4. RISK PARITY: SILVER BULLET OR A BRIDGE TOO FAR?

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4.1. INTRODUCTION

Risk parity is a class of investment strategies in which capital is allocated across asset classes so that each asset class contributes an equal amount of volatility to the total volatility of the portfolio. Because this approach favors larger allocations to lower-returning asset classes, leverage is used to achieve the desired expected return. By contrast, the typical institutional investment portfolio uses an unlevered approach in which equities typically contribute roughly 90% of the total portfolio volatility. Advocates of risk parity argue that the traditional approach is unduly dependent on equities and is thus less efficient than a more risk-balanced approach. This argument proved compelling in the wake of the global financial crisis in 2008, allowing risk parity strategies to gain significant traction with institutional investors.

In this chapter, I evaluate the risk parity argument from a theoretical standpoint using the modern portfolio theory (MPT) framework of Markowitz (1952) and Tobin (1958). I then examine the historical performance (both simulated and actual) of risk parity portfolios relative to traditional portfolios used by institutional investors. Finally, I discuss the evolution of risk parity strategies and the prevalence of their use by institutional investors.

4.2. THE RISK PARITY PORTFOLIO AND MODERN PORTFOLIO THEORY

To better understand the theoretical basis of the risk parity portfolio, it is helpful to examine it in the context of the MPT framework. Specifically, by comparing a risk parity portfolio with traditional mean–variance-optimized portfolios along the efficient frontier, we can understand the differences in composition and the role that leverage plays in achieving the expected return.

Exhibit 4.1 shows the composition of a risk parity portfolio that includes US equity, non-US equity, real estate, commodities, and fixed income. The portfolio was developed using long-term assumptions for standard deviation and correlation, as shown in **Exhibit 4.2**. Unlike mean–variance optimization, there is little consensus among practitioners on the exact methodology for determining the risk parity portfolio. The most simplistic approach ignores correlations between asset classes, arguing that they are unstable and their use leads to increased estimation error. Under that approach, the asset class weights are determined by taking the inverse of their standard deviations and scaling them so that their sum equals 1. In this analysis, I use a methodology that allows both standard deviation and correlation estimates to determine the marginal contribution of each asset class to overall portfolio risk. This approach allows us to solve for the unique portfolio in which the marginal contributions of each asset class to total portfolio risk are equal. This methodology approximates the approach described in Qian (2006). In practice, this technique results in portfolios that better approximate the "optimal portfolio" on the efficient frontier in terms of both composition and risk level. Notably, neither of these approaches requires assumptions for expected return in order

EXHIBIT 4.1. RISK PARITY PORTFOLIO

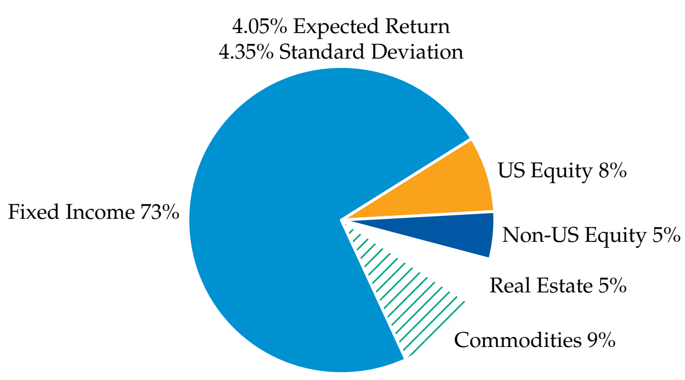


EXHIBIT 4.2. CAPITAL MARKET ASSUMPTIONS, RETURN, STANDARD DEVIATION, AND CORRELATION

Asset Class	US Equity	Non-US Equity	Real Estate	Commodities	Fixed Income
Expected Return	6.85	6.75	5.75	2.65	3.00
Standard Deviation	18.25	19.70	16.35	18.30	3.75

Expected Correlations

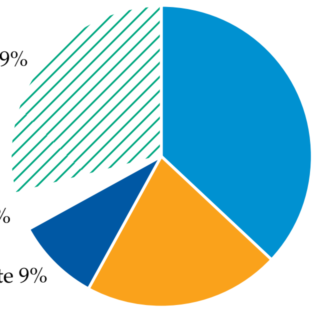
Asset Class	US Equity	Non-US Equity	Real Estate	Commodities	Fixed Income
US Equity	1.00				
Non-US Equity	0.84	1.00			
Real Estate	0.73	0.66	1.00		
Commodities	0.15	0.16	0.20	1.00	
Fixed Income	–0.11	–0.11	–0.03	–0.10	1.00

to determine the allocation between asset classes. Return expectations are required, however, to determine the appropriate amount of leverage to achieve a given level of expected return.

