# Medium and Long Term Trading Strategy by Absolute Momentum

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# *Abstract*

Momentum is one of the strongest returns generating factors and with this research we try to analyse application of momentum in size/sector/style rotation in Indian Equity Markets. We also analyse effective time frame for use of momentum in allocation to enhance risk adjusted returns in both medium & long term trading models. We optimise factors such as look back period, holding time and number of assets in the portfolio to obtain maximum profits. We also analyse optimal portfolio allocation based on momentum by including non- equity asset class in models including fixed income and gold for higher risk adjusted returns as compared to only equity focused portfolio. We then evaluate our strategies numerically and visually using comparative returns, standard deviations, profit consistency, alphas, Sharpe ratios, box plots, and maximum drawdowns under different scenarios.

**Keywords:** Momentum investing, sector asset allocation, price momentum, asset allocation, momentum trading, style factors

1. **Introduction**

Momentum is one the counter intuitive factor yet the most popular factor driving equity market returns. Momentum is defined as power of past returns to influencing future returns. In its basic form it involves analysing the past returns of a security influencing future returns.

Absolute momentum is different from relative momentum and is positive only when there is excess return from an asset over a lookback period, regardless of relative performance with other assets. There may be a case where momentum to be relatively negative but absolutely positive.

Momentum investing has more hard data backing its persistence as a strategy for outperformance than any other school of investing thought, including value. Absolute momentum is equally strong and universal as relative momentum. It has shown to perform well during extreme market conditions and across asset classes

We analyse momentum in index constituents in portfolio selection to outperform index with higher risk adjusted returns. We analyse portfolio returns based on number of index constituents for medium and long term holding period variations with portfolio selection and weights driven momentum factor based on lookback period.

1. **Literature Review**

The idea of Momentum investing has existed in the mainstream since the ‘90s. It is built on the logic that stocks that have gone up will continue to go up and that the returns from such a portfolio must be better than the broader markets. This simple premise has been shown to work on US stocks (Jegadeesh and Titman (1993))[1], industries, currencies, government and corporate bonds (Asness, Moskowitz and Pedersen (2012))[2].

The effect of absolute momentum risk, returns, and corelation of diverse markets have been extensively studied and compared to buy and hold approach (Antonacci (2012))[3]. It was seen that Absolute momentum improved the Sharpe ratio with respect to relative momentum.

Determining trend using absolute momentum also benefits to track regime changes and mitigate and mitigate the downside risk. In addition, absolute momentum gave substantially lower maximum drawdown than relative momentum also lowering the cross module correlations.

In the Indian market context, Sehgal and Balakrishnan (2002) obtained significant evidence of long-term return-reversal tendency and short-term momentum effect in Indian equities. Ansari and Khan (2012)[2] found a strong presence of momentum profit in the Indian context and pointed out the significance of behavioural factors as sources of momentum profit.

It is well documented that momentum as a strategy works in developed markets like US and Europe. But does a strategy that buys winners purely based on price returns work in the Indian markets? Since there aren’t many concrete published studies, we plan to analyse this strategy in the Indian Markets. We will back test the momentum strategy using a basket of stocks/assets with an intention to find the optimal number of assets, holding period, look back period.

**3. Methodology**

For acquiring the data from National Stock Exchange(NSE), we have used an open source python library, NSEpy. This will be the basic building block for extraction of historical data for back testing. We can fetch the daily price history of stocks/indices/derivatives using NSEpy into a Pandas data frame, providing us with a dataset with minimum daily time period data, which can be modified to larger time periods. We plan to use NSEpy data and NSE website data for relevant indices and stocks from 2010 to present date.

Once the data frame is ready with a mix of stocks, indices, fixed income indices and exchange traded funds(ETFs), we find the absolute momentum of each of the assets using a certain lookback period, ,where absolute momentum would be return in the lookback period and perform back test and analyse returns of portfolio in relevant holding period.

Absolute momentum strategy compares a security’s returns against its own historical performance. In long only version, strategy buys positive returning securities, where historical return is calculated for lookback period.

Our strategy is to leverage absolute momentum to enhance this portfolio by optimising look back period, holding time and number of assets in the portfolio to obtain risk adjusted maximum returns.

We create 3 types of implementation of Momentum Strategy

1. Index Constituent Selection based Optimization
   1. Momentum strategy is applied to portfolio of n index constituents [ Basket Elements] for various lookback period [L] where only positive returning securities are considered in portfolio and are rebalanced after a particular holding period [HP] of portfolio.
   2. Lookback period , Holding Period varies according to Trading Strategy Period
   3. In the medium term strategy, we look at a holding period of 5 days to 1 month, whereas for a long term strategy we will consider a period of 1 month to 1 year.

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Strategy/Rebalance frequency** | **Lookback period(days)** | **Holding Period(days)** |
| **Medium term** | **Weekly** | 5,10,20,60,120 | 5 |
| **Biweekly** | 5,10,20,60,120 | 10 |
| **Monthly** | 10,20,60,120,240 | 20 |
| **Long term** | **Quarterly** | 20,60,120,240 | 60 |
| **Half-yearly** | 60,120,240 | 120 |
| **Yearly** | 120,240 | 240 |

* 1. Basket Elements are number of assets in that portfolio and strategy is implemented for [5,10,15,20,30] elements in basket and only top n performing assets in lookback period are selected in portfolio. We apply 5 bps cost for transaction cost on rebalance.
  2. We keep equal weight portfolio with maximum weight to a constituent being 1/Number of Basket Elements.
  3. We also optimize weights for best performing lookback period , holding period and number of elements

1. Market Cap Allocation Optimization [Equity Asset Class]
   1. Momentum Strategy is applied to Indices of Nifty 50 [ Large Cap Index], Nifty Midcap 100 [ Mid Cap Index] and Nifty Smallcap 100 [Small Cap Index]
   2. Strategy looks to selects only the best performing index with only positive returns based on lookback period variations and rebalances based on lookback periods. We apply 5 bps cost for transaction cost on rebalance.
   3. In the medium term strategy, we look at a holding period of 5 days to 1 month, whereas for a long term strategy we will consider a period of 1 month to 1 year.

