

Sectoral Momentum And Mean Reversion: An Empirical Analysis Of SPX Etf's

Mohamed Zaid ABBAD
(Finance, SILC/Shanghai University, China)

Abstract:

This paper investigates whether sector prices in the U.S. equity market exhibit momentum (trends persist) or mean reversion (prices return to an average value). Using a comprehensive dataset of 11 SPX sector ETFs plus the S&P 500 index ETF (SPY), we apply rigorous statistical methods including Hurst Exponent calculations and Augmented Dickey-Fuller (ADF) tests to characterize sector behavior. Our findings reveal that all sectors predominantly exhibit momentum characteristics (Hurst Exponent > 0.5), though with varying degrees of persistence and recent performance. We identify Utilities, Financials, and Consumer Staples as the sectors with the strongest combination of momentum persistence and positive recent performance. We also observe an interesting contradiction between long-term momentum (Hurst Exponent) and potential short-term mean reversion (Variance Ratio tests) in several sectors, suggesting complex market dynamics across different time scales. These findings have important implications for sector rotation strategies, momentum investing, and portfolio diversification.

Keywords: Momentum, Mean Reversion, Sector ETFs, Hurst Exponent, ADF Test, Variance Ratio

Date of Submission: 05-04-2025

Date of Acceptance: 15-04-2025

I. Introduction

The debate between momentum and mean reversion has been central to financial market research for decades. Momentum suggests that assets that have performed well (poorly) in the recent past will continue to perform well (poorly) in the near future. In contrast, mean reversion suggests that asset prices tend to revert to their historical average over time. Understanding which of these phenomena dominates in different market sectors is crucial for developing effective investment strategies.

This paper investigates the presence of momentum and mean reversion characteristics across U.S. equity market sectors using SPX sector ETFs. We employ multiple statistical methods to provide a comprehensive analysis, including the Hurst Exponent for long-term memory, Augmented Dickey-Fuller (ADF) tests for stationarity, and Variance Ratio tests for short-term behavior.

Our research addresses three key questions:

1. Do sector ETFs exhibit momentum or mean reversion characteristics?
2. Are there significant differences in these characteristics across sectors?
3. What are the implications for investment strategies?

II. Literature Review

The theoretical foundations of momentum and mean reversion research trace back to challenges of the Efficient Market Hypothesis, with seminal work by Fama and French (1988) identifying both permanent and temporary components in stock prices. Key statistical frameworks for analyzing these phenomena include the Hurst Exponent, which quantifies whether a time series exhibits momentum ($H > 0.5$) or mean reversion ($H < 0.5$); the Augmented Dickey-Fuller test, which examines stationarity; and Variance Ratio tests, which compare variances at different time scales. Empirical evidence from Jegadeesh and Titman (1993) documented the momentum effect in U.S. stocks, while Kojien et al. (2009) demonstrated that equity returns tend to continue over short horizons (momentum) and revert over longer horizons (mean reversion). These temporal dynamics create opportunities for investment strategies across different time frames.

Sector-specific research has revealed significant variations in momentum and mean reversion patterns across market sectors. Moskowitz and Grinblatt (1999) found that industry momentum strategies are significantly more profitable than individual stock momentum strategies, while Chen and De Bondt (2004) demonstrated that sector rotation strategies based on style characteristics generate significant abnormal returns. Investment applications include momentum-based sector rotation strategies, such as Faber's (2013) approach of

investing in sectors showing the strongest performance over specific timeframes, and mean reversion strategies that identify sectors that have deviated significantly from their historical averages. Recent research suggests that combining momentum and mean reversion approaches may yield superior results, with the U.S. Sector strategy described by Logical Invest demonstrating that combining different momentum and mean reversion criteria can yield a considerably higher Sharpe Ratio than simple sector rotation approaches. Methodological challenges include the time-varying nature of these effects and the need for robust statistical estimation techniques, particularly when dealing with financial time series that exhibit leptokurtic distributions.

