2014

Sharpe*ning Your Beta: Understanding Risk Parity

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Contents

Executive Summary

- Risk parity comprises strategies whose goal is to define a more "efficient" mix of assets that is more diversified across the risks caused by different asset classes and economic environments, and that yields a higher Sharpe ratio than more traditional approaches. In practice, risk parity aims to achieve this by balancing the volatility contributed by different asset classes and exposures more evenly (i.e., to parity). Compared with traditional equity-oriented portfolios, risk parity portfolios have higher allocations to non-equity assets (e.g., bonds, commodities).
- While risk parity may appear complex and completely new at first blush—due to the use of a non-traditional asset allocation, derivatives, and leverage—it builds on basic concepts developed in modern portfolio theory and its underlying approach is quite simple.
- Since risk parity is typically used as a beta solution for the overall portfolio, all types of market betas are included on the menu for possible inclusion. This includes the major liquid asset classes available for passive investment (global equities, real assets, fixed income, etc.), but excludes less liquid investments in active management strategies (hedge funds, private investments, etc.).
- Since their inception, the few risk parity practitioners with long live track records have delivered strong performance. They have generated impressive returns, resiliency during drawdowns, and attractive risk/return trade-offs. With annualized returns approaching 8% to 9% per year over the last (difficult) decade, it is clear why risk parity has garnered so much interest. But the track record should be viewed in light of the unusually favorable returns of bonds over the period.
- Risk parity has inspired various strong and often negative reactions among some investment practitioners. Perhaps the most commonly levied complaint against risk parity has to do with the current market environment. With bond yields near all-time lows, and with downside risks far exceeding upside opportunities, how can now be a good time to increase exposure to bonds? Our instinct is to question today as a good time to shift to a portfolio strategy that increases the exposure to bonds—having already experienced a 30-year fixed income bull market. However, historical data on the performance of bonds in rising interest rate environments are mixed and arguments against implementing risk parity today do not invalidate it as a long-term investment strategy.
- While risk parity may theoretically deliver a "better" beta outcome with a higher Sharpe ratio, it does not come without trade-offs. In particular, it introduces a set of risks (e.g., leverage risk, increased interest rate risk, etc.) that are themselves quite challenging to manage. Implementation is difficult and requires alpha skills akin to those employed by hedge funds. In addition, the majority of implementation solutions include futures-based passive exposure, reducing opportunity for alpha generation through funded active managers. Finally, there are some potential limitations with capacity.
- In our view, risk parity is only appropriate for select investors after careful consideration of the trade-offs and with access to sophisticated tools or top-tier managers that have remaining capacity. ■

The decade of the 2000s delivered two severe tail events for risk assets, resulting in significant losses for institutional investors with equity-oriented portfolios. Most recently, during the financial crisis, global equity markets fell over 40% in 2008 (in US$ terms), resulting in total portfolio losses of over 25% for many institutional investors. Despite equity markets' ultimate recovery to new nominal highs, the level of volatility has shaken investors' confidence in their portfolio construction approach, particularly for those that must distribute a portion of their assets for operations in good years and bad.

As a result, some investors are re-evaluating their approach to allocating long-term assets and focusing more closely on risk management in an effort to find a less volatile path to meeting their long-term objectives. As part of this broader discussion, one leading alternative philosophy that has emerged is "risk parity," which comprises strategies that seek to distribute portfolio risk more equally across many asset classes (away from an equity-dominant focus) and to provide a smoother return pattern through different economic and market cycles. In part because risk parity managers have achieved very strong track records over the last decade while holding lower allocations to equity-like assets,[1] this approach has garnered significant interest among asset managers, portfolio advisors, and institutional investors.

Objectives of This Report

We provided an introduction to risk parity in our 2006 research report *Better Beta Boxes?*, but much has transpired in the intervening period. Markets have taken investors on a wild ride, while the short track records of risk parity practitioners have lengthened by eight years. Our goal for this paper is not to revisit the arguments made in that earlier report, but rather to take it as a point of departure and forge ahead.[2] Specifically, we will:

- Provide an in-depth conceptual overview of risk parity;
- Delve into the mechanics of how to construct a basic risk parity portfolio, and how such a portfolio is implemented in practice;
- Review risk parity's performance track record;
- Outline the most often-cited critiques of risk parity, with a focus on implementation and the current environment;
- Conclude with our view on whether and how institutional investors should consider using risk parity for their portfolios.

Other contributors to this report include Paul Gottuso, Sam Hecht, and Michal Pramik.

[1] For performance detail, please see Figure 10.

[2] In *Better Beta Boxes?* we observed that "unconventional asset allocation" products offered potentially attractive risk/return characteristics, but cautioned investors to be mindful of their use of leverage, short track records, and (in some cases) their fees and lack of transparency. We also noted that the use of such products would incur maverick risk and, based on the level of bond yields, timing risk.

Searching for the Best Portfolio Beta

We begin with a slight detour—an analogy about *bread*—to help frame our evaluation of risk parity.

Bread is perhaps the most basic of foods. When choosing which variety to eat, one might ask, *What is the best bread?* In comparing various types—instant rolls from a prepackaged can, a homemade loaf, or a French bakery croissant—a variety of factors could be considered, such as taste, healthiness, or sophistication.

At first glance, the light, buttery, flaky French bakery croissant might be deemed the "best." However, we would argue that the decision lies in the eye of the beholder as much as the bread itself. Who are the consumers? Will they make or buy the bread? What is their skill and budget? How much time and what tools and ingredients are available? At which meal is the bread to be served? Are the consumers allergic to some of the ingredients?

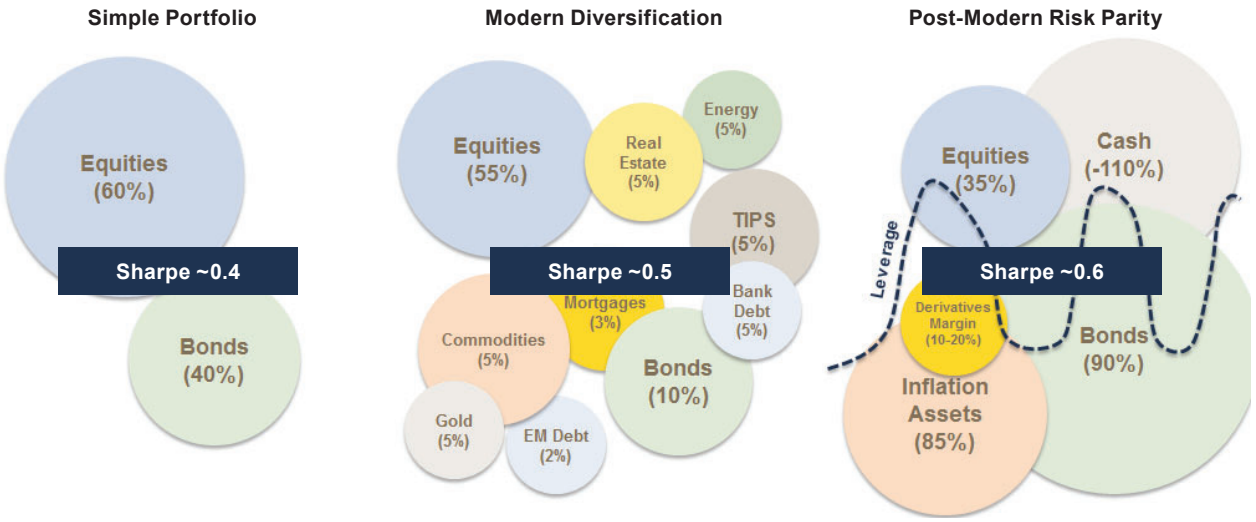
With these lenses, the breads might be judged differently. Something as basic as the decision to make or buy could sway the answer dramatically on which bread is "best" for you. After all, mastering the technique of baking croissants is a challenge; done just right, they're delicious and flaky, but if not prepared properly can turn out like lead. Furthermore, the meal matters—croissants are a classic breakfast item, but a less obvious choice at other times of day.

Beta: The Bread of Investing

Beta (i.e., passive market exposure) is the most basic building block of an investment portfolio, making beta the bread of investing. Investors might therefore ask, *What is the best beta portfolio?*

Much like the three types of bread described above, there is a range of options for constructing beta portfolios (Figure 1). A simple portfolio of stocks/bonds might be at the most basic end of the spectrum. Next we might have a fully diversified beta portfolio with a wide range of asset class exposures as a better and more sophisticated solution. And finally, risk parity's risk-balanced approach may be perceived to be an even more diversified and efficient solution to gain beta market exposure.

Figure 1. Various Types of Beta Portfolios



As we will show, based upon both theory and "live" experience over the last decade or so, risk parity appears to deliver better outcomes—namely, higher returns for the same level of volatility as its sister portfolios (resulting in a superior Sharpe ratio). Consequently, investors might be tempted to crown risk parity as the best of the beta portfolio options—the equivalent of the *boulanger's* croissant.

However, as with bread, context and implementation are similarly important when evaluating which is the best beta portfolio. Will one make or buy? What time, skills, ingredients, and tools are available? Does the investor seek beta only, or also alpha? To which kinds of beta is the market environment favorable? What are the inherent risks with each approach, and to which risks is the investor more averse?

Our view is that while risk parity may theoretically deliver a "better" beta outcome with a higher Sharpe ratio, it does not come without trade-offs. In particular, it introduces a different set of risks (e.g., leverage risk, increased interest rate and commodity risks, maverick risk) that are themselves quite challenging to manage. Implementation is difficult and requires alpha-style portfolio management skills akin to those employed by hedge funds (e.g., trading, use of derivatives, operational complexity). In addition, the majority of implementation solutions include futures-based passive exposure, reducing opportunity for alpha generation through funded active managers.[3] Finally, there are some potential limitations with capacity. Thus, we believe that risk parity is an attractive beta solution, but not a clear winner when considered in practice.

[3] Despite this constraint, alpha could conceivably be added through the use of overlay active managers at the expense of introducing even more complexity into the portfolio.

What Is Risk Parity?

Because of risk parity's "newcomer" status and the use of derivatives to implement it, many investors assume that risk parity is a completely new concept and highly complex. Neither of these conclusions is true. The concepts behind risk parity are an evolution of modern portfolio theory (dating back to Markowitz and Tobin's work on the efficient frontier and capital market line in the 1950s) and are quite simple at the core. In this section we aim to demystify risk parity and identify the core concepts of the strategy in familiar terms.

Neither New nor Complex

In Figure 2 we present a stylized comparison of three portfolio construction concepts, using efficient frontier graphs, which compare the expected real return (vertical axis) and volatility (horizontal axis) characteristics of the portfolios.

When building a portfolio, one key goal is to increase the return while minimizing the risk, one measure of which—and the key measure for risk parity portfolios—is volatility.[4] Therefore, any portfolio that moves "northwest" on the graph represents a more efficient result with higher returns and lower volatility. This efficiency may be measured with the Sharpe ratio, which represents the ratio of excess return over cash per unit of risk (volatility)—akin to how much bang (return) you get for your buck (each unit of risk).

[4] Volatility is but one of many components of risk, yet it is the main risk considered in many risk parity portfolios, in which volatility is usually described as a proxy for risk. We should emphasize that the term "risk parity," while now the accepted standard, is a bit of a misnomer—even practitioners agree that "volatility parity" or "volatility balancing" might be a better description for many of these portfolios.

