Finance Club
Open Project Summer 2024

BACK TESTING REPORT

Title: Pairs Trading Algorithm for Financial Markets (#FC24OPS2)

Strategy Description :

This strategy involves selecting two correlated stocks from the IT sector on the NSE (National Stock Exchange). The strategy uses statistical methods such as cointegration to determine the relationship between the selected pairs. By using the methods we can see TECHM(Tech Mahindra) & PERSISTENT(Persistent Systems Ltd) are correlated stocks to be used in the stratergy.

Calculating the spread = Y-b*X
where b is the linear regression constant for making the spread stationary which is independent of time

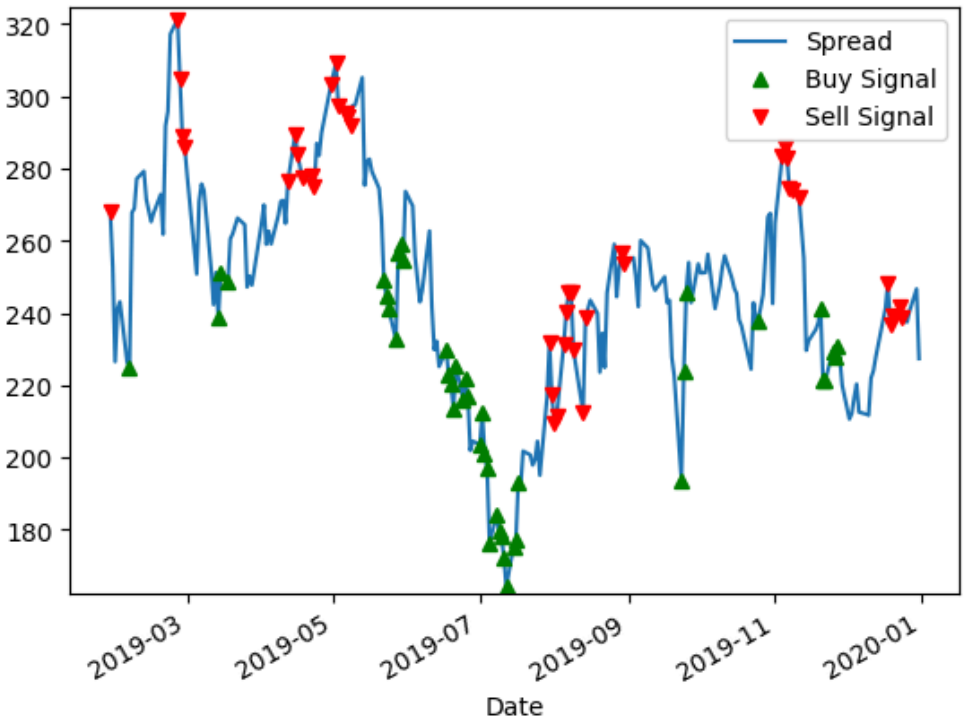
Computing the z score of the Moving average of the spread

Zscore = mean(returns)/stdev(returns)