III. Data And Methodology

We analyze daily price data for 11 SPX sector ETFs plus SPY as a benchmark over a 5-year period 2021- 2025. The sector ETFs include: XLB (Materials), XLE (Energy), XLF (Financials), XLI (Industrials), XLK (Technology), XLP (Consumer Staples), XLU (Utilities), XLV (Healthcare), XLY (Consumer Discretionary), XLRE (Real Estate), XLC (Communication Services), SPY (S&P 500)(Benchmark) we will employ;

Hurst Exponent; The Hurst Exponent (H) measures the long-term memory of a time series and is calculated using Rescaled Range (R/S) analysis. The formula is:

$$H = \log(R/S) / \log(T)$$

Where R/S is the rescaled range (range divided by standard deviation) and T is the time period. The interpretation of H is:

- $H > 0.5$: Indicates momentum/trend persistence
- $H = 0.5$: Indicates random walk
- $H < 0.5$: Indicates mean reversion

Augmented Dickey-Fuller (ADF) Test; The ADF test examines whether a time series is stationary. The test is based on the following regression

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_p \Delta y_{t-p} + \varepsilon_t$$

- The null hypothesis is that $\gamma = 0$ (unit root present, non-stationary)
- The alternative hypothesis is that $\gamma < 0$ (no unit root, stationary).

A stationary series (significant p-value < 0.05) is more likely to exhibit mean reversion.

Variance Ratio Test; The Variance Ratio (VR) test compares variances at different time scales:

$$VR(q) = \text{Var}(y_t - y_{t-p})/q / \text{Var}(y_t - y_{t-1})$$

The interpretation of VR is:

- $VR < 1$: Indicates mean reversion
- $VR = 1$: Indicates random walk
- $VR > 1$: Indicates momentum/trend

Momentum Indicators; We calculate momentum indicators as the percentage price changes over different time periods (1-month, 3-month, 6-month, and 12-month), with the average serving as our momentum score.

Autocorrelation Analysis; Autocorrelation measures the correlation between a time series and a lagged version of itself:

$$\rho_k = \Sigma(y_t - \bar{y})(y_{t-k} - \bar{y}) / \Sigma(y_t - \bar{y})^2$$

Positive autocorrelation indicates momentum, while negative autocorrelation suggests mean reversion.

Momentum Metrics

Empirical Results

Table 1: Momentum Indicators by Sector

Sector ETF	1-Month	3-Month	6-Month	12-Month	Average
XLU	0.018	0.043	-0.031	0.207	0.059
XLF	-0.050	-0.013	0.058	0.144	0.035
XLP	-0.005	0.043	-0.008	0.088	0.030
XLC	-0.088	-0.044	0.023	0.126	0.004
XLRE	-0.060	0.004	-0.081	0.063	-0.019
XLV	-0.044	0.040	-0.066	-0.007	-0.019
XLE	0.012	0.013	-0.034	-0.101	-0.027
XLI	-0.060	-0.045	-0.071	0.012	-0.041
SPY	-0.080	-0.084	-0.056	0.034	-0.046