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Strategy/Rebalance frequency** | **Lookback period(days)** | **Holding Period(days)** |
| **Medium term** | **Weekly** | 5,10,20,60,120 | 5 |
| **Biweekly** | 5,10,20,60,120 | 10 |
| **Monthly** | 10,20,60,120,240 | 20 |
| **Long term** | **Quarterly** | 20,60,120,240 | 60 |
| **Half-yearly** | 60,120,240 | 120 |
| **Yearly** | 120,240 | 240 |

1. Asset Class Allocation Optimization
   1. Momentum Strategy is applied to Indices of Nifty 50 [ Large Cap Index], Nifty Midcap 100 [ Mid Cap Index] and Nifty Smallcap 100 [Small Cap Index], Fixed Income and GoldBees
   2. Strategy looks to selects only the best performing index with only positive returns based on lookback period variations and rebalances based on lookback periods. We apply 5 bps cost for transaction cost on rebalance.
   3. In the medium term strategy, we look at a holding period of 5 days to 1 month, whereas for a long term strategy we will consider a period of 1 month to 1 year.

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Strategy/Rebalance frequency** | **Lookback period(days)** | **Holding Period(days)** |
| **Medium term** | **Weekly** | 5,10,20,60,120 | 5 |
| **Biweekly** | 5,10,20,60,120 | 10 |
| **Monthly** | 10,20,60,120,240 | 20 |
| **Long term** | **Quarterly** | 20,60,120,240 | 60 |
| **Half-yearly** | 60,120,240 | 120 |
| **Yearly** | 120,240 | 240 |

**4. Results**

1. Index Constituent Selection based Optimization
   1. Medium Term Nifty50 Analysis

**Table 1. Nifty 50 with 10 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualised return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 5 Days / 5 Days | 8.69 | 11.44 | -0.085 |
| 10 Days / 5 Days | 12.03 | 10.72 | 0.027 |
| 20 Days / 5 Days | 16.36 | 10.63 | 0.140 |
| 60 Days / 5 Days | 17.35 | 10.05 | 0.170 |
| 120 Days / 5 Days | 17.54 | 9.80 | 0.178 |
| 5 Days / 10 Days | 12.24 | 15.69 | 0.045 |
| 10 Days / 10 Days | 13.39 | 15.52 | 0.088 |
| 20 Days / 10 Days | 13.85 | 15.29 | 0.106 |
| 60 Days / 10 Days | 17.49 | 14.52 | 0.232 |
| 120 Days / 10 Days | 20.14 | 15.40 | 0.289 |
| 10 Days / 20 Days | 15.09 | 25.41 | 0.227 |
| 20 Days / 20 Days | 10.99 | 20.44 | -0.020 |
| 60 Days / 20 Days | 15.55 | 23.95 | 0.263 |
| 120 Days / 20 Days | 17.40 | 21.46 | 0.390 |
| 240 Days / 20 Days | 16.11 | 11.26 | 0.593 |
| Nifty 50 Index | 20.74 | 12.21 | 0.378 |

**Table 2. Nifty 50 with 20 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualised return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 5 Days / 5 Days | 9.68 | 8.71 | -0.067 |
| 10 Days / 5 Days | 11.94 | 8.47 | 0.027 |
| 20 Days / 5 Days | 14.39 | 8.32 | 0.115 |
| 60 Days / 5 Days | 17.40 | 8.30 | 0.204 |
| 120 Days / 5 Days | 15.31 | 7.66 | 0.155 |
| 5 Days / 10 Days | 12.69 | 10.90 | 0.081 |
| 10 Days / 10 Days | 15.61 | 10.89 | 0.224 |
| 20 Days / 10 Days | 16.10 | 11.49 | 0.234 |
| 60 Days / 10 Days | 17.35 | 10.81 | 0.299 |
| 120 Days / 10 Days | 17.52 | 10.63 | 0.311 |
| 10 Days / 20 Days | 14.72 | 17.17 | 0.295 |
| 20 Days / 20 Days | 13.40 | 17.86 | 0.184 |
| 60 Days / 20 Days | 14.43 | 17.34 | 0.270 |
| 120 Days / 20 Days | 15.72 | 14.86 | 0.422 |
| 240 Days / 20 Days | 15.48 | 10.27 | 0.574 |
| Nifty 50 Index | 20.74 | 12.21 | 0.378 |

