

# Quantitative Analysis of Price Momentum in Indian Equity Markets

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## **1. Abstract**

This paper explores the effectiveness of a price momentum-based portfolio strategy in the Indian equity market using historical stock data. Momentum investing leverages the tendency of high-performing stocks (winners) to continue outperforming and low-performing stocks (losers) to persist in underperformance. The study constructs winner and loser portfolios, selecting the top quintile of stocks based on cumulative past returns, and evaluates both long-only and short-only strategies.

Portfolio performance is assessed using two weighting approaches: equal weighting, assigning uniform weights to all stocks, and exponential weighting, prioritizing stocks with stronger recent performance. The analysis spans various formation periods (look-back windows) and holding periods (investment horizons). Findings highlight that portfolio outcomes are significantly impacted by the choice of weighting scheme, formation period and investment horizons, providing valuable insights for investors aiming to optimize returns in the Indian market.

## **2. Acknowledgements**

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### 3. Introduction:

The Efficient Market Hypothesis (EMH), proposed by Fama (1970), has been a cornerstone in financial theory, but its validity has been challenged over the years due to the emergence of market anomalies (Basu 1983; Jegadeesh and Titman 1993; Sloan 1996; Heston et al. 1999; Chan and Lakonishok 2004). Among these, the momentum anomaly has attracted significant attention from both academics and practitioners. Fama himself referred to momentum as the “premier anomaly,” recognizing its consistent ability to challenge the notion of market efficiency. Simply put, momentum refers to the tendency of stocks that have performed well in the past to continue performing well, while those with poor past performance tend to underperform.

The momentum phenomenon was first systematically documented in the influential study by Jegadeesh and Titman (1993) in their paper “Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency.” Their findings indicated that stocks with strong past returns continue to deliver superior returns over the next 3-12 months, while stocks with weak past returns continue to underperform. They argued that investors could profit by buying stocks that have performed well and short-selling those with poor past performance.

Psychological and behavioural theories suggest that investors tend to overreact to new information, causing stock prices to adjust too quickly or too slowly. This mispricing creates opportunities for momentum-based strategies, where past performance is used as a predictor of future returns. While momentum strategies have been widely researched in developed markets, their application and effectiveness in emerging markets, such as India, remain less explored.

This study aims to evaluate the performance of momentum strategies using data from the Indian stock market. By constructing portfolios based on historical returns, the research examines how momentum strategies perform under different formation and holding periods, comparing the effectiveness of equal and exponential weighting methods.

## 4. Methodology

### 4.1 Data Source

The analysis utilizes historical stock data obtained through the Yahoo Finance API, accessed via the Python library *yfinance*. The dataset focuses on Indian equities over the period from 2021 to 2024.

To identify the stock universe, the official NSE (National Stock Exchange) website was referenced to extract tickers of midcap stocks and stocks with Futures and Options (F&O) trading enabled. Including stocks with F&O availability was critical for constructing both long-only and short-only portfolios, as these instruments provide the liquidity and flexibility required for effective implementation of momentum strategies.

### 4.2 Data Preprocessing

Data preprocessing is a critical step in preparing raw data for analysis, ensuring accuracy and reliability in results.

Stocks with missing data during the formation and holding periods were excluded to maintain data integrity. The prices were aligned to the same monthly timestamps to ensure consistency across the universe. Monthly returns were calculated using the adjusted closing prices, which account for corporate actions such as dividends, stock splits, and bonus issues, ensuring accuracy in the performance measurement.

### 4.3 Momentum Calculation

Momentum strategies involve selecting stocks based on their historical price performance over a specific period, known as the "formation period." The formulas provided define how returns and momentum scores are calculated analytically and mathematically for each stock  $i$  in the trading universe.

#### 4.3.1 Monthly Return ( $R_i(t)$ )

This measures the percentage change in price from one month to the next, capturing the monthly return for stock  $i$ .

$$R_i(t) = \frac{P_i(t+1)}{P_i(t)} - 1$$

Where:

- $P_i(t)$ : Stock price at time  $t$ .
- $P_i(t + 1)$ : Stock price at the next time period.

#### 4.3.2 Cumulative Return Over the Formation Period ( $R_i^{cum}(t)$ )

The cumulative return is calculated for a  $T$ -month formation period, starting  $S$ -months before the current time. This metric reflects the total return over the formation period, excluding the most recent price movements.

$$R_i^{cum} = \frac{P_i(S + T)}{P_i(S)} - 1$$

- $T$  : Length of the "formation period" (e.g., 3, 6, or 12 months).
- $S$  : Start of the "skip period," which omits recent months to reduce the impact of short-term price reversals (usually taken  $S=1$ ).

#### 4.3.3 Risk-Adjusted Return ( $R_i^{risk Adj}$ )

$$R_i^{risk.adj} = \frac{R_i^{mean}}{\sigma_i}$$

Where:

- $\sigma_i$  : Standard deviation of monthly returns over the formation period.

This measure adjusts the stock's average return for the level of risk (volatility) it exhibits. It provides a risk-adjusted measure of performance, allowing for better portfolio construction by emphasizing returns relative to risk.

### 4.4 Momentum Portfolio Construction

The construction of momentum portfolios has been extensively studied in financial literature. Jegadeesh and Titman (1993) demonstrated that strategies buying past winners and selling past losers yield significant positive returns. Subsequent research has explored various aspects of momentum investing, including the impact of weighting schemes on factor exposures and portfolio performance.

Understanding the nuances of portfolio construction, such as selection criteria, weighting methods, and holding periods, is essential for effectively implementing momentum strategies. These elements determine the strategy's ability to capture the momentum effect and achieve superior risk-adjusted returns.

#### 4.4.1 Stock Selection and Ranking

The price-momentum strategies involve selecting stocks based on their performance, as measured by specific criteria such as cumulative returns ( $R_i^{cum}$ ), mean returns ( $R_i^{mean}$ ), risk-adjusted returns ( $R_i^{risk Adj}$ ), or other relevant metrics.

In this study, we have ranked stocks based on their cumulative returns ( $R_i^{cum}$ ) over a specified formation period. Stocks are then sorted into deciles or quintiles:

1. **Winners:** Top-performing stocks, often placed in the highest decile or quintile.
2. **Losers:** Underperforming stocks, placed in the lowest decile or quintile.

This ranking process is fundamental, as it identifies stocks that have exhibited strong or weak performance, aligning with the momentum strategy's objective to exploit the persistence of stock returns.

