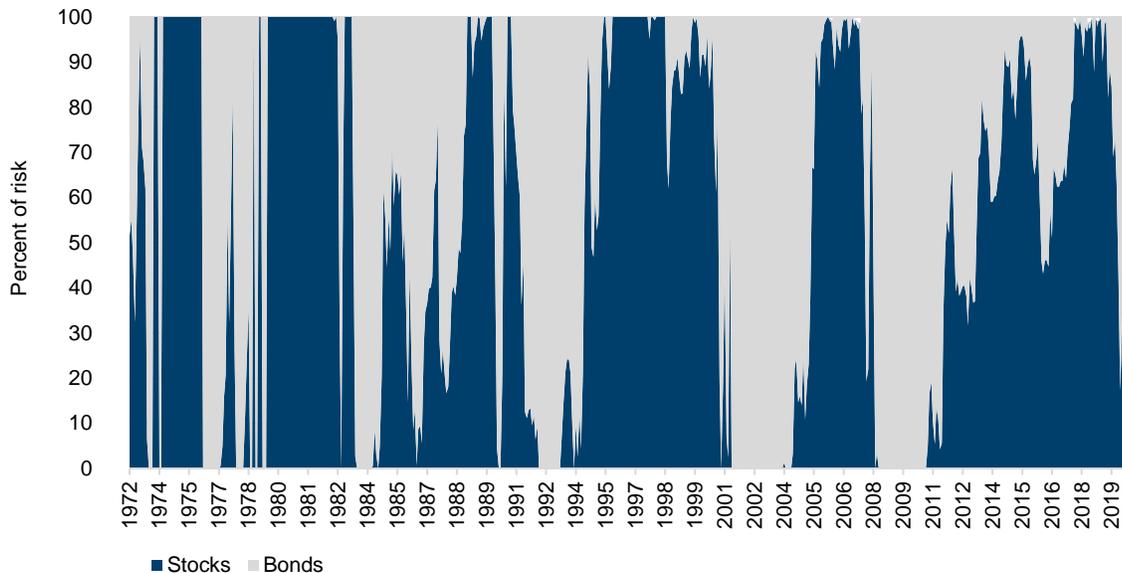
A quick argument for demonstrating the value of risk parity goes something like this:

- Take the S&P 500 stock index and 7- to 10-year U.S. Treasury bond returns
- Look at a long-term data set such as December 31, 1969 to October 31, 2020 (i.e., 50 years)
- From these, derive the historical volatility of stocks (15%) and of bonds (6%)
- Build a portfolio with a 60% stock/40% bond capital allocation; based on historical data, this portfolio would have had a Sharpe ratio of 0.48. Disaggregating the stock and bond returns, we would see that 92% of the risk, measured by standard deviation, would come from equities, despite only a 60% capital allocation.
- Then, build a risk parity portfolio of 28% stock/72% bond, leveraged 1.5X, with the effect of increasing returns by the same factor; this portfolio would have had a Sharpe ratio of 0.54 — with 50% of the risk coming from equity.

In short, risk parity seeks to balance the underlying risks of stocks and bonds and achieve a higher Sharpe ratio (i.e., it is a more efficient portfolio, delivering greater return per unit of risk).

Reframing the problem, if an investor's goal is to maximize Sharpe ratio, is a static risk allocation approach always the answer? Not necessarily. Looking at rolling three-year returns on the same data set, one gets a different answer on how much equity risk is optimal given market performance. Exhibit 1 shows the optimal equity risk weight in a portfolio on a monthly basis for the period January 1973 through September 2020. In this exhibit, we define optimal as delivering the highest possible Sharpe ratio.

Exhibit 1: Equity and fixed-income risk weights over time



Source: Columbia Threadneedle Investments. Stocks are represented by the S&P 500 Total Return and bonds are represented by the 10-year U.S. Treasury Total Return index, synthetically calculated. Please see notes for complete methodology.

Interestingly and importantly, the average across this time period is a portfolio with 54% risk from stocks and 46% coming from bonds. Many would look at a chart like this one and use it as validation for a static risk parity approach — over time, stocks and bonds appear to reach near equilibrium, even if the actual historical allocation is markedly different at any given point. However, if we can say that these sorts of swings can and should be identified ex ante, then an investor could strive to achieve a better Sharpe ratio by adapting our risk allocation approach to different market environments.