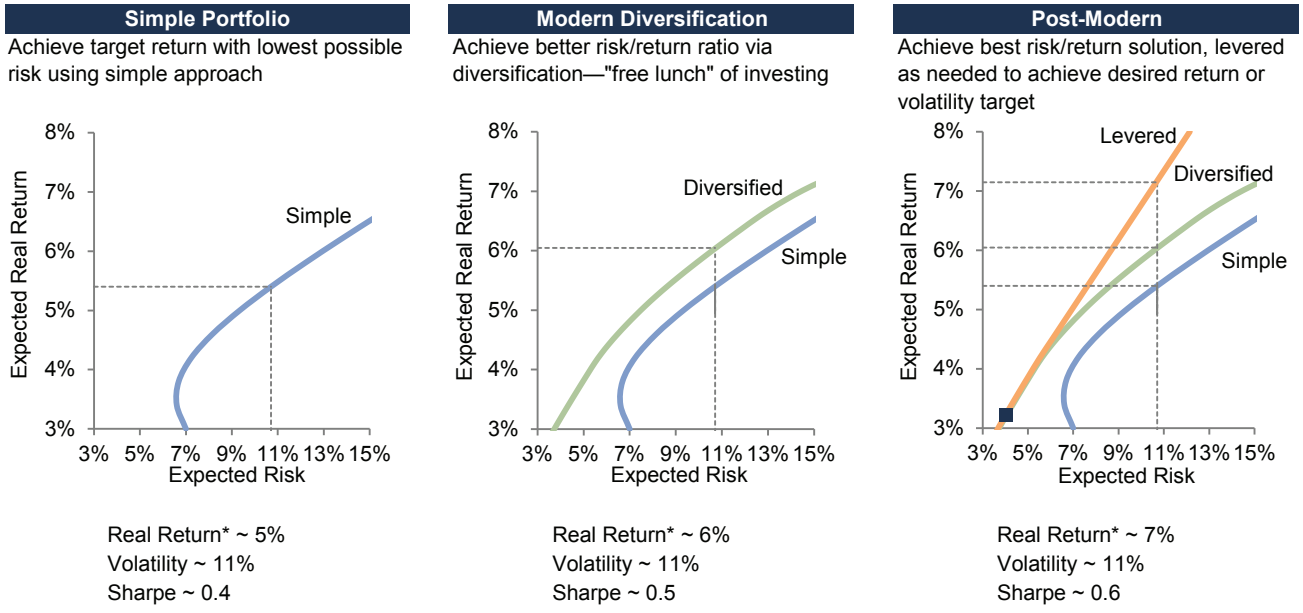
On the left we show the risk-return outcomes that could be achieved purely from portfolios that comprise a "Simple" mix of stocks and bonds.

In the middle we show a second curve that represents the innovation of modern finance—a fully "Diversified" portfolio. By including additional asset classes, and benefiting from the power of diversification, an improved portfolio is possible, including a higher expected return at the same level of volatility. This more efficient combination of assets is depicted as a new efficient frontier curve that is northwest of the first.

At the right we depict a third line representing the concept behind risk parity that builds upon existing concepts of modern finance. Instead of finding a point on the efficient curve that achieves the desired return target, it seeks to identify the *most* efficient point on the existing "diversified portfolio" curve (i.e., the point with the highest Sharpe ratio). This "best" mix of assets is represented on the chart as a dot on the diversified portfolio curve. By adding a willingness to accept leverage, this portfolio can simply be levered to almost any desired level of risk, creating the new "Levered" line that is even further northwest on the chart. This new line has an even higher expected return for the same level of risk as the other portfolios—an even more efficient risk-return outcome—but requires leverage.

There is nothing new or conceptually complex in this approach—this theory, including the potential to leverage the mix of assets with the highest Sharpe ratio, is taught in most MBA Finance 101 courses. When the concepts were introduced over 50 years ago, the derivative instruments needed to create such levered portfolios did not yet exist. Employing subsequent financial innovations, risk parity builds on these basic concepts to create more balanced portfolios that use leverage to achieve the desired level of return or risk.

Figure 2. Comparison of Simple, Modern, and Post-Modern Portfolios



* Expected real arithmetic returns.

Shift in Perspective

While the concepts behind risk parity are neither new nor complex, risk parity does require a conceptual shift in perspective of how to build an asset allocation.

Ultimately, risk parity's key goal is to define a more "efficient" mix of assets that is more diversified across the risks caused by different asset classes and economic environments, and that yields a higher Sharpe ratio than more traditional approaches. In practice, risk parity aims to achieve this by balancing the volatility contributed by different asset classes and exposures more evenly (i.e., to parity). Compared with traditional equity-oriented portfolios, risk parity portfolios have higher allocations to non-equity assets (e.g., bonds, commodities). This requires a shift in perspective from *return targeting* to *volatility balancing*.

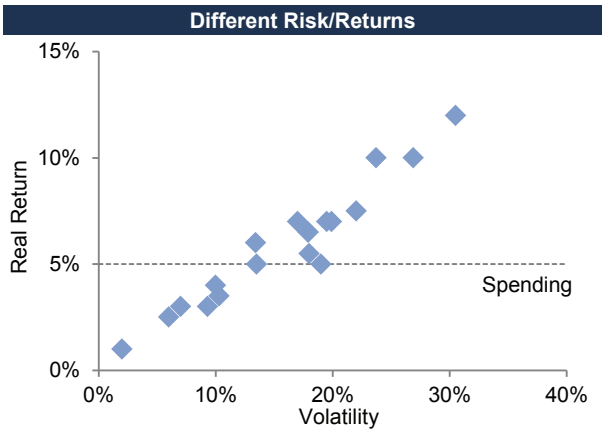
Most investors seeking relatively high returns without direct portfolio leverage use equity-oriented portfolios to reach their return objectives. Without leverage, only a preponderance of equity and equity-like "growth" assets delivers sufficiently high returns to satisfy investors' desired level of spending. The top graph of Figure 3 highlights that only a few asset classes clear the return hurdle of the dotted spending line.

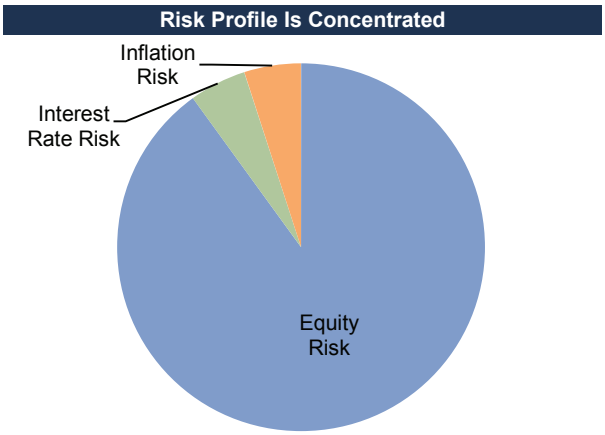
Such higher-returning asset classes also have higher volatility; thus, portfolios with high equity allocations have an even greater share of their volatility driven by equity (Figure 3, middle). As a result, most portfolios loaded up with equity-like assets must accept the volatile ride inherent in equity markets (Figure 3, bottom).

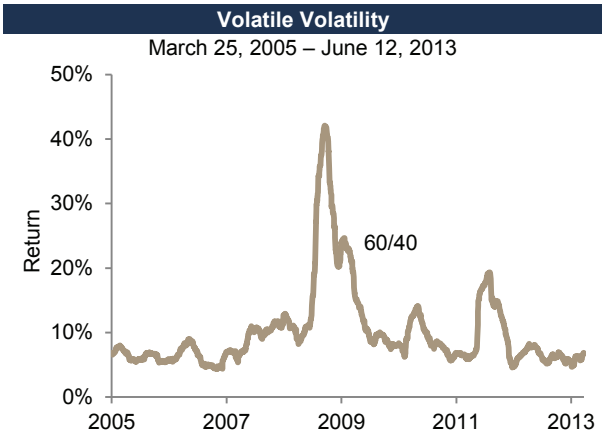
In contrast, using leverage to equalize the volatility across asset classes takes into account that Sharpe ratios of asset classes are approximately equal in equilibrium (Figure 4, top). This implies that no asset class is inherently "better" than the rest on a volatility/return basis, and that if levered to equivalent levels of volatility, they should all deliver roughly the same levels of returns. By providing a framework in which all assets are more or less equally "efficient," the focus can be on identifying the "best" diversified mix of those assets without allowing return objectives to drive the asset allocation decision.

Assembling a portfolio of "properly levered" assets in a more evenly distributed manner can create more balanced exposures to drivers of return *and volatility* than in equity-dominant portfolios (Figure 4, middle). Allocations with higher exposures to nominal bonds, inflation-linked bonds, and commodities, and fewer equities (relative to equity-dominant approaches), appear to be more volatility-balanced and yield higher Sharpe ratios over the long term. Additionally, by lessening the amount of equity-driven volatility, a risk parity portfolio is expected to dampen the downside experienced in equity tail events (Figure 4, bottom), but be more impacted by drawdowns in bond and commodity markets. Thus, the addition of leverage redistributes the risks among the asset classes; at the same time, it introduces the challenge of leverage management.

Figure 3. Portfolio Risk and Volatility of a Typical Portfolio

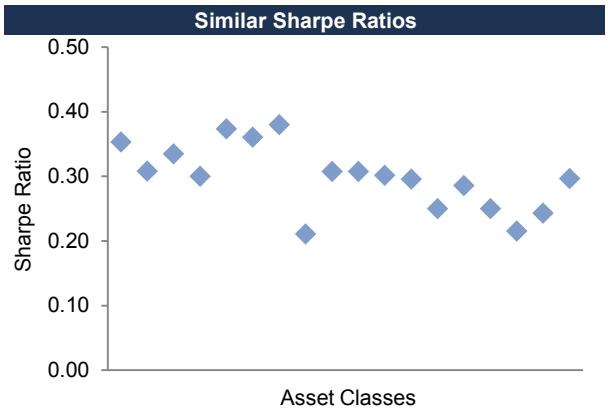


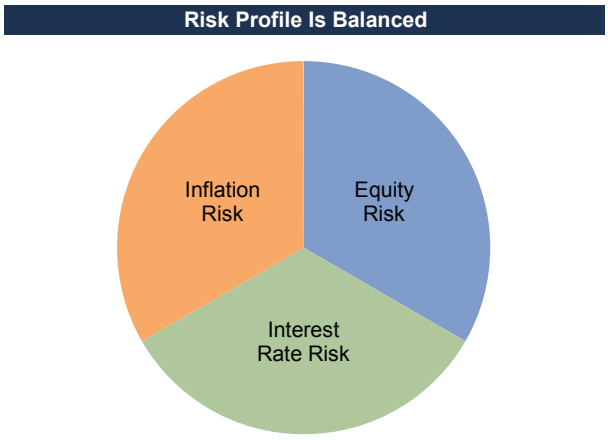


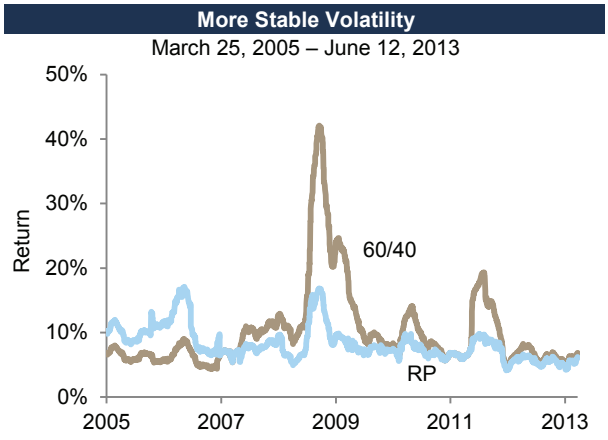


Sources: Barclays, Standard & Poor's, and Thomson Reuters Datastream.

