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RISK PARITY

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ABSTRACT

Risk parity is an asset allocation strategy that, as its name entails, aims to allocate risk equally among assets in a portfolio. Furthermore, the strategy may target a relatively constant level of overall risk for the portfolio. This involves a departure from traditional asset allocation that focuses on allocating capital, as opposed to risk.

In terms of implementation, given that asset classes have different levels of risk[1] (e.g., equities have higher risk than high quality bonds), an investor would need to use leverage to construct a risk parity portfolio with an expected level of risk (or return) that mirrors that of a traditional allocation. Leverage can be a flexible tool for investors to magnify the expected returns of a strategy, but it does come with risks; in particular, it amplifies losses and may introduce undesired liquidity and counterparty risk to a portfolio. Most risk parity portfolios use some degree of leverage.

Risk parity allocations result in higher allocations to bonds and lower allocations to equities relative to traditional capital allocations, which means they should outperform during times of equity turbulence but may underperform during periods of rising rates. Additionally, since these allocations are not widely implemented in the industry, institutional investors that adopt this allocation methodology need to be comfortable being "different" from peers, that is, having high tracking error to broad peer allocations.

This paper covers risk parity in the context of an asset allocation strategy for institutional investors. Risk parity can be understood more broadly as a methodology for allocating capital/risk to a group of assets. These additional applications are outside the scope of this paper.

BACKGROUND

Traditional asset allocation is grounded in the theory of Mean Variance Optimization (MVO). MVO is the most popular methodology used by institutional investors to build portfolios. This simple, yet powerful tool creates "efficient" portfolios that attempt to achieve objectives, such as maximum return or minimum risk portfolios, by selecting assets based on their expected return, expected risk (as defined by their standard deviation of returns) and correlations with each other.

Without delving too deep into the details of how MVO chooses portfolios, it is worth noting that at its core, the process tends to prefer assets that have relatively high risk-adjusted returns or a high level of return per unit of risk taken. Risk-adjusted returns are often measured by a statistical metric called the Sharpe Ratio. Based on the figures below and choosing only based on Sharpe Ratio, Core Bonds (which have the highest Sharpe Ratio) would be preferred ahead of Global Equities and Inflation Linked Bonds, holding all else equal.

[1] As measured by the standard deviation of returns.

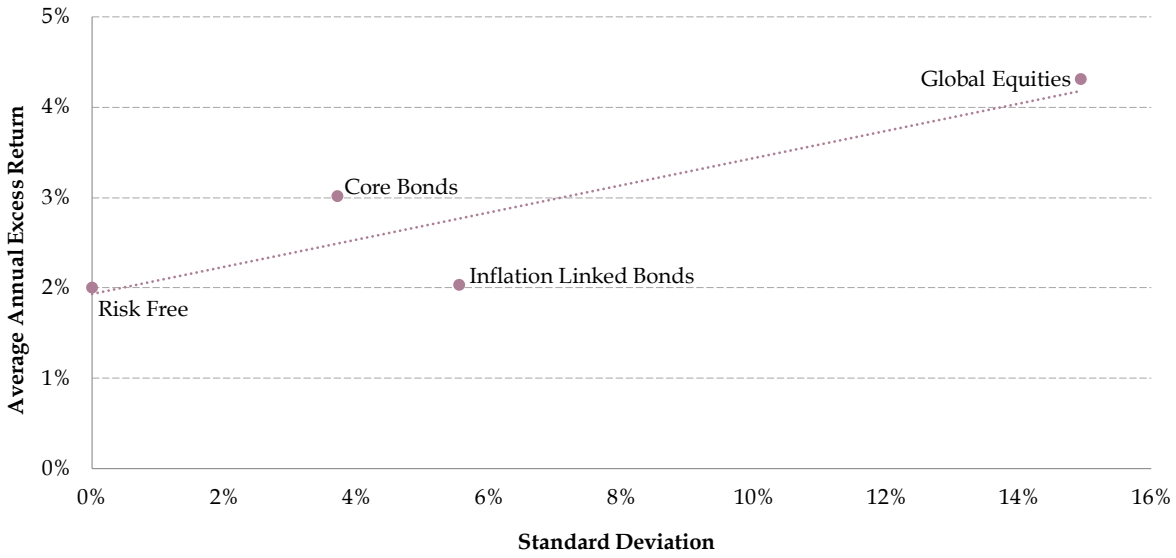
Table 1. Comparing Asset Classes Sharpe Ratios[2]

Capital Allocation	Global Equities	Core Bonds	Inflation Linked Bonds
Expected Return (20-year)	7.5%	3.6%	3.3%
Standard Deviation	19%	4.0%	7.5%
Sharpe Ratio	**0.29**	**0.41**	**0.18**

However, any investor that has used MVO to build a portfolio can attest that its results are not always as "clean" in practice as they are in theory. Detractors of MVO point to the fact that the process is extremely sensitive to changing inputs, and sometimes recommends unstable and "extreme" portfolios[3].