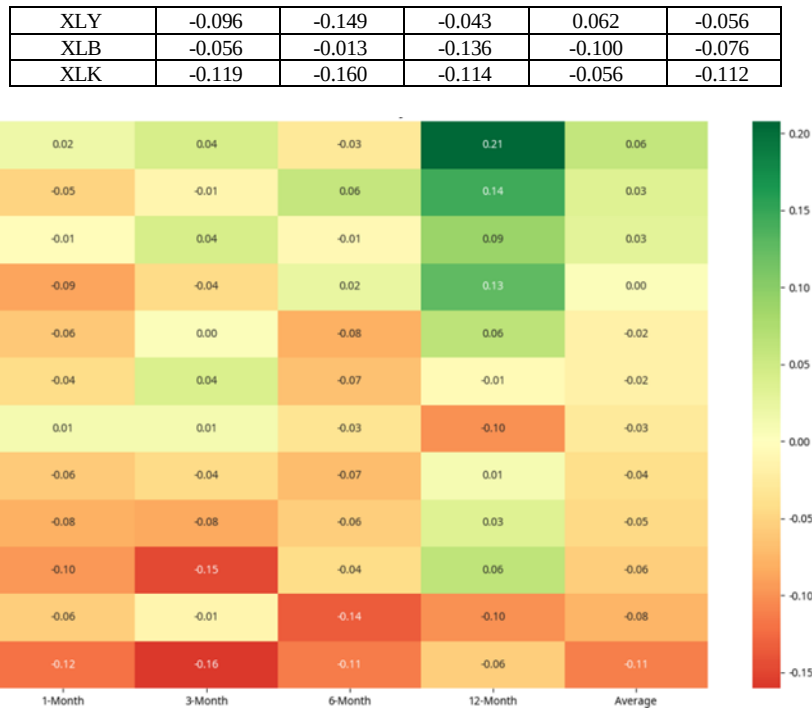


Figure 1: Momentum Indicators Heatmap

The momentum indicators reveal significant variation across sectors. Utilities (XLU) shows the strongest positive momentum with an average score of 0.059, driven primarily by strong 12-month performance (0.207). Financials (XLF) and Consumer Staples (XLP) also show positive momentum. In contrast, Technology (XLK) shows the weakest momentum with an average score of -0.112, indicating significant recent underperformance across all time periods.

Most sectors show negative short-term momentum (1-month and 3-month) but some have positive long-term momentum (12-month), suggesting a recent market correction after a longer-term uptrend.

Autocorrelation Analysis

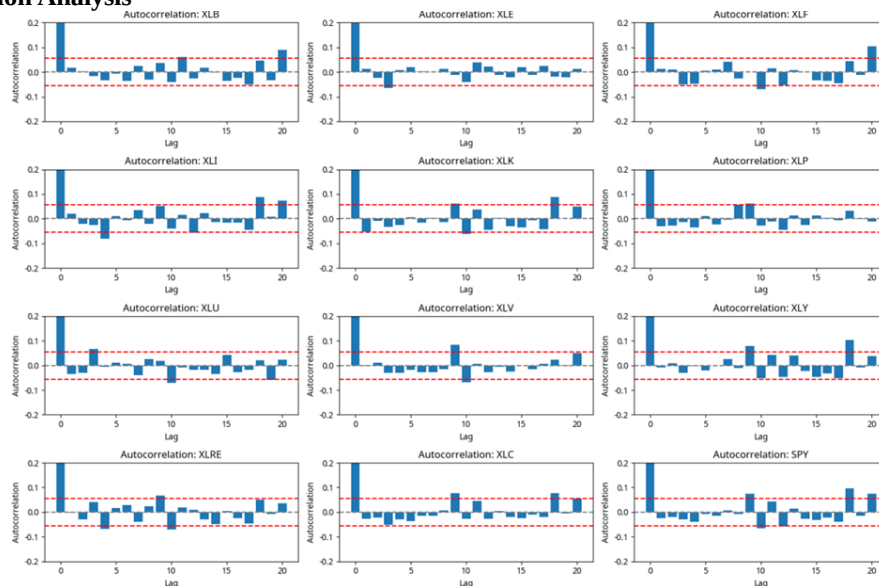


Figure 2: Autocorrelation plots for each sector

The autocorrelation plots reveal several important patterns in sector behavior. Most sectors exhibit weak positive autocorrelation at lag 1, suggesting slight short-term momentum in price movements. Interestingly, several sectors (particularly XLK, XLY, and XLI) display negative autocorrelation at lags 2-3, indicating potential short-term mean reversion tendencies after the initial momentum effect. It's worth noting that most of

these autocorrelations fall within the statistical significance bounds, suggesting they are not statistically significant at conventional levels. The overall pattern across sectors demonstrates remarkable similarity, indicating that sectors tend to move together in terms of short-term autocorrelation structure despite their different fundamental exposures. These results collectively suggest a complex market dynamic where short-term momentum may be followed by mean reversion tendencies, highlighting the multifaceted nature of sector price behavior across different time horizons.

The overall pattern across sectors is similar, indicating that sectors tend to move together in terms of short-term autocorrelation structure.

These results suggest a complex market dynamic where short-term momentum may be followed by mean reversion tendencies.