Figure 4. Portfolio Risk and Volatility of a Risk Parity Portfolio







Sources: Barclays, Standard & Poor's, and Thomson Reuters Datastream.

How to Build an Allocation

Having outlined the basic concepts underlying a risk parity approach, we now turn our attention on how to actually build such a portfolio. While all the leading practitioners have the common goal of building portfolios that are better balanced across a variety of risk sources, there is no single orthodoxy when it comes to implementation. The difference is in the details: each goes about the design and underlying assumptions differently. In this section we describe the different components of implementation in a step-by-step process, including:

- what risk factors to balance,
- what asset classes to include,
- what derivative instruments to use, and
- the resulting asset allocation.

What to Diversify?

All risk parity approaches seek to diversify their portfolios to achieve more balanced exposures across a variety of factors. Their ultimate goal is to create an asset allocation that is expected to perform decently across most macroeconomic environments. In practice, we have found two major approaches to risk parity portfolio construction.

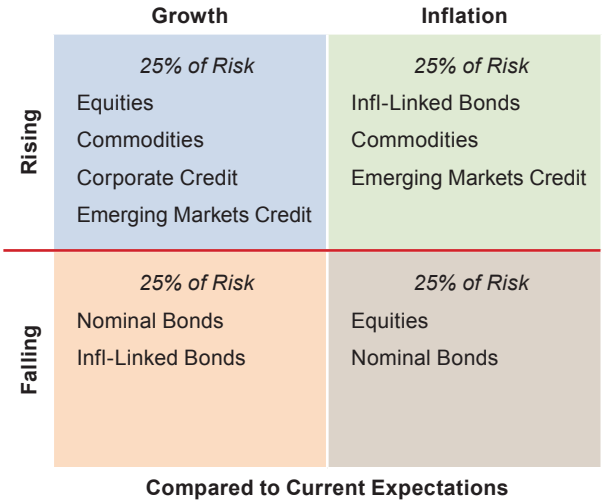
Risk Premium. The first approach argues that there are three key risk factors—equity risk, interest rate risk, and inflation risk—for which investors are paid a risk premium. A balanced approach seeks to spread the risk (volatility) budget roughly equally across these three categories, which neatly aligns with allocations to the three major premiums available to investors for assuming risk—equities (growth), bonds (deflation), and commodities/inflation-linked bonds (inflation).[5] This is the most straightforward approach, achieving balance by spreading one's risk budget for volatility across three risk factors. As this approach does not predict which risk is most prevalent, it allocates equal risk contributions, taking into account the volatility and correlation across asset classes.

Economic Environments. The second approach proposes that portfolios should instead balance across key macroeconomic environments, not risk premiums, so that they can deliver an "all-weather" solution across different types of economic regimes dominated by rising growth, rising inflation, falling growth, and falling inflation, as compared with current expectations (i.e., what markets have discounted).

Akin to the first approach, since practitioners do not believe it is possible to predict the upcoming economic environment, the portfolio's risk budget is allocated equally—in this case, across each of these market types—although historically they have not occurred with equal frequency. Then, as shown in Figure 5, they propose that investors fill their budget to each market scenario with allocations to those asset classes that have historically tended to perform well in that particular environment. Similar to the first approach, the allocations to individual asset classes are weighted based on each asset class's volatility contribution, resulting in higher weights for low-volatility assets (e.g., bonds) and lower weight for higher-volatility assets (e.g., equities) so that their contributions to the overall volatility budget are balanced.

[5] Some varieties of risk parity include a fourth key risk factor, credit; others view this as too correlated to equity risk to be treated separately. (It is also more difficult to express synthetically.)

Figure 5. Allocating Across Macro Environments



Interestingly, while these two implementation approaches are quite different, they deliver portfolios that are broadly similar and share common features: they represent a more balanced asset mix with a higher Sharpe and hold a higher proportion of capital allocations in less volatile assets (e.g., bonds). Importantly, as shown at the end of this section, both of these approaches result in asset allocations that are very similar to each other and quite close to the highest Sharpe ratio mix of assets (unlevered) outlined in the prior section.

What Asset Classes to Include?

Since risk parity is typically used as a beta solution for the overall portfolio, all types of market betas are included on the menu for possible inclusion. This includes the major liquid asset classes available for passive investment (global equities, real assets, fixed income, etc.), but excludes less liquid investments in active management strategies (hedge funds, private investments, etc.).

Because risk parity strategies typically require a degree of leverage to reach the return objectives demanded by most investors, managers focus on asset classes that can be easily levered, usually through futures. While the growth of futures markets over recent decades means that it is easy to replicate and leverage almost any major asset class today, there are some limitations as we will describe below. Some smaller or niche asset classes are therefore eliminated from risk parity strategies, but most major asset classes—such as equities, fixed income, commodities, inflation-linked bonds (ILBs), and credit—are included.

What Allocations and Leverage?

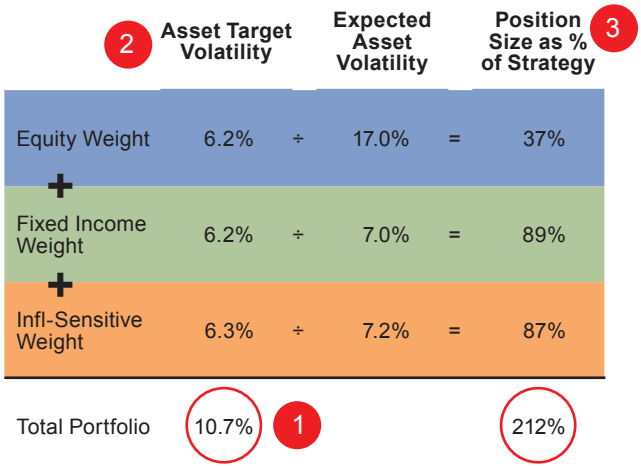
Once the definition of risk and the available menu of asset classes have been determined, the portfolio construction can be reasonably straightforward.

Unlike traditional approaches, the amount to invest in each asset class is not based on a capital allocation, but rather on a volatility allocation; that is, by each asset class's contribution to overall volatility taking into account the correlations across asset classes. Using the risk premium approach as an illustration, we show the components of this process in Figure 6.

Step 1. Establish an overall portfolio volatility budget, which represents the portfolio's overall "risk level." Most endowment investors would likely choose a standard deviation in the 10% to 12% per year range, similar to a simple 60/40 portfolio, but higher or lower is certainly possible. We selected 10.7% for this example as the expected volatility for a 60/40 portfolio over the very long term.

Step 2. Allocate the volatility budget using a mean-variance model that distributes the budget *equally* across the asset class groups that correspond to each of the risk premiums—equities, sovereign bonds, and inflation-sensitive assets (i.e., commodities and ILBs). The targets to each asset will sum to

Figure 6. Volatility Allocation Process



more than the portfolio's 10.7% budget due to the low correlations across asset groups, which provide diversification benefits and reduce the overall portfolio volatility.

Step 3. Determine the allocation weight to each asset class by dividing the volatility budget by the long-term expected volatility for each asset class (see Appendix A for our long-term equilibrium assumptions). Capital must be allocated *unequally*, since the higher volatility assets will need a lower capital allocation, and vice versa, to keep their contributions to the overall volatility budget balanced. For example, because the expected volatility of equities is two-and-a-half times the volatility of bonds, the resulting allocation has two-and-a-half times more bonds than equities so that each contributes 6.2% to the overall volatility budget.[6]

[6] Here the assumptions for volatility are taken from long-term historical assumptions for the asset class as a whole. For example, the volatility assumption for ten-year bonds is used for sovereign bonds, but this can be modified to other durations, resulting in different implementation results.

The resulting portfolio has exposures that look very different from a traditional equity-oriented portfolio. Furthermore, adding up each asset group's notional exposure, one finds the leverage required for the portfolio—using our assumptions in this example, leverage of 212% (i.e., achieving 212% market exposure on 100% capital).

Clearly this portfolio construction method is assumptions-dependent—the relative weights and total leverage will change based upon your estimates of asset class volatility and cross-correlation, as well as your desired level of portfolio volatility. While ~200% leverage is typical, as we will show in managers' actual allocations below, the allocations can vary based on the input assumptions. For example, if instead of using C|A's long-term assumptions we use *actual* asset class performance over recent decades—during which time assets delivered higher volatility and correlation than they were modeled to over the long term—such a risk parity portfolio would have lower overall leverage (163%) than our example above to compensate. Additionally, different instruments might be selected for implementation—such as using long-duration Treasuries for the fixed income component, which, due to their much higher volatility, would imply a lower level of required leverage. While unusual in practice, due to lower liquidity, it is possible to implement risk parity without leverage by using 30-year bonds or STRIPS. Our illustrative example, with ~200% leverage, represents an implementation using the most common and liquid instruments.

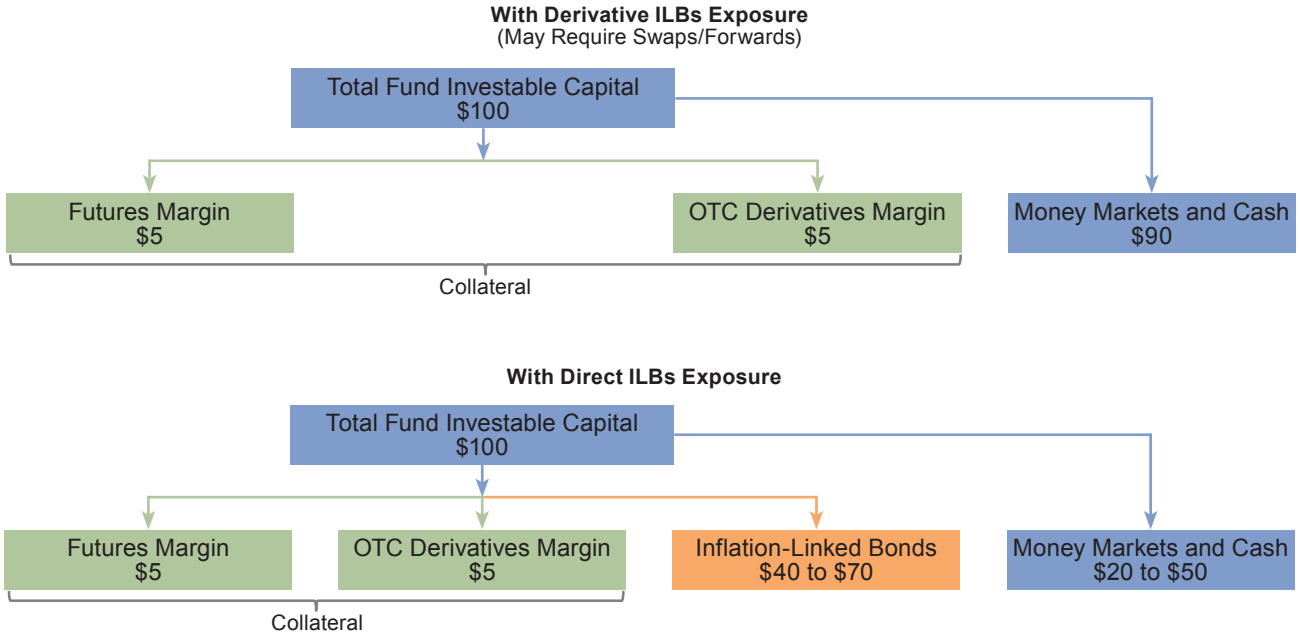
How to Implement?

