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Does Risk Parity Maximize Risk-Adjusted Returns?

A closer look at the strategy's behavior in relation to the risk and return properties of the indices in which it invests.

"What is not so obvious is that by decreasing the exposure to an asset during periods of high risk, the risk parity strategy effectively achieves a higher Sharpe ratio than if it were to increase exposure."

Earlier, we published a post investigating how risk parity funds performed immediately after the British voted to leave the European Union. We observed that the six risk parity funds with publicly available daily returns data had large drawdowns on June 24, 2016, immediately following the British vote. Four months later, we headed toward the US elections. The equity and credit markets demonstrated positive performance, and the rest of the asset classes that risk parity funds typically invest in (commodities and fixed income) haven't fared so well, as shown in the chart below. The diversified nature of risk parity funds however, has helped returns remain positive, despite the increased market volatility of the last couple of months.

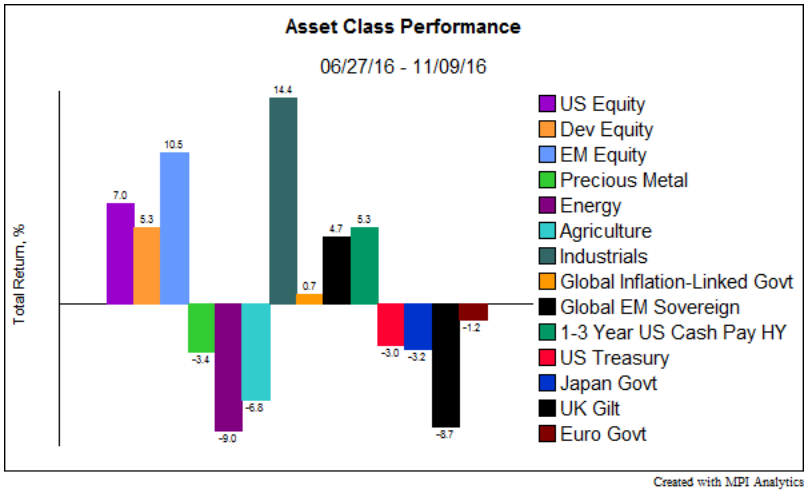

Chart 1. Performance of various asset classes leading up to and including the US Elections.

"Risk parity portfolios will allocate more weight, or apply leverage, to asset classes with lower risk."

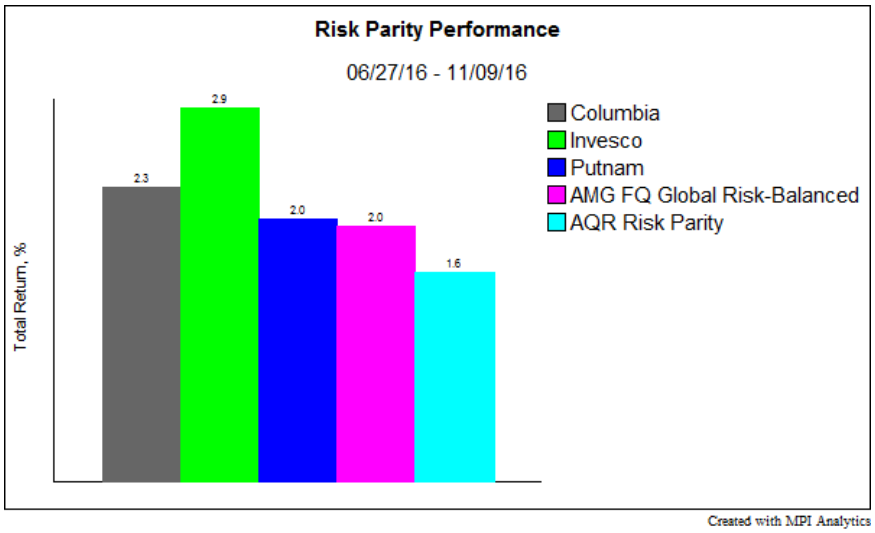

Chart 2. Performance of risk parity funds leading up to and including the US Elections.

Risk parity implementation starts from the observation that while a traditional 60/40 stock/bond portfolio appears well diversified, equities are a lot more volatile than fixed income securities. Hence, the risk from equities dominates.

In fact, for the 25-year period ending in 9/16/2016, a 60/40 US equity and bond portfolio's returns would have a 99% correlation with equities and almost 100% of its risk attributed to equities. That's not as well diversified as hoped.