An efficient mean–variance portfolio with a 6.00% expected return is shown in **Exhibit 4.3** for comparison purposes. The efficient mean–variance portfolio was derived using the same set of assumptions for standard deviation and correlation that were used to derive the risk parity portfolio. It also uses assumptions for expected returns that are required by the mean–variance framework (shown in Exhibit 4.2). This portfolio was chosen because its risk posture is similar to that of the typical multi-asset-class portfolio used by institutional investors. In practice, the volatility of this portfolio is almost completely determined by the equity components, with fixed income contributing less than 5% to the total portfolio volatility.

Under the long-term assumptions shown in Exhibit 4.2, the unlevered risk parity portfolio has an expected return that is roughly 2% lower

EXHIBIT 4.3. MEAN–VARIANCE PORTFOLIO



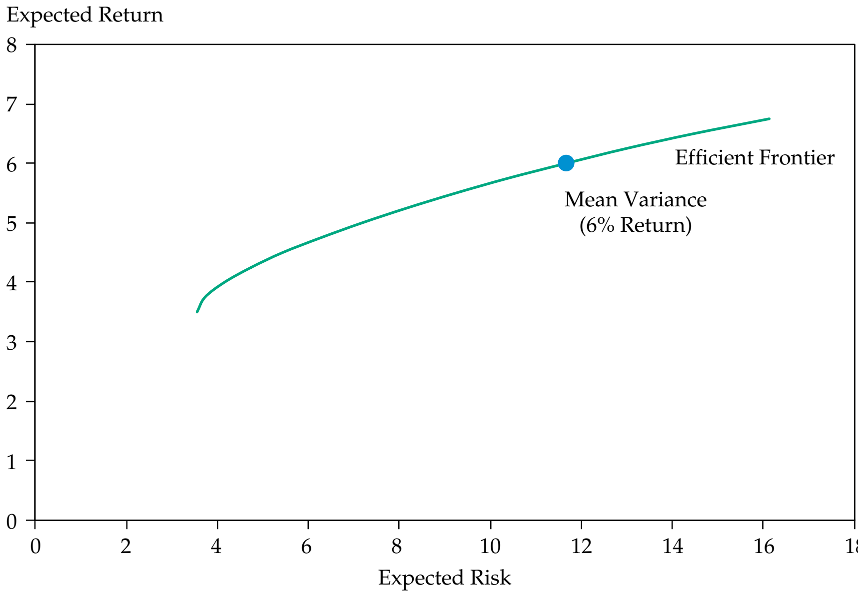
than that of the mean–variance portfolio (4.05% versus 6.00%). That is because over 70% of the risk parity portfolio is allocated to fixed income, which has an expected return of only 3%. The other higher-volatility asset classes have roughly equal weights in the portfolio. Notably, commodities have a meaningful allocation in the risk parity portfolio in spite of their low-return expectations. That is because return is ignored when solving for the risk parity portfolio, and the methodology in this example uses correlations. In the mean–variance portfolio, in which asset classes are penalized for having low expected returns, commodities receive a much smaller allocation.

The MPT framework helps explain how the use of leverage can bridge the 195 bp gap between the two portfolios. **Exhibit 4.4** depicts the efficient frontier generated using the long-term capital market assumptions in Exhibit 4.3. Each point along the efficient frontier represents the return-maximizing portfolio for that particular level of risk. These points collectively represent the efficient opportunity set for investors who do not use leverage. The 6.00% expected return portfolio from Exhibit 4.3 is shown for reference purposes.

Exhibit 4.5 adds the capital allocation line, which expands the framework to allow for the use of leverage (Tobin 1958). The intercept for the line is the borrowing rate (assumed to be 2.25% in this

EXHIBIT 4.4. EFFICIENT FRONTIER

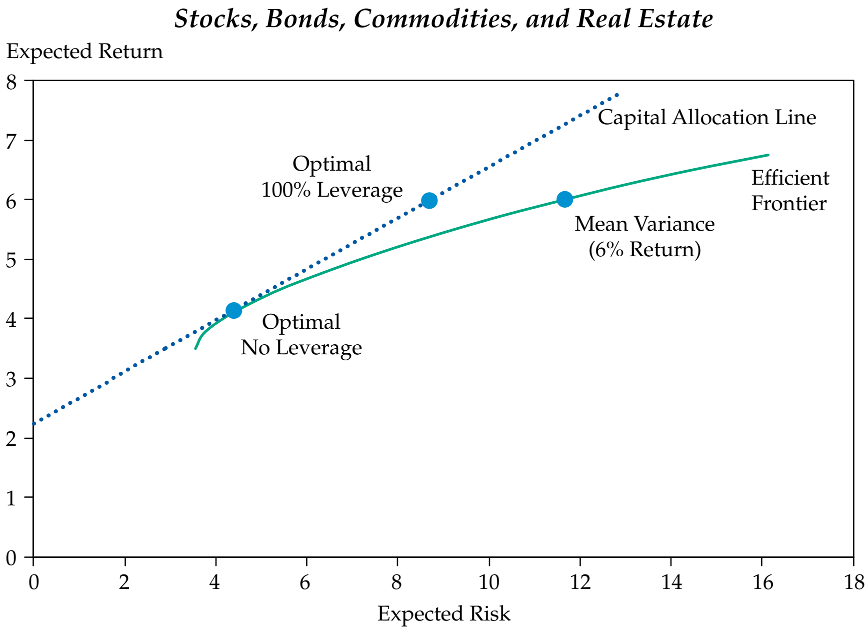
Stocks, Bonds, Commodities, and Real Estate



