

# Portfolio Optimization Primer

Consumers Sector | 1/27/2026

## Overview of Risk-Parity and Hierarchical Risk-Parity

### Risk-Parity

#### Overview of Optimization Techniques

The Risk Parity portfolio optimization uniquely focuses on equalizing the portfolio's volatility distribution rather than capital allocation. This ensures that each asset contributes equally to total portfolio volatility, providing broader exposure across economic conditions, increasing allocations to lower-volatility assets, and delivering more stable returns with reduced drawdowns. However, these updated weights may lag in performance during strong upswings in high-volatility assets like equities.

#### Economic Interpretation

Because of its structural design, Risk Parity exhibits clear sensitivities to macroeconomic conditions. In a Consumer sector portfolio, it tends to overweight low-volatility stocks, which are less exposed to cyclical swings, while underweighting more volatile or discretionary brands. As a result, the strategy may underperform in high-inflation or rising-rate environments, where traditionally stable or low-volatility equities could face pressure. Risk Parity generally performs best in stable or declining interest rate regimes, reflecting its reliance on historical volatilities and correlations rather than forward-looking projections. Importantly, this optimizer does not explicitly incorporate macroeconomic conditions into its construction.

### Hierarchical Risk-Parity (HRP)

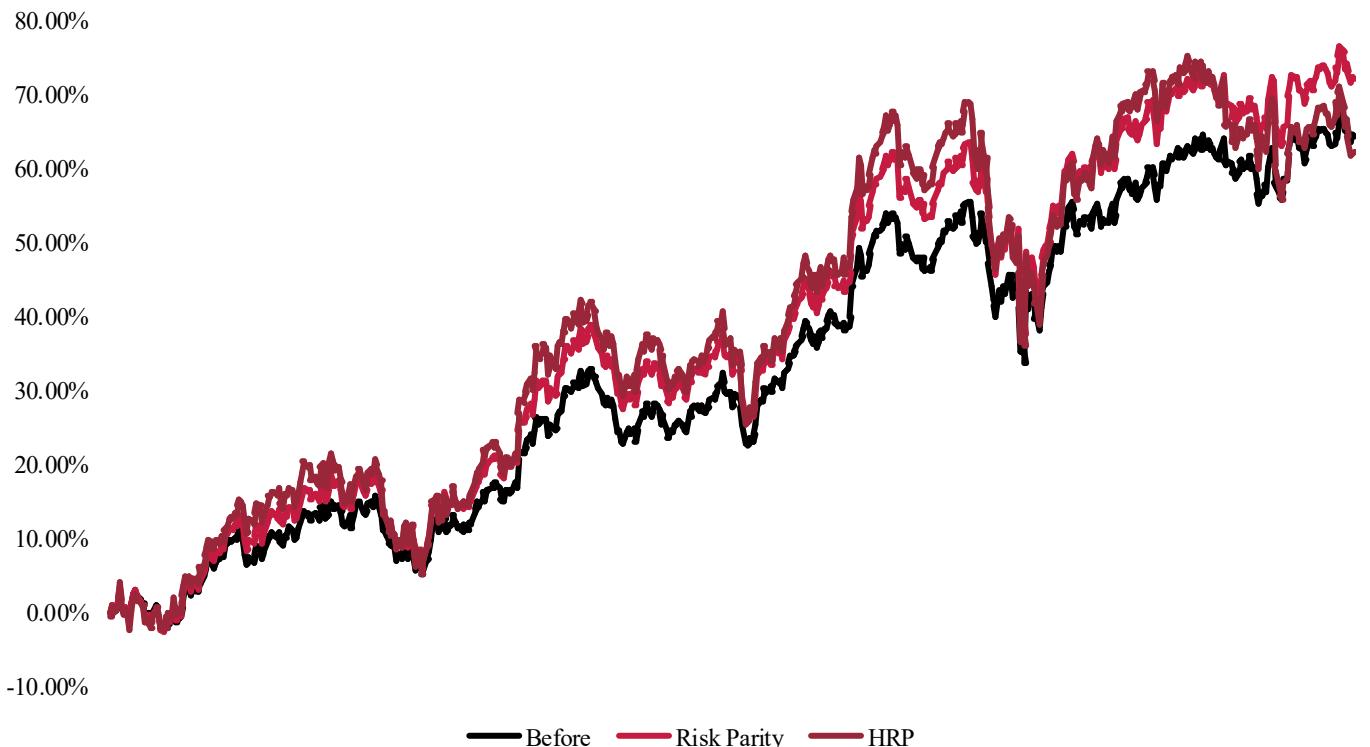
#### Overview of Optimization Techniques