Introduction to an adaptive risk approach

Adaptive risk allocation is predicated on the idea that there are certain environments in which an investor should take more risk in a particular asset class or less risk in others and that these periods can be identified ex ante. In this way, a portfolio manager can aim to protect the portfolio when that is required, or take more risk when it is appropriate — by adapting based on market conditions. This simple observation may seem axiomatic, but in practice it is not widely implemented, especially by traditional risk parity providers. For many, the rationale for not using an

adaptive approach is that it introduces human fallibility (via market timing) into what is otherwise a mechanical process. We agree...up to a point, as we believe that risk allocation strategies can be enhanced by using a relatively simple rules-based strategy to establish an optimal equity allocation. It is important to stress the rules-based component, which removes human biases and errors in judgment that a purely subjective approach introduces in establishing portfolio allocations.

In our own work, we established rules asking a few key questions to help us characterize the market and identify optimal portfolio risk weights based on the market state:

- Are stock market conditions favorable? To measure this, we examine equity momentum (as measured by a 15-day/200-day moving average crossover) and volatility (looking at the level of trailing 1-month realized volatility).
- Are bond markets behaving normally? Here, we look at a simple 10-year vs. 3-month yield curve to see if there is an inversion.

Why would a system like this one work? Momentum has been documented to be a successful trading factor and is at the heart of many successful strategies ranging from choosing stocks to trading across commodities. We have found that momentum in combination with low volatility is even more powerful. On the flip side, signals such as the inverted yield curve have served as signs that the market is going through an abnormal pricing period. When this coincides with a healthy equity market, it potentially provides even more opportunity. But when the inverted yield curve coincides with a weaker equity market, this signal combination indicates a good time to be defensive.

Based on the combination of answers to our questions, we can determine which of four possible “market states” we are experiencing at any given time, and determine a portfolio asset allocation accordingly:

Exhibit 2: Market states

		Are stock market conditions favorable? (Is momentum positive, and is volatility low?)	
		No	Yes
Are bond markets behaving normally? (Is the 10-yr./3-mo. yield curve inverted?)	Yes	Neutral market state 54% of the time	Bullish market state 34% of the time
	No	Capital preservation market state 8% of the time	Highly bullish market state 4% of the time

Source: Columbia Management Investment Advisers, LLC. Data is based on the time period from January 1, 1970 through September 30, 2020 and may not reflect future market conditions. Market states are based on a proprietary model.

- For the purposes of this paper, we will present results of our analysis based on a simplified diversified portfolio composed of U.S. equities and U.S. bonds. Equities are represented by

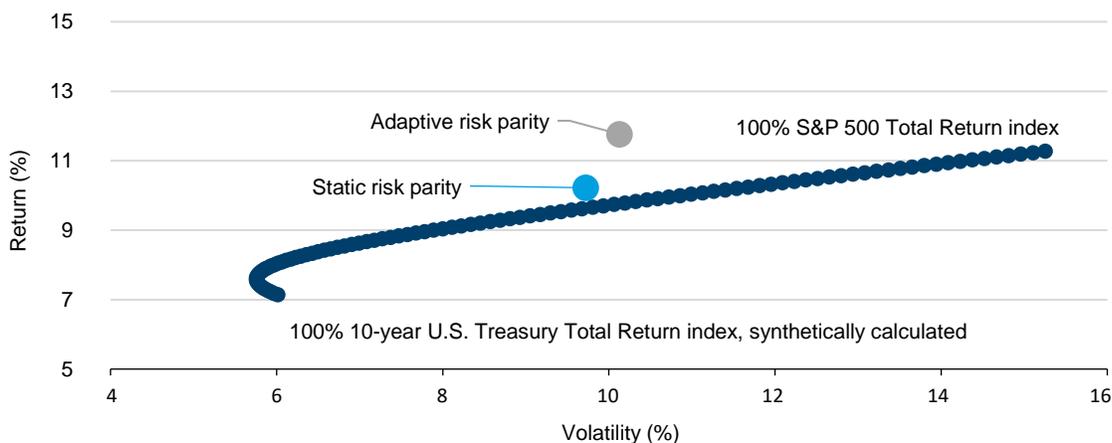
the S&P 500 Total Return index and bonds are represented by the 10-year U.S. Treasury Total Return index, synthetically calculated (see notes). In actual portfolios, allocations would be spread across a wider range of underlying asset classes.