Risk parity practitioners implement the majority of their exposures through derivatives as an easy way to gain levered exposure to various asset classes. The top of Figure 7 shows a typical risk parity implementation. Ideally, all of the exposures are implemented by buying futures contracts, which are exchange-traded and only require ~5% in collateral margin. As a result, in such an implementation, only 10% of the portfolio must be posted as margin to gain 200% in overall exposure, and 90% of the portfolio can sit in a cash money market fund, so the portfolio enjoys tremendous liquidity. Out of $100 in invested capital, an investor has access to $90 in unencumbered cash and can easily manage the exposures, leverage level, and potential margin calls on a daily basis.

However, this picture can become more complicated as some exposures cannot be accessed via derivatives. For example, most practitioners maintain a large allocation to ILBs, for which liquid futures do not yet exist.[7] To gain exposure to ILBs, managers must buy them in the physical or repo markets, or engage in swaps—but the ILB swap markets have been constrained ever since the financial crisis. Buying physicals limits the ease of implementation and reduces the level of unencumbered cash, sometimes quite significantly. The bottom of Figure 7 shows a portfolio with a 70% capital allocation to ILBs (out of 200% total exposure), bought as physicals for $70, with the resultant impact on the rest of the portfolio. While the rest of the portfolio only requires ~$8 to $10 as collateral for futures implementation, the $70 spent on ILBs means that only $20 is available in unencumbered cash (rather than $90) for the same exposure as in the first example.

[7] The lack of developed futures markets for ILBs is a function of their short history as an investment vehicle and their relative thinness in issuance and liquidity, which has resulted in minimal interest in having standardized futures with ILBs for delivery, although there are some recent developments to create this market.

Figure 7. Risk Parity Implementation Examples



Sample Manager Asset Allocations

In Figure 8 we present the allocations of four risk parity managers, as well as our simulated risk parity portfolio with 212% leverage for comparison (see Appendix B for the indexes that underlie this portfolio). Broadly, the themes are very similar. Typical leverage is about 200%, with about half of that exposure in nominal bonds. Equities represent only about 30% exposure out of the total 200%, but ILBs are a significant component of the portfolio. Most strategies share these basic characteristics.

Manager D looks somewhat different, and we include it as an example of the lack of orthodoxy in portfolio construction even among risk parity managers. Since it has become such a popular concept, many managers, particularly active managers, have rushed to launch new products with unique implementation approaches or alpha overlays. Many of these include dynamic or tactical components, which can lead to much higher leverage than the typical 200%—as in the case of Manager D, with a current exposure of over 300%.

Additionally, most of these products are available at reasonably low costs and with good liquidity—considering that they are easily implemented and only invest in passive beta instruments.

Our simulated portfolio used in the step-by-step review of implementation, while very simple in its construction, has similar allocations in terms of broad exposures as those of the key practitioners in the field.

Risk Parity on the Efficient Frontier

Having described how to build a risk parity portfolio, we return to the efficient frontier diagram. Figure 9 represents an efficient frontier model using C|A's long-term return, volatility, and correlation assumptions. We plot the same curves described conceptually in the prior section using the long-term assumptions (Appendix A) used in all of our client work.

Figure 8. Sample Risk Parity Manager Allocations

	Manager A*	Manager B	Manager C	Manager D	Simulated Risk Parity Portfolio
Tot Exposure/ Leverage	203%	201%	213%	302%	212%
Global Equity	28%	35%	38%	87%	37%
Government Bonds	92% Global Dev Bonds and EMD Spreads	106% Global Dev Bonds	135% Global Dev Bonds, Credit & Term Structure	157% Global Dev Bonds	89% Ten-Year US Treasuries
Inflation Sensitive	83% 70% Global ILBs 12% Commodities	60% Global ILBs and Commodities	40% 25% Global ILBs 15% Commodities	58% 38% Global ILBs 20% Commodities	87% 59% TIPS 28% Commodities
Fees	50 bps	40 bps	35 bps	75 bps	

* Manager A has made some recent asset allocation changes, lowering exposure from ~200% to ~160% and shifting exposures away from fixed income.
Note: Components may not sum exactly due to rounding.

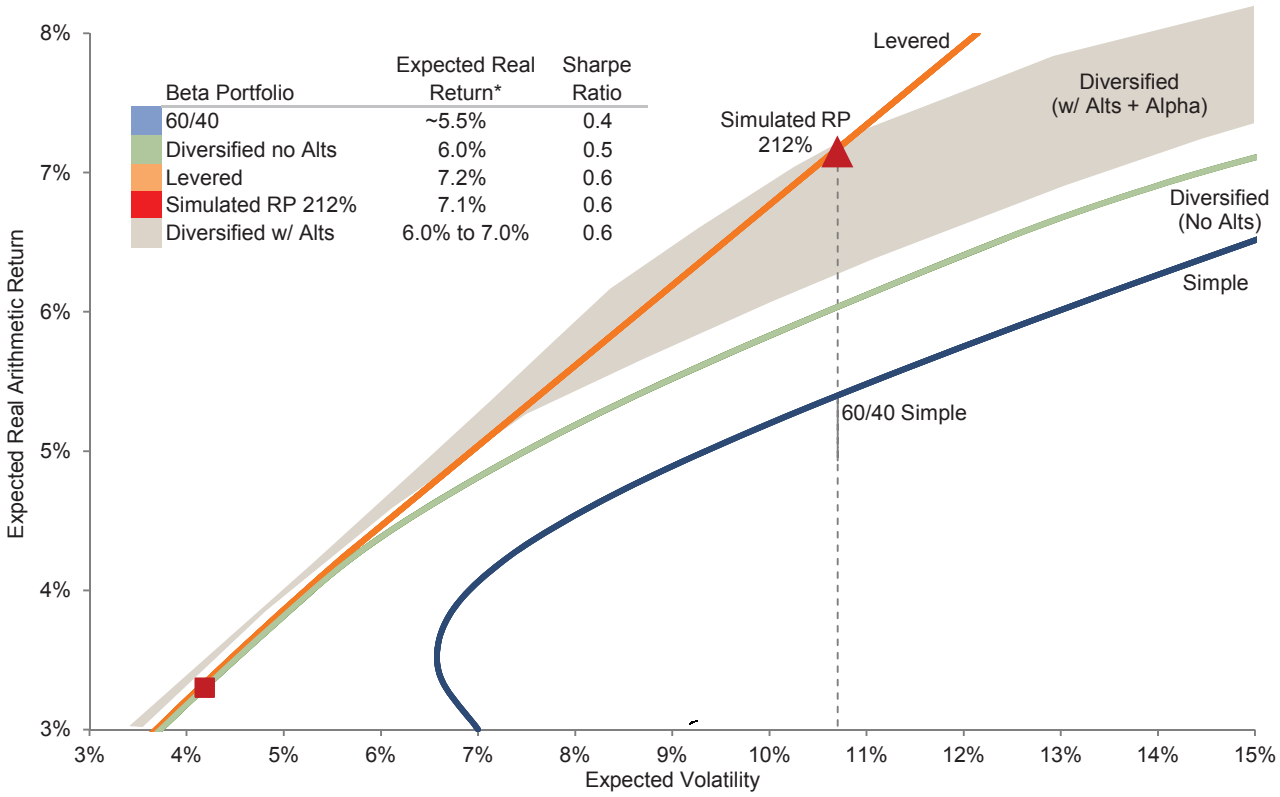
We highlight a simple 60/40 portfolio of stocks/bonds as this is a risk stance comparable to that of many institutional investors, with an expected real return of ~5.5% and volatility of just under 11%. Using this traditional approach results in a Sharpe ratio of 0.4.

The Diversified line is an unlevered diversified portfolio composed solely of beta assets (i.e., no alpha assumptions or alternative/illiquid assets). For the same level of risk as a 60/40 portfolio, a higher level of return is possible—a portfolio solution with a higher Sharpe ratio of 0.5.

The Levered line is defined by identifying the mix of assets on the solid green curve with the highest possible Sharpe ratio (shown by a red square), theoretically the ideal risk/return combination of assets, and levering that point. Levering this portfolio to a risk level equivalent to a 60/40 produces a still more efficient portfolio solution with a higher return and an even higher Sharpe ratio of 0.6.

Then we include our simulated risk parity portfolio (212% leverage), plotted on the graph as a triangle, which we built in the prior section.

Figure 9. Example of an Efficient Frontier Model



* Real arithmetic return defined at 10.7% expected volatility.

While it does not fall exactly on the Levered tangency line, it is very close and provides a beta portfolio solution with a very high Sharpe ratio.

The final curve (shaded band) is an unlevered diversified portfolio of beta *and* alternative assets—essentially an endowment model–style portfolio with the flexibility to use hedge funds and private investments and alpha potential.[8]

Note how close the simulated risk parity portfolio is to the band: the risk parity portfolio is theoretically similar in efficiency to an endowment-style portfolio *but uses beta assets only*. A significant takeaway is that similar results are possible via each approach by either levering a highly efficient mix of beta-only assets or by using an unlevered endowment approach with beta, exotic beta (e.g., alternatives), and alpha potential. As we will discuss below, it is unclear which approach is superior, since they are very different and carry distinct benefits and challenges.

[8] While there is uncertainty in the underlying assumptions for all the lines and bands, we have shown efficient frontiers as "sharp" lines for the portfolios that could be done passively, without alpha. The "blurred" band is depicted as such because it is for portfolios that include alternative investments and must be done with managers that deliver some degree of alpha—there is an implicit sharp line within the band around which the potential value-add/subtract from alpha creates the "blur."

How Has Risk Parity Performed?

Putting theory aside, it is important to look at the record in practice. Since their inception, the few risk parity practitioners with live track records have delivered strong performance, as we will demonstrate in this section, with three important caveats. First, while there have been many new entrants recently, very few risk parity managers have actual track records longer than a few years. Second, as with any return stream, the performance is beginning and endpoint dependent. Even for the practitioners with the longest track records, the period has been one in which, with the benefit of hindsight, risk parity funds would have been expected to perform well: the long bond bull market favored their high fixed income exposure, while the asset allocation permitted a relatively low weight to equity, which reduced their downside during the two major tail events in the decade of the 2000s. Finally, as outlined in the prior sections, there is no orthodoxy in implementation approaches and even the early practitioners differ significantly in their portfolio construction and level of active management overlays, making it difficult to form broad conclusions.

