

# Hidden Markov Regime Strategy

## Abstract

This research presents a regime-aware quantitative trading strategy based on Hidden Markov Models (HMM). The focus is on statistical robustness, out-of-sample validation, and downside risk control rather than raw return maximization.

## Methodology

A multivariate Gaussian HMM is trained using an expanding walk-forward framework to avoid look-ahead bias. Market regimes are inferred daily and mapped to expected Sharpe ratios, which are converted into continuous portfolio exposure via a sigmoid function.

## Risk Management

The strategy integrates a trend filter based on exponential moving averages and volatility targeting to normalize risk across time.

## Validation

Robustness is assessed using block bootstrap Monte Carlo simulations and the Deflated Sharpe Ratio, accounting for non-normal returns and data-snooping effects.

## Results

While raw returns underperform Buy & Hold, volatility-matched performance is comparable, with significantly reduced drawdowns during crisis periods.

## Conclusion

The strategy demonstrates that regime-aware exposure control can deliver statistically defensible performance with superior risk characteristics.