example). It is assumed that the investor can borrow or loan at this rate with no transaction costs. The slope of the capital allocation line is determined by finding its tangency point with the efficient frontier. The asset mix on the efficient frontier at the tangency point is considered the "optimal portfolio." The expected return and standard deviation for points on the capital allocation line to the left of the tangency point can be achieved by combining the optimal portfolio with cash. The expected return and risk for points on the capital allocation line to the right of the tangency point can be obtained by using leverage (borrowing money and investing it in the optimal portfolio).

In this example, the optimal portfolio has an expected return of roughly 4%. To achieve a return equal to that of the mean–variance portfolio, the optimal portfolio would need to be levered approximately 100%. Notably, the levered optimal portfolio has an expected standard

EXHIBIT 4.5. EFFICIENT FRONTIER AND CAPITAL ALLOCATION LINE

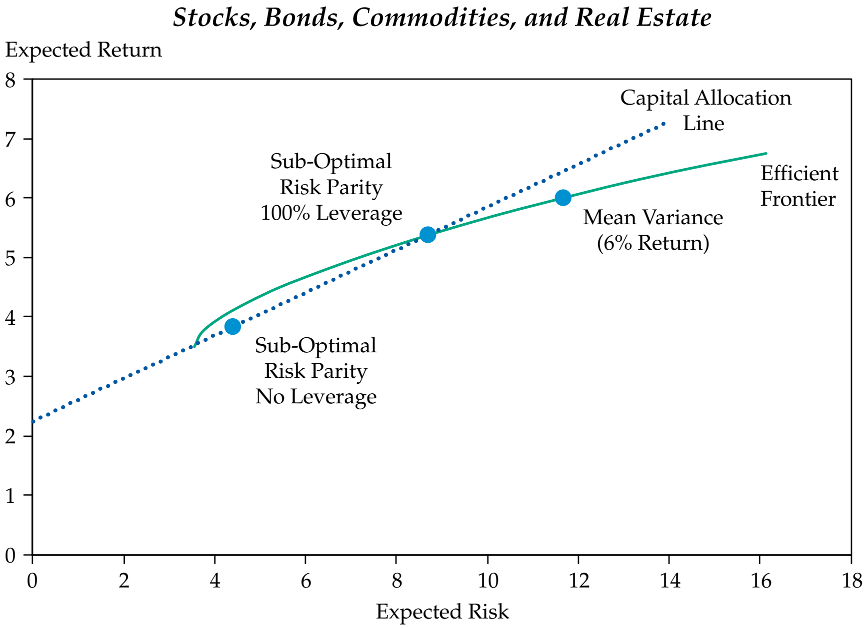


deviation approximately 25% lower than that of the mean–variance portfolio with the same expected return (an 8.70% standard deviation versus 11.65%). This example illustrates the promise of leverage, a key element of the risk parity approach.

Central to the risk parity value proposition is the question of how close the expected return and risk of the risk parity portfolio are to those of the optimal portfolio (i.e., do they reside on the efficient frontier in the same general area of risk?). **Exhibit 4.6** is designed to illustrate how important this is.

Exhibit 4.6 depicts the capital allocation line for a theoretical risk parity portfolio that resides below the efficient frontier (suboptimal). In this case, 100% leverage is needed simply to get back to the efficient frontier. An additional 30% leverage would be needed to achieve the targeted 6% expected return of the mean–variance portfolio. The resulting risk

EXHIBIT 4.6. EFFICIENT FRONTIER, CAPITAL ALLOCATION LINE, AND RISK PARITY PORTFOLIO



reduction of this 130% levered suboptimal risk parity portfolio relative to the 6% mean–variance portfolio is substantially diminished.

The MPT framework allows us to see that risk parity is an extension of the mean–variance approach with the added degree of freedom created through the explicit use of leverage. This insight leads to two important questions that are critical to evaluating the risk parity value proposition. The first is whether the risk parity portfolio lies on the efficient frontier—that is, does it deliver the maximum expected return on an unlevered basis for its expected level of risk? The second question is whether the capital allocation line is actually linear and sufficiently steep—that is, is the borrowing rate sufficiently low relative to the premium for risky assets to warrant the use of leverage, and is the cost of leverage constant relative to the amount of leverage used?