To address this issue, the risk parity approach allocates assets so that the contribution to total portfolio risk of each asset class is equal. That is, assume that bonds are half as volatile as stocks. In a simple risk parity approach and assuming zero correlation between stocks and bonds, the manager would allocate twice as much weight to bonds so that both asset classes have equal volatility. This would increase the diversity of the portfolio which in turn should improve risk-adjusted returns.

In creating this portfolio, the manager assumes that the return per unit of risk between stocks and bonds is going to be roughly identical. If it weren't, the manager would be better served investing solely in the asset class with the best risk/return characteristics.

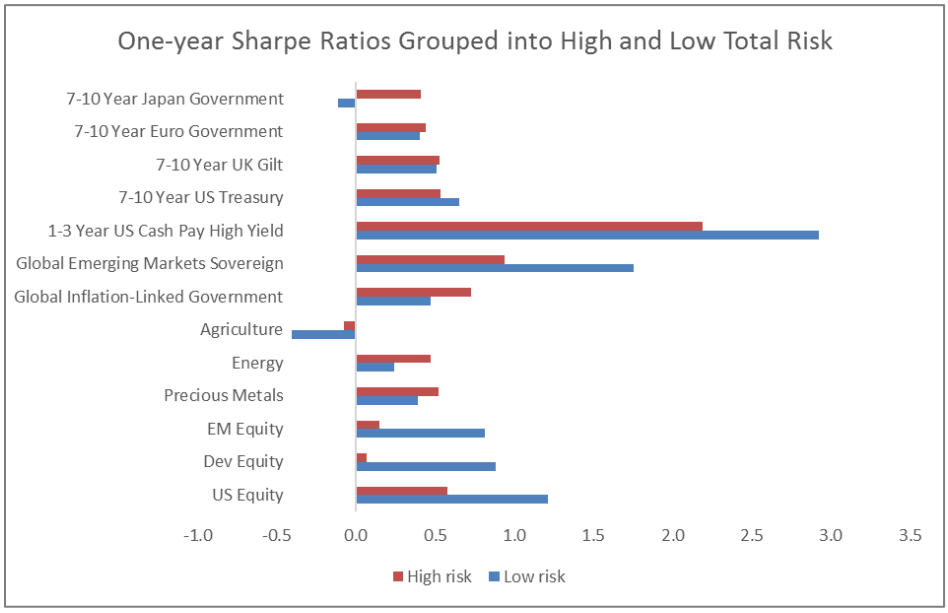

Chart 3. The above chart displays Sharpe ratios grouped into High and Low groups based on total risk. It turns out that for some asset classes like US equity, there is an almost linear decrease in the Sharpe ratio as risk increases. This is shown in the chart below where we grouped the 7743 one-year periods of Russell 1000 one-year returns into deciles to show a finer gradation.

From a modern portfolio theory standpoint, a risk parity portfolio is mean variance efficient if the Sharpe ratios across assets are identical and correlations across assets are the same.

Proponents of risk parity claim that since, in expectation, Sharpe ratios among asset classes are equal, even if correlations are not, it is very difficult to find ex ante a portfolio that is more efficient than the risk parity portfolio. In other words, a risk parity portfolio may not be perfect, but finding a better alternative is pretty tough.

Risk parity portfolios will allocate more weight, or apply leverage, to asset classes with lower risk. If the risk/return profile among assets is expected to be the same, levering the risk parity portfolio to a certain risk target is expected to produce the same return, no matter what the underlying assets are. But the risk/return profile among asset classes is the same only in expectation.

Not only can it vary considerably depending upon the time period, it can also vary depending upon the level of risk of each asset class. Since risk parity assigns more weight to low risk assets, one would hope that such assets would have the better risk/return profile.

To shed some light on this point, using daily data we measured the realized one year[1] return and standard deviation (risk)[2] of returns for asset classes that may appear in a risk parity strategy[3]. We used a rolling window of roughly 250 trading days, moving forward one trading day to create a new one-year observation. This analysis covered every day and for a period extending as far back as thirty years prior to 9/16/2016, resulting in 7743 one-year periods for the asset class with the longest history, US Equity[4]. For each asset, we grouped each one-year period into either a “Low Risk” (risk in the bottom half of each asset’s entire time period) or “High Risk” (risk in the top half of each asset’s entire period).