- In the Neutral market state (where we tend to be most of the time), a portfolio could use a risk allocation that approximates the risk weights of a capital allocation 60% equity/40% fixed income portfolio. We will assume an Equity/Fixed Income split of 30%/70%, leveraged 1.5 times.
- In the Bullish market state, we would start to rotate from fixed income toward equity assets. We will assume an Equity/Treasury split of 40%/60%, leveraged 1.75 times.
- In the Highly Bullish market state, we would make an even more meaningful shift away from fixed income and into equity. We will assume an Equity/Treasury split of 50%/50%, leveraged 1.75 times.
- In the Capital Preservation market state, we would take a much more defensive approach and make a large shift out of equity and into fixed income. We will assume an Equity/Treasury split of 15%/85% with no leverage taken.

Comparing outcomes

Using a standard efficient frontier analysis, we can observe that the (static) risk parity portfolio is a more efficient outcome than any of the traditional capital allocation portfolios. But we can also see that this adaptive portfolio has significantly higher returns with a minimal increase of risk over the period from 12/31/69 through 10/31/20:

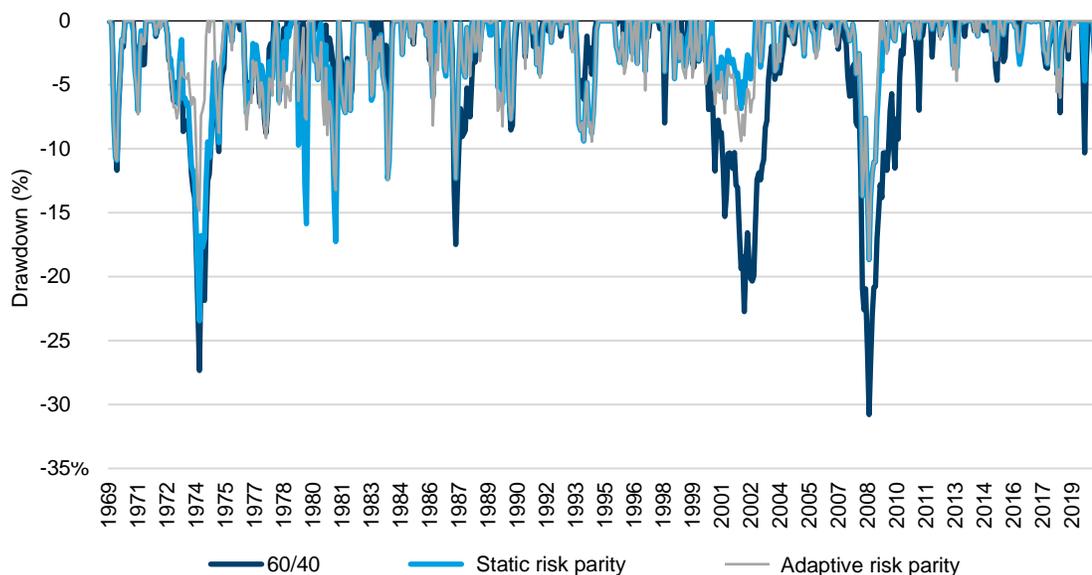
Exhibit 3: An adaptive risk approach may deliver a more efficient outcome



Source: Columbia Threadneedle Investments. For all portfolios shown above, equity is represented by the S&P 500 Total Return index and bonds are represented by the 10-year U.S. Treasury Total Return index, synthetically calculated. Please see notes for complete methodology. The static risk parity portfolio is composed of 30% equity/70% bond portfolio, leveraged 1.5 times, while the adaptive risk approach is created using the four market-state portfolios defined above. Please see notes for the full methodology. **The examples in this document were developed by Columbia Threadneedle Investments to illustrate the concepts discussed and are not representative of any particular investment. Simulated results have certain inherent limitations, do not represent actual trading, and may not reflect the impact that material economic and market factors may have had on decision-making during the period. Simulated results are based on the assumptions described, which may not reflect past or future market conditions. Different assumptions would have generated different results. No representation is being made that any investor will or is likely to achieve results similar to those shown.**