4.3. RISK PARITY AND EFFICIENCY

The question of whether the risk parity portfolio is efficient is important because this approach requires the use of leverage. As we saw in the previous section, leveraging an inefficient portfolio effectively flattens the slope of the capital allocation line, resulting in the need for greater leverage and diminishing the advantage of the levered portfolio relative to unlevered portfolios along the efficient frontier.

From the standpoint of theory, it would be pure coincidence if the risk parity portfolio and the optimal portfolio were exactly the same. That is because expected return is not used in the derivation of the risk parity portfolio, while it is a critical input in determining portfolios along the efficient frontier. This makes it extremely unlikely that the risk parity portfolio lies on the efficient frontier, let alone on the frontier *and* at the same spot as the optimal portfolio. Thus, we should accept the fact that in a purely theoretical sense, the levered risk parity portfolio is at best equal to (and probably inferior to) the levered optimal portfolio in terms of efficiency.

In practice, therefore, the question becomes, Is the risk parity portfolio a close enough approximation of the optimal portfolio to deliver on the promise of higher risk-adjusted returns? Asness, Frazzini, and Pedersen (2012) have argued that the two portfolios are sufficiently similar. They acknowledge that this is primarily because both portfolios overweight low-returning asset classes, rather than there being something special about all asset classes contributing equal risk. The advantage of overweighting lower-returning asset classes, they argue, is driven by a market inefficiency they call "leverage aversion," which they believe is sufficiently powerful to make up for any lack of efficiency on the part of the risk parity portfolio.

In simple terms, leverage aversion is the tendency of some investors to overweight risky assets relative to safer assets (presumably because they are either averse to leverage or cannot access it efficiently). This elevates the prices of risky assets relative to safer assets and results in safer assets having persistently higher risk-adjusted returns. A levered portfolio made up primarily of safer assets can take advantage of this inefficiency to generate superior risk-adjusted returns so long as it is reasonably close to the efficient frontier and leverage is sufficiently cheap.

Although empirical evidence seems to support the persistence of the leverage aversion effect (Asness, Frazzini, and Pedersen 2012; Frazzini and Pedersen 2014), that does not excuse practitioners from attempting to implement truly efficient risk parity portfolios. In practice, this often results in the relaxation of the "parity" constraint for such asset classes as commodities, which have inferior risk-adjusted returns relative to other risky assets (in many cases, they are simply excluded).

Some of the other key portfolio construction decisions that must be made in building efficient risk parity portfolios include the following: which asset classes to include; how many asset classes to include; defining the asset classes broadly or narrowly; the time horizon for measuring variance and covariance; how often the portfolio is rebalanced; how such illiquid assets as private equity and real estate should be included, and if they are included, how to measure their variance and covariance; and finally, how much leverage should be applied and how it should be structured.

It is beyond the scope of this chapter to address all these questions. For the most part, they are the same questions faced by managers of traditional unlevered institutional multi-asset class portfolios. In the next section, I will examine the one question on the list that is unique to the risk parity approach: the use of leverage.

4.4. RISK PARITY AND LEVERAGE

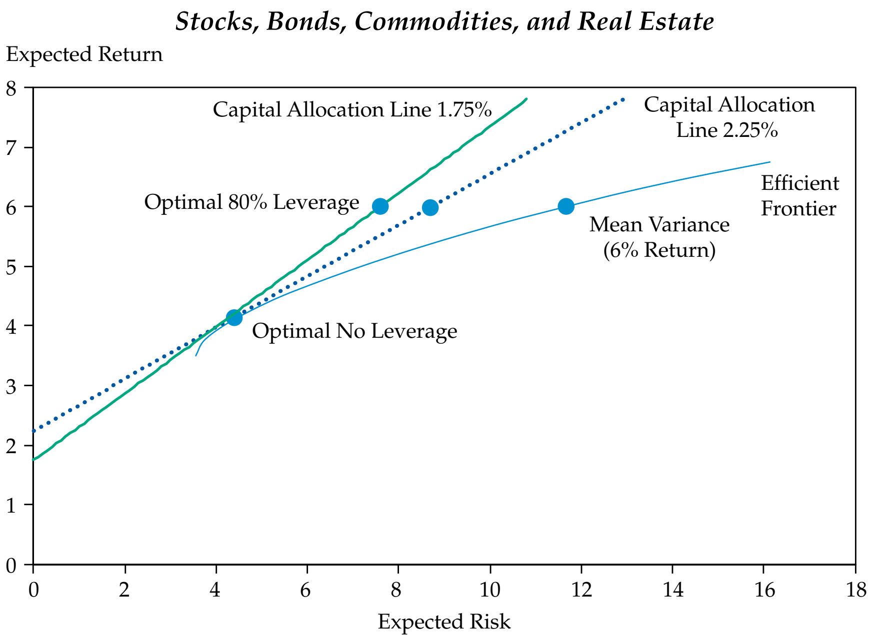
When James Tobin proposed the capital allocation line in 1958, there was a wide gap between the theory and the practical reality of leverage. In theory, you could borrow and loan virtually unlimited amounts of capital at the risk-free rate with no transaction costs. In practice, access to cost-effective leverage, particularly for the purpose of buying securities, was virtually nonexistent. Since that time, the capital markets have evolved considerably and institutional investors have access to a myriad of leverage sources—ranging from simple lines of credit, to the futures and options markets, to private party swaps, to CDOs and other exotic instruments with embedded leverage—all of which makes the prospect of implementing a risk parity portfolio much more tenable from a cost-efficiency standpoint. It also makes it substantially more complicated to identify and implement the optimal mix of leverage sources on an ongoing basis. Periods of market stress further complicate this problem.