Nevertheless, the main practitioners have generated impressive returns, resiliency during drawdowns, and attractive risk/return trade-offs, as demonstrated in Figure 10. Over a period of 17 calendar years (1997–2013), the live track record for Bridgewater's risk parity fund, its strategy delivered significantly higher returns—a 7.8% average annualized compound return—than a simple 60/40 portfolio, with roughly comparable volatility. Our simulated 212% risk parity portfolio performed even better (albeit gross of fees and transaction costs since it is simulated), confirming that even a simple volatility-parity model worked. And over an eight-year period (2006–13), the live track

Figure 10. Annual Total Returns and AACR for Risk Parity Strategies

Annual Total Returns (%)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Managers																	
Bridgewater	15.0	-1.8	15.6	9.9	-6.0	10.2	16.7	17.7	15.5	1.2	11.8	-20.2	9.4	17.6	18.1	14.7	-3.9
AQR	--	--	--	--	--	--	--	--	--	3.8	16.9	-8.4	14.4	21.5	11.4	11.7	-2.7
Simulated RP - 212%	5.9	3.6	7.2	20.8	-12.0	22.6	23.3	19.4	11.5	-0.6	24.1	-20.2	12.9	20.2	21.4	14.7	-5.0
Index																	
60% ACWI / 40% Agg	13.0	17.1	15.2	-4.3	-6.4	-7.8	21.8	11.1	7.8	14.4	10.2	-25.5	23.5	11.1	-0.8	11.9	12.7

Average Annual Compound Returns (%)
Through December 31, 2013

	17 Yr	16 Yr	15 Yr	14 Yr	13 Yr	12 Yr	11 Yr	10 Yr	9 Yr	8 Yr	7 Yr	6 Yr	5 Yr	4 Yr	3 Yr	2 Yr	1 Yr
Managers																	
Bridgewater	7.8	7.3	8.0	7.4	7.3	8.4	8.3	7.5	6.4	5.3	5.9	5.0	10.9	11.2	9.2	5.0	-3.9
AQR	--	--	--	--	--	--	--	--	--	8.1	8.8	7.5	11.0	10.1	6.6	4.3	-2.7
Simulated RP - 212%	9.2	9.4	9.8	10.0	9.2	11.2	10.2	8.9	7.8	7.4	8.6	6.2	12.4	12.3	9.8	4.4	-5.0
Index																	
60% ACWI / 40% Agg	6.6	6.2	5.5	4.9	5.6	6.7	8.1	6.8	6.3	6.1	5.0	4.2	11.4	8.6	7.7	12.3	12.7

	17 Yr AACR (%)	Std Dev (%)	Sharpe Ratio	8 Yr AACR (%)	Std Dev (%)	Sharpe Ratio
Managers						
Bridgewater	7.8	10.5	0.52	5.3	11.0	0.39
AQR	--	--	--	8.1	10.2	0.69
Simulated RP - 212%	9.2	13.1	0.54	7.4	14.4	0.46
Index						
60% ACWI / 40% Agg	6.6	10.0	0.43	6.1	11.0	0.46

Sources: Barclays, BofA Merrill Lynch, Cambridge Associates LLC, and MSCI Inc. MSCI data provided "as is" without any express or implied warranties.
Notes: Calculations are based on monthly data. Manager returns represent actual net manager returns. "RP Simulation" represents return stream simulated by C|A using the following asset classes and proxies: Global Equity - MSCI World Index through December 31, 1987, MSCI All Country World Index thereafter; Fixed Income - Barclays 10 Year Treasury Bond Index; Commodities - S&P Goldman Sachs Commodities Total Return Index. Starting April 1, 1997, the simulation also includes US TIPS, using the Barclays US TIPS Index as a proxy. The cost of leverage has been estimated using the 91-day T-bill.

record for AQR's risk parity fund, our 212% simulation again outperformed the 60/40, and AQR did better still. This can be attributed to AQR's downside protection in 2008: when a 60/40 would have lost over 25%, and other risk parity portfolios including Bridgewater lost ~20%, AQR declined only 8% due to a firm-specific dynamic allocation approach (which may be thought of as an active alpha overlay) that lowered the fund's leverage dramatically during the financial crisis.

While the *absolute* results have been impressive over these two specific time periods, the risk-adjusted results have also been robust. During the 17-year period, the Sharpe ratios of both Bridgewater and our simulated portfolio exceeded that of the simple 60/40 portfolio; during the eight-year period, AQR's Sharpe ratio did likewise, albeit over a short timeframe and using active management overlays.

However, while historical performance has been very strong to date, investors should keep in mind some important factors to evaluate if this approach makes sense going forward.

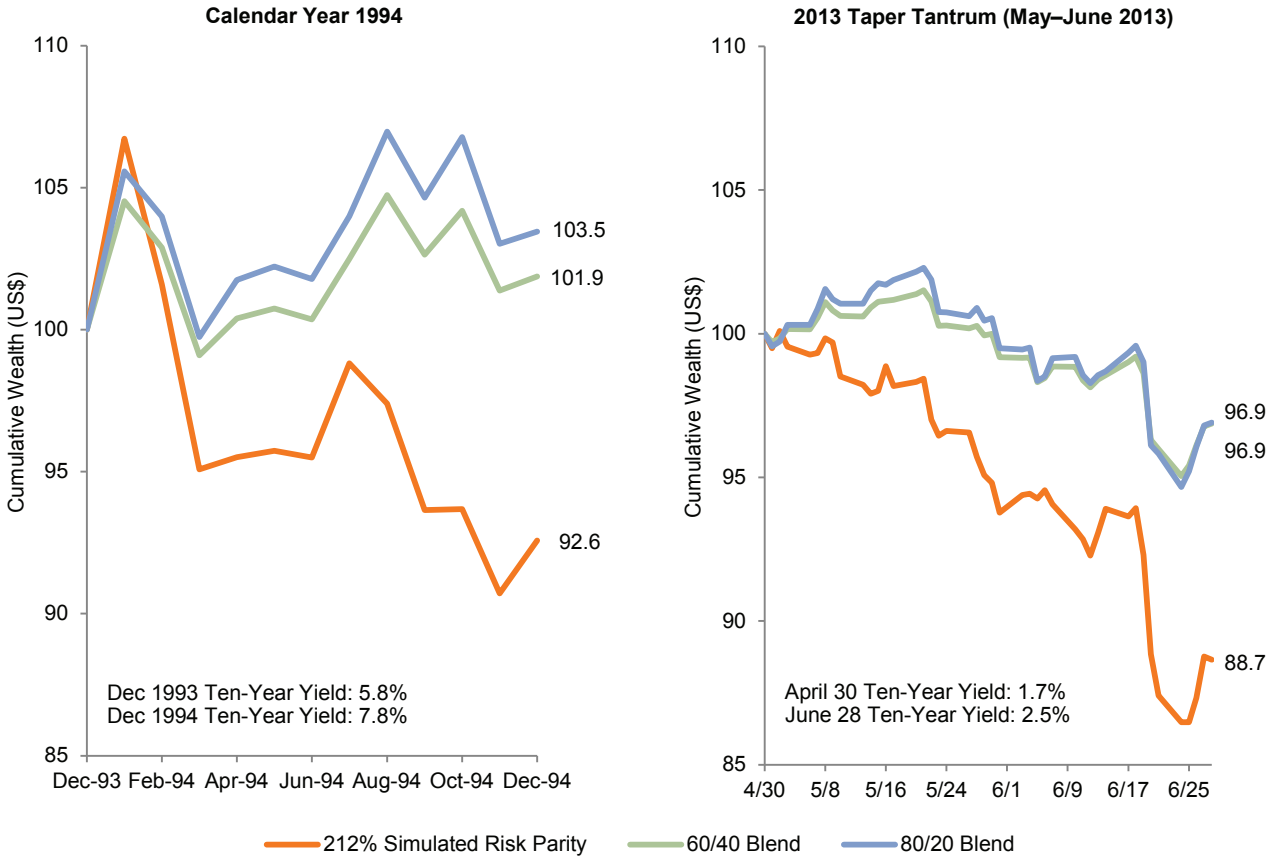
Tracking Error. Risk parity portfolios can exhibit significant tracking error relative to 60/40 benchmarks and endowment model portfolios used by peers. Over the 17- and eight-year analyses shown above, the annual tracking error of the simulated risk parity portfolio relative to the simple 60/40 has been 10.8% and 9.7%, respectively. While easy to dismiss over the long term or during periods of strong outperformance, this level of tracking error from typical benchmarks and peers can be quite difficult to live with for many committees. A good example of such a period is 2013. In a year when US equity markets gained some 30%, a 60/40 portfolio gained about 13%, and a typical endowment style portfolio gained 10% to 14%, risk parity strategies *lost* 3% to 5% as the fixed income and real assets components of their portfolios faltered badly. Risk parity investors must be prepared to look quite different from other institutional investors over any given time period, a difficult task when the strategy underperforms, as in 2013 when it lagged by almost 20% relative to more traditional equity–oriented approaches.

Environment for Bonds. Understanding the market environments when risk parity might underperform is critical. Because of its large exposure to bonds, the typical concern regarding risk parity's performance is the impact of a rising interest rate environment. This is of particular interest today as interest rates are close to historical lows. As shown in the first half of the paper, using our long-term assumptions (which reflect return expectations assuming average valuations and bond yields), a simple risk parity approach is modeled to deliver attractive results in the long term with annualized real returns of ~7%. However, this requires that bonds deliver a reasonable return in real terms and contribute to these results. Based on current yields, the consensus view from market participants, including C|A, is for bonds to deliver lower than average performance over the next five to ten years, potentially severely so if interest rates rise rapidly. Even if equities and inflation-sensitive assets delivered average returns in this scenario, the bond returns would cut the expected return for the overall portfolio significantly.

While there have not been any prolonged periods of rising interest rates during risk parity's short lifespan, rates have risen in some shorter periods. These include 1994 and 2013, as shown in Figure 11, where our simulated risk parity portfolio lost ground. However, it is important to note that rising interest rates may not always result in negative performance for bonds or risk parity portfolios, as we examine in a subsequent section of this paper.

Downturn Risk. The most troubling market environment for risk parity is a downturn in which all assets fall relative to cash. During such environments, equities, bonds, and many commodities can lose value simultaneously. Since risk parity portfolios are levered, they can suffer severely during these types of market environments. To be fair, any portfolio with risk assets would lose during such an environment, but risk parity portfolios would likely lose more due to their leverage—essentially, the benefit of "balance" stops working. The recent period around June 2013 (Figure 11), dubbed the "taper tantrum," in which all asset classes declined after the Federal Reserve announced it intended to taper its quantitative easing program, is an example of such a period. Although it lasted for only a short time, risk parity portfolios fell sharply as all asset classes

Figure 11. Risk Parity's Performance in Periods of Rising Interest Rates



Sources: BofA Merrill Lynch, Barclays, MSCI Inc., and Standard & Poor's. MSCI data provided "as is" without any express or implied warranties.
Notes: For the chart on the left, calculations are based on monthly data; for the chart on the right, calculations are based on daily data. The equity/fixed income blends are a weighted average of the MSCI ACWI and Barclays Aggregate Bond Index from January 1, 1988 to present; prior to January 1, 1988, the MSCI World Index replaces the MSCI ACWI as the equity blend component. The "212% Simulated Risk Parity" represents the following blended index: 59% Barclays US TIPS Index / 28% S&P GSCI / 37% MSCI ACWI or MSCI World prior to MSCI ACWI inception / 89% Barclays 10-Year Treasury Bellwethers Index or Barclays US Treasury Bond Index prior to Bellwethers inception / -112% 91-Day Treasury Bill Index.

lost ground simultaneously. During this short period, risk parity strategies lost about twice as much as traditional allocations, with most managers falling between 8% and 12% during second quarter 2013. Since this type of performance is a risk in almost any levered strategy, most risk parity managers employ various tools (as described below) to try to address this risk.

However, despite these considerations, historical performance has been impressive to date and appears to have delivered on risk parity's conceptual framework. With annualized returns approaching 8% to 9% per year over the last (difficult) decade, it is clear why risk parity has garnered so much interest.

Arguments Against Risk Parity

Risk parity seems appealing from a theoretical perspective, is simpler than most imagine, and performance has been great over the last decade. So what's not to like? As a relative upstart of an investment philosophy and a very different approach, risk parity has inspired various strong and often negative reactions among some investment practitioners. We summarize many of the arguments for and against risk parity in Appendix C and will not cover them in detail in this report. In our view, three of these challenges rise above the others as the key issues to consider when evaluating risk parity today:

- The case for "levered balance"
- The current environment for bonds
- The practicality of implementation

The following sections evaluate these three issues in detail.

Challenge #1: Levered Balance Better?

Fundamentally, risk parity relies on the concept that a portfolio should achieve some degree of *balance* across its components' contribution to volatility. This is viewed as desirable because the alternative, holding a concentration in equities, exposes portfolios to too much equity volatility—instead, seek a smoother ride. While balance sounds appealing, balance for its own sake is not persuasive, particularly if it requires assuming other types of risk, such as leverage, or accepting opportunity costs, such as giving up alpha. Fully appreciating the trade-offs implicit in moving from a more traditional portfolio to one using risk parity in pursuit of balance is critical.