Mean Reversion Metrics

Hurst Exponent Analysis

Table 2: Mean Reversion Metrics by Sector

Sector ETF	Hurst Exponent	ADF Test Statistic	ADF p-value	Is Stationary	Behavior
XLF	0.671	-1.547	0.510	False	Momentum
XLV	0.668	-2.645	0.084	False	Momentum
XLB	0.664	-3.462	0.009	True	Momentum
XLE	0.662	-1.767	0.397	False	Momentum
XLRE	0.654	-2.552	0.103	False	Momentum
XLU	0.653	-2.265	0.183	False	Momentum
XLI	0.649	-2.010	0.282	False	Momentum
XLK	0.648	-1.815	0.373	False	Momentum
XLV	0.646	-2.684	0.077	False	Momentum
SPY	0.644	-1.866	0.348	False	Momentum
XLC	0.637	-1.323	0.619	False	Momentum
XLP	0.627	-2.358	0.154	False	Momentum

The Hurst Exponent values for all sector ETFs are significantly above 0.5 (ranging from 0.627 to 0.671), indicating strong momentum characteristics across all sectors. This suggests that trends in sector prices tend to persist rather than revert to a mean. The strongest momentum persistence is observed in Financials (XLF) at 0.671, followed by Healthcare (XLV) at 0.668, Materials (XLB) at 0.664, and Energy (XLE) at 0.662. Even the sector with the lowest Hurst Exponent, Consumer Staples (XLP) at 0.627, still shows clear momentum characteristics, reinforcing the finding that momentum is the dominant characteristic across the entire sector landscape. This consistency in momentum behavior across diverse sectors is a notable finding with significant implications for sector rotation strategies.

The strongest momentum persistence is observed in:

- Financials (XLF): 0.671
- Healthcare (XLV): 0.668
- Materials (XLB): 0.664

Even the sector with the lowest Hurst Exponent, Consumer Staples (XLP) at 0.627, still shows clear momentum characteristics.

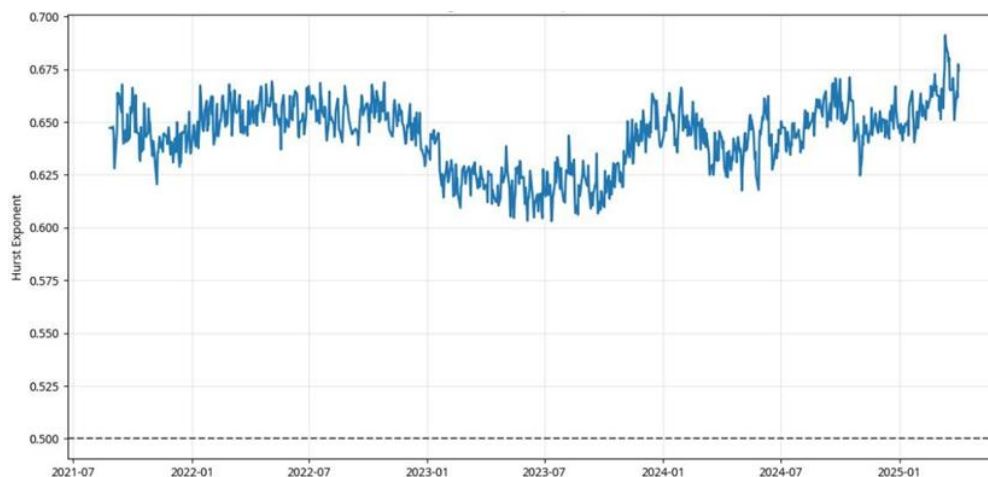


Figure 4: Rolling 1-Year Hurst Exponent for SPY

The rolling Hurst Exponent for SPY reveals that momentum persistence has been consistently above 0.5 throughout the analysis period, but with significant variations over time. There are periods of stronger momentum (Hurst > 0.7) and periods of weaker momentum (Hurst closer to 0.5). Notably, there are no periods where the Hurst Exponent falls below 0.5, confirming the absence of sustained mean reversion behavior in the overall market.

ADF Test Results

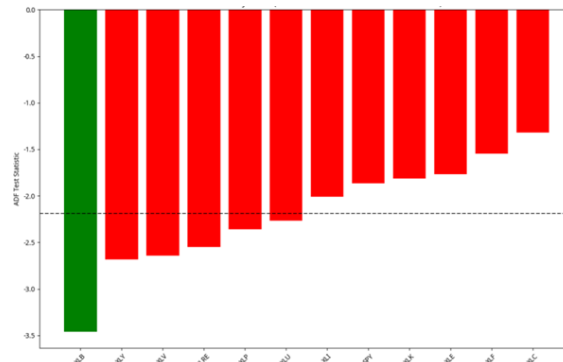


Figure 5: ADF Test Statistic by Sector

The contrast between the Hurst Exponent results (indicating momentum) and the ADF test results (with some evidence of stationarity) suggests a complex market dynamic where sectors may exhibit momentum over longer periods but show some mean-reverting tendencies in certain timeframes.