In our simple example where we assumed that the borrowing rate was 2.25%, the risk parity portfolio required approximately 100% leverage to achieve the expected return of the 6% mean–variance portfolio. If we were to drop the borrowing rate from 2.25% to 1.75%, the amount of leverage required to achieve an expected return of 6% would decline to roughly 80% and the risk reduction relative to the mean–variance portfolio would improve accordingly, as illustrated in **Exhibit 4.7**.

This example highlights the fact that relatively minor changes in the borrowing rate can affect the required leverage ratio for a risk parity portfolio with a targeted level of return.

Changes that occur on the asset side of the equation can also influence the required leverage ratio. At the time that the assumptions for this example were developed, quantitative easing and other macro factors had driven the expected premium for risky assets to very low levels. Furthermore, low yields combined with a historically high representation of government-backed bonds had driven the expected volatility of the bond market down to historical lows. In a risk parity framework, a reduction in bond volatility necessitates more bonds in the portfolio to allow them to contribute their equal share of risk. The combination of a high representation of bonds in the portfolio and low expected returns on risky assets results in a historically low expected return for the unlevered risk parity portfolio. The lower the expected return relative to the borrowing rate (a flatter capital allocation line), the greater the amount of leverage needed to achieve the targeted return.

EXHIBIT 4.7. EFFICIENT FRONTIER, CAPITAL ALLOCATION LINE, AND MEAN–VARIANCE PORTFOLIO



The fact that a flat capital allocation line results in an increase in required leverage raises the question of whether the cost of borrowing is constant relative to the amount of borrowing—that is, Is the capital allocation line actually linear, or does the slope flatten with the percentage of leverage used? In our example, the risk parity portfolio required 100% leverage to achieve the targeted level of return. It makes sense that as the amount of leverage on the portfolio increases, counterparties will demand greater compensation for the increased credit risk they bear. During periods of market dislocation when liquidity is at a premium, counterparties will demand an even higher premium or possibly withdraw their credit lines altogether for highly leveraged portfolios. A negatively sloped yield curve may also pose a challenge for maintaining the leverage required by the risk parity approach. When the short-term borrowing rate exceeds the yield on a market-oriented bond portfolio, it effectively results in a negatively sloped capital allocation line. Borrowing at the short-term rate and leveraging the portfolio under these circumstances will theoretically push it even further below the efficient frontier.

Finally, the introduction of systematic leverage will require advances in the monitoring, benchmarking, reporting, and risk-management tools used by institutional investors. Although banks and insurance companies have long used tools that look at both the debt side and the equity side of the portfolio to monitor risk and measure success or failure, the tools used by the typical pension fund or endowment focus almost exclusively on equity. Developing and implementing systems to capture data and analyze the complex interactions between a sophisticated multi-asset-class portfolio and the financing portfolio designed to support it will probably prove to be a challenge and a potential opportunity for custodians, consultants, and the investment staffs charged with the oversight of levered institutional portfolios.

4.5. RISK PARITY PERFORMANCE

Practitioners have provided substantial evidence, both through history and across global markets, that the risk parity approach would have historically delivered superior risk-adjusted returns relative to a traditional unlevered mean–variance portfolio. Asness et al. (2012) have undertaken perhaps the most careful and thorough analysis currently available in the literature. They simulated the performance of a risk parity portfolio relative to a 60/40 portfolio over 1926–2010 in the US market. They also analyzed 10 other developed markets globally over 1986–2010. In every case, the risk parity approach delivered higher risk-adjusted returns than the traditional 60/40 portfolio. In the case of the US portfolios, they tested five different borrowing rates, ranging from T-bills (the cheapest) to LIBOR (the most expensive). Their conclusions favoring the risk parity approach were robust across the entire set, although the advantage diminished meaningfully as the cost of leverage increased.