This is where risk parity comes in. Its proponents maintain that broad asset classes such as equities, bonds, and inflation-related assets[4] have similar long-term risk-adjusted returns, so using this methodology reduces dependence on input estimation, and focuses on building a portfolio that has a balanced exposure to the major asset classes by allocating risk equally to each.

Chart 2. Excess Return to Standard Deviation Relationship[5]
January 1988 – June 2018



[2] Based on Meketa Investment Group's 2018 Asset Study. The Risk Free rate is assumed as 1.98%, consistent with current 90-day Treasury Bill yields at the time of writing.

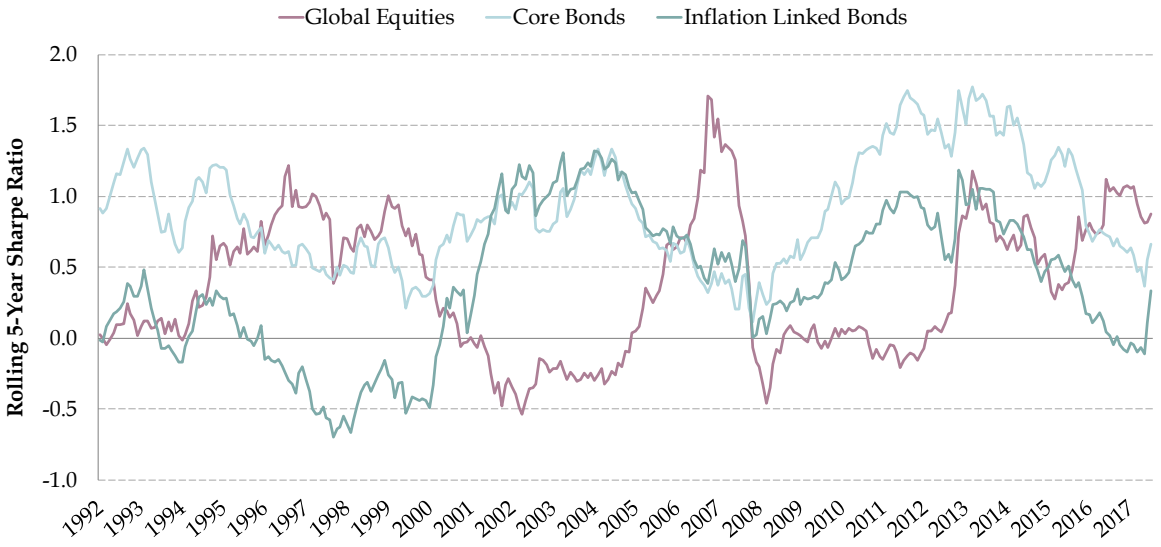
[3] Concentrated portfolios that only allocate to one or two assets (instead of making full use of the available universe).

[4] Commodities and/or Inflation Linked Bonds.

[5] Source: AQR and MIG. Global Equities, Core Bonds and Inflation Linked Bonds proxied by MSCI ACWI, Bloomberg Barclays U.S. Aggregate and Bloomberg Barclays US TIPS indices respectively. TIPS returns prior to March 1997 backfilled with MIG proprietary estimates. Risk Free plotted for reference.

Furthermore, even though most inputs are relatively static, in reality, asset returns vary over time, going through cycles of relative under and out performance. Without the ability – or desire – to time these cycles, it follows that allocating risk equally should improve diversification.[6] However, for this to be true, the asset classes included in the risk parity portfolio should have little to no expected correlation with each other over the long term.[7]

