

At Par with Risk Parity?

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Risk parity attempts to remove the equity dominance of a traditional beta-allocated portfolio and equalize all asset risk contributions. The problem is that expected return declines. The solution is to leverage part, or the whole, portfolio. The benefits of a risk parity approach—better beta diversification and more efficient portfolios—come with several trade-offs to consider before a risk parity approach is adopted.

Consider the following scenario. The Fed has raised interest rates again, but inflation remains high. Equity markets are under tremendous pressure, and the level and volume of the DJIA are in the red. But you are not worried because your portfolio is well balanced. It has been designed to navigate these types of storms. This scenario is what all portfolio managers want—portfolios that are efficient and diversified and that provide smooth returns with low operational risk.

I will begin by defining risk parity, and then I will focus on the two primary benefits of risk parity: better beta diversification with less reliance on equity and the creation of more efficient portfolios through the use of leverage. Last, I will discuss some potential problems created by risk parity allocations—specifically, the use of leverage, some of risk parity's theoretical limitations, and several implementation considerations.

Definition of Risk Parity

To define risk parity, I will use the example of a “traditional” portfolio allocation, which generally consists of 60 percent in equities and 40 percent in fixed income. Although the dollar allocation between the two asset classes is fairly balanced, the equity contribution clearly dominates the total portfolio risk. Risk parity attempts to equalize assets in terms of their risk contribution. The problem is that in doing so, the expected return of the portfolio goes down. The risk parity solution is to leverage part, or the whole, portfolio.

Risk parity is ultimately about trade-offs. On the one hand, portfolios can be created with no leverage but lower Sharpe ratios, or on the other

hand, portfolios can be created with better risk-return attributes that require the use of leverage to achieve a reasonable rate of return.

At its core, risk is a subset of risk budgeting because it focuses solely on variance. Risk parity also relaxes leverage constraints, and its goal is to generate equity-like returns with lower volatility. Although some risk parity products combine a core risk parity portfolio with an active alpha component, it is basically a quantitative approach used to create beta exposures, or alternative beta.

Although risk parity allocations can be created regardless of the number of assets a portfolio holds, the simplified two-asset portfolio in **Table 1** shows one of the trade-offs between the traditional and risk parity approaches. The expected return on Asset 1 is 8.7 percent, and on Asset 2 it is 2.1 percent. The risk of the two assets is 20.1 percent and 10 percent, respectively. Note that the numbers have been rounded and correlations have been ignored. The objective is to create a portfolio that achieves an 8 percent return. The traditional return-based optimization tilts the portfolio heavily (90 percent) toward the risky asset and allocates only 10 percent to the more conservative Asset 2. Risk parity, in contrast, is concerned only about balancing risk between the two assets. In this case, it allocates about one-third to risky Asset 1 and two-thirds to the more conservative Asset 2.

Table 1. Effect of Risk Parity in an Optimized Portfolio of Two Assets

Item	Asset 1	Asset 2	Leverage
Expected return	8.7	2.1	
Risk	20.1	10.0	
Traditional optimization	90%	10%	1.0x
Risk parity	62%	125%	1.9x

This presentation comes from the CFA Institute 2011 Asset and Risk Allocation conference held in Chicago on 5–6 April 2011 in partnership with the CFA Society of Chicago.

The problem, however, is that the expected return of the portfolio is only 4.3 percent when using the risk parity approach. To bring the expected portfolio return back to the 8 percent target, the portfolio would need to be leveraged about 1.9 times.

Risk Parity Benefits

The earlier simplified example helps define the main benefit of risk parity—less reliance on growth in the economic cycle (i.e., equity beta) to generate the required rate of return. **Figure 1** illustrates how equity dominates portfolio risk in any given allocation. Similar to Table 1, the illustration shows only two assets and ignores correlation effects. With volatilities of 20 percent for equity and 10 percent for the less risky asset, the risk contribution of equity increases quickly; in fact, it increases to more than 80 percent with an allocation of only 50 percent to equity.

Another example is the Chicago Police pension fund. Currently, the fund has a dollar allocation to equity of about 42 percent, but its risk contribution is more than 65 percent (equity beta is actually understated because correlations tend to spike in times of crisis). With risk parity, portfolios are less reliant on growth in the economic cycle to generate return and thus are less volatile. Because the pension fund is only about 35 percent funded, path dependency is paramount. In fact, the tension that negative cash flow creates between optimal and adequate allocations is probably the most important challenge pension funds face. Low volatility solutions are thus extremely valuable.