Stocks were ranked based on cumulative returns over predefined formation periods (3, 6, 9, 12 months). Portfolios of winners and losers were formed, skipping a one-month buffer to mitigate microstructure noise.

#### 4.4.2 Weighting Schemes

The allocation of weights to selected stocks significantly influences portfolio performance. We have used the below weighting schemes:

1. **Equal Weighting:** Assigning identical weights to each stock, ensuring diversification and simplicity.

$$w_i = \frac{1}{N}, \quad \text{where} \quad \sum_{i=1}^N w_i = 1$$

Each stock is assigned an equal weight ( $w_i$ ), where  $N$  is the total number of stocks in the portfolio.

2. **Exponential Weighting:** Allocating weights based on the magnitude of past returns, giving higher weights to stocks with stronger momentum.

The value of  $\delta$  taken in this study is 0.85.

$$w_i = \frac{\delta^{i-1}}{\sum_{j=1}^N \delta^{j-1}}, \quad \text{where} \quad \sum_{i=1}^N w_i = 1$$

The choice of weighting scheme affects the portfolio's exposure to the momentum factor and its risk-return profile. Studies have shown that different weighting methods can lead to varying factor exposures and portfolio efficiencies.

#### 4.4.3 Holding Period

Once the portfolio is established at  $t = 0$ , it remains unchanged for a predefined holding period ( $H$ ), which can range from 1 month to 12 months duration. The holding period is crucial, as it determines the duration over which the momentum effect is expected to persist. During this time, no rebalancing is performed to allow the momentum to play out.

#### 4.4.4 Portfolio Size and Diversification

Limiting the number of stocks in the portfolio balances the benefits of diversification with the need for concentrated exposure to the momentum factor. A focused portfolio allows for more significant gains from selected stocks, while diversification helps mitigate idiosyncratic risks. In this study we have taken the maximum number of stocks for each portfolio to be 20.

#### 4.5 Performance Metrics

The performance of the momentum-based portfolio strategy was evaluated using key metrics, including cumulative returns, monthly returns, the Sharpe ratio, and standard deviation (volatility). These metrics were compared against the NIFTY 50 index, which served as the benchmark for assessing the portfolio's relative performance.

Cumulative returns were calculated to measure the overall growth of the portfolio over the holding period. This metric provided a clear indication of the portfolio's long-term performance and allowed for direct comparison with the cumulative returns of the NIFTY 50. Monthly returns were analysed to capture short-term fluctuations in performance, enabling the identification of periods of outperformance or underperformance relative to the benchmark.

The Sharpe ratio was used to assess the portfolio's risk-adjusted returns by comparing the excess returns (over the risk-free rate) to the portfolio's volatility. A higher Sharpe ratio indicated superior risk-adjusted performance, helping to evaluate whether the returns achieved justified the risks undertaken. Additionally, the standard deviation of returns was calculated to measure portfolio volatility, reflecting the variability in returns over time. This metric highlighted the portfolio's exposure to market risks and provided a basis for comparing its stability to that of the NIFTY 50.

By benchmarking against the NIFTY 50, the analysis revealed whether the momentum strategy delivered alpha, consistently outperforming the broader market. This comparison provided insights into the strategy's ability to generate superior risk-adjusted returns and navigate market volatility.

The risk-free rate taken in this study is the RBI 10y Treasury yield, taken as a constant for all the periods under study at 6.7%

## 4.6 Limitations

The findings of this study are limited to the Indian stock market. Momentum strategies may perform differently in other emerging or developed markets due to varying market structures, investor behavior, and macroeconomic conditions. The generalizability of the results to other markets may require further research.

The analysis relies on historical price data, which may not fully capture changes in market dynamics, investor sentiment, or unforeseen events that could affect stock prices. Additionally, the study may be limited by the availability of reliable data for smaller or less liquid stocks, which could skew the results.

The analysis primarily focuses on relatively short holding periods for momentum strategies (e.g., 3-12 months). Longer-term performance may differ significantly, and the impact of momentum over extended time horizons is not captured in this study.

The results are influenced by the prevailing market conditions, including whether the market is in a bull or bear phase. The performance of momentum strategies is highly sensitive to these conditions, and the analysis may not fully capture how momentum strategies would behave under extreme market scenarios, such as financial crises or market bubbles.

The study uses historical data to model momentum strategies, assuming past performance predicts future returns. This assumption may not hold in future market conditions, especially if market dynamics change or new market anomalies emerge.

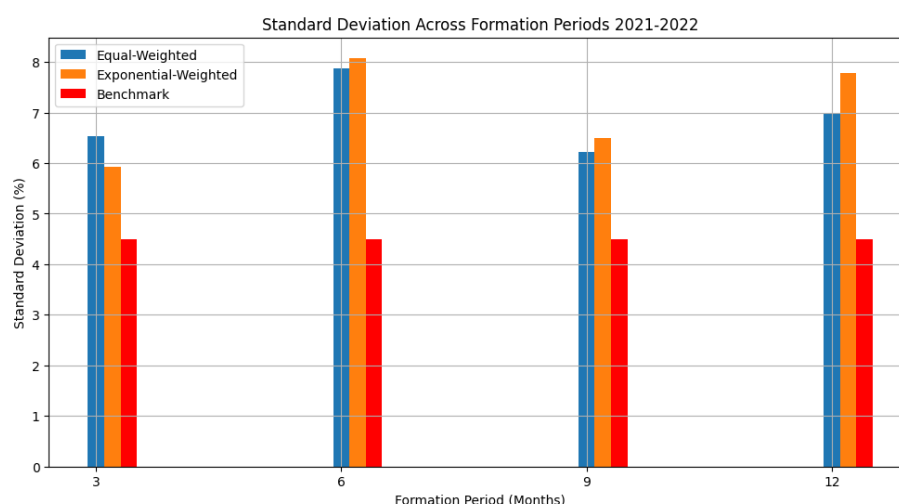


## 5. Results and Analysis

First, we will look at the results for the winner portfolios, the returns they have generated from the year 2021 to 2024 for the F&O enabled stocks and compare them with NIFTY 50 index.

The results of the price-momentum strategy shown in Tables 1, 2, 3, with formation period in 2021 and holding period in 2022 are quite favourable for momentum investors.

Compared to the benchmark NIFTY 50, all winner portfolios exhibited significant volatility, with large swings on both the positive and negative sides, as indicated by the standard deviation of monthly returns. In the first half of 2022, these portfolios underperformed the NIFTY 50; however, they delivered strong performance in the second half of the year.