**Table 3. Nifty 50 with 25 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualised return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 5 Days / 5 Days | 10.87 | 7.59 | -0.019 |
| 10 Days / 5 Days | 12.23 | 7.46 | 0.042 |
| 20 Days / 5 Days | 13.65 | 7.53 | 0.098 |
| 60 Days / 5 Days | 16.35 | 7.37 | 0.196 |
| 120 Days / 5 Days | 15.24 | 6.66 | 0.174 |
| 5 Days / 10 Days | 13.69 | 9.82 | 0.147 |
| 10 Days / 10 Days | 15.32 | 9.69 | 0.236 |
| 20 Days / 10 Days | 15.34 | 9.96 | 0.231 |
| 60 Days / 10 Days | 16.21 | 9.41 | 0.288 |
| 120 Days / 10 Days | 17.15 | 8.52 | 0.366 |
| 10 Days / 20 Days | 14.01 | 15.45 | 0.264 |
| 20 Days / 20 Days | 12.72 | 14.35 | 0.154 |
| 60 Days / 20 Days | 14.06 | 15.94 | 0.260 |
| 120 Days / 20 Days | 14.84 | 12.56 | 0.407 |
| 240 Days / 20 Days | 14.31 | 8.35 | 0.523 |
| Nifty 50 Index | 20.74 | 12.21 | 0.378 |

**Table 4. Nifty 50 with 30 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualised return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 5 Days / 5 Days | 11.26 | 6.56 | -0.003 |
| 10 Days / 5 Days | 12.64 | 6.78 | 0.064 |
| 20 Days / 5 Days | 13.60 | 6.54 | 0.110 |
| 60 Days / 5 Days | 15.85 | 6.59 | 0.200 |
| 120 Days / 5 Days | 14.24 | 5.75 | 0.155 |
| 5 Days / 10 Days | 13.82 | 9.44 | 0.159 |
| 10 Days / 10 Days | 15.20 | 8.94 | 0.248 |
| 20 Days / 10 Days | 14.96 | 8.80 | 0.238 |
| 60 Days / 10 Days | 16.18 | 7.92 | 0.338 |
| 120 Days / 10 Days | 15.77 | 6.97 | 0.355 |
| 10 Days / 20 Days | 13.30 | 13.21 | 0.231 |
| 20 Days / 20 Days | 12.56 | 13.04 | 0.150 |
| 60 Days / 20 Days | 13.73 | 15.40 | 0.239 |
| 120 Days / 20 Days | 14.33 | 11.25 | 0.394 |
| 240 Days / 20 Days | 13.85 | 7.21 | 0.517 |
| Nifty 50 Index | 20.74 | 12.21 | 0.378 |

Nifty 50 Performance Images -> [Link Here](https://drive.google.com/file/d/1744NTPXnUg10gsTjRkcEOqVfnaorJsB8/view?usp=sharing)

For Nifty 50 Index constituents we observe that Momentum strategy underperforms index returns and is not able to outperform in any combinations. We also find that best combinations with maximum Sharpe Ratio is for 240 days Lookback Period with 20 days Holding Period and 10 Number of Constituents. We observe that concentrated portfolio in Nifty Large Cap Index (Nifty 50) gives better risk adjusted returns.

* 1. Medium Term Nifty Midcap 100 Analysis

**Table 1. Midcap 100 with 10 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualised return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 5 Days / 5 Days | 14.78 | 16.51 | 0.073 |
| 10 Days / 5 Days | 20.36 | 15.43 | 0.157 |
| 20 Days / 5 Days | 16.85 | 15.32 | 0.110 |
| 60 Days / 5 Days | 22.94 | 15.86 | 0.183 |
| 120 Days / 5 Days | 37.49 | 12.97 | 0.368 |
| 5 Days / 10 Days | 18.26 | 24.84 | 0.160 |
| 10 Days / 10 Days | 16.71 | 21.31 | 0.149 |
| 20 Days / 10 Days | 21.54 | 22.27 | 0.230 |
| 60 Days / 10 Days | 30.84 | 22.87 | 0.344 |
| 120 Days / 10 Days | 36.24 | 20.18 | 0.447 |
| 10 Days / 20 Days | 13.56 | 33.12 | 0.122 |
| 20 Days / 20 Days | 17.08 | 35.26 | 0.242 |
| 60 Days / 20 Days | 30.28 | 31.13 | 0.623 |
| 120 Days / 20 Days | 23.46 | 28.72 | 0.500 |
| 240 Days / 20 Days | 20.86 | 20.56 | 0.576 |
| Midcap 100 Index | 26.67 | 17.47 | 0.379 |

**Table 2. Midcap 100 with 20 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualised return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 5 Days / 5 Days | 13.59 | 12.74 | 0.062 |
| 10 Days / 5 Days | 17.95 | 12.67 | 0.149 |
| 20 Days / 5 Days | 19.07 | 11.65 | 0.180 |
| 60 Days / 5 Days | 23.41 | 12.08 | 0.241 |
| 120 Days / 5 Days | 25.02 | 11.14 | 0.283 |
| 5 Days / 10 Days | 15.23 | 18.42 | 0.131 |
| 10 Days / 10 Days | 21.51 | 16.89 | 0.295 |
| 20 Days / 10 Days | 21.25 | 17.93 | 0.274 |
| 60 Days / 10 Days | 24.64 | 17.05 | 0.353 |
| 120 Days / 10 Days | 27.13 | 18.23 | 0.371 |
| 10 Days / 20 Days | 19.29 | 24.60 | 0.424 |
| 20 Days / 20 Days | 16.89 | 25.69 | 0.309 |
| 60 Days / 20 Days | 24.67 | 23.09 | 0.656 |
| 120 Days / 20 Days | 23.43 | 25.24 | 0.563 |
| 240 Days / 20 Days | 18.55 | 21.28 | 0.451 |
| Midcap 100 Index | 26.67 | 17.47 | 0.379 |