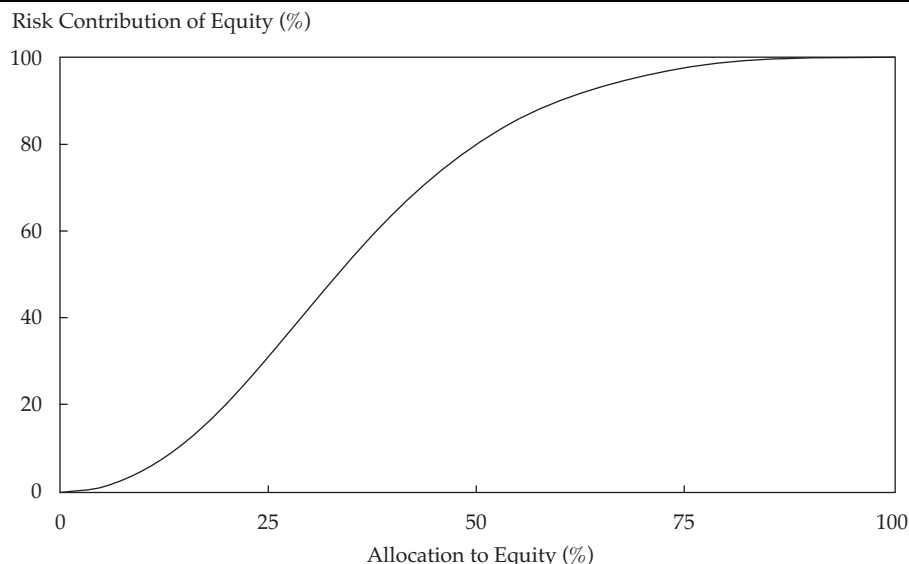
The second benefit of risk parity is its ability to create more efficient portfolios. In 1952, Markowitz introduced variance as a proxy for risk and portfolio optimization (Markowitz 1952). In other words, he asserted that risky assets can be combined in a way that minimizes variance at each level of return and maximizes return at any given risk level. He argued that rational investors should select a combination of assets situated on the efficient frontier. In the absence of leverage, the highest expected return of the portfolio is the return of the highest-returning asset class.

In 1958, Tobin argued that in the presence of a risk-free asset, risk-averse investors should hold portfolios of only two assets: the risk-free asset and a fund of risky assets (Tobin 1958). In 1964, Sharpe examined the implications of Tobin's two-fund separation theorem to develop the capital asset pricing model (CAPM), suggesting that the tangency portfolio is the market portfolio that consists of all existing assets weighted by market capitalization (Sharpe 1964).

I believe that risk parity is in total agreement with Tobin's argument but not so much with Sharpe's. Specifically, risk parity attempts to leverage an efficient portfolio instead of increasing risk along the efficient frontier. The portfolio it leverages, however, is not the tangency portfolio, which is an important point that I will revisit later.

So, to summarize, the two main benefits of risk parity are better beta diversification through lower equity exposures and increased efficiency through the use of leverage and the capital market line.

Figure 1. Risk Contribution of Equity at Various Allocation Levels



Risk Parity Trade-Offs and Limitations

The benefits of risk parity, however, also come with trade-offs and limitations. For example, risk parity appears to reject CAPM by leveraging an allocation that is not the tangency portfolio. Risk parity portfolios seem to fall somewhere between the capital market line and a line passing through the minimum-variance portfolio, as shown in **Figure 2**. Unleveraged risk parity portfolios, therefore, are not the most efficient unless all assets in the universe have identical correlations and Sharpe ratios. (For more about this subject, see Maillard, Roncalli, and Teiletche 2010.) Under these heroic assumptions, all assets in the world would become redundant.