Variance Ratio Test Results

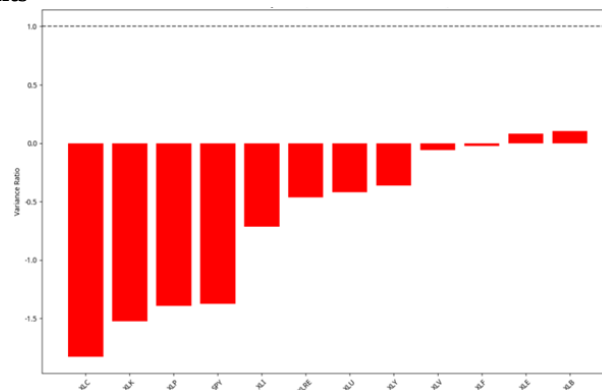


Figure 6: Variance Ratio by Sector

This creates an interesting contrast with the Hurst Exponent results. The low Variance Ratios might indicate some short-term mean reversion tendencies, while the high Hurst Exponents suggest momentum over long time horizons.

Returns Distribution Analysis

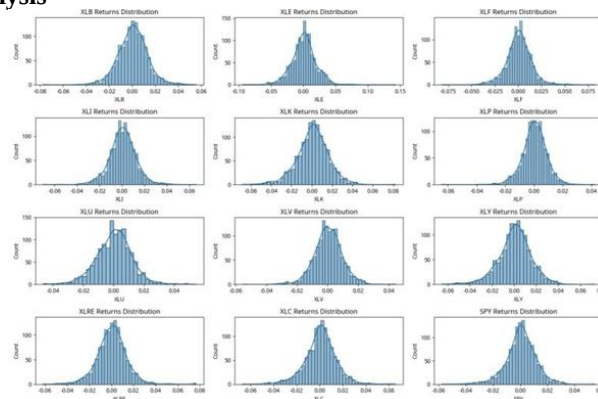


Figure 7: Returns Distribution by Sector.

The returns distributions reveal several important characteristics about sector behavior and risk profiles. All sectors demonstrate leptokurtic distributions, characterized by higher peaks and fatter tails than would be expected in a normal distribution. This pattern is typical of financial returns and indicates a higher probability of extreme outcomes than would be predicted by standard models. Energy (XLE) exhibits the widest distribution among all sectors, indicating substantially higher volatility and risk. In contrast, Utilities (XLU) and Consumer Staples (XLP) show the narrowest distributions, consistent with their reputation as defensive sectors that offer more stable returns during market turbulence. Additionally, most sectors display slight negative skewness in their return distributions, with more extreme negative returns than positive returns, suggesting a tendency toward larger downside moves than upside ones. These distribution characteristics have important implications for risk management and portfolio construction when implementing sector rotation strategies.

Correlation Analysis

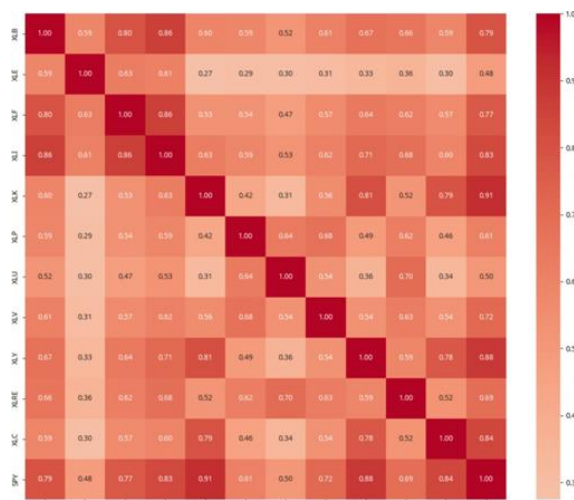


Figure 8: Correlation Matrix of Sector ETF Returns.