**Table 3. Midcap 100 with 25 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualised return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 5 Days / 5 Days | 14.23 | 11.38 | 0.084 |
| 10 Days / 5 Days | 17.53 | 11.78 | 0.151 |
| 20 Days / 5 Days | 19.52 | 11.01 | 0.198 |
| 60 Days / 5 Days | 21.69 | 11.04 | 0.235 |
| 120 Days / 5 Days | 22.75 | 9.92 | 0.279 |
| 5 Days / 10 Days | 17.91 | 16.30 | 0.220 |
| 10 Days / 10 Days | 19.23 | 16.34 | 0.252 |
| 20 Days / 10 Days | 21.61 | 16.78 | 0.299 |
| 60 Days / 10 Days | 23.74 | 15.88 | 0.359 |
| 120 Days / 10 Days | 25.72 | 16.00 | 0.394 |
| 10 Days / 20 Days | 18.63 | 24.41 | 0.400 |
| 20 Days / 20 Days | 17.41 | 23.29 | 0.362 |
| 60 Days / 20 Days | 23.16 | 21.09 | 0.658 |
| 120 Days / 20 Days | 23.41 | 21.42 | 0.657 |
| 240 Days / 20 Days | 17.61 | 18.80 | 0.453 |
| Midcap 100 Index | 26.67 | 17.47 | 0.379 |

**Table 4. Midcap 100 with 30 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualised return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 5 Days / 5 Days | 13.82 | 10.76 | 0.077 |
| 10 Days / 5 Days | 17.90 | 10.93 | 0.169 |
| 20 Days / 5 Days | 20.37 | 10.62 | 0.221 |
| 60 Days / 5 Days | 21.43 | 10.44 | 0.243 |
| 120 Days / 5 Days | 22.22 | 9.23 | 0.289 |
| 5 Days / 10 Days | 18.61 | 15.26 | 0.252 |
| 10 Days / 10 Days | 21.03 | 15.70 | 0.304 |
| 20 Days / 10 Days | 23.02 | 15.41 | 0.354 |
| 60 Days / 10 Days | 21.92 | 15.60 | 0.326 |
| 120 Days / 10 Days | 24.28 | 15.28 | 0.383 |
| 10 Days / 20 Days | 19.05 | 22.24 | 0.455 |
| 20 Days / 20 Days | 18.11 | 23.42 | 0.393 |
| 60 Days / 20 Days | 20.67 | 21.08 | 0.554 |
| 120 Days / 20 Days | 20.53 | 20.66 | 0.558 |
| 240 Days / 20 Days | 17.60 | 19.10 | 0.446 |
| Midcap 100 Index | 26.67 | 17.47 | 0.379 |

Midcap 100 Performance Images -> [Link Here](https://drive.google.com/file/d/1aZCYUVIHRRHfo7iHLaPz3SwAdHhswb0P/view?usp=sharing)

For Midcap 100 Index constituents we observe that Momentum strategy can outperform index returns in certain combinations. We also find that best combinations with maximum Returns is for 120 days Lookback Period with 10 days Holding Period and 10 Number of Constituents. We observe that concentrated portfolio in Nifty Midcap Cap Index (Nifty 50) gives better risk adjusted returns and with diversification by increasing index constituents decreases absolute returns.

* 1. Medium Term Nifty Smallcap 100 Analysis

**Table 1. Smallcap 100 with 10 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualised return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 5 Days / 5 Days | 36.40 | 19.52 | 0.246 |
| 10 Days / 5 Days | 45.07 | 19.73 | 0.286 |
| 20 Days / 5 Days | 68.19 | 17.79 | 0.406 |
| 60 Days / 5 Days | 51.31 | 19.86 | 0.310 |
| 120 Days / 5 Days | 44.18 | 17.22 | 0.320 |
| 5 Days / 10 Days | 63.51 | 29.24 | 0.465 |
| 10 Days / 10 Days | 39.64 | 27.85 | 0.357 |
| 20 Days / 10 Days | 74.47 | 27.38 | 0.538 |
| 60 Days / 10 Days | 72.89 | 26.00 | 0.559 |
| 120 Days / 10 Days | 81.02 | 22.87 | 0.666 |
| 10 Days / 20 Days | 36.52 | 38.53 | 0.607 |
| 20 Days / 20 Days | 39.91 | 36.00 | 0.694 |
| 60 Days / 20 Days | 42.86 | 41.00 | 0.650 |
| 120 Days / 20 Days | 25.84 | 28.86 | 0.562 |
| 240 Days / 20 Days | 53.30 | 42.34 | 0.732 |
| Midcap 100 Index | 21.80 | 10.52 | 0.248 |

**Table 2. Smallcap 100 with 20 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualised return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 5 Days / 5 Days | 25.22 | 15.13 | 0.215 |
| 10 Days / 5 Days | 26.33 | 15.77 | 0.218 |
| 20 Days / 5 Days | 36.29 | 14.60 | 0.320 |
| 60 Days / 5 Days | 44.61 | 15.22 | 0.361 |
| 120 Days / 5 Days | 34.50 | 14.01 | 0.319 |
| 5 Days / 10 Days | 38.58 | 22.15 | 0.431 |
| 10 Days / 10 Days | 30.98 | 21.54 | 0.365 |
| 20 Days / 10 Days | 42.13 | 23.22 | 0.441 |
| 60 Days / 10 Days | 55.65 | 22.22 | 0.555 |
| 120 Days / 10 Days | 46.15 | 19.77 | 0.548 |
| 10 Days / 20 Days | 25.62 | 31.67 | 0.511 |
| 20 Days / 20 Days | 27.43 | 30.85 | 0.566 |
| 60 Days / 20 Days | 40.92 | 33.17 | 0.765 |
| 120 Days / 20 Days | 31.60 | 29.23 | 0.690 |
| 240 Days / 20 Days | 22.60 | 24.96 | 0.541 |
| Midcap 100 Index | 21.80 | 10.52 | 0.248 |