Volatility balance is achieved by increasing the relative proportions of less volatile assets (e.g., bonds). Since these also deliver less return, leverage is required to avoid lower overall portfolio returns.[9] But leverage creates hurdles of its own. Additionally, because the leverage is achieved through derivatives, specifically index futures, exposure becomes entirely passive, severely limiting the opportunity for alpha through active management.[10]

As noted earlier, the recent "taper tantrum" period is a good example of how the benefits of a balanced approach can break down. During this period all risk assets lost value simultaneously, and both equity-dominant portfolios and more balanced approaches lost value. However, risk parity strategies fell much more steeply because of their leverage. Additionally, their fully passive approach did not afford the opportunity for active managers to protect against broad market movements.

In short, risk parity's balance objective is not obviously better if it requires assuming certain costs. The trade-off is *either* to be unlevered and exposed to concentrated equity volatility with some potential for alpha, *or* to be less concentrated and less volatile, but levered and needing to manage that leverage, and giving up alpha. We see these as two different models each with benefits and challenges investors must consider.

[9] Assuming typical implementation with most common and liquid fixed income instruments.

[10] To get around this alpha constraint, some managers have added a tactical component, modifying the implementation based on current conditions. To be clear, use of such tilts is an alpha-seeking overlay to an otherwise purely passive beta strategy. The first generation of risk parity products did not explicitly address valuations—the risk to be "balanced" was volatility, not price risk. It appears that, mostly based on "client demand," some managers have recently launched risk parity products with tactical overlays that shift exposures based on their macro views and valuations, including holding fewer bonds today.

Challenge #2: Current Environment

Perhaps the most commonly levied complaint against risk parity has to do with the current market environment. A shorthand description of risk parity is "levered bonds," which does not quite do justice to the strategy as the entire portfolio is levered (not only fixed income). Nevertheless, the simplification does highlight the main difference between equity-oriented and risk parity portfolios, higher exposure to bonds. The critique asks, with bond yields near all-time lows, and with downside risks far exceeding upside opportunities, how can now be a good time to increase exposure to bonds?

We agree with, first, the observation that "more bonds" is a defining characteristic of all risk parity strategies and, second, the investment community's consensus that high-quality bonds currently present an unattractive risk/return profile. Current market conditions are likely not favorable for a risk parity approach today and many see this as a key issue for consideration, as outlined in detail in the performance section of this report. To recap, forward-looking expected returns for bonds appear unattractive based on current yields. Since bonds make up such a large portion of risk parity portfolios—creating substantial exposure to interest rate risk—low or negative returns for bonds would severely impact overall expected portfolio returns.

Risk parity proponents offer a host of counter-arguments; some are compelling, others less so.

- **Strategic Foundation.** Risk parity proponents suggest that the strategy is intended as a strategic allocation for the long term. Just like a policy portfolio, the strategic allocation is based on long-term assumptions, not current environment considerations. Though the current entry point may not appear attractive, it does not discredit the approach as a strategic allocation. The same concern could be leveled at a traditional, equity-oriented approach—the fact that the years 1999 or 2007 were not ideal launch points for an equity-oriented portfolio does not dismiss it as a robust approach for the long term.
- **Why Not Japan?** Risk parity is built on the assumption that it is difficult to predict what tomorrow's economic environment will look like, including the direction of bond prices. While the investment community has coalesced around the view that rates must go up from here, what if the opposite happens? Could the United States or Eurozone fall into a Japan-like scenario of the 1990s and 2000s, in which delever-aging pressures push the global economy into a decade-long (or more) malaise that causes rates on ten-year sovereign bonds to match those of Japan? Such a scenario, in which a traditional portfolio would suffer greatly, is not impossible to envision for the developed world today. Risk parity, with its larger exposure to high-quality bonds, would likely outperform in such an environment.
- **It's All About Expectations.** What matters for bond performance in rising rate environments is not whether yields rise, but whether they rise more than what is already discounted. Today, because the yield curve shows that the market is already discounting a significant increase in yields, there should be no negative impact on bonds from rate increases—unless they are larger/quicker than what is expected. For example, in the period between mid-2004 and mid-2006, short rates increased by almost 450 bps. Because this rate increase was largely expected by market participants,

bond yields were about flat and experienced positive performance. We agree that markets move based on changes in expectations, and the yield curve reflects what "everyone knows"—that yields should eventually rise. But we would not be so sanguine that the future will unfold according to expectations. As we saw in June 2013, markets and the yield curve did not expect the Fed's taper comments, and moved dramatically in the short term, hurting bondholders (and risk parity portfolios).

In sum, our instinct is to question today as a good time to shift to a portfolio strategy that increases the exposure to bonds—having already experienced a 30-year fixed income bull market. However, historical data on the performance of bonds in rising interest rate environments are mixed and arguments against implementing risk parity today do not invalidate it as a long-term investment strategy.

Challenge #3: Implementation

Finally, *implementation* itself is a significant challenge. To clarify, risk parity *can be* and *is* easily implemented today by a number of managers. However, extended to the "typical" institutional investor and the collective of "all" institutional investors, implementing risk parity poses significant obstacles today and going forward.

Managing leverage and capacity constraints are two practical implementation challenges that are significant for most investors. Below, we address why risk parity is not feasible for the typical institution to implement directly[11] and why outsourcing can be a challenge, as well as the challenges that could emerge if the industry as a whole adopted this approach.

Leverage Requires Tending. Risk parity portfolios typically require leverage, achieved through the use of derivatives. While neither is inherently problematic—like nuclear energy, depending on whose hands they are in and the care that is taken, they can be used for good or for ill—many investors are so averse to them that their policy guidelines explicitly bar using either. Because most risk parity portfolios are levered from 200% to 300%, broad drawdowns can have an exacerbated effect on the portfolio. (At the most basic, a severe but not fatal loss for an unlevered portfolio could drive a levered one all the way to zero.) As a result, leverage can magnify behavioral issues, cause unintended consequences, and in certain instances potentially result in a total loss of capital. *As a result, employing leverage requires expertise and active management.*

Unfortunately, managing leverage and its associated risks is a complex and real-time process, which is not feasible for most institutions to do *on their own, and is not easy even for managers.* Common themes in dealing with leverage are that it is tricky to manage, demands continual monitoring, and may require complex tools and analysis.

Leading risk parity practitioners use a variety of tools to manage the leverage in their portfolios, ranging from the simple (use of stop-loss limits) to the complex (dynamic asset allocation based on volatility targeting), to the draconian ("emergency" solutions that completely exit the risk parity strategy in certain market conditions). As an example, one manager that uses a dynamic approach to manage exposures and leverage adjusts the asset allocation of the risk parity strategy daily based on forward-looking forecasts of volatility for each asset class. This

[11] We would note that some elements of endowment model portfolios, such as alternative assets, are also sufficiently complicated that institutions typically outsource them to managers.

sophisticated process shifts the allocations for various asset classes from an unlevered portfolio to a maximum of 300% leverage.

The track record of these tools is mixed. Take the practice of dynamic rebalancing based on volatility forecasting. *In theory*, this method should protect practitioners from the worst drawdowns in specific asset classes—if their volatility forecasting works. If volatility rarely spikes in isolation, and bad events are typically the culmination of a slow rise in volatility, practitioners argue that they can reduce their exposure when volatility spikes.[12] As evidence, they point to equities during the 2008 financial crisis: during 2007–08, volatility in equities rose significantly from historical lows. While volatility was rising, dynamic rebalancing adjusted their equity exposure down, so that by the time the crisis was full-blown, these funds had already reduced their equity exposure so that it would not contribute too much to the portfolio's overall risk budget. *In practice*, the record is mixed. While this systematic approach seemed to work historically and during the financial crisis, it did not work during the "taper tantrum" in June 2013. Bond markets responded so quickly to the Fed's guidance that it was not possible to get out in advance of the volatility spike. Additionally, the portfolio insurance breakdown in 1987 is a good example of the potential failings of trying to manage portfolio exposures dynamically through systematic processes.

In short, leverage management inherently requires skill and timing—that is, alpha. Given that implementation approaches require real-time leverage management, risk parity is not, in our view, a feasible option to run internally for most investors, and requires sophisticated manager capabilities if outsourced. Much like in the bread analogy—where to achieve the croissant's perfect flakiness, you need a *boulanger's* special techniques—you need special tools and skills not available to many institutional investors to dynamically manage leverage risks or to assess when market conditions warrant completely exiting the strategy. Furthermore, while options exist to outsource implementation, there is no orthodoxy on how to manage leverage risk. Many of the practitioners use very different methods and tools to address this risk, some of which may introduce unintended consequences or exposures. As a result, we ask:

- Does it make sense to have a beta exposure that requires sophisticated manager tools and alpha skills to implement and monitor real-time?
- Does it make sense to have a beta exposure that can't be implemented directly by most institutional investors?

Capacity: We Can't All Have Beta. Another implementation challenge is capacity. We were perplexed to discover that several of the leading managers' risk parity funds were closed or capacity constrained. AQR's "full" implementation of risk parity (currently $25 billion) is closed, and Bridgewater's strategy ($70 billion) is currently open but has periodically "paused" from taking new capital and the firm has openly considered launching a major markets version due to capacity considerations. How can beta strategies be closed or close to capacity? Shouldn't beta be available to all?

What we found is that there can be limitations to capacity in implementing risk parity, mostly due to the use of leverage and futures, which

[12] Using the example of an overvalued asset, a valuation-based call would suggest trimming a position when its price rises too high, with the risk of being early; a volatility-forecasting call would suggest trimming a position when its price starts to fall and volatility spikes, with the risk of being too late.

could become exacerbated if a large number of investors flocked to this approach.

These managers have limited remaining capacity in their "main" risk parity funds because they have run into capacity issues in certain smaller futures markets. At roughly $100 billion combined (and then levered 2x) they simply want to avoid representing too large a slice of market liquidity. As a result, they have evaluated or launched "major markets" versions of their strategies, which strip out the most liquidity-constrained markets.

To illustrate market capacity limitations and their implication for risk parity implementation, take the example of inflation-linked bonds, which most managers employ for a portion of their inflation-hedging assets. Because levered exposure to ILBs is not readily available via futures, risk parity managers must implement using other instruments. Historically, managers preferred repos as a way to implement their large (50% to 70%) levered exposure to ILBs while keeping as much unencumbered cash as possible.

However, since the financial crisis of 2008, repo markets for ILBs have dried up as banks significantly reduced their inventory, forcing most practitioners operating at scale to implement ILB exposure by buying physical securities. This lack of capacity in ILB repos/swaps has constrained managers' ability to use leverage and cut into their unencumbered budget significantly, which reduces their flexibility and margin of safety, and highlights the need to manage the exposures and leverage actively.

Finally, imagine a scenario where the largest sovereign wealth funds and pension funds adopt risk parity as their core beta approach. Collectively, they control trillions of dollars of assets, which would be levered 200% to 300% if managed using this approach. Could futures markets handle this type of volume? For the smaller asset classes the answer is likely no.

Extending this scenario to an environment in which many smaller institutions (or even retail investors) adopt this approach, one must wonder how much capacity is available.

Furthermore, if all these investors selected a *dynamic* implementation approach, which rapidly dials leverage up and down based on market conditions, the behavior of futures markets could be dramatically changed. Would major asset classes be impacted? Can futures markets support that kind of scale, or would implementation have to be radically re-imagined? Would management of leverage levels impact or accentuate certain market moves?