But the advantages are not just limited to more attractive traditional risk/return tradeoffs as shown in our efficient frontier. A further benefit of the adaptive approach is more attractive drawdown characteristics. Over the 1969–2020 period, we would have seen a max drawdown of -31% for the 60% equity/40% fixed income capially allocated portfolio, a -23% for the static risk parity portfolio, and -19% using the adaptive risk approach. Exhibit 3 illustrates similar return patterns on a rolling three-year basis:

Exhibit 4: An adaptive risk approach seeks to deliver a better drawdown profile



Source: Columbia Threadneedle Investments. For all portfolios shown above, equity is represented by the S&P 500 Total Return index and bonds are represented by the 10-year U.S. Treasury Total Return index, synthetically calculated. Please see notes for complete methodology. The static risk parity portfolio is composed of 30% equity/70% bond portfolio, leveraged 1.5 times, while the adaptive risk approach is created using the four market-state portfolios defined above. Please see notes for the full methodology. **The examples in this document were developed by Columbia Threadneedle Investments to illustrate the concepts discussed and are not representative of any particular investment. Simulated results have certain inherent limitations, do not represent actual trading, and may not reflect the impact that material economic and market factors may have had on decision-making during the period. Simulated results are based on the assumptions described, which may not reflect past or future market conditions. Different assumptions would have generated different results. No representation is being made that any investor will or is likely to achieve results similar to those shown.**

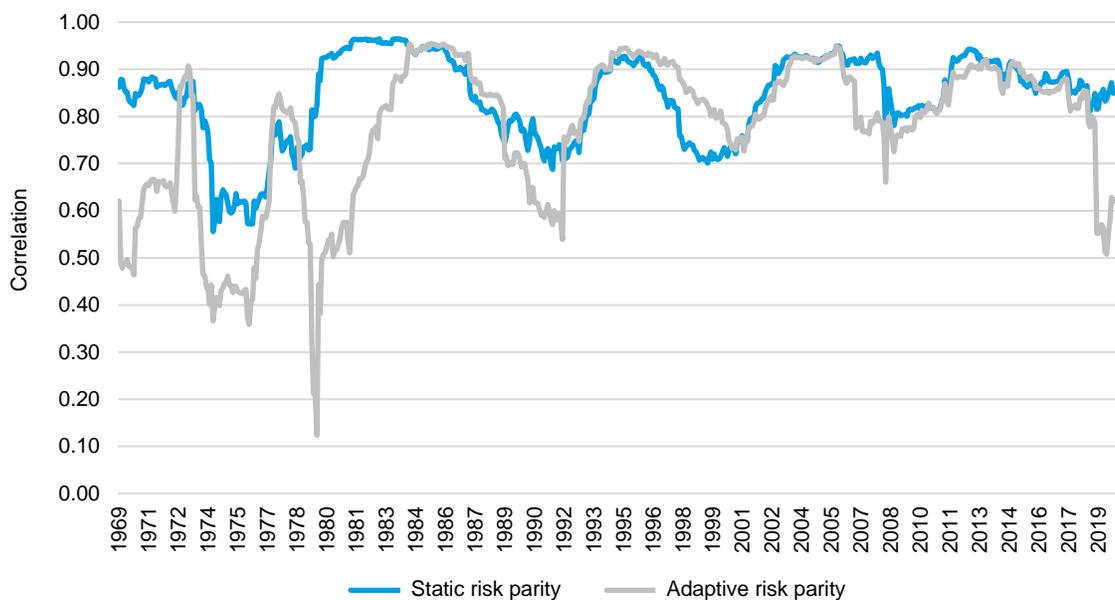
Addressing criticisms of risk allocation approaches

A common criticism of risk parity is that it has found success during what has largely been a single directional cycle for interest rates. On September 30, 1981, the 10-year U.S. Treasury yield reached a month-end high of 15.84%; that number declined to a month-end low of 0.53% on July 31, 2020. Not only are these the highest and lowest results over the past 50 years, but they exceed any of the extremes seen over the entire 20th century. A static risk parity portfolio is, by design, overweight fixed income and underweight equity relative to a 60% equity/40% fixed income capially allocated comparative benchmark. But by using an adaptive approach, we can mitigate the degree of this fixed income overweight; in fact, our representative policy portfolio has

a 75% equity weight in the Highly Bullish market state, 15% more than the 60% equity/40% fixed income portfolio. Simplistically, if our expectation was for a different yield environment — with flat or certainly upward yields — we might not see the same advantages of the allocation to Treasuries in a risk parity portfolio. By varying that allocation in an adaptive portfolio during a flat-to-rising yield environment, the lower Treasury allocations in the Bullish and Highly Bullish market states are more likely to outperform static alternatives.