Hierarchical Risk Parity (HRP) enhances traditional risk-based portfolio optimization by clustering assets based on their correlation structure and allocating risk recursively. By grouping highly correlated assets together, HRP limits over-allocation to similar securities, improving diversification within a Consumer sector portfolio where firms often share overlapping demand drivers and cyclical exposures, a limitation presented in Risk Parity. As a result, HRP is more robust to estimation error and mitigates extreme portfolio vulnerabilities arising from historical relationship breakdowns during market shifts. However, HRP remains sensitive to the choice of clustering methodology, which directly influences how assets are grouped and how risk is ultimately allocated.

#### Economic Interpretation

Since HRP clusters assets that move together, it prevents over-allocation to highly correlated consumer cyclical stock groups, providing more stable and diversified exposure across both defensive and cyclical segments. The strategy is more resilient to inflationary shifts because it responds to changes in how assets move together rather than relying on assumptions that can break down when market conditions change. Across interest rate regimes, HRP helps limit excessive concentration in long-duration or rate-sensitive clusters, enhancing resilience during periods of monetary tightening or policy transitions. From a style perspective, because discretionary exposures tend to cluster together, HRP effectively caps their combined influence, maintaining a more balanced allocation between income-oriented and growth-oriented assets. Importantly, this optimizer does not explicitly incorporate macroeconomic conditions into its construction.

Cumulative Returns Over Time (3-Year Return)



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## Overview of Mean Variance and Black-Litterman

### Mean Variance

#### Overview of Optimization Techniques

Mean-Variance optimization chooses portfolio weights by balancing two goals: higher returns and smaller ups and downs. Rather than weighing everything equally, it accounts for how each stock behaves and how the stocks move together, then favors combinations that have offered a better tradeoff between reward and stability. Its strengths are that it follows a clear, widely used framework, encourages diversification by considering relationships between holdings, and provides a structured way to be more aggressive or conservative. Its weaknesses are that small input changes can lead to different results, it can concentrate too much on a few names without limits, and it can struggle when market conditions shift.

#### Economic Interpretation

Mean-Variance optimization can be weak in the consumer sector, not because it “ignores macro” in a unique way, but because it is driven by the same historical patterns that macro shocks often break. Like risk parity and HRP, it does not explicitly model inflation, rates, or consumer strength; the difference is that Mean-Variance uses estimated returns to actively chase the best-looking risk-return tradeoff, which makes it more vulnerable when the environment changes. If the historical window reflects a benign period for discretionary names, the optimizer may tilt toward them even as inflation stays sticky or rates rise and spending slows, because it has no built-in mechanism to recognize that regime shift. It still promotes diversification through correlations, but when correlations and expected returns change during macro transitions, the “best” portfolio from the past can become poorly positioned going forward.

