Pairwise Trading: A Quantitative Approach to Exploiting Market Inefficiencies

Colloquium Presentation

By

Kodarapu Kaushik 2021IMG-031

Table Of Contents

Motivation

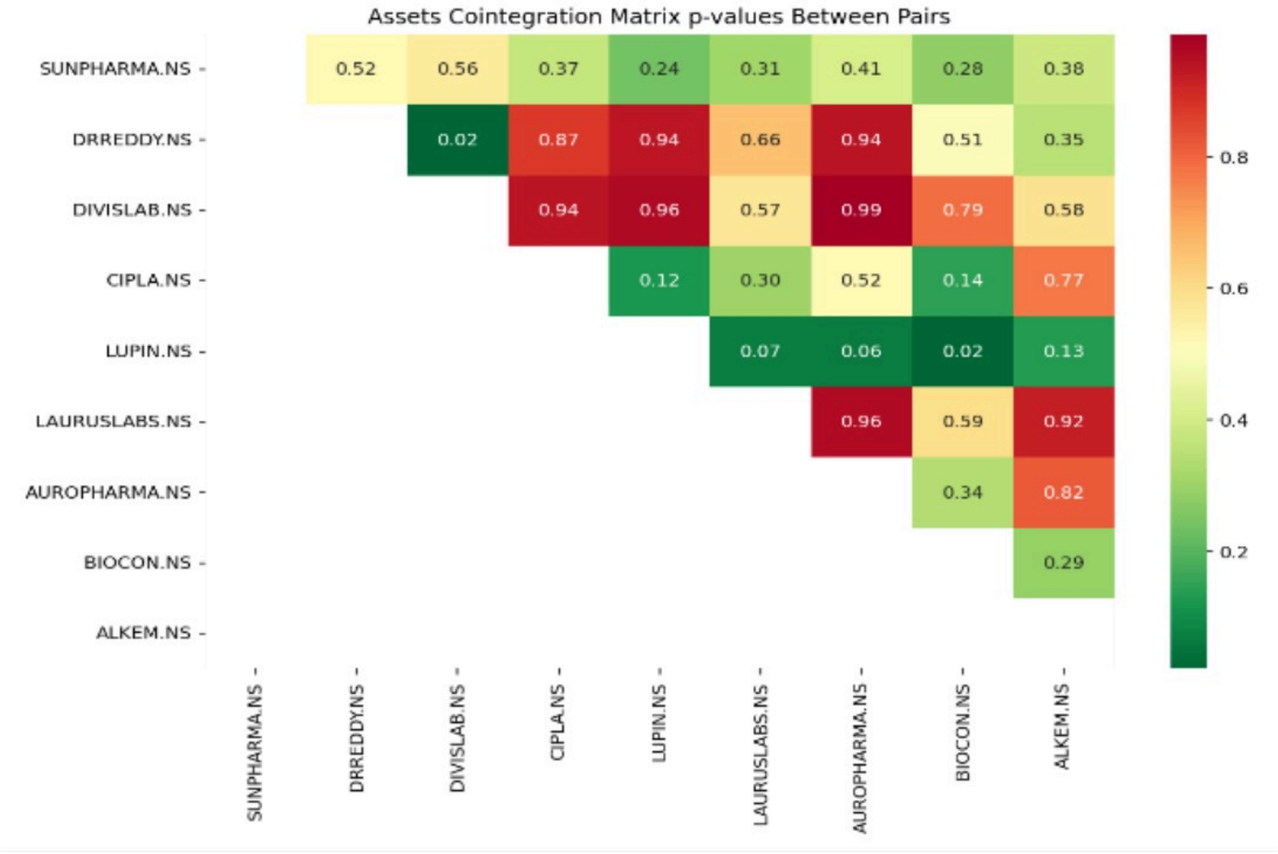
- Financial markets show high volatility and frequent mispricing.
- Traditional single-stock trading is risky and less predictable.
- Pair trading leverages correlation and mean reversion to reduce exposure.
- Provides market-neutral strategy, minimizing systematic risk.
- Need for robust comparison between cointegration (long-term stability) and distance (short-term deviations).