Among the weighting schemes, the exponential weighting scheme consistently outperformed the equal-weighted scheme and the benchmark,

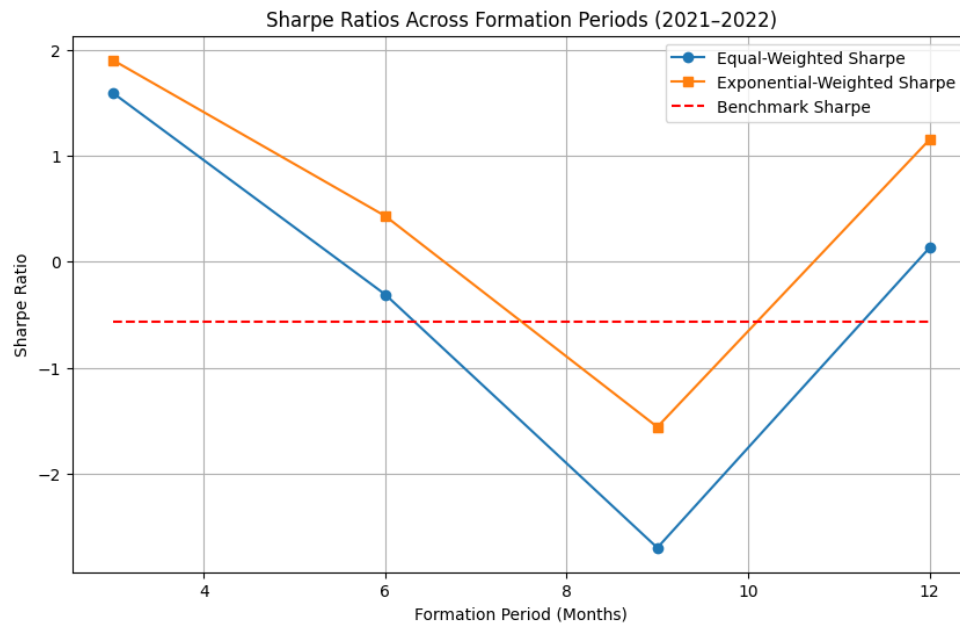
achieving a higher Sharpe Ratio. With the exception of the winner portfolios with a formation period (FP) of 9 months under both weighting schemes, all winner portfolios outperformed the benchmark.

The findings also reveal that while price-momentum strategies exhibited higher volatility compared to the benchmark, 6 out of 8 price-momentum strategies outperformed the benchmark in terms of both absolute returns and risk-adjusted returns, as measured by the Sharpe Ratio. These results highlight the potential of momentum strategies, especially when using exponential weighting, to deliver superior performance despite higher levels of risk.

Tables 4, 5, 6 show the results when the price-momentum strategy is applied with formation period in 2022 and holding period in 2023.

We see that the equal weighted portfolios gave a much better performance than the exponential weighted portfolio and the benchmark. The volatility of the benchmark was

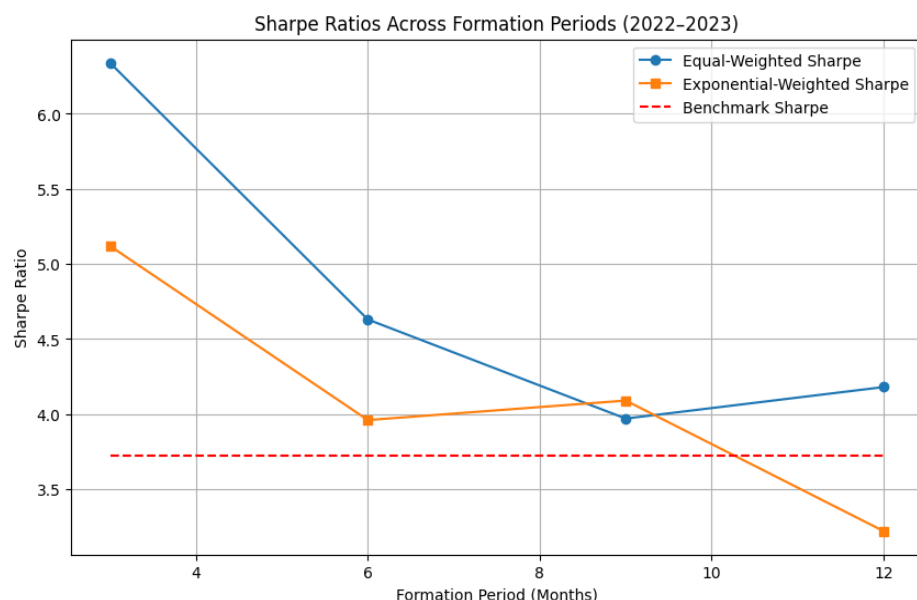
3.54%, while the volatility of the momentum portfolios was 6.43% at a minimum. The highest Sharpe Ratio was 6.34 for the portfolio with 3-month FP. Equal weighted portfolios doing



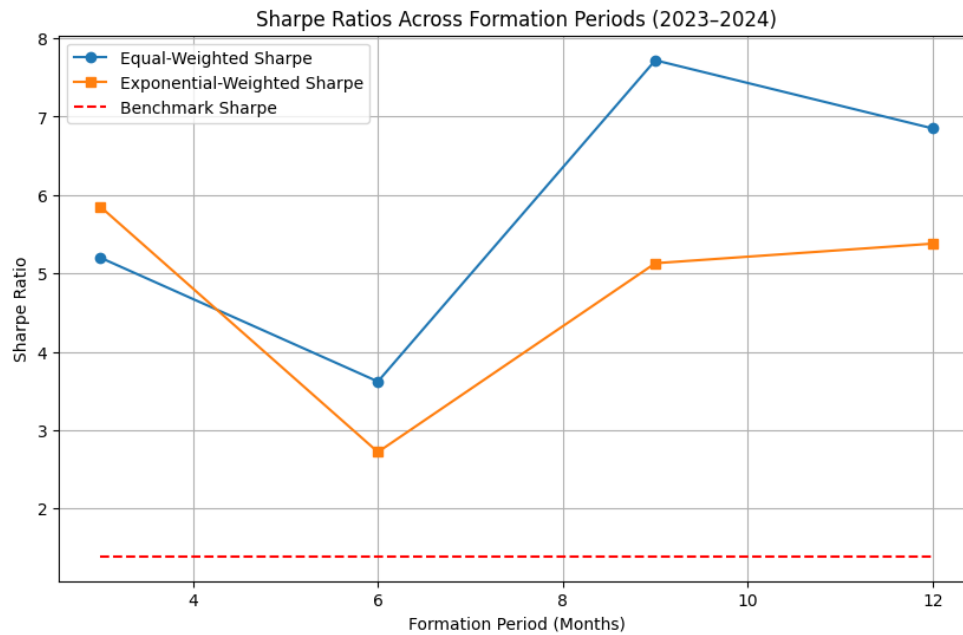
better than exponential weighting portfolio indicate that the top weighted stocks in the winners did not enough momentum to sustain and give higher returns. Whereas equal weighted portfolio which have higher weights allocated to the bottom half of the stock portfolio performed well, indicating that momentum was picked up by them.