Exhibit 5 compares the rolling three-year correlation of Treasury total return vs. the alphas (relative to 60% equity/40% bonds) of the static and adaptive risk parity portfolios:

Exhibit 5: An adaptive risk approach is less correlated with U.S. Treasury returns



Source: Columbia Threadneedle Investments. For all portfolios shown above, equity is represented by the S&P 500 Total return and bonds are represented by the 10-year U.S. Treasury Total Return index, synthetically calculated. Please see notes for complete methodology. The static risk parity portfolio is composed of 30% equity/70% bond portfolio, leveraged 1.5 times, while the adaptive risk approach is created using the four market-state portfolios defined above. Please see notes for the full methodology. **The examples in this document were developed by Columbia Threadneedle Investments to illustrate the concepts discussed and are not representative of any particular investment. Simulated results have certain inherent limitations, do not represent actual trading, and may not reflect the impact that material economic and market factors may have had on decision-making during the period. Simulated results are based on the assumptions described, which may not reflect past or future market conditions. Different assumptions would have generated different results. No representation is being made that any investor will or is likely to achieve results similar to those shown.**

Are they both positively correlated to fixed income direction? Yes, but note that the adaptive approach has gone through multiple periods with considerably lower sensitivity to the fixed income return, and by extension, the direction of interest rates.

Conclusion

Risk parity has been arguably the most disruptive innovation in the history of the asset allocation industry. The idea to invest with an attention to risk as opposed to capital changed the landscape for sophisticated diversified investors and has led to more advanced risk management methods for asset allocation portfolios, both traditional and alternative. We believe that by using an adaptive approach, rather than a static policy portfolio, investors can reap the benefits of risk parity science, protect against the downside of market crises and have opportunities to participate in the upside during calm environments. By taking an adaptive approach, risk parity can continue to be a successful, relevant investment strategy for the uncertainties that the future holds.

Important notes

The examples in this document were developed by Columbia Threadneedle Investments to illustrate the concepts discussed and are not representative of any particular investment. Simulated results have certain inherent limitations, do not represent actual trading, and may not reflect the impact that material economic and market factors may have had on decision-making during the period. The glide paths illustrated were developed with the benefit of hindsight. Simulated results are based on the assumptions described, which may not reflect past or future market conditions. Different assumptions would have generated different results. No representation is being made that any investor will or is likely to achieve results similar to those shown.

For all portfolios shown above, equity is represented by the S&P 500 Total Return index and bonds are represented by the 10-year U.S. Treasury Total Return index, synthetically calculated.

The Capital Allocation portfolio is composed of 60% equity and 40% bonds.

The Static Risk Allocation is composed of 30% equity and 70% bonds, leveraged 1.5 times, which is intended to represent an equal risk weight to equities and bonds.

The Adaptive Risk Allocation portfolio is composed of varying allocations to equities and bonds, contingent on prevailing stock and bond conditions.

- In the Neutral market state, the portfolio is composed of 30% equity/70% bonds, leveraged 1.5 times.
- In the Bullish market state, the portfolio is composed of 40% equity/60% bonds, leveraged 1.75 times.
- In the Highly Bullish market state, the portfolio is composed of 50% equity/50% bonds, leveraged 1.75 times.

- In the Capital Preservation market state, the portfolio is composed of 15% equity/85% bonds, with no leverage taken.

This historical back-test is hypothetical in nature and does not include investment management fees or transaction costs that would be incurred by an actual managed portfolio. The cost of leverage is assumed to be equal to the cash yield (based on the Bloomberg Generic 3-month Government Yield); no additional borrowing costs above and beyond cash were included in the calculation of these results.

Performance assumes the reinvestment of dividends and other earnings and is calculated in U.S. dollars. It assumes the sub-portfolios will earn the returns of the underlying indices. It also assumes that the portfolio is reallocated to the market state's portfolio on the first day of each month whereas there may be delays in the actual reallocation.

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