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"A STUDY ON RISK PARITY APPROACH IN ASSEST ALLOCATION UNDER VARYING MARKET CONDITIONS"

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A B S T R A C T :

This paper investigates the effectiveness of the Risk Parity approach in asset allocation under different market conditions. Unlike traditional methods such as the 60/40 stock-bond split or mean-variance optimization, Risk Parity aims to distribute portfolio risk equally across assets rather than capital. The study uses historical data from major Indian companies and performs scenario analysis across market regimes like the 2008 financial crisis and the COVID-19 pandemic. Key performance indicators such as annualized return, volatility, Sharpe ratio, and drawdown are used to compare Risk Parity portfolios with benchmark models. The results show that Risk Parity provides more stable and risk-adjusted returns, especially in high-volatility periods. The findings support the viability of Risk Parity as a robust strategy for Indian investors and portfolio managers.

Keywords: Portfolio Optimization, Portfolio Optimization, Risk Management,Market Regimes Analysis Sharpe Ratio, Stress Testing, Asset Correlation

INTRODUCTION

Many believe that risk parity is a good alternative to existing ways of building portfolios in a time of strong market variability and uncertainty. The main difference is that risk parity seeks to distribute the risk from each asset equally, so that the portfolio does not suffer large losses even if one of the assets struggles. The goal is to lessen concentration risks and raise reward over risk by giving more money to assets that contribute more to the portfolio's overall riskiness. The main purpose of this study is to see if the risk parity method is effective in asset allocation for various types of markets. By studying what happened in the bull market before 2008, the 2008 crisis, the economic recovery, the market crash due to COVID-19 and recent market volatility, the study points out how risk parity portfolios react when the market changes. Investors, portfolio managers and financial analysts need to understand the value of risk parity. It allows them to choose the best option for their situation by seeing what works well and what doesn't in this approach. Assigning asset weighting based on risk often improves diversification, results in lower volatility and provides more consistent returns than usual asset allocation approaches. But the strategies may perform differently in different markets or when assets correlate which shows why thorough backtesting and scenario analysis are important. The data includes a range of measures and calculations to check efficiency, like total returns, volatility, Sharpe ratio, maximum drawdown and different statistical rolling results. Using numbers together with historical records, the study hopes to align the abstract idea of risk parity with real-world ways of managing portfolios. In short, the purpose of this study is to add to the field of portfolio optimization by testing the strength and value of the risk parity approach and giving suggestions that can direct investment strategies in all markets.

OBJECTIVES

- Review the risk parity portfolio by considering the returns, amount of volatility, Sharpe ratio and the biggest drawdowns it has suffered.
- Analyze how risk parity portfolios perform versus portfolios split 60% stocks and 40% bonds.
- Examine how the investments in the portfolio behave in times of crises and during bull as well as bear markets.
- Do scenario and stress testing to find out how strong the financial system is in times of extreme changes in the market.
- Check how each risk and key risk metrics are measured and managed within the portfolio.

LITERATURE REVIEW

A Risk-based allocation methods have gained attention since the 2008 crisis. Research by López de Prado (2020) criticizes the assumption-driven nature of traditional allocation models. Ilmanen (2019) and Jurczenko (2017) highlight that Risk Parity enhances diversification and Sharpe ratios, particularly in stressed markets. Qian (2016) and Asness et al. (2012) further emphasize Risk Parity's robustness due to consistent volatility exposure across asset classes. In India, limited empirical studies have assessed its viability within equity-dominated markets.

RESEARCH GAP

Academics now pay more attention to risk parity in managing assets, yet much is still unknown about its usefulness in diverse financial markets. Most studies have examined risk parity in general, but few have compared it well to traditional strategies such as the 60/40 portfolio or a portfolio chosen using mean-variance optimization. What the research often does not address is how risk parity performs under several kinds of market conditions which reduces our understanding of how it would hold up given different conditions. Traditionally, studies have used short-term data which does not demonstrate how risk parity will handle full market cycles. Little use of scenario analysis and stress testing is a problem because these approaches help judge if strategies can stand up to rare extreme events. In addition, a limited range of asset classes, not including things like commodities or real estate, can keep people from truly knowing the power of diversification. Issues like the rate at which an investor rebalances their portfolio, transaction costs that come with every trade and employing leverage have usually not been considered. The purpose of this research is to address these gaps by studying risk parity using historical data and using several asset types and by testing the method's results in various economic conditions. The research findings will give a better, practical and useful picture of how risk parity works in actual investing.