Objective

- Conduct a comparative study of cointegration vs. distance approaches.
- Apply both methods across five key sectors: IT, Banking, Realty, Auto, and Pharma.
- Measure returns, risk-adjusted metrics and portfolio efficiency.
- Identify which method works best in which sector.
- Provide insights for future market-neutral trading strategies.

Literature Review

- Pairs trading is a statistical arbitrage strategy that profits from mispriced securities.
- Cointegration approach identifies stock pairs with long-term stable relationships.
- Distance approach focuses on short-term correlation and price deviations.
- Recent studies also explore the use of machine learning and data-driven methods for spread modeling and risk management.



Proposed Methodology

- **Data**: Collected stock price data sector-wise.
- **Cointegration Method:** Test for long-term relationships, model spread, use Z-score signals.
- **Distance Method:** Measure short-term deviations with Euclidean distance, apply entry/exit rules.
- **Evaluation:** Compare performance using returns, risk measures, and portfolio outcomes.

$$Y_t = \alpha + \beta X_t + \varepsilon_t$$

εt (the spread) is stationary, the pair is cointegrated.

$$Z_t = \frac{\varepsilon_t - \mu}{\sigma}$$

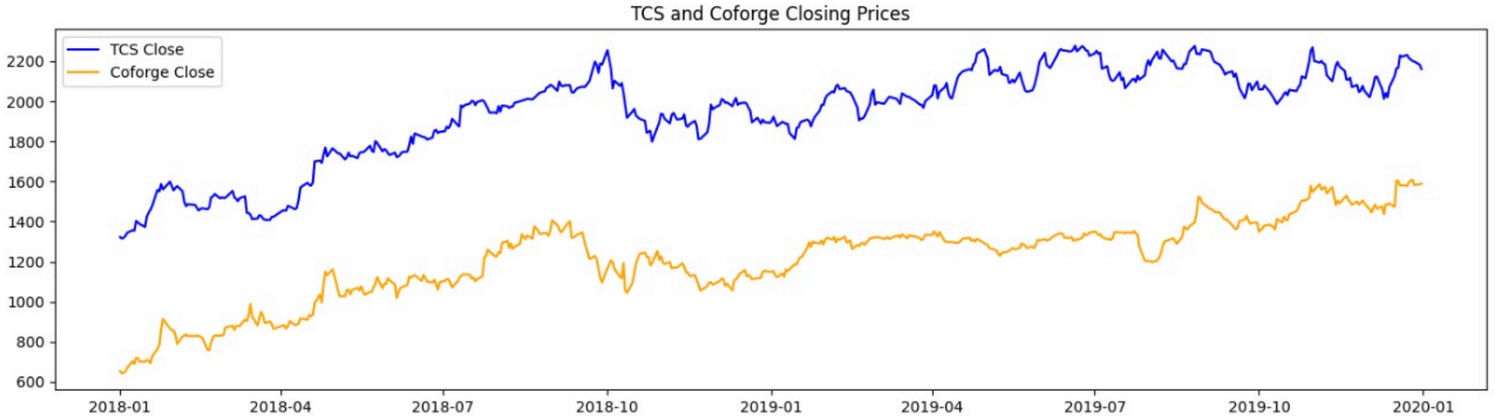
Regression/Correlation → Spread → Z-score → Trade Entry/Exit → PnL Calculation → Performance Comparison

