Risk Parity VS Traditional 60/40 Portfolio

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Abstract

This paper presents a comparative analysis between a Risk Parity investment strategy and a traditional 60/40 portfolio, investigating their performances over a 10-year period using backtesting methodologies. The Risk Parity strategy, known for allocating assets based on risk contribution rather than market capitalization, aims to deliver enhanced risk returns and more consistent returns across various market conditions. This strategy employs a sophisticated model that adjusts asset weights based on the volatility and correlation of individual assets, enhancing the portfolio's ability to manage risk and reduce exposure to market behaviors. The traditional 60/40 portfolio, a benchmark for conservative investment approaches, allocates 60% to equities in our case SPY and 40% to bonds AGG which in turn offers a balance of growth and income with moderate risk. Our analysis uses various metrics including cumulative returns, volatility, Sharpe Ratio, maximum drawdown, and beta, providing a comprehensive view of the risk-adjusted performance of each strategy.

Risk Parity VS Traditional 60/40 Portfolio

The foundation of the risk parity strategy is centered around assets being allocated based on their risk contributions, rather than their market value. It aims to allocate risk evenly across various assets, enhancing the risk-adjusted returns of the portfolio. By weighting assets on volatility and correlation, it is effective in creating a smooth performance trajectory and mitigating risk concentration. It is a favored strategy among investors that seek to reduce exposure to market volatility and downturns due to its ability to provide consistent returns across different market conditions compared to traditional investment strategies that may rely heavily on a single asset class.

Implementation of Risk Parity Strategy

Pre-processing and beginning Calculations

My strategy begins with data fetching, where I retrieve historical financial data for a set of assets using Yahoo Finance. Focusing on the adjusted close prices over a 10-year period, I incorporate forward filling which manages gaps in my data by filling missing data with the previous day. Following my data preparation, my strategy continued to calculate returns as percentage changes from one day's closing prices to the next. Through these basic steps, I was able to prepare my data for all future models in my strategy.

Volatility and Correlation

In terms of volatility, working with accurate and dynamic measurements of the risk associated with each asset is crucial for the risk parity approach. Volatility, representing the degree of variation in asset prices over time, is a key indicator of risk. For my volatility calculation I employed the GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model to estimate the conditional volatility of each asset). GARCH allows us

to analyze the changing levels of volatility over time within financial markets and estimate the conditional volatility of each asset, crucial for understanding the inherent risk of investment choices over time. It is very useful when needing to capture volatility clustering, where high-volatility events are followed by high-volatility events, and low-volatility events follow low-volatility events. By incorporating past volatilities and returns, the GARCH model provides a responsive measure of risk and can adapt to changes in the market. The output from this modeling process is a time series of estimated volatilities for each asset, which are then used to determine how much weight each asset should have in the portfolio to achieve risk parity.

In terms of correlation, it is important to our model as it helps us understand the relationships between our assets and in turn structuring a portfolio where risk contributions from different assets offset each other, therefore minimizing overall portfolio risk. I employ a rolling window approach where correlations between returns of the assets are calculated every 30 days, ensuring our estimates are updated frequently to reflect the latest market conditions, something that is needed for maintaining a balanced risk distribution. To ensure sufficient data points I also employed correlation to be computed with a minimum number of periods set to 80% of the window size.

Correlation is used with our volatility estimated to calculate the inverse volatility and inverse correlation weighted allocations. By considering risk and relationship the strategy can equalize the risk contributed by each asset.

Risk Parity Weight Calculation

As mentioned above the volatility calculated from the Garch models that provide conditional volatility for each asset is used in my weight calculation by inversing each asset's volatility. This is because, in the risk parity strategy, an asset with higher volatility should have a lower weight in the portfolio, as it represents a higher risk. Similarly, I use the rolling correlation matrix, and inverse it to make sure risk is spread evenly considering how assets may relate to each other. at an asset with higher volatility should have a lower weight in the portfolio, as it represents a higher risk. From there, I multiply the two and get my raw weights, which are then normalized to make sure weight allocation remains constrained to 100%.

I decided to incorporate expected returns to maximize my risk-return by scaling them relative to the expected return among the assets, ensuring that weights are adjusted according to an asset's return potential. By using an alpha parameter I can blend risk-based weights with the scaled expected returns allowing me to optimize for returns while keeping my risk leveled. While this may seem odd considering the strategy, enhancing risk-return is at the foundation of it, and through testing a balance can be found. Finally, my weights are derived from

$$\mathbf{W} = \alpha \cdot \mathbf{W}_{RP} + (1-\alpha) \cdot \mathbf{R}_{ER}$$

Where:

$WRP = IC \cdot IV / \sum(IC \cdot IV)$

- **IC** is the inverse of the correlation matrix & **IV** is the vector of inverse volatilities

$R_{ER} = R/\max(R)$

- R is the vector of expected returns

Backtesting

Backtesting is crucial when understanding the robustness of a strategy over time. It involved creating a historical simulation of the strategy to understand its potential performance under past market conditions. I backtested my strategy using various performance metrics, against a 60/40 SPY AGG portfolio to prove the validity and robustness of my strategy.