Tables 7, 8, 9 show the results when the price-momentum strategy is applied with formation period in 2023 and holding period in 2024.

All the price-momentum strategies have shown exceptional

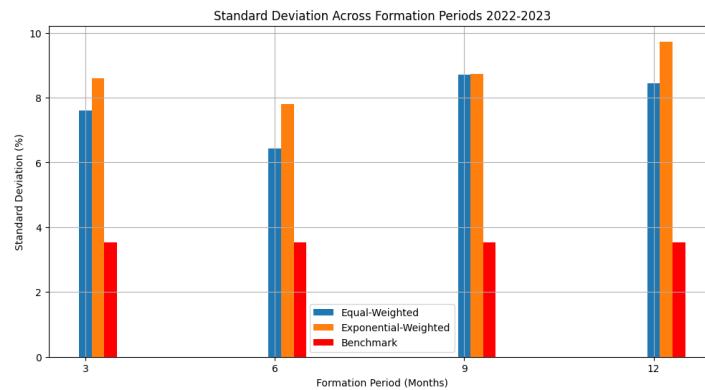


performance beating the benchmark both in returns and Sharpe Ratio. The benchmark gave 11.06% return in 11 months and a Sharpe of 1.39, compared to the minimum return of 23.20% and maximum return of 44.62% through momentum, with a better risk adjusted returns.



From the three plots shown above, it is evident that equal-weighted winner portfolios have consistently delivered better risk-adjusted returns (as measured by the Sharpe Ratio) compared to the exponential-weighted portfolios and the benchmark when market momentum picked up during the second half of the period under study.

Equal-weighted portfolios outperformed in periods when broader market momentum was strong, showcasing their ability to capture returns from a diverse set of stocks rather than relying heavily on a few top-performing ones.



Among the 12 winner portfolios studied, the exponential weighting scheme outperformed in only half the cases, while equal weighting showed superior performance in the remaining half.

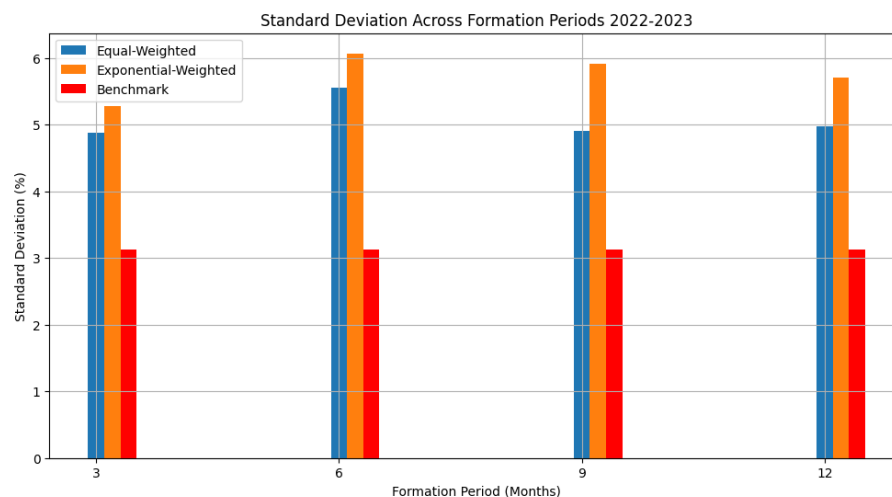
This suggests that while exponential weighting can amplify the gains from stronger performers, it is not consistently effective, particularly in volatile or trend-reversal phases.

Across all formation periods (3, 6, 9, and 12 months), equal weighting demonstrated less variability in Sharpe Ratios, indicating better stability and robustness across different market conditions.

Both weighting schemes outperformed the benchmark Sharpe Ratio during most periods, reflecting the efficacy of momentum strategies in delivering superior returns relative to a passive index like NIFTY 50.

Another important observation in the winner portfolios is that the cumulative returns of the second half of the year are more than the cumulative returns in the first half of the year.

Now we will look at what happened when we short sold the losers according the price-momentum strategy.



Tables 10 through 15 show the results for when the losers are short sold. Given the performance of the price-momentum strategy to in these cases, its safe to say that almost all of the portfolios have underperformed the benchmark. The portfolios with highest negative returns happened to be when the holding period was the year 2023. It was the only year that all the portfolios had negative returns. While in other years, the portfolios gave a positive return by the end of the year, however experiencing higher volatility.

From 2021 through 2024, all the portfolios which short sold losers had a negative Sharpe Ratio and higher volatility. Using leverage to short sell stocks with such expected returns is not a good strategy. In this context, short selling is particularly risky as the strategy goes against the prevailing market trend, which led to significant losses. Even stocks that have historically underperformed may experience price increases due to the overall market rally, exacerbating the challenges of implementing momentum-based strategies that involve short selling losers.

## 6. Conclusions

When the broader market is in a bull run, short selling individual stocks becomes an even less favourable strategy. During such periods, momentum typically drives the entire market upwards, including stocks that would otherwise be considered losers. The broad market indices often reflect a general positive sentiment, and stocks across sectors tend to exhibit upward price movements.

Thus, during bull markets, momentum strategies that involve going long on stocks are likely to perform well, as the positive market-wide momentum drives prices upward. Conversely, momentum strategies that incorporate short selling are likely to underperform. In such market conditions, the broader market's positive sentiment tends to lift even underperforming stocks, thereby reducing the effectiveness of short positions. The market-wide momentum can offset the expected returns from short selling, leading to losses or diminished returns for those employing this strategy.