To provide further evidence, we can compare a risk parity portfolio to a mean–variance portfolio over the 20-year period ended

31 December 2016. Note that this was a particularly good time for risk parity, because the period was characterized by two major crises in the global equity markets: a consistently upwardly sloping yield curve and a general decline in interest rates. The exercise is still worthwhile, however, because it provides some color around the patterns of performance that yielded the superior risk-adjusted results. The two portfolios are constructed using the same set of asset classes detailed in the first section.[1] **Exhibit 4.8** reports the historical returns, standard deviations, and correlations for each asset class over the period.

Both portfolios are assumed to maintain a constant asset allocation over the period and are rebalanced quarterly. The risk parity portfolio is assumed to maintain a constant amount of leverage. The risk parity portfolio is derived using the approach discussed earlier that allows standard deviations and correlations to solve for the portfolio, whereby each asset class contributes the same marginal risk to the total. The borrowing rate is assumed to be equal to one-month LIBOR. The historical returns over the period are used to determine the constant leverage ratio of roughly 65%, which is needed to generate exactly a 7.5% annualized return. The mean–variance portfolio is derived using the same set of historical inputs. To make the comparison with the risk parity portfolio more intuitive, the portfolio along the efficient frontier that generated a 7.5% annualized return is chosen. The composition of the two portfolios is shown in **Exhibit 4.9**.

Neither portfolio closely resembles the portfolios used by large institutional investors over the last 20 years. The mean–variance portfolio benefits from knowing in advance the return patterns of each asset class and wisely assigns zero weights to both commodities

[1]The indexes used to represent each asset class are as follows:

1. US equity: Russell 3000 Index
2. Non-US equity: MSCI EAFE Index for Q1 1997 through Q4 2000 and MSCI ACWI ex-US Index for Q1 2001 through Q4 2016
3. Real estate: FTSE NAREIT Composite Index
4. Commodities: Goldman Sachs Commodities Index
5. Fixed income: Bloomberg Barclays Aggregate Index

EXHIBIT 4.8. RETURN, STANDARD DEVIATION, AND CORRELATION FOR 20 YEARS ENDED 31 DECEMBER 2016

Asset Class	US Equity	Non-US Equity	Real Estate	Commodities	Fixed Income
Return	7.86	4.35	9.02	−1.92	5.29
Standard Deviation	17.28	19.75	19.83	25.04	3.51

Expected Correlations

Asset Class	US Equity	Non-US Equity	Real Estate	Commodities	Fixed Income
US Equity	1.00				
Non-US Equity	0.88	1.00			
Real Estate	0.60	0.54	1.00		
Commodities	0.21	0.34	0.24	1.00	
Fixed Income	−0.35	−0.29	0.04	−0.18	1.00

and international equities. The risk parity portfolio includes everything it is offered regardless of return but perfectly balances the marginal contribution to risk across the asset classes over the 20-year period.

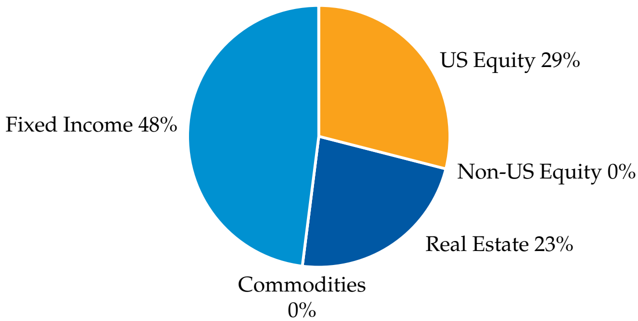
As expected, the risk parity portfolio generated the same return as the mean–variance portfolio with roughly 60% of the volatility over the period, resulting in a higher Sharpe ratio (0.90 versus 0.62) and substantially reduced drawdowns during the 2001–02 and 2008–09 crises relative to the mean–variance portfolio. **Exhibit 4.10** depicts the cumulative return of the risk parity portfolio relative to the mean–variance portfolio over the period. It allows us to see exactly which periods risk parity had an advantage and which ones it did not.

The shaded areas indicate the periods when the risk parity portfolio would have outperformed the mean–variance portfolio. With its reduced exposure to equity risk and increased exposure to interest rate risk, the risk parity portfolio would have weathered the bursting of the