### Black-Litterman

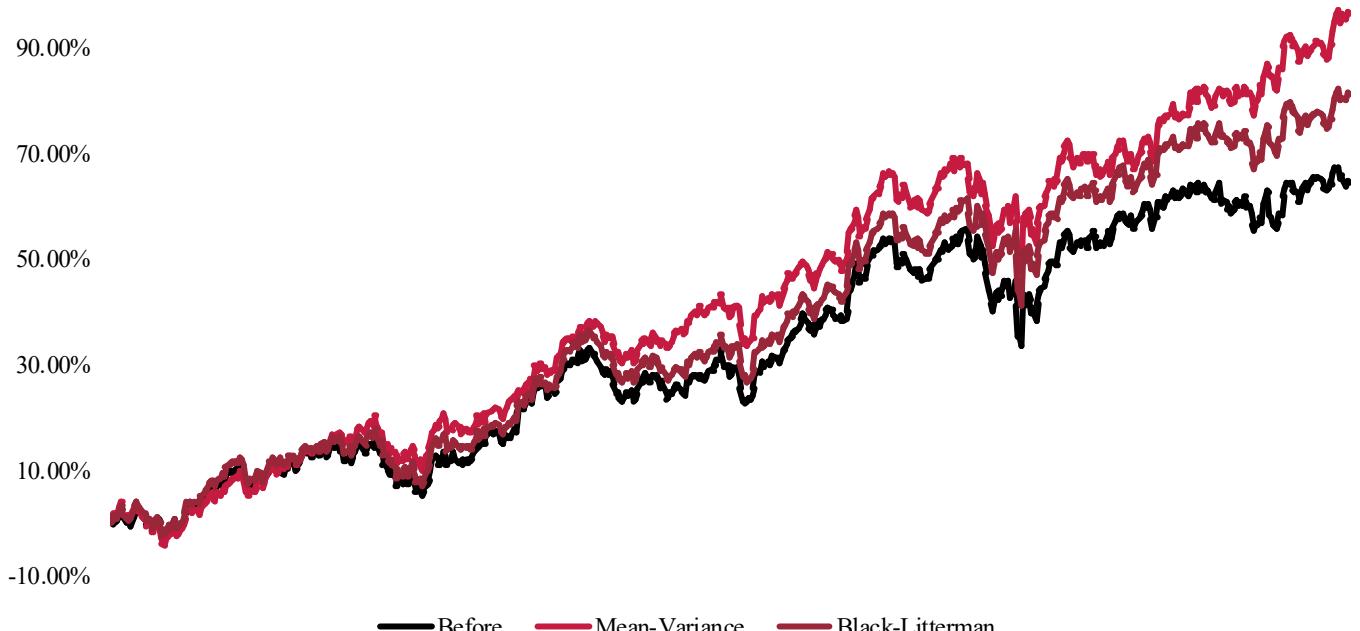
#### Overview of Optimization Techniques

Sentiment-Enhanced Black-Litterman builds on the standard Black-Litterman approach by combining two sources of “what we think will happen next”: the team’s own views and the tone of recent financial news. In practice, it reads current headlines about each company, summarizes whether the coverage is mostly positive or negative, and then uses that information to gently tilt the portfolio toward stocks with stronger sentiment and away from those with weaker sentiment, while still keeping the overall portfolio diversified. The benefit is that it makes the process less dependent on one person’s opinion and more responsive to new information that may be emerging in the market. The tradeoff is that it only works well if the news is reliable and consistently available, and it adds extra moving parts that can amplify noise when headlines are misleading, overly hyped, or intentionally manipulated.

#### Economic Interpretation

Black-Litterman is advantageous for the consumer sector as it integrates macro positioning views, such as favoring staples over discretionary goods during inflationary periods. This model effectively reflects beliefs about pricing power and margin pressure, allowing for more confident investments in staples and cautious approaches to discretionary items. Unlike naive Mean-Variance, Black-Litterman adapts better to interest-rate changes by considering which consumer businesses withstand higher rates and altered demand. It's particularly effective for portfolios affected by structural changes not reflected in historical data. However, the model's success depends heavily on accurately specifying views and confidence levels; flawed inputs can result in erroneous investment strategies despite the model's theoretical strengths.