Chart 3. Rolling Asset Class Sharpe Ratios[8]
January 1988 – June 2018

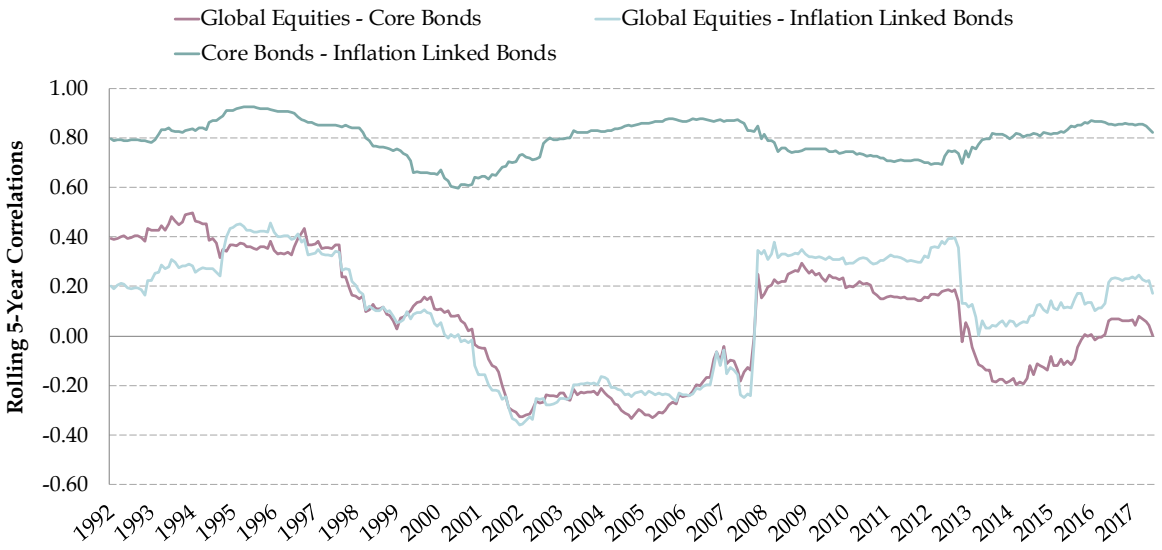


[6] This would mean avoiding being concentrated (in terms of allocated risk) in the current worst performing asset. The opposite is also true unfortunately, as a broad risk parity allocation will avoid overweighting the best performing assets.

[7] The correlation profile of assets is a very important assumption when evaluating the investable universe of Risk Parity strategies. In general, these strategies tend to allocate to Equities, Core Bonds, and Inflation Linked Assets, given the underlying assumption that these assets should be lowly correlated over the long term because their returns are driven by different economic factors, such as growth, interest rates, and inflation, respectively. Some risk parity portfolios create a fourth "bucket" for credit, but this asset class is not necessarily orthogonal to the other buckets (i.e., it has at least a fair amount of positive correlation to equity).

[8] Source: AQR and MIG. Global Equities, Core Bonds, and Inflation Linked Bonds proxied by MSCI ACWI, Bloomberg Barclays U.S. Aggregate and Bloomberg Barclays US TIPS indices respectively. TIPS returns prior to March 1997 backfilled with MIG proprietary estimates.

Chart 3. Rolling Asset Class Correlations[9]
January 1988 – June 2018



PORTFOLIO CONSTRUCTION

Risk Parity starts by creating a long-only portfolio that seeks to balance risks. The chart below shows how a risk parity allocation achieves a more balanced risk allocation than a traditional capital allocation, where the majority of risk taken is concentrated in equities. Furthermore, the resulting portfolio is superior from a risk-adjusted perspective (i.e., higher Sharpe Ratio). Unfortunately, not everything is positive, as the risk parity's portfolio expected return is considerably lower than the traditional allocation portfolio.

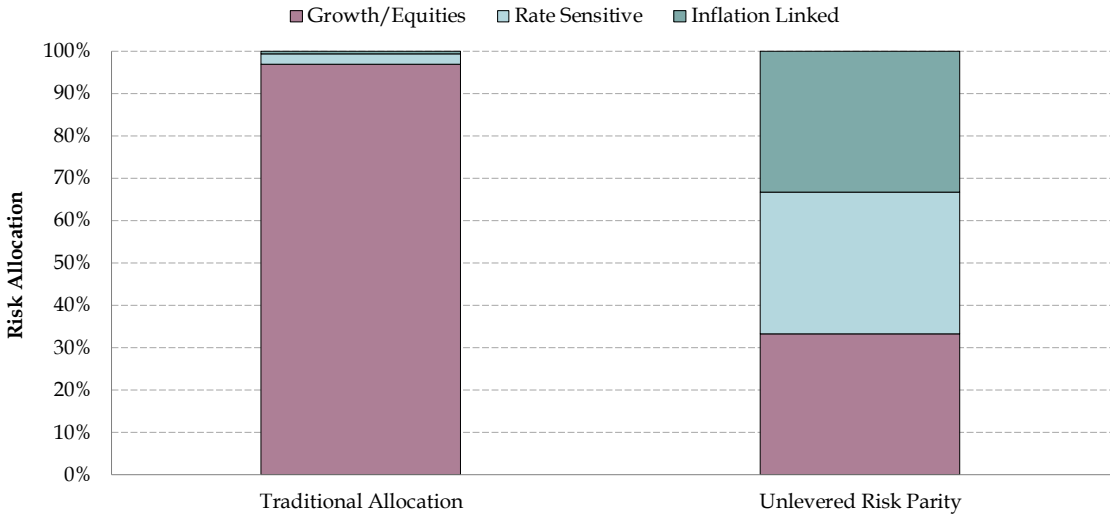
Table 4. Traditional and Risk Parity Allocations[10]