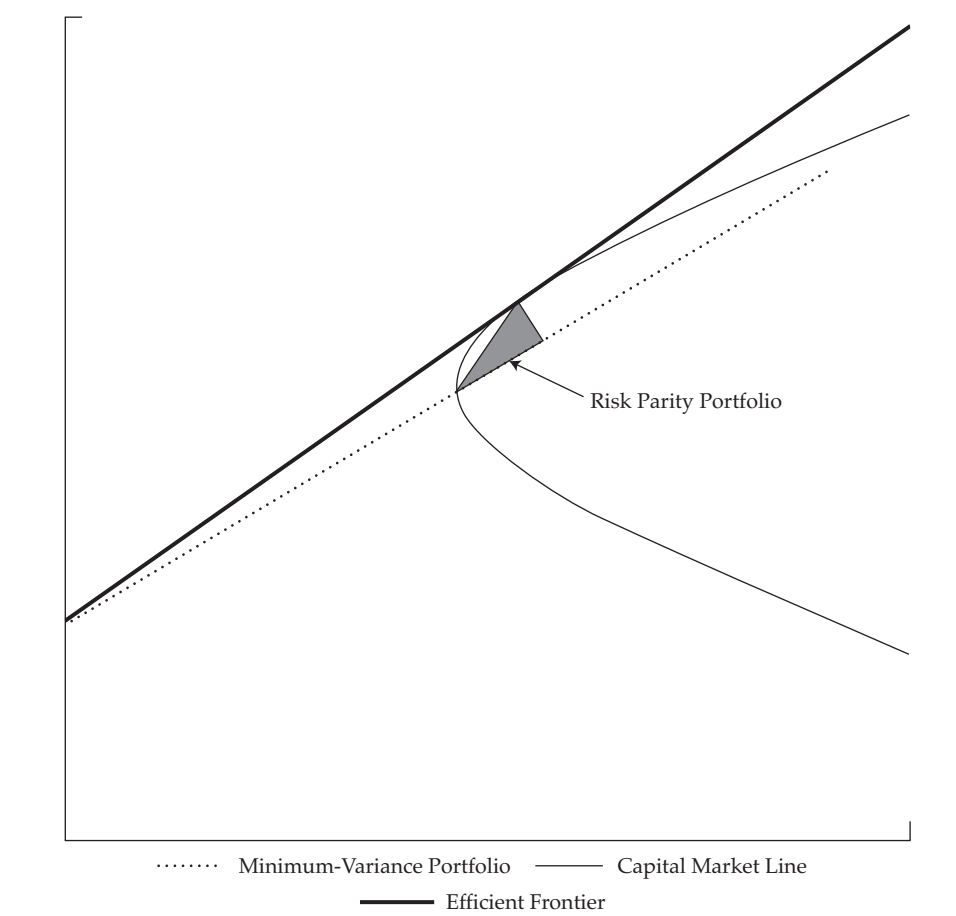
Risk parity proponents believe that unleveraged portfolios are “close enough” to the efficient portfolio, but that belief suggests another trade-off. On the one hand, investors can allocate using a theory that is imperfect but fairly well defined, or on the other hand, they can use an approach that is

not very well defined but has generated attractive returns for the past 10–15 years.

Importantly, risk parity also ignores returns, which brings up an interesting point. If it can be defined *ex ante* that the risk parity portfolio will outperform the market portfolio and thus investors who disregard expected returns are better off than those who try to predict returns, there is no value in seeking information beyond what is embedded in historical variance and correlations. (For more thoughts about markets being informationally inefficient, see Grossman and Stiglitz 1980.) That assertion might be a stretch for some investors. Several theories that attempt to explain the recent outperformance of risk parity portfolios are being considered.

One of the theories is that risk parity portfolios provide better diversification than other portfolios, especially in different economic regimes. Although some research has shown mathematical limits to these diversification benefits, consider the experiential side of the claim; with a traditional allocation,

Figure 2. Position of Risk Parity Portfolio in Relation to Minimum-Variance Portfolio, Capital Market Line, and Efficient Frontier



risk is dominated by economic cycles through equity exposures and fixed income and real asset allocations only matter at the tails of the distribution.

Risk parity takes another approach. First, it identifies a set of economic regimes, or states of the world, and then selects a set of risk contributions that equally addresses these different states of the world by allocating equally to these risk factors. From a beta allocation perspective, this nonquantitative argument is intuitively attractive and is one of the best lines of defense for risk parity portfolios.

Unfortunately, it is not without problems. First, the approach is quite subjective. Second, correlations between the assets as well as correlations between the assets and the different states of the world need to be estimated. These correlations must also be assumed to be stable over time. More importantly, some risk parity products assign equal probabilities to the states of the world, which has not been the case historically.