Cumulative Returns Over Time (3-Year Return)

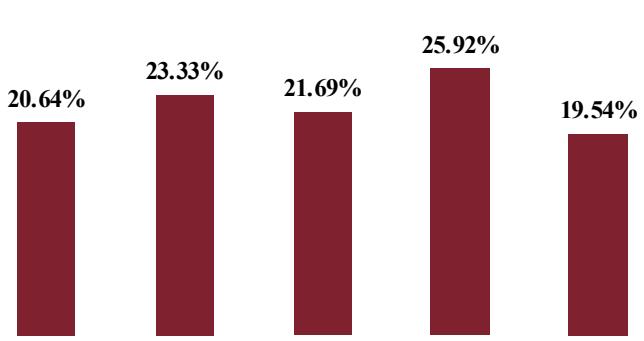


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## Comparative Analysis

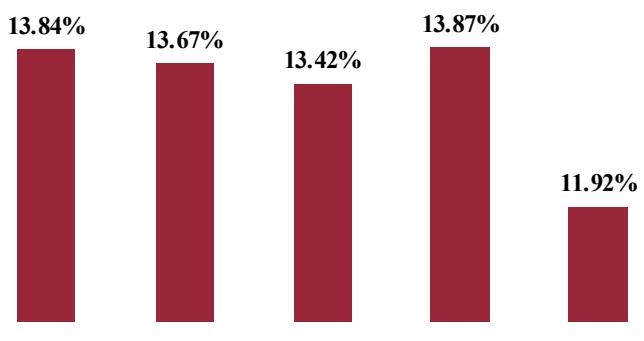
Optimizer	Annual Return	Annual Vol	Sharpe Ratio	Sortino Ratio
Before	20.64%	13.84%	1.166	1.809
Risk Parity	23.33%	13.67%	1.378	2.159
HRP	21.69%	13.42%	1.281	2.000
MV	25.92%	13.87%	1.545	2.398
BL	19.54%	11.92%	1.262	1.995



### Expected return (Annual Return)

Highest (MV): 25.92%  
Lowest (BL): 19.54%

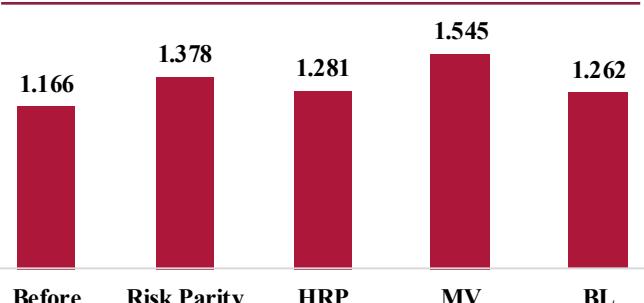
**Interpretation:** MV is the most return-seeking under our inputs; BL's view/posterior setup is currently producing a lower expected return even though it concentrates into a few names.



### Volatility (Annual Vol)

Lowest (BL): 11.92%  
Highest (MV): 13.87%

**Interpretation:** Black-Litterman is the most "risk-light" with the lowest volatility, while Mean-Variance (MV) has the highest volatility, and HRP's volatility sits in between due to clustering that can concentrate weights in higher-risk groups.



### Sharpe ratio (Risk Adj)

Highest (MV): 1.545  
Lowest (BL): 1.262

**Interpretation:** MV dominates risk-adjusted performance in this run because it combines the highest expected return with relatively low vol. BL has the lowest Sharpe because the expected return is materially lower despite low vol.

Capital Allocation For Each Stock					
Tickers	Before	RP	HRP	MV	BL
AZO	9.40%	17.34%	23.35%	18.62%	13.71%
MAR	12.67%	12.00%	7.85%	16.24%	20.00%
MNST	15.23%	16.83%	27.48%	0.00%	7.99%
WMT	14.40%	16.79%	12.60%	13.51%	20.00%
TJX	18.07%	16.85%	17.41%	11.63%	12.04%
FLUT	10.14%	9.61%	6.41%	20.00%	6.26%
AMZN	11.98%	10.57%	4.91%	20.00%	20.00%

After analyzing the optimization model, AZO and TJX had the highest average weights at approximately 19.48% and 14.85%, respectively. AZO's strong performance is highlighted by 23.35% in HRP and consistent double-digit allocations across all models. TJX showed balanced allocations from 11.63% to 17.41%, peaking at 17.41% in HRP. Conversely, MNST had the lowest average weight at 11.08%, being completely excluded from Mean Variance and Black-Litterman models due to poor expected returns. AMZN and FLUT averaged 13.87% and 14.01%, showing significant variability in model performance, with higher allocations in Mean Variance and Black-Litterman but lower weights in risk-based models. This indicates both stocks may have strong return potential but also pose higher volatility risks.