Capital Allocation	Traditional Allocation	Unlevered Risk Parity
Growth/Equities	60%	15%
Rate Sensitive	35%	56%
Inflation Linked	5%	29%
Expected Return (20 Years)	**6.5%**	**4.4%**
Standard Deviation	**11.6%**	**5.3%**
Sharpe Ratio	**0.39**	**0.46**

[9] Global Equities, Core Bonds, and Inflation Linked Assets proxied by MSCI ACWI, Bloomberg Barclays U.S. Aggregate and Bloomberg Barclays US TIPS indices respectively. TIPS returns prior to March 1997 backfilled with MIG proprietary estimates.
TIPS were used to represent Inflation Linked assets, yet Commodities, either as stand-alone or in combination with TIPS are also commonly used for this bucket, given their low correlation profile relative to stocks and bonds.

[10] Expected Return, Volatility, and Correlation figures based on Meketa Investment Group 2018 Asset Study.

Chart 5. Risk Decomposition by Allocation



In order to bring the portfolio's risk up to a level where its expected return is commensurate with most investor's objectives, leverage needs to be introduced. This is usually done by levering up the entire unlevered risk parity portfolio.[11]

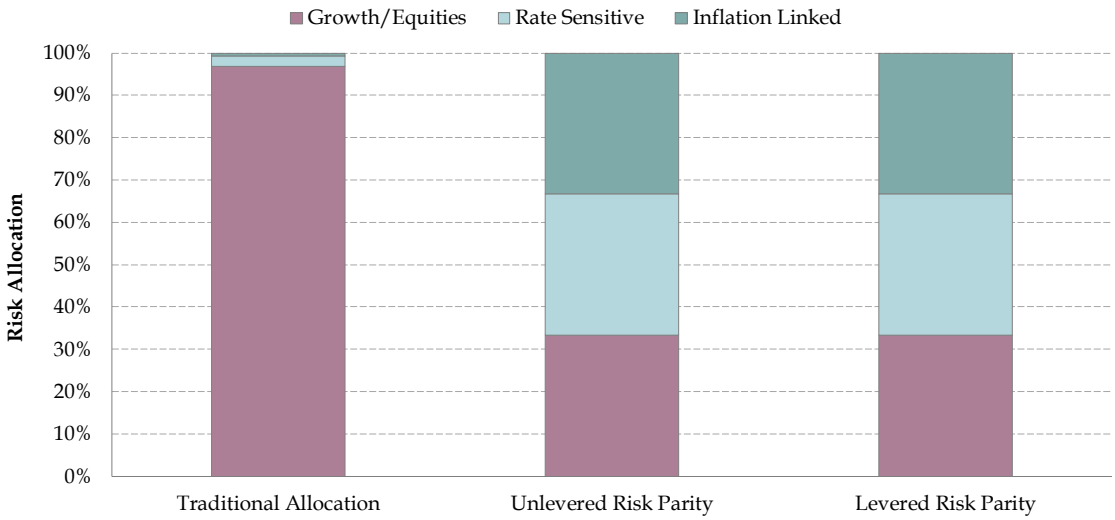
Table 6. Traditional and Risk Parity Allocations[12]
Includes Levered Risk Parity

Capital Allocation	Traditional Allocation	Unlevered Risk Parity	Levered Risk Parity
Growth/Equities	60%	15%	34%
Rate Sensitive	35%	56%	124%
Inflation Linked	5%	29%	64%
Risk Free (Leverage)	0%	0%	-121%
Expected Return (20 Years)	**6.5%**	**4.4%**	**7.0%**
Standard Deviation	**11.6%**	**5.3%**	**11.6%**
Sharpe Ratio	**0.39**	**0.46**	**0.43**
Gross Exposure	**100%**	**100%**	**343%**

[11] This process is consistent with Finance Theory that argues that in order to increase the expected return of an efficient portfolio, leverage should be used, as opposed to overweighting higher return asset classes. However, this also assumes that leverage is always available at the risk free rate (with no volatility or correlations to the rest of the assets in the portfolio).

[12] Expected Return, Volatility, and Correlation figures based on Meketa Investment Group 2018 Asset Study.