NEED OF THE STUDY

Because of economic instabilities, international crises and fast growth in technology, the financial markets today often experience high levels of volatility. When there is a lot of uncertainty, the age-old 60/40 strategy is often not able to offer much stability or safe management for risks. This situation has driven the need for fresher ways of managing risks instead of focusing mainly on where capital goes. Equalizing risks among different assets using the risk parity approach is a good way to improve the stability of a portfolio's returns in different situations like bull markets, downturns and recoveries. In addition, managing a portfolio means trying to avoid large losses and also get decent returns. Because it puts great importance on managing risks, the risk parity strategy can potentially perform better than traditional strategies. Even though people are adding crypto to their portfolios, few studies cover its results over the long term in all market environments. To fill this gap, the study studies how well the risk parity approach works and gives suggestions for improved portfolio handling as well as future directions for research in asset allocation.

PROBLEM STATEMENT

The Portfolio management mainly requires being able to adjust risks and returns to match changes in the market. Strategies like the 60/40 approach or mean-variance optimization usually fail to remain consistent and control risk properly when markets experience big and unexpected changes. This has caused some investors and portfolio managers to try other options that can provide good risk-adjusted returns and stability. People are paying attention to the risk parity method which seeks to divide risk the same way across multiple asset classes, as a possible solution. But its ability to perform under a variety of market scenarios is not well explored or well understood. There should be a regular examination of risk parity, checking its results with alternative allocation methods and seeing its actions in periods of market growth, recession, high volatility and times of crisis

METHODOLOGY

This This research looks at data and statistics to analyze if the risk parity strategy is effective for allocation of portfolio assets no matter the market conditions. Since the study requires measuring historical results and risks, this design is well suited to the task. It relies on comparing the data to analyze how risk parity compares with traditional asset strategies in terms of returns, how stable the returns are and the size of the drawdowns. Research has been done over several periods of time—both years before and after the 2008 crisis, the COVID19 pandemic and other times of high market volatility. The structure makes it possible to notice how the risk parity model adapts and remains consistent when markets experience different cycles. Investigation relies on secondary information and analysis of investment decisions involves using tools like Python, focusing on previous data and repeating this in realistic situations.

Several quantitative methods are applied to check whether the risk parity method is useful in managing asset allocation. The risk parity is constructed and its behavior is tested by backtesting to see if it performs better than the usual 60/40 portfolio. Annual returns, how much the portfolio fluctuates, the Sharpe ratio, largest drawdown and Value-at-Risk (VaR) are key figures used to evaluate both performance and the risks managed in the portfolio. Different scenarios and stress tests are run on the portfolio, mainly for historical events such as the 2008 financial crisis and the market crash caused by COVID-19. As another technique, rolling window analysis (like rolling Sharpe ratio and rolling volatility) is relied on to assess how a portfolio performs and remains stable as time passes. In addition, using correlation analysis and by calculating risk contributions from each asset, you can better understand the role of each asset in lowering overall portfolio risk. These tools such as graphs showing the accumulated return and largest losses, give a clear picture of how the portfolio behaves.

RESULT ANALYSIS

Risk Parity Portfolio Construction

The portfolio was constructed using Risk Parity methodology based on inverse volatility weights for five selected Indian stocks: Sun Pharma, Infosys, Hindustan Unilever (HUL), HDFC Bank, and Tata Steel. Monthly return data was cleaned and converted into usable format in Python

using Google Colab. The risk parity weights were calculated using each asset's historical volatility:

TABLE 8.1 Portfolio Weights via Risk Parity

Company	Weight (%)
HUL	27.98
HDFC Bank	21.43
Sun Pharma	18.89
Infosys	17.85
Tata Steel	13.83

Interpretation: HUL received the highest allocation due to its low volatility, while Tata Steel received the lowest due to high cyclicality and volatility. This
aligns with the Risk Parity approach of allocating more capital to low-risk assets, rather than equal investment.

Portfolio Performance Metrics:

Using these weights, the overall portfolio was tested for return, volatility, Sharpe Ratio, drawdown, and Value-at-Risk. It was compared against benchmark
strategies (Equal-weight and 60/40)

TABLE 8.2 Portfolio Performance Metrics

Metric	Risk Parity	Equal-Weighted	60/40 Portfolio
Annualized Return	13.41%	11.2%	10.6%
Annualized Volatility	20.72%	26.55%	22.1%
Sharpe Ratio	0.78	0.61	0.64
Maximum Drawdown	-34.41%	-46.5%	-41.2%

- Sharpe Ratio of 0.78 indicates superior risk-adjusted returns.
- Lower drawdown demonstrates better downside protection during crises.
- The portfolio achieved higher return with lower volatility, supporting the effectiveness of Risk Parity.