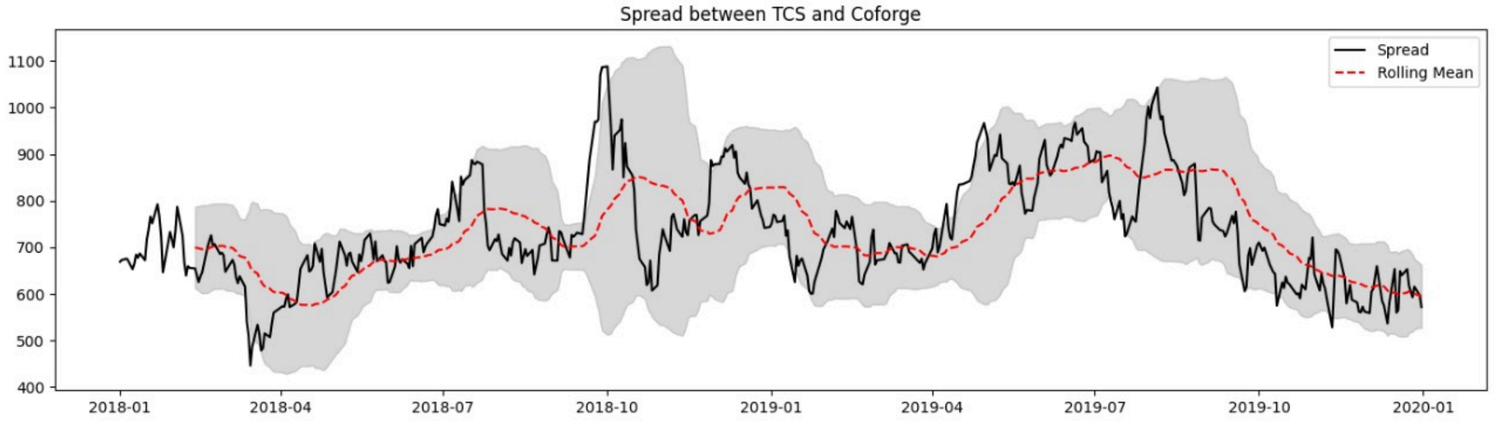
Sample dataset

```
tcs.head()
```

Date	Open	High	Low	Close	Adj Close	Volume
2018-01-01	1341.150024	1347.400024	1317.500000	1322.800049	1152.955811	1351760
2018-01-02	1330.000000	1334.800049	1310.099976	1315.599976	1146.680298	1920290
2018-01-03	1316.000000	1334.500000	1315.599976	1319.324951	1149.926880	1257120
2018-01-04	1325.000000	1331.000000	1320.000000	1328.550049	1157.967651	913082
2018-01-05	1325.000000	1349.750000	1325.000000	1344.599976	1171.956909	1153706

Results


TCS and Coforge Closing Prices
TCS Close
Coforge Close
2200
2000
1800
1600
1400
1200
1000
800
600
2018-01
2018-04
2018-07
2018-10
2019-01
2019-04
2019-07
2019-10
2020-01


Spread between TCS and Coforge
Spread
Rolling Mean
1100
1000
900
800
700
600
500
400
2018-01
2018-04
2018-07
2018-10
2019-01
2019-04
2019-07
2019-10
2020-01


Z-Score with Buy and Sell Signals
Z-Score
Buy Threshold
Sell Threshold
Buy Signal
Sell Signal
4
3
2
1
0
−1
−2
−3
2018-04
2018-07
2018-10
2019-01
2019-04
2019-07
2019-10
2020-01