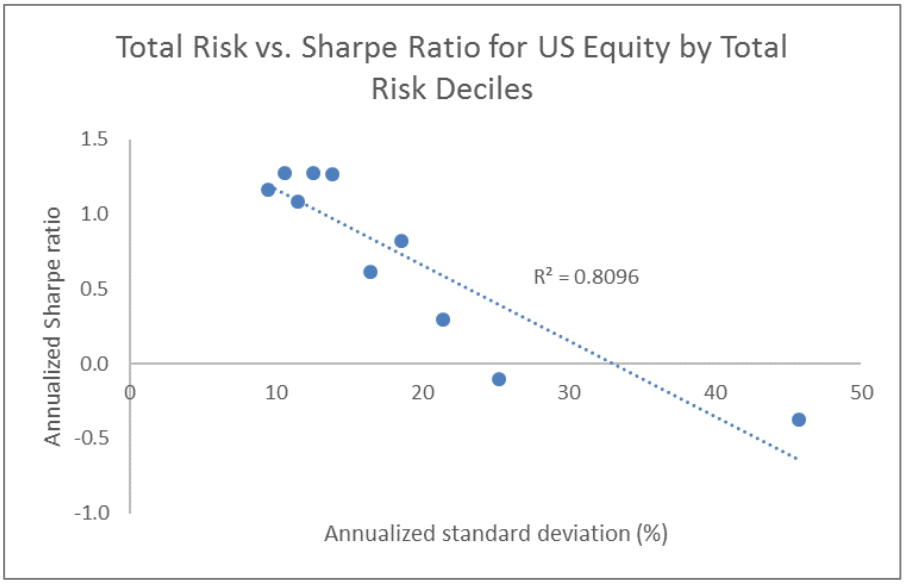

Chart 4. Relationship between Sharpe ratio and standard deviation for US Equities. Each dot represents a total risk decile of one-year periods for the Russell 1000.

To compare the risk and return for each asset class, we graphed the one-year Sharpe ratio[5] by the Low Risk and High Risk groupings.

Over the entire study period, eight of the 14 asset classes in Low Risk time periods experienced greater risk adjusted returns vs. High Risk periods, on average.

US equities for example, represented here by Russell 1000, have a Sharpe Ratio of 1.21 in low risk periods, while they have a Sharpe ratio of 0.58 in high risk periods. This Sharpe Ratio behavior was consistent across all equity and credit indices we looked at, while commodities had higher Sharpe Ratios in high risk periods and fixed income was rather indifferent.

Please note that this does not mean that equities always generate higher returns in low risk environments. While true when examining the average one-year returns at those periods since 1985, in the post-financial crisis period (October 2008 through now) equities have generated lower returns on low risk environments. It is the risk-adjusted returns that tend to increase in low risk environments.

This insight may explain some of the recent gains of risk parity funds. Risk parity allocates higher weights to assets with lower risk. If, as we've seen, an asset's Sharpe ratio and risk are inversely related, risk parity dictates increasing an asset's weight in periods of higher (expected) risk-adjusted returns.

Despite the increase in risk in many asset classes from a year ago, risk parity funds have weathered this summer's somewhat choppy asset markets fairly well. We can hope that the empirical Sharpe ratio behavior of some asset classes will keep acting as a tailwind for future performance.

1) Results were similar when we calculated the Sharpe ratio across asset classes using a five year instead of a one year period.
2) Note that we've used the realized risk for each time period. As this wouldn't be known in advance, a risk parity fund manager would either have to use the forecasted risk to select assets. We also realize that risk may be defined in ways that have not been explored in this paper.
3) To represent US equity, we used Russell 1000, for Developed markets excluding US we used MSCI EAFE, for Emerging market equities we used MSCI EM, for commodities we used SP GSCI indices.
4) US equities and Agriculture started on 2 January 1985. US Treasuries 7-10 year started on 31 October 1986, UK Gilt 7-10 year and JGB 7-10 years started on 29 December 1989, Euro-zone government 7-10 year began on 30 September 1993, developed ex-US and emerging market equities started on 1 June 1995, emerging market debt and US Treasuries 1-3 year began on 2 January 1997, global high yield debt and global inflation-linked bonds started on 2 January 1998 and precious metals and energy began on 15 January 1999. Results were consistent, though less pronounced, when using data since October 2008.
5) The risk-free rate was represented by the three-month US Treasury bill. Results were consisted when calculating the Sharpe ratio by adjusting the variance by the serial correlation observed in the return time series, which aims to obtain a more accurate annualized figure.

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