**Table 3. Smallcap 100 with 25 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualised return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 5 Days / 5 Days | 26.62 | 13.94 | 0.247 |
| 10 Days / 5 Days | 27.57 | 14.89 | 0.242 |
| 20 Days / 5 Days | 34.30 | 13.57 | 0.327 |
| 60 Days / 5 Days | 37.72 | 13.53 | 0.355 |
| 120 Days / 5 Days | 33.26 | 13.23 | 0.325 |
| 5 Days / 10 Days | 37.34 | 20.74 | 0.446 |
| 10 Days / 10 Days | 34.00 | 20.89 | 0.409 |
| 20 Days / 10 Days | 37.97 | 21.33 | 0.441 |
| 60 Days / 10 Days | 41.72 | 19.83 | 0.508 |
| 120 Days / 10 Days | 41.79 | 18.70 | 0.538 |
| 10 Days / 20 Days | 26.18 | 31.81 | 0.522 |
| 20 Days / 20 Days | 27.48 | 31.22 | 0.562 |
| 60 Days / 20 Days | 34.11 | 29.61 | 0.732 |
| 120 Days / 20 Days | 28.95 | 29.60 | 0.624 |
| 240 Days / 20 Days | 25.24 | 26.31 | 0.596 |
| Midcap 100 Index | 21.80 | 10.52 | 0.248 |

**Table 4. Smallcap 100 with 30 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualised return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 5 Days / 5 Days | 24.50 | 12.97 | 0.239 |
| 10 Days / 5 Days | 26.90 | 13.88 | 0.251 |
| 20 Days / 5 Days | 30.08 | 12.75 | 0.306 |
| 60 Days / 5 Days | 32.17 | 12.28 | 0.339 |
| 120 Days / 5 Days | 28.00 | 11.98 | 0.301 |
| 5 Days / 10 Days | 33.99 | 19.71 | 0.432 |
| 10 Days / 10 Days | 32.28 | 19.92 | 0.408 |
| 20 Days / 10 Days | 34.34 | 20.06 | 0.429 |
| 60 Days / 10 Days | 38.86 | 19.48 | 0.489 |
| 120 Days / 10 Days | 36.99 | 17.60 | 0.517 |
| 10 Days / 20 Days | 24.64 | 29.94 | 0.513 |
| 20 Days / 20 Days | 25.97 | 28.25 | 0.577 |
| 60 Days / 20 Days | 34.79 | 30.12 | 0.733 |
| 120 Days / 20 Days | 26.72 | 25.41 | 0.660 |
| 240 Days / 20 Days | 22.26 | 23.99 | 0.550 |
| Midcap 100 Index | 21.80 | 10.52 | 0.248 |

Smallcap 100 Performance Images -> [Link Here](https://drive.google.com/file/d/1uJ6EqMzTBriXe0yaZ1SbezyuX6fyCR5y/view?usp=sharing)

For Smallcap 100 Index constituents we observe that Momentum strategy can outperform index returns in various combinations. We also find that best combinations with maximum Returns is for 120 days Lookback Period with 10 days Holding Period and 10 Number of Constituents. We observe that concentrated portfolio in Nifty Small Cap Index (Nifty 50) gives better risk adjusted returns and with diversification by increasing index constituents decreases absolute returns.

* 1. Long term Nifty 50

**Table 1. Nifty 50 with 10 elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk (%)** | **Sharpe Ratio** |
| 20 Days / 60 Days | 6.63 | 15.80 | -0.104 |
| 60 Days / 60 Days | 12.73 | 11.01 | 0.071 |
| 120 Days / 60 Days | 13.49 | 12.45 | 0.092 |
| 240 Days / 60 Days | 12.01 | 10.75 | 0.049 |
| 60 Days / 120 Days | 11.40 | 14.17 | 0.050 |
| 120 Days / 120 Days | 15.53 | 13.92 | 0.336 |
| 240 Days / 120 Days | 13.73 | 14.14 | 0.217 |
| 120 Days / 240 Days | 16.45 | 15.60 | 0.544 |
| 240 Days / 240 Days | 14.50 | 7.40 | 0.694 |
| Nifty 50 Index | 20.74 | 12.21 | 0.378 |

**Table 1. Nifty 50 with 20 Elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 20 Days / 60 Days | 8.64 | 14.60 | -0.040 |
| 60 Days / 60 Days | 10.94 | 9.90 | 0.008 |
| 120 Days / 60 Days | 10.07 | 9.79 | -0.029 |
| 240 Days / 60 Days | 13.01 | 8.72 | 0.088 |
| 60 Days / 120 Days | 9.47 | 13.35 | -0.129 |
| 120 Days / 120 Days | 10.68 | 11.43 | -0.032 |
| 240 Days / 120 Days | 12.81 | 10.20 | 0.182 |
| 120 Days / 240 Days | 12.50 | 12.05 | 0.200 |
| 240 Days / 240 Days | 15.93 | 10.70 | 0.685 |
| Nifty 50 Index | 20.74 | 12.21 | 0.378 |