To stimulate the historical performance of my portfolio and 60/40, I use my calculated weights and the fixed weight of the 60/40 combined with daily returns to reveal how it would have been done throughout periods. To be thorough with my testing I created a module that would let me subset months so I could test both through various periods.

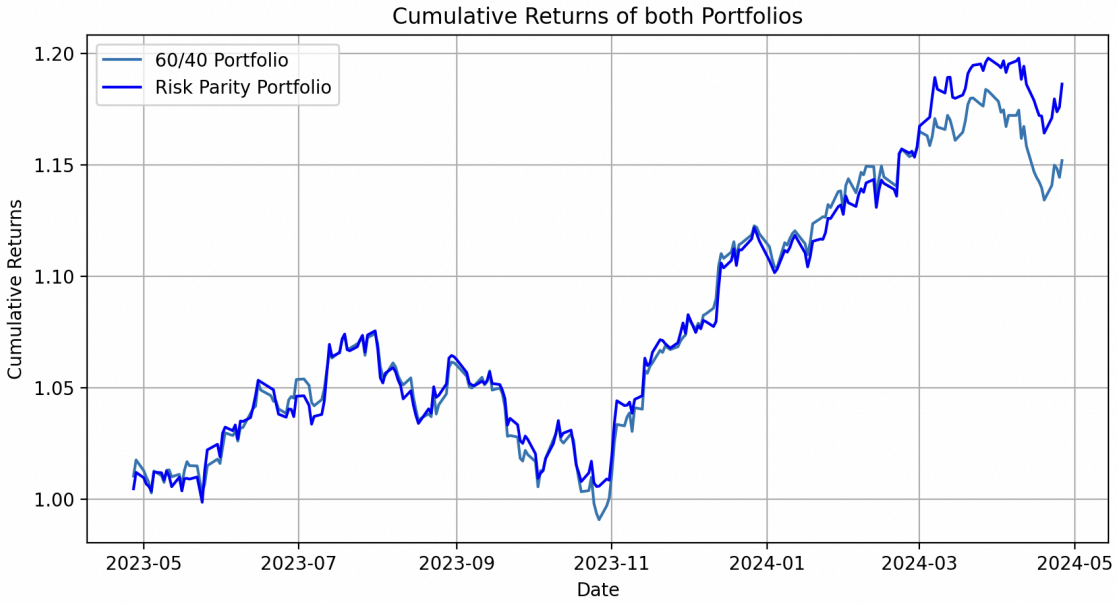
To compare my performances I used metrics:

- *Cumulative Returns*: The total returns generated by the portfolios over the testing period
- *Sharpe Ratio*: This ratio helps assess the risk-adjusted returns, factoring in the volatility of the portfolio returns relative to a risk-free rate (.002)
- *Maximum Drawdown*: This metric measures the largest single drop from peak to trough in the portfolio's value, indicating the potential risk of losses
- *Beta*: Measures the portfolio's sensitivity to market movements (SPY)

My backtesting process provides a historical perspective on how the risk parity strategy might have performed and offers valuable insights into its potential strengths and weaknesses. Comparing it against a traditional 60/40 portfolio helps decide whether the more complex risk parity approach offers benefits over a traditional portfolio.