### Implications on Portfolio Construction

#### 6.1.1 Choice of Weighting Scheme:

The choice between equal-weighted and exponential-weighted portfolios depends on the investor's risk tolerance and market conditions. Equal-weighted portfolios tend to perform better in capturing broad-based momentum, as their diversification across all winner stocks reduces dependency on a few top performers. This approach is ideal for risk-averse investors who prefer stable returns with relatively lower volatility.

On the other hand, exponential-weighted portfolios amplify the performance of the strongest momentum stocks, making them particularly suitable for aggressive investors with a higher risk tolerance. These portfolios are also advantageous for investors who can accurately identify the early stages of a momentum trend and focus on stocks that exhibit the highest momentum. By concentrating weights on the top-performing stocks, exponential weighting can deliver superior returns during periods when market momentum is concentrated.

However, as market-wide momentum begins to pick up, this portfolio can be rebalanced into an equal-weighted portfolio, distributing the weight more evenly across all momentum stocks. This approach allows investors to capitalize on the initial surge from a few top-performing stocks and then transition to a more stable and diversified portfolio as broader momentum develops.

Despite its potential for high returns, the exponential-weighted portfolio often experiences greater volatility and is more sensitive to reversals in individual stock trends, which can

magnify losses if the momentum fades unexpectedly. Therefore, it is a strategy best employed in well-monitored and dynamically managed portfolios.

### **6.1.2 Formation and Holding Period Selection:**

The choice of formation (FP) and holding periods (HP) significantly influences portfolio performance. Shorter formation periods, such as three months, have generally delivered superior Sharpe ratios for equal-weighted portfolios, as observed with a Sharpe ratio of 6.34 during the 2022–2023 period. This indicates that shorter FPs capture recent momentum trends effectively. Conversely, exponential-weighted portfolios may benefit from slightly longer formation periods, but their performance is less consistent. Investors should carefully align the FP and HP with their strategy and market outlook, as these parameters determine the portfolio's responsiveness to momentum.

### **6.1.3 Risk Management**

Momentum strategies inherently exhibit higher volatility compared to passive benchmarks like the NIFTY 50. For example, equal-weighted and exponential-weighted portfolios recorded standard deviations of 7.60% and 8.59%, respectively, during the 2022–2023 period, compared to the benchmark's 3.54%. To manage this additional risk, investors should consider combining momentum strategies with defensive or low-volatility portfolios. Additionally, employing risk controls, such as setting exposure limits or using stop-loss mechanisms, can help mitigate the impact of market reversals.

### **6.1.4 Diversification**

Equal-weighted portfolios outperform when market momentum is broad-based, as the diversification across a larger set of winner stocks smoothens returns. This makes them particularly effective during phases of general market recovery or bullish trends. In contrast, exponential-weighted portfolios excel when momentum is concentrated in a few high-performing stocks, such as during sector-specific rallies. Therefore, understanding the nature of market momentum is crucial for choosing the appropriate weighting scheme.

### **6.1.5 Timing**

Across all years and portfolio types, the second half of the year (July–December) consistently delivered higher cumulative returns compared to the first half (January–June). This could be due to broader market momentum picking up in the latter half of each year or seasonal effects in the Indian equity markets.

Portfolio managers can adopt a dynamic approach by allocating capital between equal-weighted and exponential-weighted strategies based on prevailing market conditions. For instance, in times of widespread bullish momentum, equal-weighted portfolios may yield higher returns due to their broader exposure. Conversely, during concentrated market rallies led by a few stocks or sectors, exponential-weighted portfolios can maximize gains. This flexibility allows investors to adapt their strategy to market dynamics and optimize returns.

## 7. Further Research

1. Further research can be done considering a rebalancing the portfolio using a rolling window, and analyse the impact of varying the portfolio's starting month to assess seasonality or market cycle effects.
2. Feasibility of the portfolio can be measured by taking into account the transaction charges to gauge real world performance.
3. Perform Stress Testing and calculate Value-at-Risk (VaR) to assess the portfolio's vulnerability under different market conditions.
4. Investigate additional performance metrics like Sortino ratio, and maximum drawdown for a more comprehensive risk-return analysis.
5. The study could be expanded to explore alternative definitions of momentum, such as "relative strength" or "price momentum," to determine which definition best captures the underlying market trends.
6. While this study primarily focuses on momentum during bull markets, further research could explore how momentum strategies perform in sideways and bear markets or during market corrections. Understanding momentum's behaviour in these conditions would provide a more complete picture of its risk and reward profile.
7. Extending momentum strategies to other asset classes, such as bonds, commodities, or even cryptocurrencies, could yield insights into the broader applicability of the momentum effect. Different asset classes might react differently to momentum-based trading strategies due to their unique market dynamics.
8. Research could be expanded to examine the timing of factor exposure of momentum, to assess if certain factors (like momentum, size, value etc) perform better at different stages of the market cycle. This would involve dynamically adjusting factor weights based on market conditions.
9. The liquidity of stocks used in momentum strategies may significantly influence performance. Future research could examine how liquidity constraints impact the implementation and profitability of momentum strategies, especially in small-cap stocks or in emerging markets like India.



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## 9. Appendix

Table 1

Equal weighted portfolio (2021-2022)								
	Formation period (months)							
	3		6		9		12	
Holding period (months)	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns
1	-3.49%	-3.49%	-3.59%	-3.59%	-3.57%	-3.57%	-1.43%	-1.43%
2	-9.04%	-5.75%	-8.53%	-5.12%	-9.18%	-5.82%	-6.31%	-4.95%
3	-4.96%	4.48%	-1.29%	7.91%	-1.90%	8.01%	3.02%	9.96%
4	-4.72%	0.25%	-2.59%	-1.31%	-7.05%	-5.24%	1.28%	-1.69%
5	-8.98%	-4.47%	-8.03%	-5.59%	-13.68%	-7.14%	-4.47%	-5.67%
6	-13.88%	-5.39%	-17.93%	-10.76%	-20.82%	-8.26%	-14.85%	-10.87%
7	-1.51%	14.37%	-3.86%	17.15%	-13.24%	9.57%	-3.40%	13.45%
8	4.92%	6.52%	4.84%	9.06%	-8.64%	5.30%	3.07%	6.70%
9	3.12%	-1.71%	4.45%	-0.38%	-11.26%	-2.87%	-0.27%	-3.24%
10	10.29%	6.96%	8.86%	4.23%	-8.66%	2.93%	4.56%	4.84%
11	19.91%	8.72%	11.02%	1.98%	-5.36%	3.61%	7.76%	3.06%
12	17.06%	-2.38%	4.23%	-6.12%	-10.12%	-5.03%	7.64%	-0.11%
Std deviation		6.53%		7.87%		6.22%		7.00%
Sharpe Ratio		1.59		-0.31		-2.70		0.13