A second theory that some risk parity proponents are putting forward to justify recent returns is leverage aversion. Most investors are restricted by choice or by regulation in how they can apply leverage to their portfolios. As a result, in an attempt to earn the desired rate of return, they must increase allocation to the riskier assets (i.e., equities) in their portfolios. Thus, the theory posits that risk parity portfolios are able to capture a leverage aversion premium embedded in low-risk assets. The leverage aversion theory, however, is also burdened by a limitation related to market efficiency. If a leverage aversion premium does exist, then increased

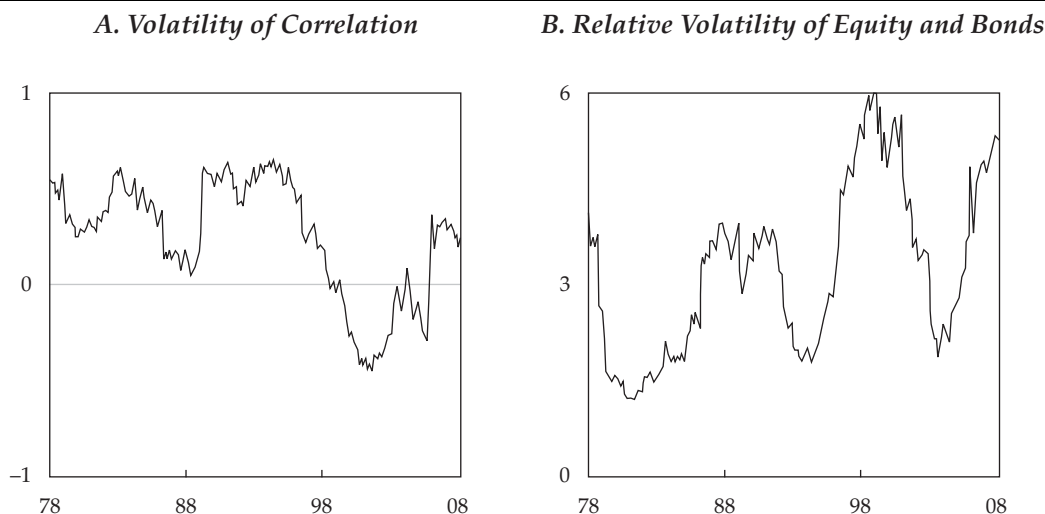
allocations to risk parity would arbitrage away this advantage over time.

Focusing on risk more than in the past is an excellent goal for investors. But putting no value whatsoever on forecasting returns would free up time for most investors, and the savings could be used to address some of the other problems that come with risk parity—one of them being leverage. As I pointed out earlier, risk parity increases allocations to lower-volatility assets to gain diversification benefits, which lowers the expected return of the portfolio. To regain a competitive return, leverage must be applied to the portfolio, primarily on the low-volatility asset classes.

There are, of course, mathematical limits to the benefits of leverage (see Ruban and Melas 2010). For example, the level of correlations between assets in a portfolio obviously matters a great deal. But equally important is consistency in correlations over time. Certainly, 2008 and 2009 were a harsh reminder that correlations fluctuate over time, even between bonds and equity.

Figure 3 illustrates these two points—correlations between portfolio assets and the consistency of the correlations over time—using a 36-month rolling correlation between equity, represented by the S&P 500 Index, and bonds, represented by the Barclays U.S. Aggregate Index. Panel A shows how volatile the correlations have been over the past three decades, reaching a high of 60 percent, or 0.6, in the early 1990s and a low of –40 percent, or –0.4, about 10 years ago. Panel B shows the relative volatility of equity and bonds, which also has fluctuated a great deal over the past three decades.

Figure 3. Volatility of the 36-Month Rolling Correlation of Equity and Bonds, 1978–2008