Chart 7. Risk Decomposition by Allocation
Includes Levered Risk Parity



The levered risk parity portfolio in the example above involves levering up the unlevered version so that the portfolio's volatility matches that of the traditional allocation. As we can see, the resulting portfolio is still superior from a risk-adjusted perspective, but now it also has a higher expected return than the traditional allocation. Again, not all is positive, as the levered risk parity portfolio requires a leverage ratio of over two.

IMPLEMENTATION ISSUES

1. Investable Universe

Most risk parity strategies are constrained to investing only in bonds, equities, inflation linked securities and sometimes credit. However, institutional portfolios invest in a wide array of additional asset classes. Examples include credit-related securities (e.g., high yield and bank loans), private equity (e.g., buyouts and venture capital), real assets (e.g., real estate and infrastructure), and hedge funds.

Risk parity strategies need to invest in asset classes that are flexible enough to be easily levered. While using borrowing facilities[13] could, in theory, solve this issue, in practice, what occurs is that risk parity allocates capital through liquid derivatives such as futures, which offer cheap (almost free at times) and less risky leverage. Unfortunately, this means the strategy's universe is usually constrained to asset classes with liquid futures markets.[14]

[13] Any type of short-term credit provided by a bank or non-traditional lender.

[14] There are risk parity products/strategies that implement portions of their allocations that do not have developed futures markets (e.g., TIPS) through physical assets (i.e., direct ownership). However, directly owning the assets further constrains the strategy's total exposure limits and its ability to access leverage.
Additionally, these exposures are passively implemented. Thus, risk parity crowds out active management, and any manager alpha that might be available in less-efficient asset classes must be foregone.

2. Leverage[15]

Leverage is a key requirement for risk parity. While unlevered risk parity portfolios can offer attractive expected risk-adjusted returns, they will likely have expected return levels that fall short of most institutional investor's return objectives. In order to bring the allocation to an attractive expected return level, the portfolio needs to use leverage.

As expressed in the investable universe section, risk parity strategies usually access leverage through liquid derivatives such as futures. The dynamics of these contracts is such that by posting an initial margin of, for example, $1, an investor can achieve an economic exposure to the asset class of $10 or more.[16] Positions are then marked to market (valued) daily, so that any gains or losses increase or reduce this initial margin. In order to maintain the position, an investor needs to maintain what is called a "maintenance margin"[17] in her account at all times, or else be forced to exit the position.

Accessing leverage through exchange-traded futures is the preferred approach for creating risk parity portfolios, as futures markets for traditional asset classes are very liquid, offer virtually no counterparty risk, and have mechanisms in place that can limit the losses to an investor. This is a significant departure from models that access leverage through credit lines or borrowing facilities with banks or other lenders, as these are less liquid, are exposed to counterparty risk, and tend to meaningfully increase in cost during turbulent times.

3. Volatility Targeting

As we saw with the levered risk parity portfolio example, in order for a risk parity strategy to offer expected returns comparable to traditional capital allocations, the portfolio's expected risk (i.e., volatility) also needs to be increased (with leverage). Generally, risk parity implementations will select a target risk level,[18] say 10%, and construct a portfolio to match it.

Similar to how traditional capital allocation portfolios need to rebalance their weights periodically in order to avoid unwanted drift, risk parity portfolios also need to adjust both their asset class allocations and overall portfolio leverage in order to maintain a desired volatility level.

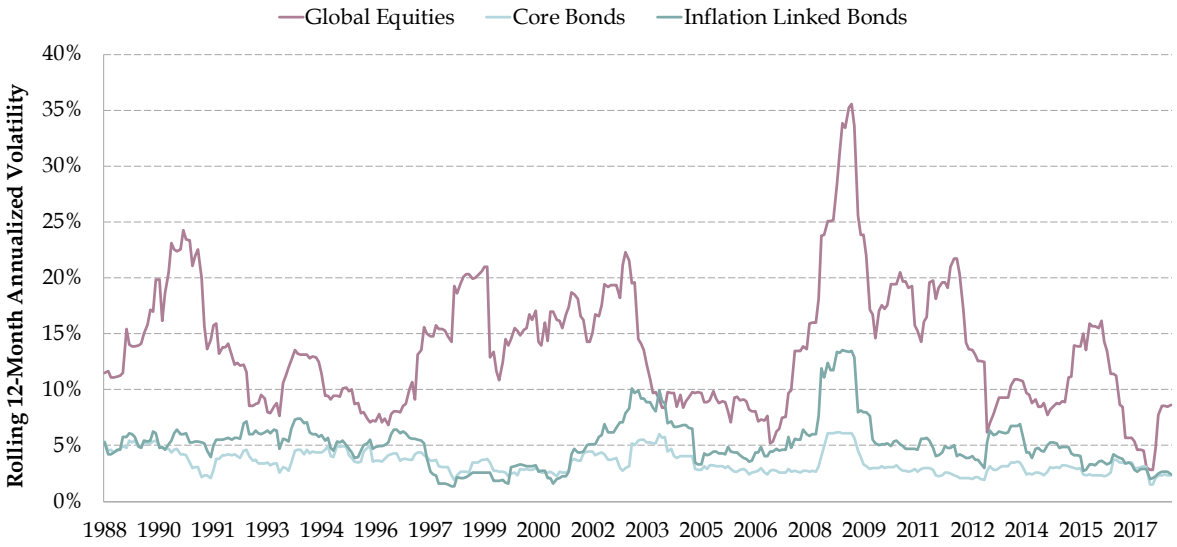
[15] Leverage is the use of borrowed funds to purchase an asset or make an investment. Doing so creates economic exposures that exceed the value of the capital put up for the investment.