Results

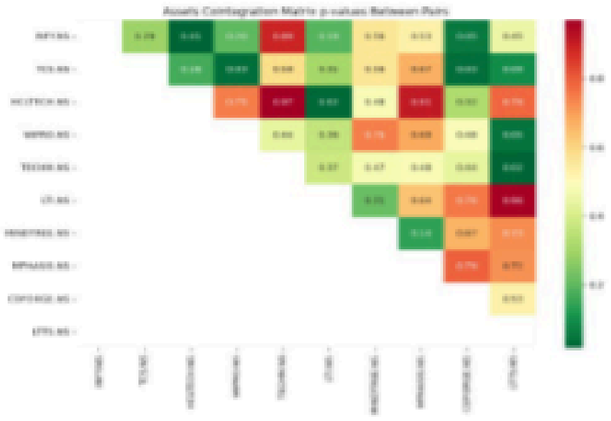


Figure 2: Asset Cointegration

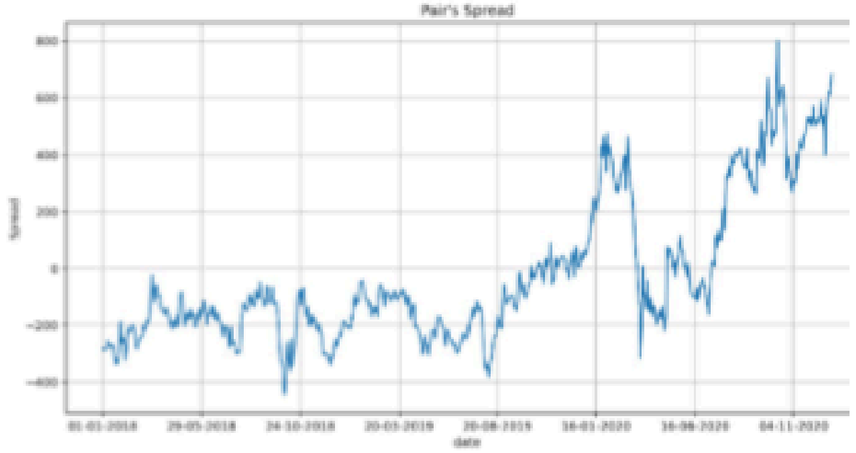


Figure 3: Pair Spread

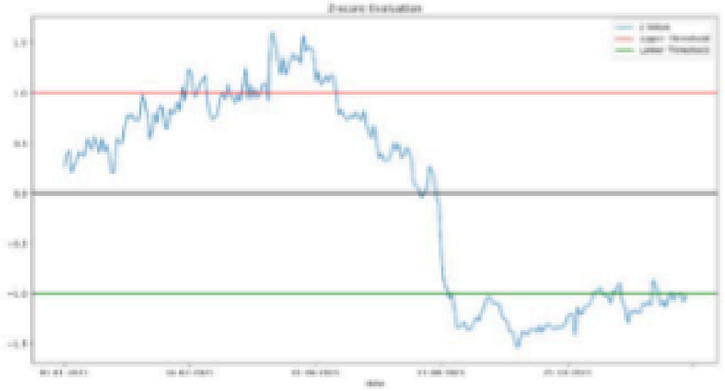


Figure 4: Z-Score

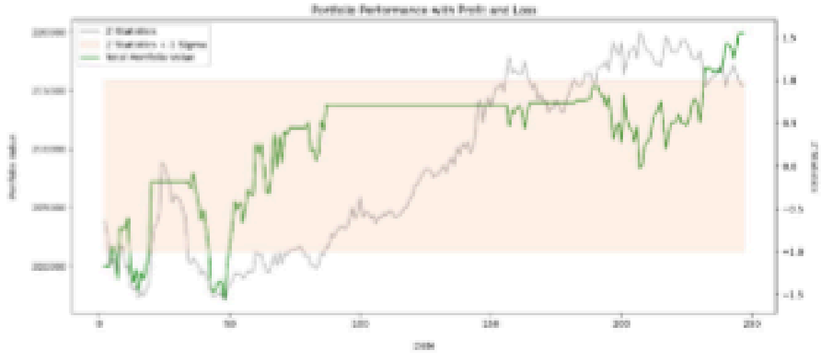


Figure 5: Portfolio Performance

Online Course 1 :Learning

- Decide the right production quantity and schedule.
- Source raw materials from reliable suppliers.
- Manufacture cost-effectively with smooth processes.
- Maintain organized inventory and monitor closely.
- Ensure timely customer delivery.
- Manage product returns with reuse/recycling strategies.

Online Course 2 : Learning

- **Neural networks** identify and interpret patterns.
- **Association rule mining** reveals hidden connections.
- **Big data** requires specialized tools and infrastructure.
- **Clustering** groups similar items into meaningful categories.
- **Experimentation & active learning** improve data quality.
- **Reinforcement learning** optimizes decisions through trial-and-error.

Thank You