Table 2

Exponential weighted portfolio (2021-2022)								
	Formation period (months)							
	3		6		9		12	
Holding period (months)	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns
1	-4.46%	-4.46%	-1.64%	-1.64%	0.10%	0.10%	-0.85%	-0.85%
2	-7.38%	-3.06%	-4.71%	-3.12%	-5.19%	-5.28%	-5.62%	-4.80%
3	-6.41%	1.04%	0.86%	5.85%	2.44%	8.04%	4.61%	10.83%
4	-6.10%	0.33%	1.18%	0.32%	-1.75%	-4.09%	5.59%	0.95%
5	-8.93%	-3.01%	-4.21%	-5.33%	-7.89%	-6.25%	-0.69%	-5.95%
6	-13.16%	-4.64%	-14.87%	-11.13%	-15.94%	-8.74%	-10.47%	-9.84%
7	-0.66%	14.39%	0.19%	17.69%	-6.46%	11.29%	3.81%	15.94%
8	6.05%	6.75%	13.08%	12.86%	0.93%	7.89%	14.43%	10.23%
9	6.28%	0.22%	13.07%	-0.01%	-0.27%	-1.18%	10.43%	-3.49%
10	12.55%	5.90%	17.70%	4.10%	1.61%	1.88%	17.35%	6.26%
11	21.24%	7.72%	17.54%	-0.13%	3.20%	1.57%	18.66%	1.12%
12	17.99%	-2.68%	10.18%	-6.27%	-3.45%	-6.45%	15.64%	-2.54%
Std deviation		5.93%		8.08%		6.49%		7.78%
Sharpe Ratio		1.90		0.43		-1.56		1.15

Table 3

2022	NIFTY 50	
Holding period (months)	Cumulative Returns	Monthly Returns
1	-0.27%	-0.27%
2	-3.41%	-3.15%
3	0.45%	3.99%
4	-1.64%	-2.07%
5	-4.62%	-3.03%
6	-9.24%	-4.85%
7	-1.32%	8.73%
8	2.14%	3.50%
9	-1.68%	-3.74%
10	3.59%	5.37%
11	7.89%	4.14%
12	4.13%	-3.48%
Std deviation		4.49%
Sharpe Ratio		-0.57

Table 4

Equal weighted portfolio (2022-2023)								
	Formation period (months)							
	3		6		9		12	
Holding period (months)	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns
1	-4.70%	-4.70%	-8.82%	-8.82%	-12.03%	-12.03%	-11.60%	-11.60%
2	-10.55%	-6.15%	-14.22%	-5.92%	-21.80%	-11.11%	-20.38%	-9.93%
3	-10.16%	0.43%	-11.67%	2.97%	-16.32%	7.01%	-14.60%	7.26%
4	-0.82%	10.40%	-3.57%	9.17%	-8.91%	8.86%	-8.04%	7.68%
5	-3.95%	-3.16%	-3.57%	0.01%	-8.72%	0.21%	-7.93%	0.11%
6	0.34%	4.47%	0.05%	3.75%	-4.77%	4.33%	-3.37%	4.96%
7	12.68%	12.30%	12.73%	12.67%	4.14%	9.36%	5.18%	8.84%
8	16.46%	3.35%	14.67%	1.73%	4.59%	0.43%	5.29%	0.10%
9	36.96%	17.60%	24.20%	8.31%	11.90%	6.99%	13.11%	7.43%
10	32.16%	-3.50%	20.29%	-3.15%	8.46%	-3.07%	9.12%	-3.53%
11	41.11%	6.77%	26.87%	5.47%	22.44%	12.89%	23.38%	13.07%
12	54.89%	9.77%	36.46%	7.56%	41.28%	15.39%	41.95%	15.05%
Std deviation		7.60%		6.43%		8.71%		8.44%
Sharpe Ratio		6.34		4.63		3.97		4.18

Table 5

Exponential weighted portfolio (2022-2023)								
	Formation period (months)							
	3		6		9		12	
Holding period (months)	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns
1	-6.42%	-6.42%	-8.04%	-8.04%	-12.60%	-12.60%	-14.06%	-14.06%
2	-13.86%	-7.96%	-15.70%	-8.34%	-21.44%	-10.11%	-24.77%	-12.46%
3	-12.81%	1.22%	-12.94%	3.28%	-16.51%	6.27%	-18.17%	8.77%
4	-3.04%	11.21%	-3.88%	10.40%	-8.71%	9.35%	-11.57%	8.07%
5	-7.29%	-4.38%	-7.07%	-3.32%	-8.54%	0.18%	-12.44%	-0.99%
6	-4.23%	3.29%	-3.84%	3.48%	-5.73%	3.08%	-8.98%	3.95%
7	10.12%	14.99%	11.00%	15.43%	4.52%	10.86%	-1.67%	8.03%
8	12.31%	2.00%	11.98%	0.88%	5.51%	0.95%	-0.14%	1.56%
9	33.23%	18.63%	25.89%	12.43%	15.28%	9.26%	6.47%	6.62%
10	28.80%	-3.33%	21.19%	-3.74%	10.95%	-3.76%	2.29%	-3.93%
11	37.58%	6.82%	27.52%	5.22%	24.62%	12.33%	18.28%	15.63%
12	50.68%	9.52%	37.53%	7.84%	42.43%	14.29%	38.00%	16.67%
Std deviation		8.59%		7.79%		8.73%		9.73%
Sharpe Ratio	5.12		3.96		4.09		3.22	

Table 6

2023	NIFTY 50	
Holding period (months)	Cumulative Returns	Monthly Returns
1	-2.59%	-2.59%
2	-4.57%	-2.03%
3	-4.26%	0.32%
4	-0.37%	4.06%
5	2.22%	2.60%
6	5.83%	3.53%
7	8.95%	2.94%
8	6.19%	-2.53%
9	8.31%	2.00%
10	5.23%	-2.85%
11	11.04%	5.52%
12	19.85%	7.94%
Std deviation		3.54%
Sharpe Ratio		3.72