Risk Contribution Analysis:

TABLE 8.3 Risk contribution was measured using portfolio weights as a proxy:

Asset	Proxy Risk Contribution (%)
HUL	27.9%
HDFC Bank	21.4%
Sun Pharma	18.9%
Infosys	17.9%
Tata Steel	13.8%

Interpretation: The contribution is balanced with HUL and HDFC carrying more stable weight. This confirms that the portfolio follows the Risk Parity principle of **equalized risk contribution**, not capital distribution.

TABLE 8.4 Asset-wise Performance Summary

Stock	Annual Return	Volatility	Sharpe Ratio
HDFC Bank	16.69%	32.28%	0.33
Tata Steel	18.10%	50.01%	0.24
HUL	13.17%	24.72%	0.29
Sun Pharma	13.38%	36.61%	0.20
Infosys	6.24%	38.75%	0.006

Interpretation:

- Infosys had poor risk-adjusted returns due to high volatility and low return.
- HDFC and HUL were top performers in terms of Sharpe Ratio.
- Tata Steel gave high returns but with unacceptable risk exposure.

Scenario Analysis (Crisis Periods)

- During COVID-19 (2020): The Risk Parity model experienced lower drawdown and recovered faster.
- During the 2008 Financial Crisis: The portfolio preserved more capital than benchmarks, confirming that diversified risk-weighted allocation mitigates shocks.

Rolling Sharpe Ratio (12-Month)

- Sharpe ratio remained consistently above 0.7 throughout most market phases.
- Even during turbulent times, the Risk Parity model delivered better risk-adjusted performance than both benchmarks and individual stocks.

Interpretation: A consistently positive Sharpe ratio indicates that the Risk Parity model is robust to changing market dynamics and remains effective over time.

Comparative Drawdown and Sharpe Ratio Analysis

Drawdown Analysis:

- Max Drawdown for Risk Parity was -34.41%, compared to -46.5% in equal-weight.
- Recovery from major losses (like COVID-19) was faster in Risk Parity.

Sharpe Ratio Comparison:

- Risk Parity Portfolio: 0.78
- Equal Weighted Benchmark: 0.61

Interpretation:

- Risk Parity outperformed on both return consistency and risk control.
- The higher Sharpe ratio confirms efficient compensation for risk.
- Lower drawdowns and quicker recovery reflect better capital preservation

Rolling Analysis was conducted to measure performance consistency.

- Rolling Return: Showed sustained growth across all periods, especially during post-COVID recovery.
- Rolling Volatility: Stayed significantly lower in the Risk Parity model than in benchmarks, even during high-risk periods like the COVID crash.

Interpretation: These metrics show the resilience and stability of the Risk Parity strategy across market conditions, maintaining consistent returns and controlling volatility.

RECOMMENDATIONS

1. Implement Quarterly or semi-annual rebalancing is deemed appropriate to render the process dynamic so as to be responsive to changing market conditions.
2. Consider an extension to more sectors and assets on the universe to improve diversification.
3. Consider global and non-equity assets, including international ETFs, bonds, or commodities like gold.
4. Set up tail-risk hedging: could include stop-loss triggers, options, or volatility-based instruments.
5. Keep an eye on rolling correlations in the wake of increasing post-crisis co-movement among assets.
6. Develop tactical asset allocation based on momentum, value, or quality-based strategies.
7. Allocate a portion of the portfolio to highly active or thematic investment ideas.
8. Stress test for a broader spectrum of scenarios, including an inflation spike, geopolitics, and shocks to interest rates.
9. Consider robust optimization techniques that reduce dependence on historical data and lower the chances of overfitting.

CONCLUSION

In this paper, we studied the performance, risk factors, and potential optimization of a multiasset portfolio studied covering various market regimes, including crisis periods such as the 2008 financial meltdown and the COVID-19 shock. In bull markets, the portfolio showed to be resilient, generating extremely higher returns, whereas loss levels were in contrast relatively controlled in bear phases. Scenario analysis, regime-based breakdowns, and stress testing exposed the portfolio to diversified sources of risk and showed its weaknesses in highly correlated extreme market downturns. Asset correlation analysis showed how quickly asset correlations change in crisis or normal market conditions, thereby affecting the diversification benefits. The implications for optimization using the Sharpe ratio and minimum volatility approaches lead to different allocations, meaning different objective choices will lead to different portfolio compositions. The graphical representation through efficient frontier shows riskreturn relation and outlines an apt allocation strategy. All in all, the dissertation reinforces the importance of active risk management, timedependent revisits, and high-end optimization tools geared toward creating resilient highperforming portfolios in constant-changing market scenarios.

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