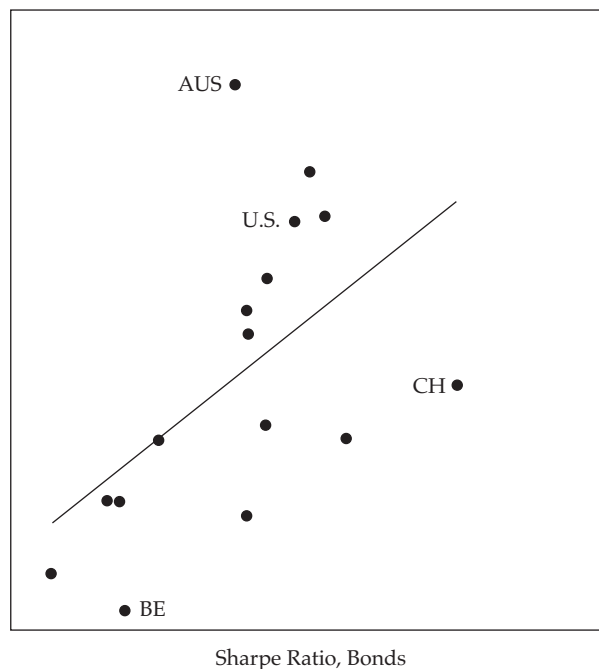
Note: Equity is represented by the S&P 500, and bonds are represented by the Barclays U.S. Aggregate Index.

Location also makes a difference. In **Figure 4**, I used long-term data to compare the level of efficiency between equities and bonds in different countries. As before, I ignored correlations. It is clear that the level of efficiency is not constant from country to country. Some countries, such as Switzerland (CH), have higher efficiency in bonds, and some countries, such as Australia (AUS), have higher efficiency in equity. Because various countries have different efficiencies in assets and thus different Sharpe ratios, earning a certain return requires different amounts of leverage. For example, using historical data, investors in Sweden would only need to leverage their portfolios 1.4 times to earn an 8 percent return but investors in Italy need closer to 4.0 times.

The benefits of leverage also fluctuate with borrowing rates, especially in fixed income. Lower borrowing costs mean that leverage has a lot more value, and changes in interest rates cause shifts in the minimum-variance portfolio, the capital market line, and most likely, the efficient frontier. Leverage also increases uncertainty, and higher levels of uncertainty make probabilistic calculations suspicious.

Figure 4. Efficiency Level of Equities and Bonds for Various Countries

Sharpe Ratio, Equity



Note: AUS is Australia, CH is Switzerland, and BE is Belgium.

Source: Elroy Dimson, Paul Marsh, and Mike Staunton, *Triumph of the Optimists: 101 Years of Global Investment Returns* (Princeton, NJ: Princeton University Press, 2002).

This issue is particularly relevant to backtesting and is extremely problematic when the forecaster is facing unknown probability distributions. Such risks as kurtosis, skewness, liquidity, counterparty, and contagion, among others, are all magnified.

Finally, low volatility is not the same as low risk. Looking at risk exclusively through the lens of volatility lacks dimension. For example, demographic changes or secular shifts are not captured by volatility. I doubt that 10 years ago many investors were very worried about the possible default or downgrade of developed European countries' sovereign debt. Historical correlations and volatilities do not capture this type of unlikely, but possible, event. Of course, these types of problems will also hurt a traditionally allocated portfolio. The difficulty is that when a portfolio uses leverage, the unexpected becomes more relevant and makes other types of risk management techniques more important. In other words, risk parity does not get rid of the tail. It just switches from one type of tail, equity risk, to another, the unknown.

Products and Implementations

There are several key differences in products and implementation among risk parity providers. These differences include leverage, risk exposures, asset classes or vehicles, and beta-only versus beta plus alpha.

Leverage. A product can have different amounts of leverage—minimum, average, and maximum levels. Leverage can also be implemented in various ways. For instance, it can be achieved through borrowing and leveraging the entire portfolio or through leveraging up only specific assets by using derivative instruments.

Risk Exposures. The types of risk exposure included in risk parity portfolios vary. Although most managers focus on equity, interest rate, and inflation betas, other managers include credit risk and other factors in their allocations.

Asset Classes. The asset classes and investment vehicles used to express a manager's views also vary. Considerable differences exist among portfolios (for example, OTC swaps versus a listed future or exchange-traded funds versus individual stocks).

Beta-Only vs. Beta Plus Alpha. Some products are quantitative beta-only, others combine beta and qualitative alpha, and yet others are solely alpha strategies (qualitative and/or quantitative).

Liquidity and Fees. All of these product differences affect the level of fees and the level of liquidity. Liquidity is usually a little bit lower and fees are a little bit higher than those of more traditional beta exposures.

Volatility Estimates. Another important and interesting difference is how volatility is estimated as a key input to risk parity allocation. Some managers use a more backward-looking historical view to build portfolios, whereas others have a more forward-looking approach and try to forecast future volatilities.