To us, capacity issues appear to be a serious consideration, even if theoretical at this point. *Beta that is not available to all?* How could the *boulanger's* croissant be the best "basic" bread if it's not available to everyone or if some of the ingredients are capacity constrained? You already cannot buy this beta through some providers' flagship funds; *could systemic capacity become a meaningful constraint as we look forward?*

So What to Do? Questions for Investors

As with all our other investment advice, we do not believe in a single, one-size-fits-all solution, but rather that the recommendation be tailored to an investor's specific circumstances. To assist in this decision, investors need to ask themselves a series of questions that will allow them to evaluate *whether* risk parity is right for them, *in what form*, and *to what extent*.

Before starting down this questionnaire, we would like to state our general view: understanding the trade-offs across different types of risks is good. Investors should look at portfolios with a risk-based perspective—our own portfolio construction framework, aptly titled the Risk Allocation Framework (RAF), applies a multi-dimensional risk-based philosophy to allocations. Institutional investors should seek to build portfolios that deliver a desired level of returns subject to a set of constraints, including tolerance for volatility, need for liquidity, sizing of hedges, operational complexity, and opportunity to add alpha, among others. This means weighing *all* the risks that their investments face, and making trade-offs among them. "Traditional" portfolios are still appropriate solutions for most institutional investors, and can be improved by focusing on striking the right "balance" across multiple risks. A risk parity approach lessens the dependence on equity volatility, but presumes that volatility balance across risk factors (or assets exposed to different economic regime risks) plus leverage is better than equity concentration. We cannot empirically answer the question of which is superior, as the relative performance will depend heavily on the ability to manage leverage over the long term and the macroeconomic environment over the shorter term. Investors have to evaluate what is appropriate for them.

What to Ask

To Lever or Not to Lever? Traditional portfolios typically assume a no-leverage constraint, which is why a risk parity type of approach has not been possible without accepting a much lower portfolio return. If the leverage constraint is lifted, risk parity is simply an extension of modern portfolio theory. A key decision for institutions in determining how to allocate the beta of their portfolios is whether they accept the risks involved in assuming leverage, which takes the place of the risk from a concentration in equity. Our view is that investors should be willing to at least consider accepting this risk if it delivers a superior solution, but before moving forward with it in practice they must first consider the implications for implementation: can you manage the leverage, and do other gains compensate for the alpha potential you would forego from active managers?

Insource or Outsource? If leverage is permitted, the next decision for institutions is how to implement. Yet insourcing is not practical for all but a small minority of institutions. Because the management of leverage is tricky, we would only propose internal implementation of risk parity by large institutions with significant staff, sophisticated tools, and expertise, meaning most investors will need to outsource to implement risk parity.

If Outsource, How? We have good and bad news. The bad news first: the pioneers and industry leaders have reached or are nearing capacity in their flagship funds, which might necessitate considering "major markets" versions. One must evaluate if these versions provide the full benefits of the strategy. The good news is that because risk parity has gained significant momentum over the last

decade, many managers have jumped into this space, offering new products for investors with varying flavors of tactical overlays and unique value-add features. However, these managers are relatively new to the space, have smaller asset bases, and their track records are short.

Dynamic or Static? Holding a volatility-balanced strategic asset allocation is the core benefit of risk parity. A dynamically (re) balanced approach or a set of tactical overlays is unnecessary to gain this core benefit. However, considering that implementation involves leverage and requires management, employing a dynamic volatility-targeting approach and using stop-loss limits may have benefits. Investors should be mindful that using these practices may mitigate downside, but there is no guarantee that they will do so as they are active overlays.

How Much to Give to Risk Parity? This is an issue that is hotly debated. According to one argument, if risk parity is believed to be a superior source of beta, it's simply better and should therefore be used for 100% of the beta exposure. (All croissants, all the time.) Yet we have found very few institutions are actually doing this; instead, most employing risk parity use it for a portion of their beta exposure sized at 5% to 15% of the overall portfolio. Additionally, because institutions have understood that it is difficult to manage on their own, they have outsourced, bringing the concern of how much to outsource to a single manager, particularly considering the few with long track records.

Can You Manage the Maverick Risk? Few institutions have been willing to face this challenge. Even if one has full conviction in risk parity in theory, maverick risk—and the pressures from an oversight board or committee—must not be discounted. Though risk parity could have strong performance over the long term, there will be periods when it underperforms traditional approaches significantly, which might compel an institution to bail out—perhaps at the worst possible moment—and get whipsawed. As with other behavioral risk issues, the best remedy may be understanding, fully and in advance, just how much a risk parity portfolio could deviate from more traditional allocations: "be ready to be different."

Does a Small Allocation Make Sense? Many institutions are allocating to risk parity as a manager or sleeve in a traditional portfolio. In our view this can make sense, perhaps taking the role of a portfolio diversifier or a substitute for a portion of fixed income. Yet it is unclear that a partial allocation will make a portfolio significantly more risk-balanced unless it is used at scale (25% to 50% of the portfolio). And on the flip side, risk parity is, by its nature, a beta-only solution, without the potential for value added above their beta.

Can the Endowment Model and Risk Parity Be Combined? "In parallel," yes—one could have a portfolio that was half-and-half, or that had a preponderance to one approach with a significant share for the other. As noted above, it's not clear what benefit this brings, and it highlights the conflict between the two approaches: every dollar added to a risk parity approach is a dollar unavailable for allocation to the endowment model's active managers with more alpha potential.

"On top of one another," no. It may be tempting to seek to use risk parity's asset group proportions and then to lever active managers (and their alpha) within each asset group. However, active manager alpha—especially in alternatives—typically comes with some

measure of illiquidity, and levering up illiquid investments is likely to prove a toxic mix.

"Carved out," maybe—conceptually this would involve playing to each approach's strengths, with equity exposure achieved via unlevered capital allocations to active managers, and levered fixed income and real asset exposure via futures "alongside" that as a risk parity completion portfolio. While it sounds appealing, we are skeptical that once considerable capital is "used up" to fund physical allocations to equities, there would be enough liquidity remaining to margin the futures and maintain sufficient room for error. At a minimum, this approach might preclude the ability to employ ILBs as a component of the inflation-risk bucket, since they cannot be easily levered today. Additionally, the liquidity mismatch between the active and passive strategies could complicate the required rebalancing in a levered strategy.

Is Now a Good Time? While this is impossible to know, today's historically low bond yields suggest that now *may* not be a good time to implement a risk parity approach. The medium term could include either a strong global recovery and rising rates *or* Japan-style deflation and declining rates, but the more likely scenario appears to be a rising rate environment. Events in 2013 provided a live (if rare to date) example that risk parity is not fool-proof and can suffer badly in certain environments.

Conclusion

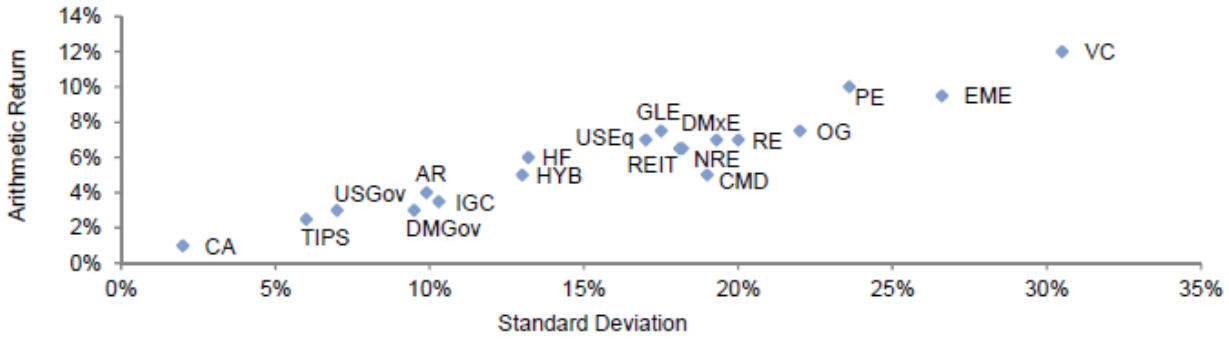
Risk parity is a reasonable means to achieve more balanced portfolio exposures than equity-dominant counterparts, with a higher expected Sharpe ratio and an expectation of smoother volatility. Yet uncertainties remain, in large part because this "beta" comes with a dose of active management and the outstanding 20-year performance record transpired during one of the greatest bond bull markets on record. With these important caveats, over the last ~20 years the approach appears to have delivered on its theoretical underpinnings. From the theoretical perspective and in recent practice, risk parity appears to be the beta equivalent of the *boulanger's* croissant in our bread analogy—an attractive approach for portfolio construction.

Investors considering risk parity must examine their attitudes about using leverage and managing exposures internally or externally, the compatibility of their alpha strategy with risk parity beta, how much they are willing to allocate in the current environment, and timing of entry, particularly considering today's low rate environment.

Akin to the *boulanger's* croissant, implementing risk parity is not easy and requires special tools and skills; even more daunting, important ingredients are limited and may cause allergic reactions to some, and the best bakeries have limited capacity for new business. In our view, risk parity is only appropriate for select investors after careful consideration of the trade-offs and with access to sophisticated tools or top-tier managers that have remaining capacity. ■

Appendix A: US Equilibrium Asset Class Assumptions

	Real Arithmetic Return	Standard Deviation	*Range Contains 50% of 25-Year Periods* [1]	*Implied Real Compound Return*
U.S. Equity	7.0	17.0	**4.8 - 9.2**	*5.7*
Developed Market ex U.S. Equity	7.0	19.3	**4.5 - 9.5**	*5.3*
Emerging Market Equity	9.5	26.6	**6.2 - 12.9**	*6.4*
Global Equity	7.5	17.5	**5.2 - 9.8**	*6.1*
Absolute Return	4.0	9.9	**2.7 - 5.3**	*3.5*
Equity Hedge Funds	6.0	13.2	**4.3 - 7.8**	*5.2*
Venture Capital	12.0	30.5	**8.3 - 15.9**	*8.1*
Private Equity	10.0	23.6	**7.0 - 13.1**	*7.6*
Commodities	5.0	19.0	**2.6 - 7.5**	*3.3*
Natural Resource Equity	6.5	18.2	**4.2 - 8.9**	*5.0*
Real Estate Securities	6.5	18.1	**4.2 - 8.9**	*5.0*
Real Estate	7.0	20.0	**4.4 - 9.6**	*5.2*
Oil & Gas	7.5	22.0	**4.7 - 10.4**	*5.3*
U.S. Government Bonds	3.0	7.0	**2.1 - 3.9**	*2.8*
U.S. TIPS	2.5	6.0	**1.7 - 3.3**	*2.3*
Developed Market Government Bonds	3.0	9.5	**1.7 - 4.3**	*2.6*
Investment Grade Credit	3.5	10.3	**2.1 - 4.9**	*3.0*
High Yield Bonds	5.0	13.0	**3.3 - 6.7**	*4.2*
Cash	1.0	2.0	**0.7 - 1.3**	*1.0*



Correlations

	USEq	DMxE	EME	GLE	AR	HF	VC	PE	CMD	NRE	REIT	RE	OG	USGov	TIPS	DMGov	IGC	HYB	CA
USEq	1.0																		
DMxE	0.7	1.0																	
EME	0.6	0.7	1.0																
GLE	0.9	0.9	0.8	1.0															
AR	0.4	0.6	0.4	0.5	1.0														
HF	0.7	0.8	0.6	0.8	0.5	1.0													
VC	0.6	0.6	0.5	0.6	0.4	0.5	1.0												
PE	0.6	0.7	0.5	0.7	0.4	0.6	0.5	1.0											
CMD	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0										
NRE	0.5	0.7	0.6	0.7	0.4	0.6	0.4	0.5	0.4	1.0									
REIT	0.7	0.7	0.6	0.8	0.5	0.7	0.5	0.6	0.1	0.6	1.0								
RE	0.4	0.5	0.3	0.5	0.3	0.4	0.3	0.3	0.0	0.4	0.6	1.0							
OG	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.5	0.5	0.2	0.2	1.0						
USGov	0.0	0.0	-0.1	0.0	0.1	0.0	0.0	0.0	-0.2	-0.1	0.1	0.0	-0.1	1.0					
TIPS	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.0				
DMGov	0.1	0.3	0.0	0.2	0.4	0.3	0.2	0.2	-0.2	0.1	0.3	0.2	0.1	0.7	0.3	1.0			
IGC	0.3	0.5	0.2	0.4	0.5	0.5	0.3	0.4	-0.1	0.3	0.5	0.4	0.2	0.7	0.3	0.9	1.0		
HYB	0.6	0.6	0.5	0.7	0.5	0.7	0.4	0.5	0.0	0.5	0.7	0.4	0.2	0.1	0.1	0.4	0.7	1.0	
CA	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.2	0.2	0.2	0.0	1.0

[1] Over 25-year periods arithmetic returns are expected to fall within the range half the time.