**Table 1. Nifty 50 with 25 Elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 20 Days / 60 Days | 8.86 | 11.99 | -0.057 |
| 60 Days / 60 Days | 9.77 | 9.94 | -0.041 |
| 120 Days / 60 Days | 9.42 | 9.05 | -0.067 |
| 240 Days / 60 Days | 12.24 | 8.67 | 0.059 |
| 60 Days / 120 Days | 8.63 | 12.81 | -0.229 |
| 120 Days / 120 Days | 10.44 | 9.62 | -0.083 |
| 240 Days / 120 Days | 12.44 | 9.58 | 0.149 |
| 120 Days / 240 Days | 13.10 | 8.67 | 0.358 |
| 240 Days / 240 Days | 15.09 | 8.72 | 0.695 |
| Nifty 50 Index | 20.74 | 12.21 | 0.378 |

**Table 1. Nifty 50 with 30 Elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 20 Days / 60 Days | 8.70 | 11.19 | -0.072 |
| 60 Days / 60 Days | 9.78 | 8.00 | -0.062 |
| 120 Days / 60 Days | 9.05 | 9.20 | -0.083 |
| 240 Days / 60 Days | 11.52 | 8.25 | 0.028 |
| 60 Days / 120 Days | 8.56 | 13.07 | -0.229 |
| 120 Days / 120 Days | 11.14 | 7.32 | -0.016 |
| 240 Days / 120 Days | 12.84 | 9.04 | 0.199 |
| 120 Days / 240 Days | 12.79 | 7.43 | 0.340 |
| 240 Days / 240 Days | 15.00 | 9.81 | 0.611 |
| Nifty 50 Index | 20.74 | 12.21 | 0.378 |

Nifty 50 Performance Images -> [Link Here](https://drive.google.com/file/d/1DmZ_o8km6h2ivuMkF9UwNmZRn0atFlse/view?usp=sharing)

For Nifty 50 Index constituents we observe that Momentum strategy underperforms index returns and is not able to outperform in any combinations. We also find that best combinations with maximum Annual returns is for 120 days Lookback Period with 240 days Holding Period and 10 Number of Constituents. We observe that concentrated portfolio in Nifty Large Cap Index (Nifty 50) gives better risk adjusted returns.

* 1. Long term Nifty Midcap 100

**Table 1. Nifty Midcap 100 with 10 Elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 20 Days / 60 Days | 10.32 | 18.07 | 0.022 |
| 60 Days / 60 Days | 17.90 | 14.64 | 0.170 |
| 120 Days / 60 Days | 20.63 | 14.33 | 0.217 |
| 240 Days / 60 Days | 20.25 | 13.69 | 0.217 |
| 60 Days / 120 Days | 15.81 | 19.73 | 0.278 |
| 120 Days / 120 Days | 22.80 | 19.19 | 0.534 |
| 240 Days / 120 Days | 22.73 | 22.76 | 0.468 |
| 120 Days / 240 Days | 20.97 | 22.79 | 0.652 |
| 240 Days / 240 Days | 19.21 | 25.76 | 0.514 |
| Midcap 100 Index | 26.67 | 17.47 | 0.379 |

**Table 1. Nifty Midcap 100 with 20 Elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 20 Days / 60 Days | 10.11 | 17.51 | 0.017 |
| 60 Days / 60 Days | 12.97 | 12.37 | 0.077 |
| 120 Days / 60 Days | 19.94 | 14.63 | 0.202 |
| 240 Days / 60 Days | 20.60 | 12.59 | 0.236 |
| 60 Days / 120 Days | 11.97 | 11.27 | 0.091 |
| 120 Days / 120 Days | 19.91 | 20.15 | 0.422 |
| 240 Days / 120 Days | 20.05 | 22.28 | 0.397 |
| 120 Days / 240 Days | 17.15 | 17.62 | 0.546 |
| 240 Days / 240 Days | 17.12 | 26.31 | 0.413 |
| Midcap 100 Index | 26.67 | 17.47 | 0.379 |

**Table 1. Nifty Midcap 100 with 25 Elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 20 Days / 60 Days | 11.20 | 16.29 | 0.037 |
| 60 Days / 60 Days | 13.45 | 12.42 | 0.090 |
| 120 Days / 60 Days | 16.97 | 14.07 | 0.159 |
| 240 Days / 60 Days | 20.39 | 12.58 | 0.232 |
| 60 Days / 120 Days | 12.12 | 9.51 | 0.114 |
| 120 Days / 120 Days | 17.66 | 18.07 | 0.370 |
| 240 Days / 120 Days | 19.18 | 22.20 | 0.371 |
| 120 Days / 240 Days | 18.70 | 20.62 | 0.578 |
| 240 Days / 240 Days | 16.15 | 25.37 | 0.371 |
| Midcap 100 Index | 26.67 | 17.47 | 0.379 |

**Table 1. Nifty Midcap 100 with 30 Elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 20 Days / 60 Days | 11.59 | 15.67 | 0.045 |
| 60 Days / 60 Days | 11.89 | 12.43 | 0.048 |
| 120 Days / 60 Days | 13.72 | 12.89 | 0.095 |
| 240 Days / 60 Days | 17.93 | 12.23 | 0.192 |
| 60 Days / 120 Days | 11.32 | 9.84 | 0.022 |
| 120 Days / 120 Days | 15.20 | 14.55 | 0.301 |
| 240 Days / 120 Days | 16.83 | 19.03 | 0.323 |
| 120 Days / 240 Days | 18.25 | 17.65 | 0.625 |
| 240 Days / 240 Days | 15.08 | 20.95 | 0.351 |
| Midcap 100 Index | 26.67 | 17.47 | 0.379 |

Midcap 100 Performance Images -> [Link Here](https://drive.google.com/file/d/1bGJnl6bAMgl_PTr4O1p6PvanXK3aytE9/view?usp=sharing)

For Midcap 100 Index constituents we observe that Momentum strategy can outperform index returns in certain combinations. We also find that best combinations with maximum Returns is for 120 days Lookback Period with 120 days Holding Period and 10 Number of Constituents. We observe that concentrated portfolio in Nifty Midcap Cap Index (Nifty 50) gives better risk adjusted returns and with diversification by increasing index constituents decreases absolute returns.