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## Recommended Optimization Framework: HRP and Black-Litterman Hybrid

A hybrid optimization framework that integrates Hierarchical Risk Parity (HRP) with Black-Litterman (BL) is applied to the consumer sector portfolio, providing both structural stability and forward-looking flexibility. HRP allocates risk by analyzing the relationships among stocks, preventing overconcentration in highly correlated consumer sub-sectors and enhancing diversification to withstand market fluctuations. Complementing this, the Black-Litterman model incorporates investor views and market sentiment into portfolio weights, adjusting expected returns to reflect forward-looking macroeconomic and business-specific perspectives. This hybrid approach combines HRP's risk-aware foundation with Black-Litterman's adaptability, enabling the portfolio to remain resilient under current market conditions while positioning strategically for anticipated economic changes.

### Fit with the Nature of Consumer Businesses

This framework fits consumer businesses particularly well because consumer stocks naturally fall into economic groups such as discretionary (AMZN, MAR, FLUT) and defensive or value-oriented names (WMT, TJX, AZO). HRP limits excessive exposure to similar stocks by clustering assets based on correlations, which is reflected in our allocation table where HRP caps certain discretionary names like AMZN (4.91%) and FLUT (6.41%) while allocating more to stable performers like AZO (23.35%) and TJX (17.41%). This mirrors economic reality, as auto parts retailers and discount chains tend to be more resilient with stable demand patterns. Black-Litterman further strengthens this by allowing analysts to explicitly favor businesses with strong return prospects, which is evident in the BL portfolio's maximum weights in AMZN (20.00%), MAR (20.00%), and WMT (18.62%), while having a lower percentage of FLUT (6.26%) based on forward-looking conviction.

### Fit with the Macro Environment

From a macroeconomic perspective, this hybrid approach is well suited to the current and forward-looking environment characterized by higher interest rates, inflation uncertainty, and frequent regime shifts. Pure Risk Parity frameworks struggle in rising rate and inflationary regimes because they structurally favor low-volatility assets, while Mean-Variance optimization relies too heavily on historical data and can overweight discretionary stocks during worsening macro conditions. In contrast, HRP reduces excessive concentration in rate-sensitive or cyclical clusters and remains stable as correlations evolve, while Black-Litterman allows the portfolio to adapt by incorporating macro views such as emphasizing pricing power or margin resilience. Together, they create a portfolio that adjusts intelligently as inflation, growth, and rates change.

### Practical Implications for Portfolio Construction

In practical terms, this framework improves position sizing by determining weights first through structural risk, then refining by economic conviction. For example, HRP limits exposure to correlated names, reducing AMZN to 4.91% and FLUT to 6.41% compared to their 20.00% Mean-Variance allocations, while Black-Litterman selectively reduces stocks, such as FLUT (6.26%) and MNST (7.99%), reflecting a conviction-based, macro-aware approach. From a risk management standpoint, the framework reduces correlation risk through hierarchical clustering, incorporates macro views via explicit forward-looking assumptions, and avoids unstable portfolios driven by noisy historical inputs. This multi-model approach prevents over-concentration while balancing historical risk patterns with return expectations, resulting in improved risk-adjusted outcomes and greater stability across economic cycles.

### Limitations and Caveats

However, there are important limitations to consider. Black-Litterman depends heavily on the quality of the analyst's macro views and confidence levels, meaning poor assumptions can lead to poor outcomes despite the model's strengths. HRP's risk allocations depend on how assets are clustered, so clusters should be validated using economic and business logic, not solely statistical correlations, to ensure that allocations reflect meaningful groupings. Finally, the hybrid approach is more complex than traditional methods and requires strong documentation and discipline to ensure transparency and consistency.

Hybrid Weightings	
AZO	20.98%
MAR	12.04%
MNST	13.73%
WMT	15.45%
TJX	12.11%
FLUT	13.20%
AMZN	12.45%

### Cumulative Returns Over Time (3-Year Return)