[16] Hypothetical example only, does not reflect current leverage ratios available for derivatives contracts.

[17] Maintenance margins are lower than initial margins and vary by asset class, depending on factors such as the asset's volatility.

[18] Target Risk levels vary, usually between 5% and 20%. Levels are chosen with objectives such as matching equity market volatility, or bond market volatility, among others.

Chart 8. Asset Class Volatility[19]



Asset class volatility is not constant – it moves up and down over time with returns. What this means for a risk parity allocation is that when the volatility of an asset is decreasing (increasing), it will appear less risky (riskier), so in order to maintain the target level of risk at the portfolio level, the strategy will increase (decrease) leverage and/or its risk exposure to the asset.[20] More simply, a volatility targeting strategy will increase leverage when expected volatility declines, and reduce it when volatility increases.

Volatility targeting creates a risk management challenge to implementation, given that increasing volatility tends to correlate with decreasing returns and vice versa. So while returns can be augmented by increasing leverage during benign periods, the opposite is also true. Losses may be amplified during periods of rising volatility, as it most likely involves increased selling at a loss. If not managed carefully, this de-levering could result in meaningful losses, especially during periods of volatility spikes.

4. Interest Rate and Equity Risk

The traditional risk parity portfolio generally has higher (and/or levered) allocations to low risk assets like bonds, and lower allocations to higher risk assets such as equities. This creates a portfolio profile with higher interest rate risk and lower equity risk relative to traditional allocations.

[19] Global Equities, Core Bonds, and Inflation Linked Bonds proxied by MSCI ACWI, Bloomberg Barclays U.S. Aggregate and Bloomberg Barclays U.S. TIPS indices respectively.

[20] This explanation assumes risk is standard deviation of returns only. Sophisticated implementations of risk parity will include other measures of risk as well as the correlations between assets. The same logic applies: the less risky (riskier) an asset becomes and the less (more) correlated it becomes relative to the other assets in the portfolio, the higher (lower) its risk parity allocation should be, translating directly to higher (lower) leverage.

The table below shows how this dynamic translates to performance during stress events based on four markets factors: rising rates, widening spreads, a strengthening dollar, and equity bear markets. It shows that risk parity portfolios are expected to suffer far worse returns relative to traditional allocations during interest rate spike scenarios. The trade-off, however, is that they would outperform traditional allocations during negative scenarios for equities.

A higher bond allocation has helped historical performance, as we have lived through a secular decline in interest rates since the early 1980s. While forecasting the future path of interest rates has been an exacerbating exercise since the Global Financial Crisis, it is clear that the current starting point for interest rates should not lead to similar tailwinds as the historical periods.

Table 9. Stress Scenarios[21]