* 1. Long term Nifty Smallcap 100

**Table 1. Nifty Smallcap 100 with 10 Elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 20 Days / 60 Days | 19.06 | 22.41 | 0.151 |
| 60 Days / 60 Days | 28.06 | 26.94 | 0.204 |
| 120 Days / 60 Days | 32.10 | 24.45 | 0.237 |
| 240 Days / 60 Days | 31.16 | 24.70 | 0.229 |
| 60 Days / 120 Days | 29.94 | 20.78 | 0.683 |
| 120 Days / 120 Days | 25.40 | 35.82 | 0.392 |
| 240 Days / 120 Days | 25.32 | 33.63 | 0.408 |
| 120 Days / 240 Days | 32.04 | 41.20 | 0.678 |
| 240 Days / 240 Days | 22.32 | 48.88 | 0.438 |
| SmallCap 100 Index | 21.80 | 10.52 | 0.248 |

**Table 1. Nifty Smallcap 100 with 20 Elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 20 Days / 60 Days | 17.07 | 20.36 | 0.135 |
| 60 Days / 60 Days | 31.95 | 19.83 | 0.273 |
| 120 Days / 60 Days | 29.64 | 21.43 | 0.241 |
| 240 Days / 60 Days | 23.28 | 20.66 | 0.198 |
| 60 Days / 120 Days | 20.58 | 19.46 | 0.460 |
| 120 Days / 120 Days | 30.25 | 34.11 | 0.470 |
| 240 Days / 120 Days | 23.09 | 31.71 | 0.382 |
| 120 Days / 240 Days | 28.51 | 35.59 | 0.674 |
| 240 Days / 240 Days | 22.44 | 37.40 | 0.501 |
| SmallCap 100 Index | 21.80 | 10.52 | 0.248 |

**Table 1. Nifty Smallcap 100 with 25 Elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 20 Days / 60 Days | 17.16 | 18.62 | 0.141 |
| 60 Days / 60 Days | 23.52 | 17.08 | 0.226 |
| 120 Days / 60 Days | 28.44 | 21.01 | 0.237 |
| 240 Days / 60 Days | 25.80 | 19.36 | 0.229 |
| 60 Days / 120 Days | 16.39 | 19.95 | 0.299 |
| 120 Days / 120 Days | 28.49 | 35.37 | 0.436 |
| 240 Days / 120 Days | 25.51 | 35.58 | 0.395 |
| 120 Days / 240 Days | 27.19 | 35.05 | 0.649 |
| 240 Days / 240 Days | 22.39 | 37.62 | 0.498 |
| SmallCap 100 Index | 21.80 | 10.52 | 0.248 |

**Table 1. Nifty Smallcap 100 with 30 Elements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 20 Days / 60 Days | 16.63 | 18.39 | 0.135 |
| 60 Days / 60 Days | 24.42 | 16.83 | 0.239 |
| 120 Days / 60 Days | 25.12 | 18.96 | 0.226 |
| 240 Days / 60 Days | 21.46 | 17.12 | 0.202 |
| 60 Days / 120 Days | 20.15 | 22.64 | 0.397 |
| 120 Days / 120 Days | 25.03 | 32.09 | 0.409 |
| 240 Days / 120 Days | 20.60 | 31.33 | 0.336 |
| 120 Days / 240 Days | 25.82 | 36.74 | 0.596 |
| 240 Days / 240 Days | 22.05 | 36.58 | 0.497 |
| SmallCap 100 Index | 21.80 | 10.52 | 0.248 |

SmallCap 100 Performance Images -> [Link Here](https://drive.google.com/file/d/1a99wJSviwx-fOc9V2MsUarb9AhJcm6XX/view?usp=sharing)

For Smallcap 100 Index constituents we observe that Momentum strategy can outperform index returns in various combinations. We also find that best combinations with maximum Returns is for 120 days Lookback Period with 10 days Holding Period and 10 Number of Constituents. We observe that concentrated portfolio in Nifty Small Cap Index (Nifty 50) gives better risk adjusted returns and with diversification by increasing index constituents decreases absolute returns.