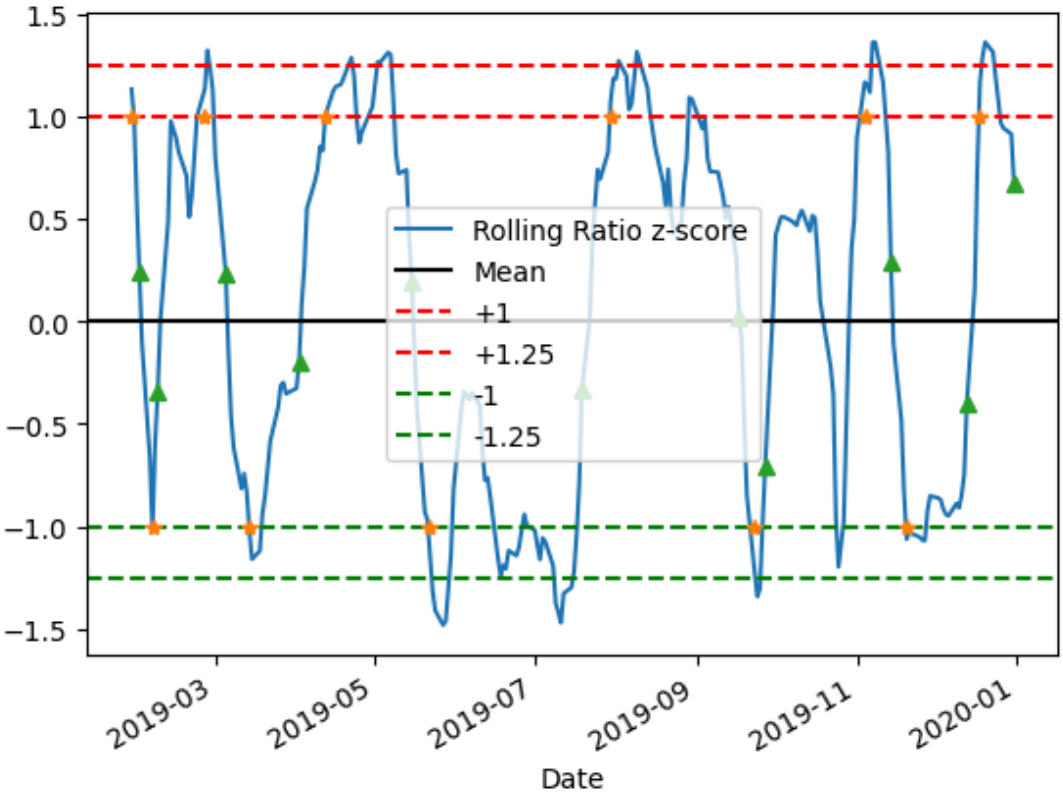
If the z score exceeds +1 giving a SELL signal to spread (SHORT Y LONG X)

And if the z score drops below -1 giving BUY signal to spread(LONG Y SHORT X)

Both the positions are squared off whenever the Z-score changes its sign or touches the 0.



INTERPRETING BUY AND SELL SIGNALS FOR SPREAD



Z SCORE AND PLOTTING THE OPENING AND CLOSING POSITIONS

BACKTESTING THE STRATEGY:

Considering the following parameters of test -

INITIAL BOOK SIZE : Rs.10000 RISK-FREE-RATE : 0.00%

TRANSACTION COSTS : 0.01(1% for every trade executed)

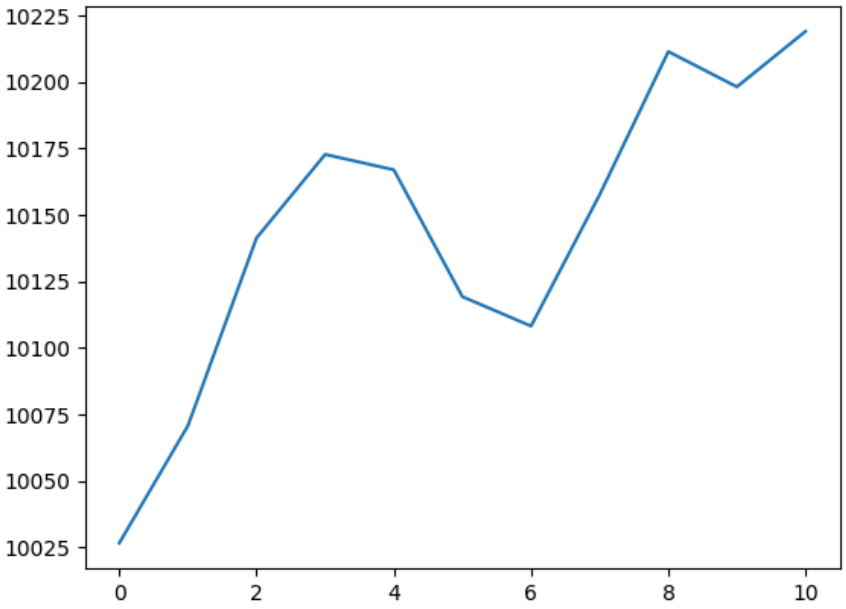
Key Performance Metrics:

1. **Annualized Returns -**

Annualized returns in pair trading reflect the strategy's average annual profit, extrapolated from historical performance. Calculated from cumulative returns over a specific period, it standardizes comparisons and aids in forecasting future profitability. This metric is essential for evaluating investment strategies and setting performance expectations over extended periods.