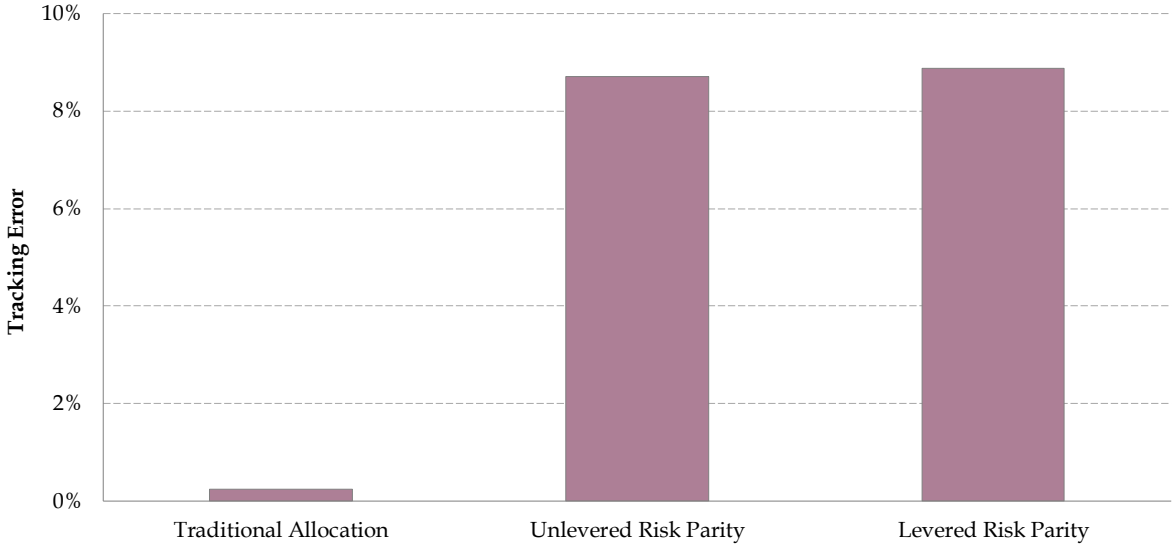
Scenarios	Traditional Allocation	Unlevered Risk Parity	Levered Risk Parity
10-year Treasury Bond rates rise 100 bps	3.7%	-1.3%	-3.4%
10-year Treasury Bond rates rise 200 bps	1.3%	-6.1%	-13.7%
10-year Treasury Bond rates rise 300 bps	-1.7%	-11.0%	-24.2%
Baa Spreads widen by 50 bps, High Yield by 200 bps	-1.3%	2.0%	2.3%
Baa Spreads widen by 300 bps, High Yield by 1000 bps	-19.7%	-4.9%	-11.9%
Trade Weighted Dollar gains 10%	0.2%	3.9%	3.2%
Trade Weighted Dollar gains 20%	-3.0%	-0.2%	-0.7%
U.S. Equities decline 10%	-5.2%	0.2%	-1.3%
U.S. Equities decline 25%	-14.7%	-2.8%	-7.7%
U.S. Equities decline 40%	-26.0%	-8.5%	-18.9%

5. Active Risk (Maverick Risk)

While a risk parity allocation for an institutional portfolio is a valid strategy, it is also not widely implemented among the investment industry. Capital-based allocations based on MVO concepts (or extensions) continue to be commonplace in the space. This means that institutional investors that wish to implement risk parity for their portfolios will take on meaningful tracking error (i.e., active risk or "maverick" risk) relative to peers. Understanding and quantifying this risk is key to determining if they will be comfortable being significantly "different" from peers at any point in time.

[21] Based on Meketa Investment Group 2018 Asset Study.

Chart 10. Expected Tracking Error relative to Peers[22]



6. Derivatives Infrastructure and Knowledge

The implementation of levered risk parity allocations requires that institutional investors have sufficient infrastructure to trade and manage derivatives contracts. Investors without sufficient staff and infrastructure may access risk parity strategies through investment managers who offer a range of risk parity solutions, varying from simple asset-based risk parity portfolios to more complicated risk factor parity portfolios. Management fees start at 0.5% and can go much higher.

HISTORICAL PERFORMANCE

The table below shows how risk parity portfolios as constructed in previous sections would have fared during several notable historical scenarios (both positive and negative). Consistent with the stress scenarios results, here we can observe that risk parity allocations tend to perform better than traditional allocations during turbulent times for equities (due to their inherent equity underweight) but underperform during periods of rapidly rising rates, given their levered bond exposures.

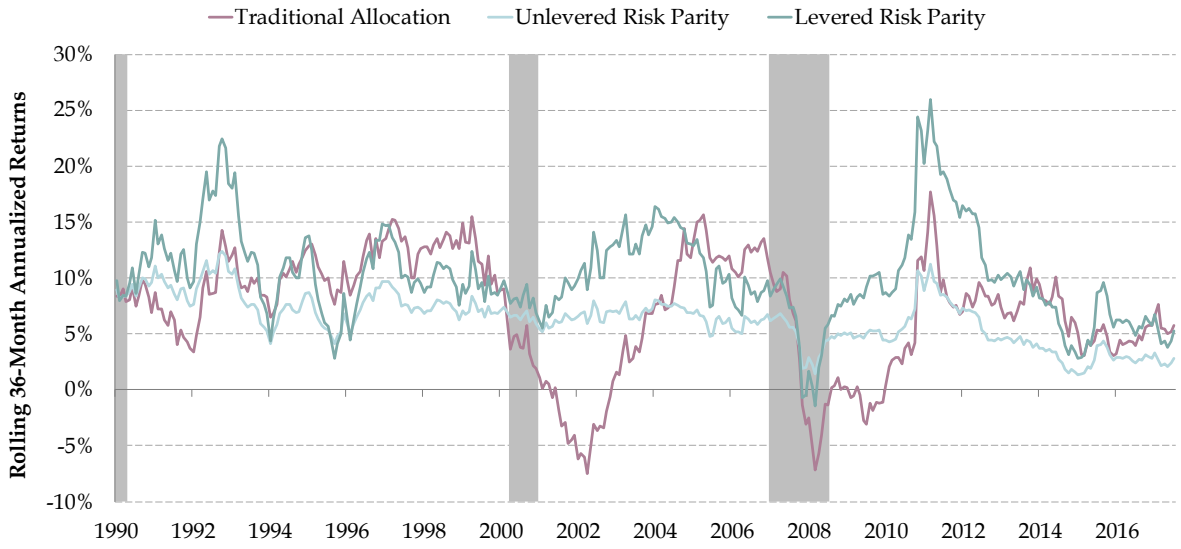
[22] Peer portfolio defined as 60% Growth/Equities and 40% Rate Sensitive.