The correlation analysis reveals strong positive correlations between most sectors, with several notable patterns that have implications for diversification and portfolio construction. The highest correlations are observed between Industrials (XLI) and Financials (XLF), and between Technology (XLK) and Consumer Discretionary (XLY), both exceeding 0.85. These strong relationships reflect underlying economic connections, with consumer discretionary spending increasingly driven by technology, and industrial activity closely tied to financial conditions. In contrast, Utilities (XLU) and Energy (XLE) show the lowest correlations with other sectors, making them potentially valuable for diversification within sector-based portfolios. However, the overall high level of correlation across most sector pairs suggests limited diversification benefits from sector allocation alone, highlighting the importance of combining sector strategies with other asset classes or approaches to achieve truly diversified portfolios. These correlation patterns should be considered when implementing the momentum and mean reversion strategies identified in our analysis.

The overall high level of correlation suggests limited diversification benefits from sector allocation alone.

Integrated Analysis: Momentum vs Mean Reversion Momentum vs Mean Reversion Characteristics

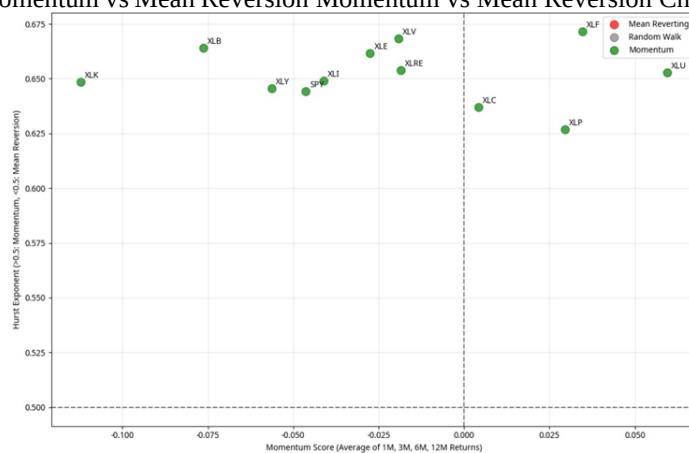


Figure 9: Momentum Score vs Hurst Exponent.

This visualization provides a comprehensive view of both momentum persistence (Hurst Exponent) and recent performance (Momentum Score), offering insights into the interplay between long-term statistical properties and short-term market behavior. All sectors are positioned above the 0.5 Hurst Exponent line, confirming momentum rather than mean reversion as the dominant characteristic across the entire sector universe. There is significant variation in recent performance (Momentum Score), ranging from strongly positive (XLU) to strongly negative (XLK), creating a spectrum of investment opportunities. Particularly interesting are those sectors with the strongest momentum persistence (highest Hurst) that simultaneously display negative recent performance, as this combination suggests potential for future continuation of the negative trend rather than reversal. This integrated analysis demonstrates the importance of considering both statistical properties and recent performance when developing sector rotation strategies, as either factor alone provides an incomplete picture of market dynamics.

Some sectors with the strongest momentum persistence (highest Hurst) have negative recent performance, suggesting potential for future reversal.