Results

1 Year Lookback



Weights

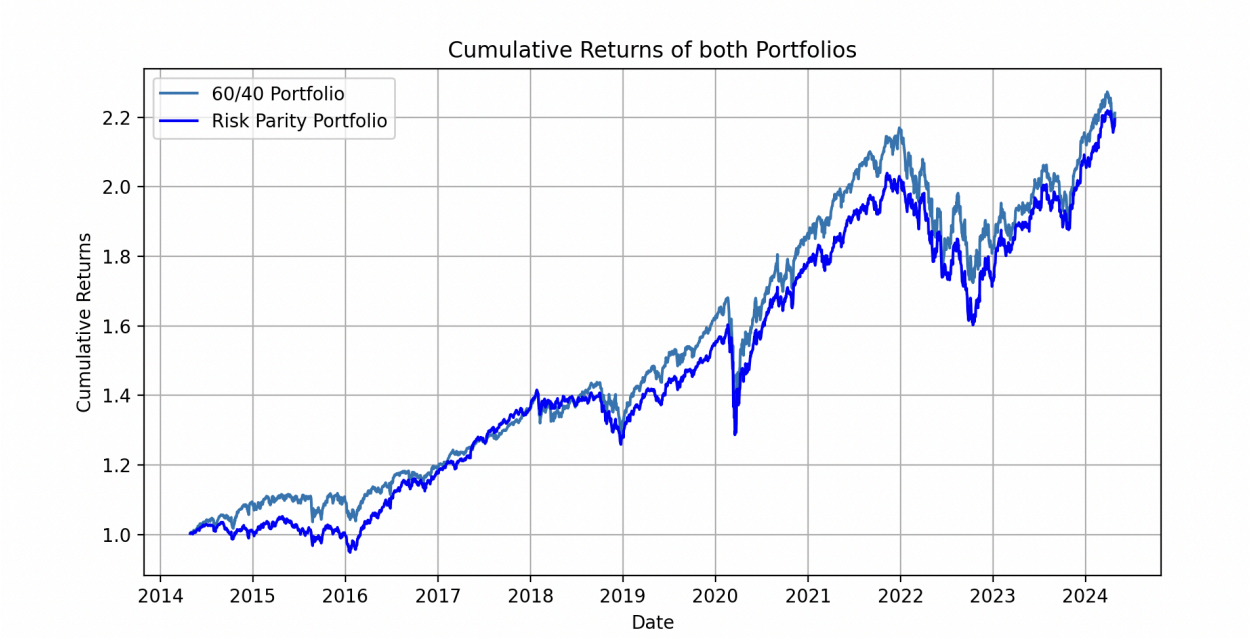
Asset	RP	60/40
VWO	.060839	0
TLT	.047034	0
NVDA	.073981	0
BNDX	.170246	0
GLD	.066382	0
DBC	.069872	0
IGF	.061158	0
AGG	.117110	.4

Performance Metrics

Strategy	Cumulative Return	Volatility	Sharpe Ratio	Maximum Drawdown	Beta
Risk Parity	0.186165	8.160001	2.133502	-1.096297	0.566893
60/40	0.151893	8.169417	1.772069	-1.12140	0.660979

SPY	.071294	.6
PSP	.055641	0
HYG	.132054	0
EFA	.071471	0

10 Year Lookback



Weights

Asset	RP	60/40
VWO	.058225	0
TLT	.058025	0
NVDA	.068048	0
BNDX	.181053	0

Performance Metrics

Strategy	Cumulative Return	Volatility	Sharpe Ratio	Maximum Drawdown	Beta
Risk Parity	1.194201	9.338197	0.889479	-2.002749	0.463082
60/40	1.211816	10.877462	0.785292	-0.723139	0.609965

GLD	.053291	0
DBC	.067497	0
IGF	.062406	0
AGG	.131378	.4
SPY	.071489	.6
PSP	.048449	0
HYG	.134306	0
EFA	.065833	0

Discussion

In terms of 1-year lookback, as we can see the weights vary from roughly .04 to .17 showing allocation varying based on asset volatility and correlation. The risk parity strategy outperformed the 60/40 in every metric, using an alpha of .94. Cumulative returns were roughly 3 percent greater for my risk parity strategy with volatility being comparable, but still lower for my strategy. Since we have a customizable alpha that can be changed based on investors' wants, the comparable volatility is not something to worry about as if an investor was volatility averse, the alpha could easily be changed to one. Due to the higher returns, our Sharpe ratio was also .3 higher than 60/40. The maximum drawdown, which measures the largest single drop from peak to trough shows that 60/40 had a deeper drop which lets us know in the past 12 months our strategy was more resilient. With our beta being .1 lower than 60/40 we can conclude that our strategy shows a more diversified approach that reduces exposure to market swings.

In terms of 10 years, our returns were slightly lower by .02 but with our volatility being 1.5 less than 60/40, our risk-adjusted returns were much better as seen in our Sharpe ratio of .88 vs the 60/40 Sharpe of .78. Drawdown for ours was much higher than the 60/40 portfolio, which is a cause for concern regardless of our Sharpe since it lets us know that our portfolio's maximum loss is much higher than 60/40. This also lets us know that we may have periods where certain asset classes are exposed to suffer significant declines. To combat this one may apply dynamic weighting to make sure we don't have concentrated high-risk periods. In terms of beta, ours was .46 compared to .6 meaning our portfolio was not swayed by market movements comparatively.

Final Thoughts

The backtesting results show us the e advantages and challenges of the Risk Parity strategy compared to the traditional 60/40 portfolio. Over one year, the Risk Parity strategy outperformed the 60/40 portfolio in all metrics demonstrating Risk Parity's ability to deliver risk-adjusted returns. Over ten years, the Risk Parity strategy showed lower volatility and a higher Sharpe Ratio, indicating superior risk-adjusted returns, it experienced a higher maximum drawdown compared to the 60/40 portfolio. This could suggest that while the Risk Parity strategy can effectively reduce volatility and enhance returns relative to risk, it may still be vulnerable to occasional significant losses. Through dynamic weighting and rebalancing such issues can be combated. To conclude, the Risk Parity strategy offers a compelling alternative to traditional investment approaches, especially for investors seeking to minimize volatility and enhance returns.