Table 7

Equal weighted portfolio (2023-2024)								
	Formation period (months)							
	3		6		9		12	
Holding period (months)	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns
1	6.06%	6.06%	9.67%	9.67%	5.83%	5.83%	3.97%	3.97%
2	8.51%	2.31%	12.05%	2.16%	6.32%	0.47%	5.17%	1.15%
3	6.45%	-1.90%	10.81%	-1.11%	7.76%	1.35%	8.36%	3.04%
4	16.97%	9.88%	23.36%	11.33%	18.64%	10.10%	19.03%	9.85%
5	24.88%	6.76%	27.68%	3.50%	25.98%	6.19%	29.38%	8.70%
6	32.94%	6.45%	34.97%	5.71%	37.13%	8.85%	42.11%	9.84%
7	38.28%	4.02%	42.87%	5.85%	48.15%	8.03%	49.35%	5.09%
8	44.81%	4.72%	40.34%	-1.77%	56.70%	5.77%	53.22%	2.59%
9	44.16%	-0.45%	38.62%	-1.22%	52.19%	-2.87%	49.01%	-2.74%
10	34.53%	-6.68%	28.32%	-7.43%	46.25%	-3.91%	41.13%	-5.29%
11	32.11%	-1.80%	26.82%	-1.17%	44.62%	-1.11%	40.72%	-0.29%
12								
Std deviation		4.88%		5.56%		4.91%		4.97%
Sharpe Ratio		5.20		3.62		7.72		6.85

Table 8

Exponential weighted portfolio (2023-2024)								
	Formation period (months)							
	3		6		9		12	
Holding period (months)	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns
1	6.61%	6.61%	10.29%	10.29%	9.45%	9.45%	7.15%	7.15%
2	9.31%	2.53%	9.51%	-0.71%	6.15%	-3.02%	4.82%	-2.17%
3	7.46%	-1.70%	7.64%	-1.71%	6.39%	0.23%	7.08%	2.16%
4	18.18%	9.98%	20.52%	11.97%	17.88%	10.80%	18.19%	10.37%
5	27.04%	7.49%	25.88%	4.45%	25.13%	6.15%	27.51%	7.89%
6	36.41%	7.38%	30.80%	3.90%	34.58%	7.55%	37.65%	7.95%
7	43.36%	5.09%	40.95%	7.76%	47.02%	9.25%	49.63%	8.70%
8	51.49%	5.67%	38.01%	-2.09%	52.28%	3.58%	53.75%	2.75%
9	51.76%	0.17%	33.99%	-2.91%	45.26%	-4.61%	47.05%	-4.36%
10	40.27%	-7.57%	24.02%	-7.43%	38.27%	-4.81%	38.53%	-5.79%
11	37.59%	-1.91%	23.20%	-0.67%	37.06%	-0.87%	37.39%	-0.82%
12								
Std deviation		5.28%		6.07%		5.92%		5.71%
Sharpe Ratio		5.85		2.72		5.13		5.38

Table 9

2024	NIFTY 50	
Holding period (months)	Cumulative Returns	Monthly Returns
1	-0.01%	-0.01%
2	1.17%	1.18%
3	2.76%	1.57%
4	4.04%	1.24%
5	3.70%	-0.33%
6	10.51%	6.57%
7	14.84%	3.92%
8	16.15%	1.14%
9	18.79%	2.28%
10	11.40%	-6.22%
11	11.06%	-0.31%
Std deviation		3.13%
Sharpe Ratio		1.39

Table 10

Equal weighted portfolio (2021-2022)								
	Formation period (months)							
	3		6		9		12	
Holding period (months)	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns
1	8.03%	8.03%	8.33%	8.33%	4.64%	4.64%	5.63%	5.63%
2	15.09%	6.53%	18.32%	9.23%	16.06%	10.91%	17.12%	10.88%
3	6.10%	-7.81%	13.60%	-3.99%	15.41%	-0.56%	13.83%	-2.81%
4	6.32%	0.21%	10.99%	-2.31%	10.14%	-4.57%	9.03%	-4.22%
5	12.52%	5.83%	21.11%	9.12%	18.35%	7.46%	14.44%	4.97%
6	22.65%	9.00%	30.33%	7.62%	23.93%	4.71%	21.30%	5.99%
7	10.28%	-10.08%	21.67%	-6.65%	18.37%	-4.48%	12.81%	-7.00%
8	1.42%	-8.03%	13.94%	-6.35%	15.06%	-2.80%	7.64%	-4.58%
9	10.63%	9.08%	15.44%	1.32%	18.44%	2.94%	11.29%	3.40%
10	6.19%	-4.01%	8.93%	-5.64%	16.13%	-1.95%	7.47%	-3.44%
11	2.77%	-3.22%	1.24%	-7.06%	7.82%	-7.15%	3.40%	-3.78%
12	4.39%	0.0158	-3.97%	-0.0514	11.56%	0.0347	8.38%	0.0481
Std deviation		7.11%		6.82%		5.48%		5.71%
Sharpe Ratio		-0.32		-1.57		0.89		0.29

Table 11

Exponential weighted portfolio (2021-2022)								
	Formation period (months)							
	3		6		9		12	
Holding period (months)	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns
1	7.21%	7.21%	8.51%	8.51%	5.62%	5.62%	5.56%	5.56%
2	11.02%	3.55%	16.59%	7.45%	15.81%	9.65%	16.46%	10.33%
3	4.68%	-5.71%	10.83%	-4.94%	13.87%	-1.68%	13.06%	-2.92%
4	3.25%	-1.37%	9.51%	-1.19%	10.44%	-3.01%	8.90%	-3.68%
5	9.56%	6.12%	20.24%	9.79%	18.08%	6.92%	16.30%	6.79%
6	21.17%	10.60%	30.08%	8.18%	23.34%	4.45%	22.74%	5.53%
7	9.00%	-10.05%	21.54%	-6.57%	18.09%	-4.26%	12.40%	-8.43%
8	-2.75%	-10.78%	13.49%	-6.62%	13.28%	-4.07%	9.23%	-2.82%
9	5.98%	8.97%	16.49%	2.65%	17.15%	3.42%	13.11%	3.56%
10	0.77%	-4.91%	9.11%	-6.34%	13.44%	-3.16%	9.23%	-3.43%
11	-1.49%	-2.25%	0.32%	-8.06%	6.84%	-5.82%	6.06%	-2.90%
12	0.31%	0.018324	-4.11%	-0.0441	10.27%	0.0321	11.11%	0.0476
Std deviation		7.25%		6.97%		5.17%		5.71%
Sharpe Ratio		-0.88		-1.55		0.69		0.77