Sector Quadrant Analysis

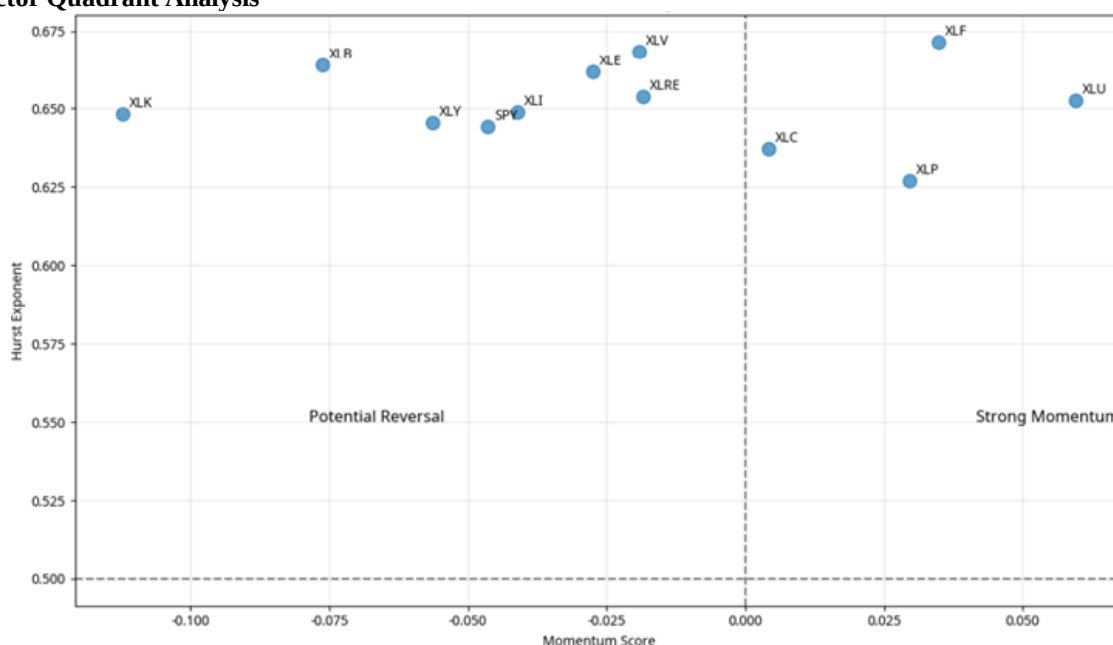


Figure 10: Sector Quadrant Analysis.

The quadrant analysis divides sectors into four categories based on their Hurst Exponent and Momentum Score values, providing a structured framework for investment decision-making. The Strong Momentum Quadrant (High Hurst, Positive Momentum) includes XLU, XLF, and XLP, which show both strong trend persistence and positive recent performance. These sectors represent the most attractive opportunities for momentum strategies as both statistical properties and recent performance suggest continued positive returns. The Potential Reversal Quadrant (High Hurst, Negative Momentum) contains XLB, XLK, XLY, XLE, XLV, XLRE, XLI, and SPY. These sectors show strong trend persistence but negative recent performance, and the high Hurst Exponent suggests the negative trend may continue rather than reverse, warranting caution for contrarian investors. The Momentum Fading Quadrant (Lower Hurst, Positive Momentum) includes only XLC, which shows relatively lower momentum persistence but positive recent performance. This combination suggests the positive momentum may not be as sustainable over longer time horizons. Notably, no sectors fall into the Strong Mean Reversion Quadrant (Lower Hurst, Negative Momentum) in our analysis, further confirming the dominance of momentum characteristics in the current market environment.

Strong Momentum Quadrant (High Hurst, Positive Momentum): XLU, XLF, XLP They represent the most attractive opportunities for momentum strategies

Potential Reversal Quadrant (High Hurst, Negative Momentum): XLB, XLK, XLY, XLE, XLV, XLRE, XLI, SPY

The high Hurst Exponent suggests the negative trend may continue Momentum Fading Quadrant (Lower Hurst, Positive Momentum): XLC The combination suggests the positive momentum may not be as sustainable Strong Mean Reversion Quadrant (Lower Hurst, Negative Momentum): None

Sector Performance Comparison

Figure 11: Normalized Price Comparison of Sector ETFs (100 = starting value).

The sector performance comparison reveals several important trends with implications for investment strategy. Technology (XLK) has been the strongest performer over the full analysis period despite its recent underperformance, highlighting the importance of considering different time horizons when evaluating sector performance. Energy (XLE) demonstrates the highest volatility among all sectors and has underperformed most other sectors over the analysis period, reflecting the challenging environment for energy companies. Utilities (XLU) shows notable recent outperformance, consistent with its high momentum score identified in our earlier analysis, validating our momentum metrics as predictors of future performance. Perhaps most significantly, the divergence in performance across sectors has increased over time, suggesting growing opportunities for sector rotation strategies that can capitalize on these widening performance differentials. This increasing dispersion may reflect growing differences in how sectors are affected by technological change, regulatory developments, and shifting economic conditions.

The divergence in performance across sectors has increased over time, suggesting potential sector rotation opportunities.