EXHIBIT 4.9. COMPOSITION OF MEAN–VARIANCE PORTFOLIO AND RISK PARITY PORTFOLIO LEVERAGED 65%

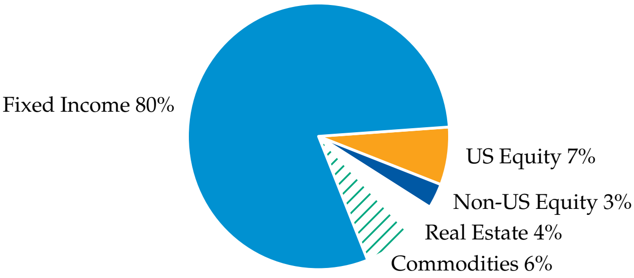
Mean–Variance Portfolio

7.50% Expected Return
8.39% Standard Deviation



Risk Parity Portfolio Leveraged 65%

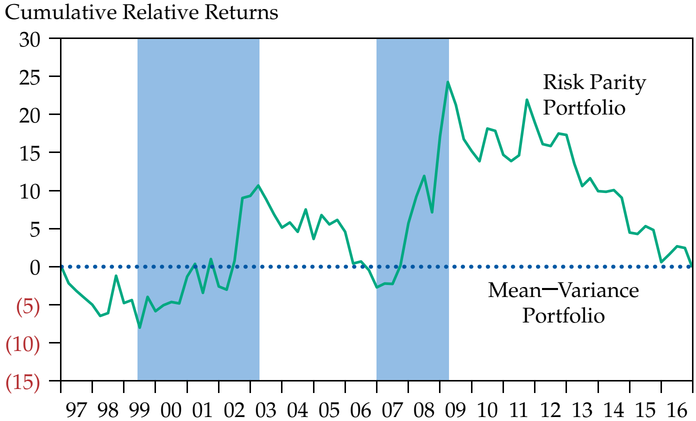
7.50% Return
5.78% Standard Deviation



dot-com bubble and the global financial crisis better than the mean–variance portfolio. During periods of strong equity performance, however, the risk parity approach would have consistently trailed.

Exhibit 4.11 illustrates the repercussions of this performance pattern in the context of the Callan Total Fund Sponsor Database, a broad universe of over 1,500 public and corporate pension funds, foundations, endowments, and other pools of institutional capital.

EXHIBIT 4.10. CUMULATIVE RETURN RELATIVE TO MEAN–VARIANCE PORTFOLIO FOR 20 YEARS ENDED 31 DECEMBER 2016

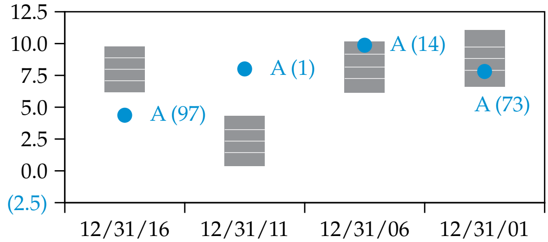


As Exhibit 4.11 shows, the performance ranking of the risk parity portfolio would have been quite volatile over the period, bouncing around from the bottom to the top of this broad distribution of diversified multi-asset-class portfolios. This pattern indicates that although a risk parity strategy might have been a good diversifier as a component of one of these portfolios, it would have been very difficult to maintain the risk parity approach at the policy level for a large institutional investor. Very few, if any, institutions have the patience and perspective to stick with a program that has the potential to land them in the 99th percentile relative to peers over a five-year period. This helps explain the fact that although there has been almost no adoption of the risk parity approach at the policy level among institutional investors, many of them have carved out strategic allocations to the approach as part of their overall asset allocation.

4.6. US INSTITUTIONAL HISTORY OF RISK PARITY

Although the risk parity approach has been pitched as a superior alternative to the traditional unlevered mean–variance-efficient portfolios favored by institutions, there has been only one case of a large public institution attempting to adopt it at the policy level. Coming out of

EXHIBIT 4.11. RETURN RANKINGS FOR FIVE-YEAR PERIODS



	12/31/16	12/31/11	12/31/06	12/31/01
10th Percentile	9.79	4.31	10.17	11.06
25th Percentile	9.08	3.17	9.31	9.90
Median	8.17	2.18	8.31	8.76
75th Percentile	7.19	1.24	7.24	7.69
90th Percentile	6.18	0.37	6.14	6.60
Risk Parity Portfolio ● A	4.38	8.01	9.88	7.82

Source: Callan.

the global financial crisis in 2009, the San Diego County Employees Retirement Association (SDCERA) was looking for an alternative to the standard equity-centric approach that had allowed it to lose over $2 billion (peak to trough) during the crisis. The SDCERA ultimately outsourced the management of the entire portfolio to Integrity Capital (since merged with Salient Partners), which implemented a risk parity strategy at the total portfolio level. The experiment was abandoned in July 2015, after the SDCERA portfolio had consistently trailed peers during the seven-year bull market for equities that followed the crisis (McDonald 2015). This episode highlights the challenge for institutions of pursuing an investment policy that is fundamentally different from the approach used by peers. By all accounts, the SDCERA portfolio was delivering on its promise of lower volatility, but in a bull equity market, this took the form of lower returns relative to peers. Sadly, the strategy was abandoned before the flip side of the volatility reduction equation could be fully realized.