Benchmark and Attribution. A major decision is the benchmark that will be used to measure the performance of the risk parity product because it greatly affects performance attribution and risk management. Although I am not convinced it is the right benchmark to use, the traditional 60/40 equity/bond split is commonly used. Other options include the policy portfolio, cash, and even T-bills. My preference is to use the policy portfolio as an “opportunity cost” index. But remember that in most cases, a levered product is being compared with an unlevered benchmark, which will probably require some testing and adjustments.

Tolerance for Tracking. A high tolerance for tracking is needed because risk parity portfolios can and will underperform under certain market conditions. They will also, of course, outperform in other market conditions, but that scenario is usually less of a problem. Risk parity investors thus must keep a long-term view, which can be a challenge with

intermediate-term performance evaluation cycles, as well as changes in trustees, consultants, and investment staff.

Conclusion

Risk parity has profound implications because it concerns such important issues as volatility or, in other words, risk management, dynamic beta allocations, and market efficiency. Yet, it still appears as a work in progress. The decision to implement risk parity depends on an investor’s beliefs about these issues, as well as his or her own needs and resources. For all of its benefits, its trade-offs can be considerable. Specifically, investors need to assess their ability to implement adequate risk management and performance attribution practices, which are a serious challenge with alternative investments. The choice of risk parity solutions is also based on investors’ need for efficiency, which can be found by comparing the Sharpe ratio of their portfolios with that of risk parity products.

Ultimately, investors cannot have it all. There is more to risk than volatility, and volatility parity is not risk parity. Thinking about risk is a necessary step in the right direction because path dependency matters a great deal. But higher efficiency through extreme diversification also creates the need for leverage, and with leverage comes uncertainty. Efficiency makes a portfolio sharper, but portfolio returns pay the bills, and with leverage, the devil is still in the left tail.

This article qualifies for 0.5 CE credits.

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Question and Answer Session

Samuel Kunz, CFA

Question: How is the leverage obtained in most risk parity programs?

Kunz: The most common approach is to leverage specific assets through the use of futures, which lowers counterparty risk. And for those who manage liquidity well, this approach also lowers borrowing risk.

Question: What other risks do you see in risk parity portfolios?

Kunz: With leverage comes contagion risk. Counterparty risk and cash management risk are also present in risk parity portfolios.

Question: If volatility parity is not risk parity, then how do you achieve risk parity?

Kunz: Volatility, from a statistical point of view, lacks dimension. From an operational point of view, there is certainly more to risk than just volatility. I give examples of risk as demographic change and such long-term secular shifts as changing technologies as well as natural disasters. Risk is not just a number. Volatility is a narrower view of the world than is the concept of risk.

Howard Marks (2011) starts one of the three chapters he

devoted to risk in his last book with a quote from Elroy Dimson that astutely captures this idea: "Risk means more things can happen than will happen." Investors face a myriad of risks, including counterparty, model, concentration, headline, pricing, and of course, leverage.

In other words, reducing an intricate concept into a single number might indeed create a false sense of confidence and thus create the risk of missing the big picture.

Question: So, risk parity is not risk parity?

Kunz: Correct, risk parity is volatility parity. Risk parity is a good step in the right direction, but I do not think it is a finished product. When I was evaluating risk parity, I thought about a product that would use semivariance as the input for risk because we all know that the good side of volatility is performance.

Volatility was good, for example, in 1998 when the equity market was going up. But volatility also has a bad side, so maybe the answer is a product that focuses exclusively on the negative side of the volatility.

Question: How important is rebalancing in a risk parity program?

Kunz: Rebalancing is extremely important. Because the relative volatilities of the assets included in a risk parity portfolio fluctuate over time, allocations need to be adjusted almost continuously. The use of leverage means that rebalancing needs to occur not only at the asset level (relative exposures), but also at the overall portfolio level because most of these strategies target specific volatility levels.

Again, some managers rely on historical data to adjust the weightings, and others use a more forward-looking approach in an attempt to forecast volatilities. Interestingly, one might think about risk parity almost as a convex strategy.

Because spikes in volatility generally occur during downturns, positions in assets with the largest volatility expansions are typically reduced the most in times of stress (and vice versa). In a risk parity strategy, investors buy when prices rise and sell when they fall, which tends to generate a unique and interesting pattern of results as long as there is a trend.