Appendix B: Simulated Risk Parity 212% Portfolio

Calculations are based on monthly data. The "212% Simulated Risk Parity" represents the following blended index over time:

- Prior to January 1, 1981:
  - 37% S&P GSCI
  - 37% MSCI World Index
  - 102% Barclays U.S. Treasury Bond Index
  - -75% 91-Day Treasury Bill Index
- January 1, 1981, to January 1, 1988:
  - 37% S&P GSCI
  - 37% MSCI World Index
  - 102% Barclays 10-Year Treasury Bellwethers Index
  - -75% 91-Day Treasury Bill Index
- January 1, 1988, to March 1, 1997:
  - 37% S&P GSCI
  - 37% MSCI ACWI
  - 102% Barclays 10-Year Treasury Bellwethers Index
  - -75% 91-Day Treasury Bill Index
- Since March 1, 1997:
  - 59% Barclays U.S. TIPS Index
  - 28% S&P GSCI
  - 37% MSCI ACWI
  - 89% Barclays 10-Year Treasury Bellwethers Index
  - -112% 91-Day Treasury Bill Index

Portfolio assumes monthly rebalancing and cash borrowed at 91-Day Treasury Bill interest rate.

Appendix C: Annotated Bibliography

In this report we do not attempt to rule on either theoretical or empirical arguments. Many papers and analyses have been published in favor of and against risk parity, yet the jury is still out. We provide an annotated bibliography for those interested in examining in more depth a sample of the literature of these debates.

Theoretical arguments against risk parity criticize the portfolio construction method on a number of grounds. First, while the approach attempts to achieve a balance in the risks facing a portfolio, the measure of risk that is used is simply volatility (standard deviation of returns). Although surely a useful approach, risk-*cum*-volatility is viewed by some as too limited a metric for a concept as multi-dimensional as risk. Second, it is unclear why certain asset classes are included in the mix, as the rationale for why investors should expect a risk premium for some of them is not well specified. Third, there is dissatisfaction with the capital allocation outcome, as the resultant portfolio still has a heavy weight to a single asset class—except that in risk parity it is to fixed income rather than to equities.

On the *empirical* side, it is hard to get comfortable with risk parity's historical return profile beyond its fairly short run in recent years. Only a single manager has live results that extend further back than ten years. Back-tests offer some additional (if limited) evidence to support the approach, but even this is challenging in practice—the very instruments used to implement risk parity did not exist more than about 30 years ago, inherently bounding the observable universe. In part due to this relatively small sample set, assessing a proof of concept for the strategy across a more robust set of economic environments and geographies is difficult. (In fairness, most alternative assets—core contributors to the endowment model—present similar empirical challenges, yet sophisticated investors appear to have gotten comfortable with them regardless.)

Con—Key Papers

Anderson, Robert M., Steven W. Bianchi, and Lisa R. Goldberg. "Will My Risk Parity Strategy Outperform?" *Financial Analysts Journal* 68, no. 6 (November/December 2012): 75–93.

- In a response to an earlier paper (Asness et al. 2012), the authors test four strategies, simplified to comprise only US equity and US Treasury bonds, two of which are risk parity strategies, and argue that (i) which strategy outperformed in historical backtests is materially endpoint-dependent, (ii) performance rankings can be reversed when transaction costs are taken into account, especially if leverage is involved, and (iii) even a statistically significant return premium does not guarantee outperformance over long investment horizons.

Inker, Ben. "The Hidden Risks of Risk Parity Portfolios." GMO White Paper (March 2010).

- The author argues that risk parity portfolios suffer from "three basic weaknesses": (i) volatility and risk are not the same, (ii) the risk premiums of some of the included asset classes (specifically, commodities, and possibly government bonds) may be nonexistent, and (iii) many of the included asset classes's returns exhibit negative skew, which in combination with leverage could be dangerous.

Lee, Marlena. "Eight Decades of Risk Parity." Dimensional Fund Investors (August 2011).

- The author backtests simple (stock/bond only) risk parity strategies in 19 countries over the period 1930–2010, and argues

that the evidence is mixed: (i) the benefits of risk parity are sample and time period specific—namely, during the last 30 years of falling inflation and interest rates, and (ii) risk parity portfolios' Sharpe ratios are no higher than 60/40 "balanced" portfolios.

Con—Additional Papers

Inker, Ben. "The Dangers of Risk Parity." *The Journal of Investing* 20, no. 1 (Spring 2011): 90–98.

- The author reiterates the first two points from an earlier paper (Inker 2010), doing a more in-depth review of the underlying return and standard deviation assumptions.

Rappoport, Peter and Nicholas Nottebohm. "Improving on Risk Parity: Hedging Forecast Uncertainty." J.P. Morgan Asset Management (2012).

- The authors argue that (i) risk parity has done well in periods when there is large uncertainty in the return forecasts used in asset allocation, as risk parity essentially ignores such forecasts, but (ii) in hypothetical tests, risk parity would do less well in periods in which return forecasts were more certain (and therefore useful), specifically when they forecast significant differences in Sharpe ratio across asset classes, and (iii) one can improve on risk parity's returns by assessing whether estimated Sharpe ratios are statistically significant, and if so, deviating from the risk parity allocation.

Pro—Key Papers

"Comments on GMO's 'The Hidden Risks of Risk Parity Portfolios'." AQR Capital Management (April 2010).

- In a response to an earlier paper (Inker 2010), the authors argue that (i) volatility is one of the most important measures of risk, (ii) they too would not include asset classes with no long-term risk premiums, but even asset classes with a "more tenuous" claim to risk premiums can be valuable additions for their diversification benefits, and (iii) leverage is not a concern for negatively skewed assets if the leverage is managed properly. They further argue that (iv) they prefer some leverage over extreme concentration in equity risk, and (v) in terms of market timing, it is easier to forecast volatility than return.

"Comments on DFA's 'Eight Decades of Risk Parity'." AQR Capital Management.

- In a response to an earlier paper (Lee 2011), the authors argue that (i) the duration of bonds employed in portfolios matters, as longer-duration bonds have lower Sharpe ratios, (ii) the "windfall gains" from the last 30 years of falling interest rates drove only a small portion of risk parity's outperformance in that period, (iii) practitioners use short-term (less than three-year) measures of the relative volatility of stocks and bonds to scale their portfolio exposures, whereas the paper used a 30-year measure in its evaluation, and (iv) the paper's simplification of portfolios to only stocks and bonds, and exclusion of inflationary-biased assets, skews the results against simplified risk parity during 1950–80 and toward it during 1980–2010. They also reiterate (v) their preference for leverage risk over (equity) concentration risk, as they view the former as better-rewarding and more able to be managed.

Asness, Clifford S., Andrea Frazzini, and Lasse H. Pedersen. "Leverage Aversion and Risk Parity." *Financial Analysts Journal* 68, no. 1 (January/February 2012): 47–59.

Appendix C: Annotated Bibliography

- The authors argue that (i) investor aversion to leverage alters demand for asset classes, such that safer assets must offer higher risk-adjusted returns than riskier ones, (ii) thus investors with the ability to apply leverage can earn higher risk-adjusted returns by overweighting safer assets, and (iii) empirically this is shown by both long-term and broad multi-geography backtests in which risk parity achieved a higher Sharpe ratio than 60/40 portfolios.

Dalio, Ray. "Engineering Targeted Returns & Risks." Bridgewater Associates (June 2010).

- The author argues that (i) the use of leverage in portfolios permits more diversification and thus Sharpe ratios about 0.25 higher than those of typical unlevered portfolios, which for a portfolio with 10% annual volatility would imply returns 2.5% per year higher, (ii) the main risk to such a levered balanced portfolio is an environment when asset classes broadly underperform cash, but (iii) a "moderately leveraged, highly diversified portfolio is considerably less risky than an unleveraged, non-diversified one."

Pro—Additional Papers

Alankar, Ashwin, Michael DePalma, and Myron Scholes. "An Introduction to Tail Risk Parity: Balancing Risk to Achieve Downside Protection." AllianceBernstein (2012).

- Rather than use volatility as the primary measure of risk (as in risk parity), the authors argue that "expected tail loss (ETL)" is a preferable risk metric, as it protects portfolios better than risk parity during economic crises while it simplifies to risk parity during "normal markets." ETL is claimed to provide implicit insurance by reducing exposures to assets that pose greater expected tail risk; however, ETL is a proprietary measure and is not defined so as to enable third parties to test the claims.

Alvarez, Miguel-A, Yin Luo, Rochester Cahan, Javed Jussa, and Zongye Chen. "Portfolios Under Construction: Risk Parity and Risk-Based Allocation." Deutsche Bank Quantitative Strategy (October 13, 2011).

- The authors test three risk-based allocation strategies—minimum variance, risk parity, and maximum diversification—against each other and against 60/40, and argue that (i) no one strategy is the panacea, but (ii) risk parity produces similar cumulative return to the 60/40 but with much lower levels of risk, and (iii) risk parity seems to be more robust to portfolio concentration and to different economic environments.

Gorman, Steve. "Is Parity Passé? A Better Way to Balance Risk." Wellington Management (December 2013).

- The author argues that (i) while risk parity should balance exposures across asset classes and economic environments, an appropriately balanced portfolio should have larger risk allocations to the likelier economic regimes, (ii) implementation should be customized within asset classes to better balance and mitigate risk, (iii) spending some premium on hedges can help manage drawdowns, and (iv) forecasting volatility is a more tractable problem than forecasting return, and volatility forecasts can be used to manage the portfolio toward constant volatility, which should produce a slightly better Sharpe ratio over time.

Appendix C: Annotated Bibliography

Peters, Ed. "Essential Beta: Global Growth Through Risk Parity." FirstQuadrant (August 2012).

- The author describes a novel risk parity approach, "Essential Beta," that is claimed to improve upon the basic portfolio construction's Sharpe ratio by (i) balancing risk within as well as across asset classes and (ii) adding a tail-risk hedging component—a dynamic put-spread collar strategy—designed to counteract the portfolio risk from levered bonds' inflation exposure in expansionary periods.

Peters, Ed. "Essential Beta: More Than Leveraged Bonds." FirstQuadrant (August 2012).

- The author elaborates on his earlier paper on "Essential Beta," arguing that even if the impact of the bond bull market is removed from the backtest, the risk parity portfolio would still have outperformed a 60/40 with comparable volatility over 1988–2011, and with lower equity correlation. ■