Given the difficulty of pursuing risk parity at the policy level, the preponderance of institutional adoption has been in the form of incremental allocations to the strategy, either as part of an "absolute return" allocation or as a fully dedicated risk parity allocation. Generally, these allocations have been in the range of 3%–5% of the portfolio and have been implemented by investing with managers who specialize in the approach. There is some debate regarding which firm first offered a risk parity product, but a good argument can be made that Ray Dalio and Bob Prince of Bridgewater Associates were the first to implement it at an institutional level with their “All Weather” portfolio, launched in 1996. It was not until 2005, however, that the term *risk parity* was coined in a white paper written by Edward Qian (2005) of PanAgora Asset Management. In the years since the 2008 financial crisis, roughly two dozen firms have launched products in the United States designed and marketed around the concept of risk parity; as of 31 December 2016, total assets managed across these strategies exceeded $120 billion.[2] **Exhibit 4.12** provides a list of the firms that had submitted data on risk parity strategies to either the Callan Global Manager Research Database or the eVestment Global Database as of that date.

As risk parity passes through its first decade since the term was coined (and its second decade since the launch of the original “All Weather” strategy), the products being marketed under the moniker continue to evolve. Many practitioners have adopted an explicitly tactical (or dynamic) approach to implementing risk parity, constantly shifting their allocations across asset classes as well as their use of leverage to respond to changes in their outlook for expected returns and risks. Other practitioners have gone beyond the use of simple asset classes in their portfolio construction and have started to use “risk premiums” as the building blocks for their risk parity portfolios. A third category of managers has abandoned the strict interpretation of “parity” altogether in their risk allocations, focusing instead on optimizing risk-adjusted returns across their multi-asset-class portfolios. Complicating things even further is the fact that many of these strategies are offered at varying levels of targeted volatility to appeal to a broader array of investors. The end result is a universe of products that arguably have more differences than similarities. This can be seen in **Exhibit 4.13**, which contrasts the range of returns

[2]Callan Global Manager Research Database.

EXHIBIT 4.12. FIRMS WITH RISK PARITY PRODUCTS AS OF 31 DECEMBER 2016

AllianceBernstein, LP (AB)	JP Morgan Asset Management
Aquila Capital Investment	Neuberger Berman Group, LLC
AQR Capital Management	PanAgora Asset Management
BlackRock, Inc.	Parametric Portfolio Associates
Boston Advisors LLC	Pear Tree Funds
Bridgewater Associates, LP	Putnam Investments
Columbia Threadneedle Investments	Salient Partners, LP
First Quadrant, LP	Schroder Investment Management Limited
Fulcrum Asset Management	Wellington Management Company, LLP
Global Asset Management (GAM) Invesco, Ltd	Zadia Gestion
Janus Capital Group	

Sources: Callan Global Manager Research Database and eVestment Global Database.

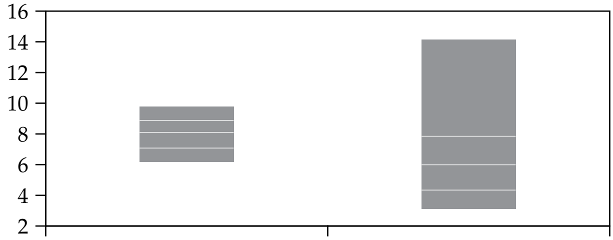
across risk parity products with the range of returns across Callan's Total Fund Sponsor Database over the three-year period ended 31 December 2016.

As Exhibit 4.13 shows, the dispersion of returns across the risk parity universe over this fairly short period was significantly wider than that of the fund sponsor universe. The median return was also 211 bps lower, indicating that the typical experience with risk parity over the period had the effect of reducing the overall portfolio return. Exhibit 4.13 points out the importance when selecting a risk parity strategy of having a very clear understanding of how it is constructed, what its targeted risk level is over time, and how it can be expected to perform in a variety of market conditions.

4.7. CONCLUSION

After the global financial crisis, it is not surprising that institutional investors took an acute interest in alternatives to equitycentric

EXHIBIT 4.13 RETURNS FOR THREE YEARS ENDED 31 DECEMBER 2016 (RISK PARITY UNIVERSE VS. CALLAN TOTAL FUND SPONSOR UNIVERSE)



	Fund Sponsor Universe	Risk Parity Universe
10th Percentile	9.79	14.14
25th Percentile	9.08	7.84
Median	8.17	6.06
75th Percentile	7.19	4.36
90th Percentile	6.18	3.12

strategies. The fact that the previous 15 years had been characterized by two major crises in the global equity markets, a consistently upwardly sloping yield curve, and a general decline in interest rates made risk parity look like a particularly compelling option. Although concerns about peer risk and the use of leverage made adoption at the policy level untenable, many institutions carved out strategic allocations to risk parity in an effort to further diversify their portfolios. Practitioners have responded with a wide variety of products, and assets managed across these strategies have steadily grown. Questions remain about the use of leverage—specifically, levering fixed income—during a period of rising rates or one characterized by a persistently inverted yield curve. Practitioners argue, however, that interest rate risk is but one of many exposures in a well-balanced risk parity portfolio and that the approach will ultimately show its worth over the long run by delivering on its promise of a higher risk-adjusted return.

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