1. Market Cap Allocation Optimization [Equity Asset Class]

**Table 1. Marketcap Allocation**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 120 Days/240 Days | 15.51 | 17.77 | 0.425 |
| 240 Days/240 Days | 13.77 | 17.76 | 0.282 |
| 120 Days/120 Days | 12.73 | 14.13 | 0.149 |
| 240 Days/120 Days | 11.61 | 14.31 | 0.064 |
| 60 Days/120 Days | 12.44 | 11.54 | 0.135 |
| 120 Days/60 Days | 11.75 | 10.50 | 0.041 |
| 20 Days/60 Days | 9.90 | 12.74 | -0.014 |
| 240 Days/60 Days | 12.48 | 10.66 | 0.065 |
| 60 Days/60 Days | 13.07 | 11.98 | 0.081 |
| 10 Days/20 Days | 25.97 | 11.98 | 0.394 |
| 120 Days/20 Days | 19.22 | 10.23 | 0.294 |
| 20 Days/20 Days | 21.54 | 12.58 | 0.295 |
| 240 Days/20 Days | 18.89 | 9.96 | 0.291 |
| 60 Days/20 Days | 26.34 | 10.74 | 0.443 |
| 10 Days/10 Days | 20.63 | 10.42 | 0.239 |
| 120 Days/10 Days | 16.85 | 9.43 | 0.176 |
| 20 Days/10 Days | 20.40 | 11.41 | 0.216 |
| 5 Days/10 Days | 17.36 | 10.67 | 0.169 |
| 60 Days/10 Days | 22.73 | 9.77 | 0.294 |
| 10 Days/5 Days | 18.23 | 13.55 | 0.093 |
| 120 Days/5 Days | 12.00 | 13.54 | 0.019 |
| 20 Days/5 Days | 16.56 | 14.15 | 0.074 |
| 5 Days/5 Days | 16.18 | 12.86 | 0.075 |
| 60 Days/5 Days | 15.03 | 14.30 | 0.057 |
| SmallCap 100 Index | 21.80 | 10.52 | 0.248 |
| Midcap 100 Index | 26.67 | 17.47 | 0.379 |
| Nifty 50 Index | 20.74 | 12.21 | 0.378 |

Market Cap Allocation Performance Images -> [Link Here](https://drive.google.com/file/d/14ubYtKuPeTAYGIPqzmShGkjECLRxULE4/view?usp=sharing)

For Equity Market cap Allocation optimization Momentum strategy underperforms index returns and is not able to outperform in any combinations. We also find that best combinations with maximum returns is for 60 days Lookback Period with 20 days Holding Period.

1. Asset Class Allocation Optimization

**Table 1. Asset Class Allocation**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lookback / Holding Period** | **Annualized return (%)** | **Ann Risk** | **Sharpe Ratio** |
| 120 Days/240 Days | 18.30 | 22.58 | 0.638 |
| 240 Days/240 Days | 15.32 | 22.03 | 0.426 |
| 120 Days/120 Days | 17.68 | 12.69 | 0.538 |
| 240 Days/120 Days | 16.68 | 11.90 | 0.496 |
| 60 Days/120 Days | 15.95 | 8.36 | 0.603 |
| 120 Days/60 Days | 11.24 | 11.43 | 0.025 |
| 20 Days/60 Days | 11.06 | 13.38 | 0.026 |
| 240 Days/60 Days | 12.06 | 10.58 | 0.051 |
| 60 Days/60 Days | 13.69 | 12.62 | 0.096 |
| 10 Days/20 Days | 22.67 | 14.99 | 0.248 |
| 120 Days/20 Days | 11.55 | 21.90 | 0.034 |
| 20 Days/20 Days | 15.08 | 15.80 | 0.109 |
| 240 Days/20 Days | 16.22 | 17.10 | 0.125 |
| 60 Days/20 Days | 11.72 | 19.11 | 0.036 |
| 10 Days/10 Days | 17.48 | 10.21 | 0.193 |
| 120 Days/10 Days | 12.72 | 10.48 | 0.055 |
| 20 Days/10 Days | 16.63 | 11.14 | 0.159 |
| 5 Days/10 Days | 15.31 | 10.02 | 0.138 |
| 60 Days/10 Days | 18.36 | 10.97 | 0.200 |
| 10 Days/5 Days | 18.20 | 11.80 | 0.120 |
| 120 Days/5 Days | 14.66 | 11.63 | 0.069 |
| 20 Days/5 Days | 15.05 | 12.63 | 0.071 |
| 5 Days/5 Days | 10.42 | 11.84 | -0.013 |
| 60 Days/5 Days | 16.33 | 12.16 | 0.092 |
| SmallCap 100 Index | 21.80 | 10.52 | 0.248 |
| Midcap 100 Index | 26.67 | 17.47 | 0.379 |
| Nifty 50 Index | 20.74 | 12.21 | 0.378 |

Asset Class Allocation Performance Images -> [Link Here](https://drive.google.com/file/d/1gyayXf_Ad4mxdmv6f9kdBLSq7uLZg6hl/view?usp=sharing)

For Asset Class Allocation Optimization we observe that Momentum strategy underperforms index returns and is not able to outperform in any combinations. We also find that best combinations with maximum Sharpe Ratio is for 10 days Lookback Period with 20 days Holding Period.

1. **Results**

We analyse the momentum factor on the daily data based momentum strategies on the themes of index constituent optimization and relative asset calls momentum on the liquid equity indices for the Indian markets.

As for the momentum factor based on daily data for index constituents are concerned we conclude that higher concentration (lower number index constituents) increases returns of basket. We also observe that for large cap index momentum factor is not able to outperform by index constituent selection. Momentum factor works for midcap and smallcap indices constituents where they are able to outperform respective index and are able to generate better risk adjusted returns and higher sharpe ratios. This indicates that size factor enhances momentum factors performance..

We analysed market cap optimization and asset class allocation for momentum factor and Momentum strategy underperformed individual indices in terms of performance. This indicates that market cap optimization needs to be enhanced with inclusion of only midcap and small indices with other asset class.

1. **Further work**

There are established equity momentum strategies research across international markets, the implementation of our strategies on the Indian markets would help to provide insight to Indian market factor research.   
We find that momentum outperforms with small cap and mid cap index constituents, we can further research on baskets based on growth, value and quality factors to analyse performance for momentum and these factors.

We have used very basic implementation of momentum factor which is absolute return in lookback period, we can implement momentum factor with additional factor including other momentum indicators eg moving averages, relative strength etc. Efficacy of these individual factors can be analysed further

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