Table 11. Historical Scenarios[23]

Scenarios	Traditional Allocation	Unlevered Risk Parity	Levered Risk Parity
Negative			
Taper Tantrum (May-Aug 2013)	-2.1%	-4.6%	-10.2%
Global Financial Crisis (Oct 2007 - Mar 2009)	-24.2%	1.0%	-1.6%
Popping of the TMT Bubble (Apr 2000 - Sep 2002)	-16.2%	19.7%	31.7%
Asian Financial Crisis (Aug 1997 - Jan 1998)	-0.1%	2.9%	3.4%
Rate spike (1994 Calendar Year)	1.6%	-3.1%	-11.5%
Crash of 1987 (Sep - Nov 1987)	-12.0%	-1.2%	-4.4%
Strong dollar (Jan 1981-Sep 1982)	4.5%	19.6%	13.7%
Volcker Recession (Jan - Mar 1980)	-6.9%	-8.0%	-21.3%
Stagflation (Jan 1973- Sep 1974)	-20.6%	-0.3%	-17.0%
Positive			
Global Financial Crisis Recovery (Mar 2009 - Nov 2009)	39.8%	18.2%	40.2%
Best of Great Moderation (Apr 2003 -Feb 2004)	29.8%	12.2%	25.9%
Peak of the TMT Bubble (Oct 1998 - Mar 2000)	33.8%	11.1%	16.4%
Plummeting Dollar (Jan 1986 - Aug 1987)	70.6%	27.4%	48.5%
Volcker Recovery (Aug 1982 - Apr 1983)	35.6%	24.6%	47.2%
Bretton Wood Recovery (Oct 1974 - Jun 1975)	30.2%	13.1%	23.4%

[23] Based on Meketa Investment Group 2018 Asset Study. Simplified example for illustration purposes only. Does not include potential allocation changes (e.g., changes in leverage or target volatility) to portfolios during the periods studied.

Chart 12. Rolling 36-Month Annualized Returns[24]



A rolling return analysis shows similar results. With the caveat that Risk Parity strategies have had a clear tailwind of declining interest rates during the sample period, one can observe how they tend to defend better than traditional allocations during turbulent times.

[24] Based on Meketa Investment Group 2018 Asset Study. Simplified example for illustration purposes only. Does not include potential allocation changes (e.g., changes in leverage or target volatility) to portfolios during the periods studied.

CONCLUSIONS

Risk parity is a strategy that allocates risk (as opposed to capital) in a balanced manner. Given that its expected return and volatility without leverage tends to be much lower than for traditional allocations, risk parity utilizes leverage to increase the expected return, and consequently expected risk of the portfolio.

Portfolios that allocate through risk parity will usually have higher (and usually levered) exposure to bonds and lower exposure to equities than traditional allocations. This means the strategy tends to do better during times of equity declines but underperform during periods of rising rates.

There are several important issues to take into account when considering risk parity strategies. The first one is leverage: leverage is a flexible tool that amplifies both gains and losses for a portfolio, but may also expose it to additional risks such as liquidity and counterparty risk. In order to mitigate these risks, risk parity is usually implemented with the almost exclusive use of liquid exchange-traded derivatives, such as futures. These derivatives vastly reduce liquidity and counterparty risk, as well as borrowing costs, but they also considerably reduce the investable universe for investors.

Finally, in order to implement a successful Risk Parity strategy, investors need to be comfortable with an allocation that is very different (in terms of expected tracking error) from peers, which will inevitably lead to periods of underperformance, most likely during times of strong equity rallies.

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