Table 12

Equal weighted portfolio (2022-2023)								
	Formation period (months)							
	3		6		9		12	
Holding period (months)	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns
1	1.73%	1.73%	2.57%	2.57%	4.37%	4.37%	1.50%	1.50%
2	4.29%	2.52%	4.68%	2.06%	7.52%	3.02%	4.13%	2.58%
3	9.00%	4.51%	9.76%	4.85%	11.78%	3.97%	5.93%	1.73%
4	0.64%	-7.67%	1.25%	-7.75%	-1.30%	-11.71%	-3.25%	-8.67%
5	-7.55%	-8.14%	-10.03%	-11.14%	-9.34%	-8.14%	-10.45%	-7.44%
6	-9.94%	-2.58%	-14.75%	-5.25%	-14.21%	-5.38%	-14.66%	-4.70%
7	-9.27%	0.74%	-18.10%	-3.92%	-21.12%	-8.05%	-20.89%	-7.30%
8	-14.84%	-6.13%	-23.77%	-6.93%	-24.54%	-4.34%	-24.12%	-4.08%
9	-16.17%	-1.56%	-25.14%	-1.80%	-25.82%	-1.70%	-24.16%	-0.06%
10	-12.35%	4.55%	-22.32%	3.77%	-25.69%	0.17%	-23.02%	1.49%
11	-19.38%	-8.02%	-29.05%	-8.66%	-31.63%	-7.99%	-31.19%	-10.61%
12	-24.78%	-0.067	-33.60%	-0.0642	-40.26%	-0.1263	-38.19%	-0.1018
Std deviation		4.98%		5.38%		5.96%		5.03%
Sharpe Ratio		-6.33		-7.49		-7.88		-8.92

Table 13

Exponential weighted portfolio (2022-2023)								
	Formation period (months)							
	3		6		9		12	
Holding period (months)	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns
1	3.17%	3.17%	2.23%	2.23%	4.25%	4.25%	0.88%	0.88%
2	6.85%	3.56%	4.95%	2.65%	5.78%	1.46%	2.98%	2.09%
3	12.00%	4.82%	10.52%	5.31%	9.42%	3.44%	5.26%	2.21%
4	3.30%	-7.76%	2.78%	-7.00%	-1.39%	-9.88%	-1.54%	-6.46%
5	-6.47%	-9.46%	-7.05%	-9.57%	-9.59%	-8.31%	-10.11%	-8.71%
6	-9.31%	-3.04%	-11.99%	-5.32%	-12.35%	-3.05%	-13.34%	-3.59%
7	-7.27%	2.26%	-16.99%	-5.68%	-19.92%	-8.64%	-21.02%	-8.86%
8	-12.92%	-6.09%	-23.21%	-7.49%	-24.43%	-5.64%	-26.46%	-6.89%
9	-13.80%	-1.01%	-23.69%	-0.62%	-25.64%	-1.60%	-26.18%	0.38%
10	-9.96%	4.46%	-21.60%	2.74%	-24.95%	0.93%	-26.06%	0.16%
11	-16.51%	-7.27%	-27.22%	-7.17%	-30.46%	-7.34%	-33.23%	-9.69%
12	-22.73%	-0.0745	-32.65%	-0.0746	-42.33%	-0.1706	-41.93%	-0.1303
Std deviation		5.47%		5.19%		6.34%		5.30%
Sharpe Ratio		-5.38		-7.59		-7.73		-9.17

Table 14

Equal weighted portfolio (2023-2024)								
	Formation period (months)							
	3		6		9		12	
Holding period (months)	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns
1	-0.07%	-0.07%	0.05%	0.05%	0.80%	0.80%	-1.28%	-1.28%
2	-0.73%	-0.66%	1.37%	1.32%	4.77%	3.94%	4.69%	6.04%
3	1.29%	2.03%	3.52%	2.12%	7.45%	2.55%	8.18%	3.33%
4	-2.43%	-3.68%	-7.41%	-10.56%	0.60%	-6.37%	-0.98%	-8.47%
5	-1.92%	0.53%	-5.88%	1.65%	4.12%	3.50%	-1.26%	-0.28%
6	-9.38%	-7.61%	-15.97%	-10.72%	-4.06%	-7.85%	-9.55%	-8.39%
7	-13.19%	-4.21%	-19.16%	-3.80%	-9.62%	-5.80%	-14.18%	-5.12%
8	-11.79%	1.61%	-16.11%	3.78%	-5.75%	4.28%	-9.58%	5.36%
9	-14.23%	-2.76%	-20.89%	-5.70%	-10.26%	-4.78%	-11.64%	-2.28%
10	-3.37%	12.66%	-12.49%	10.62%	-2.44%	8.71%	-4.49%	8.09%
11	3.82%	7.44%	-5.36%	8.15%	5.76%	8.41%	3.56%	8.43%
Std deviation		5.63%		6.89%		5.95%		6.21%
Sharpe Ratio		-1.19		-0.97		-1.13		-1.08



Table 15

Exponential weighted portfolio (2023-2024)								
	Formation period (months)							
	3		6		9		12	
Holding period (months)	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns	Cumulative Returns	Monthly Returns
1	-1.45%	-1.45%	1.74%	1.74%	1.87%	1.87%	0.49%	0.49%
2	-6.06%	-4.67%	4.45%	2.66%	6.71%	4.75%	7.01%	6.49%
3	-3.95%	2.24%	5.92%	1.41%	10.10%	3.18%	11.62%	4.31%
4	-8.85%	-5.10%	-5.93%	-11.19%	2.32%	-7.07%	0.88%	-9.63%
5	-8.40%	0.49%	-3.56%	2.52%	4.63%	2.25%	-0.94%	-1.80%
6	-14.72%	-6.89%	-14.50%	-11.34%	-2.58%	-6.89%	-7.30%	-6.43%
7	-19.00%	-5.03%	-18.06%	-4.17%	-7.17%	-4.71%	-11.39%	-4.41%
8	-17.22%	2.20%	-15.44%	3.20%	-3.45%	4.01%	-7.32%	4.60%
9	-18.55%	-1.61%	-18.82%	-3.99%	-7.51%	-4.20%	-8.86%	-1.66%
10	-7.76%	13.24%	-8.95%	12.16%	0.92%	9.11%	-2.11%	7.40%
11	0.03%	8.45%	-0.97%	8.76%	9.66%	8.66%	5.50%	7.77%
Std deviation		6.18%		7.35%		5.85%		5.93%
Sharpe Ratio		-1.08		-0.91		-1.15		-1.13