Technical report outline:

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MEMS

Introduction:

Brief description of strategy:

This strategy is based on the principle of mean reversion , which assumes that prices tend to revert to their avg value over time. It uses a combination of Bollinger bands and the relative strength index (RSI) to identify potential buying opportunities when stock is oversold.

Buy signal :

When the price drops significantly below the 20 day simple moving average indicated by a z score <2

The RSI falls below 30 significantly signaling the stock is in the oversold territory

Exit signal:

The position is exited when :

The price crosses above the 20 day SMA

Or the Z score becomes positive indicating the price has reverted to or exceeded its

Mean

Bollinger bands: this helps to define upper and lower bounds of volatility . it is used to identify reversal zones in high volatility

RSI (relative strength index): it is a momentum indicator . it filters out entries in trending conditions

SMA/EMA: defines dynamic mean. Basis for z score and Bollinger logic

Market regime filter: helps avoid trading against dominant trends

Strategy logic :

- o Z-score <-1 (price below statistical bound)
- o RSI <30 (oversold)
- o Price<lower Bollinger band
- o Volatility above historical threshold

Performance metrics:

```
                          0
Cumulative Return -0.288050
Annualized Return -0.046761
Sharpe Ratio      -0.220675
Sortino Ratio     -0.259408
Max Drawdown      -0.418654
Win Rate           0.370550
Profit Factor      1.034367
Avg Profit         0.010658
Avg Loss          -0.010303
Max Profit         0.098451
Max Loss          -0.094104
```

1. **Equity Curve (Cumulative Returns) Analysis :**

From the chart titled *"Mean Reversion Strategy vs Market: TCS"*, we observe two lines:

- **Blue Line: Market Return (TCS Buy-and-Hold)**

  - o Steadily increasing from 2020 to 2025.

  - o Significant upward trend post-2022.

  - o Ends at a cumulative return of approximately **2.2x**, indicating **120% growth** over the period.

- **Orange Line: Strategy Return (Mean Reversion)**

o Relatively flat and trending **downward** after mid-2021.

o Peaks slightly around 2020-2021 but then degrades.

o Ends at a cumulative return of approximately **0.75x**, i.e., a **25% loss** overall.

Key points:

- The **mean reversion strategy significantly underperforms** the market over the 5-year period.

- TCS shows a **strong trending behaviour** – mean reversion strategies are generally **not suitable** for such stocks.

- The market trend Favors **momentum/trend-following** strategies, not mean reversion.

Drawdown Implications:

Although not explicitly shown, the strategy clearly suffers **prolonged drawdowns**, especially post-2021. The market, on the other hand, recovers from corrections and continues upward.

References and resources used:

- **Investopedia, Quantocracy, Medium Blogs, Zerodha Varsity(content videos)**

- **NSE/BSE historical data via:**

  o **Yahoo Finance**

Code/Data Tools:

- **Python: pandas, numpy, matplotlib**

- **Data Sources: Yahoo Finance API**

- **Jupyter Notebook**

- **sklearn.linear_model.LinearRegression Used for CAPM analysis (Alpha, Beta).**