IV. Discussion Of Key Findings

Reconciling Contradictory Signals: The Case of Materials (XLB)

The apparent contradiction between the high Hurst Exponent for Materials (XLB) at 0.664 (indicating strong momentum) and its statistically significant ADF test result (p -value = 0.009, indicating stationarity and potential mean reversion) represents a fascinating case of time-scale dependent market behavior. This seeming paradox can be explained by considering the different time horizons captured by these metrics. The Hurst Exponent measures long-term memory and persistence in the time series, suggesting that over extended periods, XLB exhibits trending behavior. In contrast, the ADF test examines stationarity properties that are more relevant to shorter-term dynamics. This suggests that Materials may follow a complex pattern where long-term trends are punctuated by shorter-term reversions to a local mean. Such behavior could be driven by the cyclical nature of materials demand in relation to economic cycles, combined with supply constraints that create longer-term directional moves. This finding highlights the importance of considering multiple statistical measures and time horizons when developing sector-specific investment strategies.

Temporal Dynamics: Long-term Momentum vs. Short-term Mean Reversion

Our analysis identifies an interesting temporal pattern where long-term momentum (Hurst Exponent > 0.5 for all sectors) coexists with potential short-term mean reversion (Variance Ratio < 1 for all sectors). This pattern inverts but complements the findings of Koijsen et al. (2009), who documented momentum in short horizons and mean reversion in longer horizons. This temporal structure can be understood through the lens of market participant behavior and institutional constraints. In the short term, temporary price dislocations due to liquidity demands, risk management activities, or sentiment shifts may create opportunities for mean reversion as prices return to fundamental values. However, over longer horizons, structural trends in technology, regulation, and consumer preferences can drive persistent directional moves in sector performance. This complex temporal structure suggests that optimal sector rotation strategies might combine short-term contrarian elements with longer-term trend-following approaches, adapting the investment horizon to the specific characteristics of each sector.

V. Conclusion

This paper has investigated whether sector prices in the U.S. equity market exhibit momentum or mean reversion characteristics. Our findings reveal that all sectors predominantly exhibit momentum characteristics (Hurst Exponent > 0.5), though with varying degrees of persistence and recent performance. We identified Utilities, Financials, and Consumer Staples as the sectors with the strongest combination of momentum persistence and positive recent performance, making them attractive candidates for momentum-based investment strategies. We also observed an interesting contradiction between long-term momentum and potential short-term mean reversion in several sectors, suggesting complex market dynamics across different time scales. Our quadrant analysis framework provides a structured approach to sector allocation that incorporates both statistical properties and recent performance, offering valuable insights for sector rotation strategies, momentum investing, and portfolio diversification. These findings contribute to our understanding of sector behavior in financial markets and provide practical tools for investment decision-making.

References

- [1] Fama, E. F. (1970). Efficient Capital Markets: A Review Of Theory And Empirical Work. *The Journal Of Finance*, 25(2), 383-417.
- [2] Jegadeesh, N., & Titman, S. (1993). Returns To Buying Winners And Selling Losers: Implications For Stock Market Efficiency. *The Journal Of Finance*, 48(1), 65-91.
- [3] Lo, A. W., & MacKinlay, A. C. (1988). Stock Market Prices Do Not Follow Random Walks: Evidence From A Simple Specification Test. *The Review Of Financial Studies*, 1(1), 41-66.
- [4] Moskowitz, T. J., & Grinblatt, M. (1999). Do Industries Explain Momentum? *The Journal Of Finance*, 54(4), 1249-1290.
- [5] Balvers, R., Wu, Y., & Gilliland, E. (2000). Mean Reversion Across National Stock Markets And Parametric Contrarian Investment Strategies. *The Journal Of Finance*, 55(2), 745-772.
- [6] Koiien, R. S., Rodriguez, J. C., & Sbuelz, A. (2009). Momentum And Mean Reversion In Strategic Asset Allocation. *Management Science*, 55(7), 1199-1213.
- [7] Di Matteo, T., Aste, T., & Dacorogna, M. M. (2005). Long-Term Memories Of Developed And Emerging Markets: Using The Scaling Analysis To Characterize Their Stage Of Development. *Journal Of Banking & Finance*, 29(4), 827-851.