- Annualized Returns calculated as follows -

1. Year(2019 - 2020) : 2.189137623775332 %



2. Total Returns :-

Total returns represent the overall profit or loss generated by an investment, taking into account all gains and losses accrued over a specified period. In the context of trading or investing, total returns are calculated as the difference between the final value of the investment (commonly referred to as "final book size(F.B)") and its initial value.
(I.B = Rs.10,000)

Total returns = (F.B-I.B)/I.B %

Total Returns between **Year 2020-2024** :

Risk Analysis:

1. **Sharpe Ratio**

   The Sharpe ratio measures the risk-adjusted return of an investment or trading strategy. Here's the formula for calculating the Sharpe ratio:

$$Sharpe\ Ratio\ = \frac{Mean(Returns) - Risk-free-Rate}{Stdev(Returns)} \times \sqrt{No\ of\ trading\ days}$$

   The Sharpe ratio indicates how much excess return an investment or strategy generates per unit of risk (volatility) taken. A higher Sharpe ratio implies better risk-adjusted performance.

   Sharpe Ratio for 2019-2020 : *1.948292135796434*

2. **Maximum Drawdown**

   Maximum drawdown refers to the largest peak-to-trough decline in the value of an investment or trading account over a specific period, typically expressed as a

percentage. It measures the worst loss experienced before a new peak in value is achieved.

$$Maximum\ Drawdown\ =\ \frac{Peak\ value - Through\ Value}{Peak\ Value} \times\ 100\%$$

Understanding maximum drawdown helps investors:

- **Manage Risk:** Assess the potential downside and volatility of an investment.
- **Set Expectations:** Gauge the resilience and recovery potential of a strategy or portfolio.
- **Compare Strategies:** Compare different investment options based on their risk profiles and drawdown experiences.

Maximum Drawdown (2019-2020) : (-0.63%)

3. Win-loss ratio

The win-loss ratio measures the proportion of profitable trades to losing trades in a trading strategy or investment approach. It indicates the strategy's success rate based on trade outcomes, helping assess consistency and profitability. A ratio above 1 signifies more wins than losses, highlighting a potentially effective strategy.

$$Win\ -\ Loss\ Ratio\ =\ \frac{No\ of\ winning\ Trades}{No\ of\ Losing\ Trades}$$

Win_Loss Ratio for 2019-2020 : *1.75*

4. Information Ratio(I.R)

The Information Ratio measures the risk-adjusted return of an investment relative to a benchmark. It quantifies how much excess return the investment generates per unit of active risk taken, typically compared to a relevant market index. A higher Information Ratio indicates better performance relative to the benchmark, reflecting

the investment manager's ability to generate alpha (excess return) while managing risk effectively.

$$I.R = \frac{Mean(Returns) - Risk-free-Rate}{Stdev(Returns)}$$

I.R for 2019-2020 : *0.748*

5. Transaction Costs

Transaction costs are fees incurred when buying or selling financial assets, such as stocks or bonds. They include brokerage commissions, exchange fees, and regulatory charges. Transaction costs impact investment returns by reducing profits or increasing losses from trades. Minimizing transaction costs is crucial for optimizing portfolio performance and overall profitability in trading and investing activities.

T-C for 2019-2020 : 0.7487511092271971

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Final value of booksize:  10218.913762377533 2.189137623775332 %
Cumulative Returns: 218.16501126830624
Sharpe Ratio: 1.948292135796434
Information Ratio:0.5874321814942657
Total Transaction Costs: 0.7487511092271971
Maximum Drawdown: -0.63%
Win-Loss Ratio: 1.75
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