Quantitative Strategy Proposal

New England Investment Consulting Group

designed for our quantitative strategies pipeline Phase 1: Idea Generation and Defense.

2023/23/01

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Strategy Overview:
Cointegrated Pairs Trading

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Cointegrated Pairs Trading

01

- Combine pre-selection tests, cointegration tests, technical indicator analysis, and portfolio optimization
- Focus on mid-large cap equities in the US (S&P 500)
- Identify pairs with mean reverting behavior
- Rely on z-score, moving averages as technical indicators

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Assumptions

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- Pairs follow mean reverting behavior
  - Long-term linear relationship

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Strategy Description

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[1] Determining an investment universe

- Focus on longevity and stable long-term growth
- S&P 500
- Fundamental screening
  - Mid/Large Cap Companies
  - Stable YoY EPS Growth

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[2] Pre-Select Pairs Candidates

- Brunetti & DeLuca (2023): 7 pre-selection measures
  - Sum of Squared Deviations
  - Price Ratio
  - Correlation of Log-Price Time Series
  - etc.

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[3] Cointegration Tests

- Run Engel-Granger/Johansen Tests
  - Brunetti & DeLuca (2023)

```
from statsmodels.tsa.stattools import coint
from statsmodels.tsa.vector_ar.vecm import coint_johansen
```

[4] High-Variance Screening

- Krauss (2015): Pairs should exhibit
  - (1) high spread variance
  - (2) high mean reverting tendency
- Rank pairs based on these criteria

[5] Generate Buy/Sell Signals

- Compute ratio of prices of top 15 pairs from previous step
  - P{Security A}/P{Security B}
- Z-score of current ratio value w.r.t. previous 50 day window (medium.com)
  - When z-score is high (>1), Security A is relatively expensive (short) and Security B is relatively cheap (buy) → exit positions when reverted to mean (i.e. -1 < z < 1)
  - Further investigation to determine optimal windows
- Opportunity integrate further signals and machine learning
  - Bollinger Bands with pairs

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03

Strategy Rationale

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Feasibility

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- Thorough research exists
- "Statistical arbitrage with Cointegration" - Machine Learning for Trading
- yfinance for data
- statsmodels for cointegration tests
- Market-Neutral strategy - can yield profits in both bull and bear markets

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Uniqueness

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- Thorough pre-selection measures for pairs
- Emphasis on high variance pairs
- Dynamically optimize allocations in portfolio
- Initial fundamental screening to weed out potentially unstable companies

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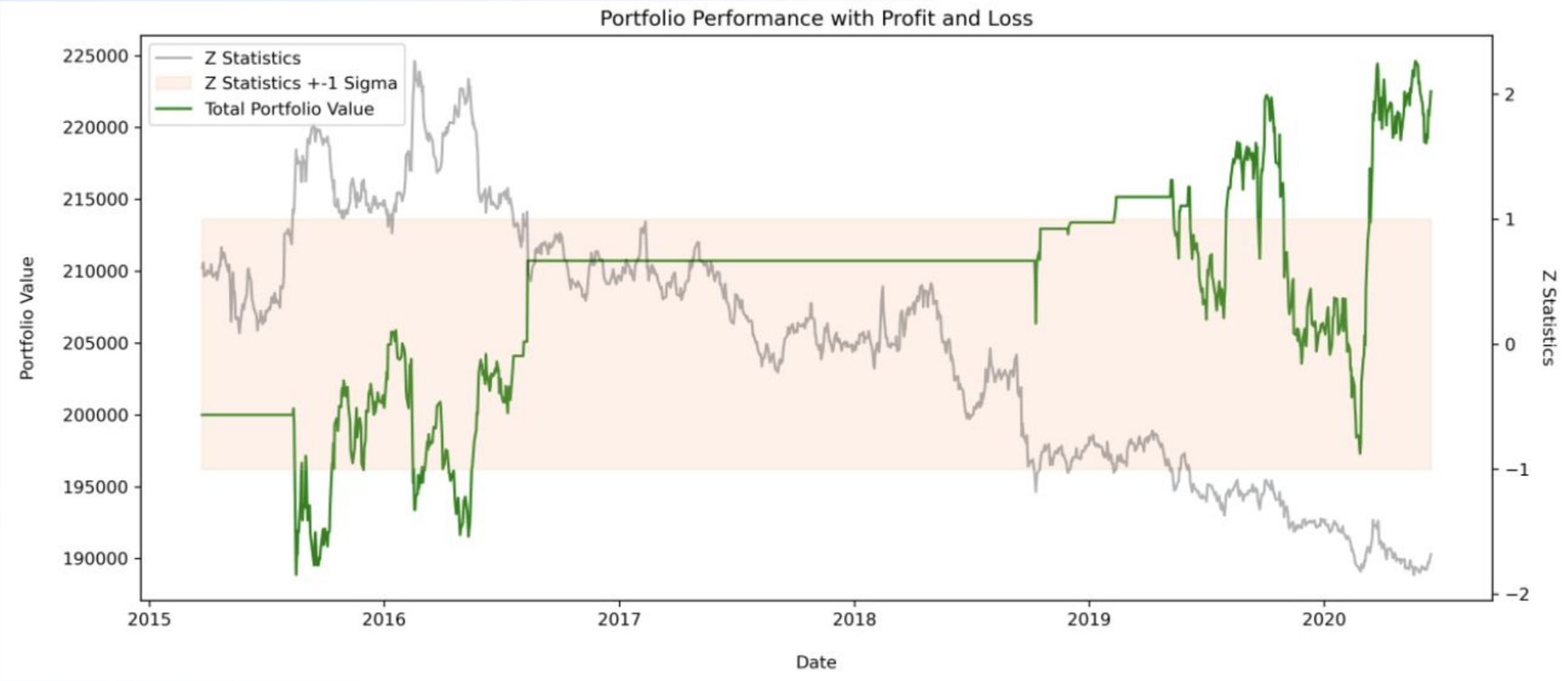
Potential Profitability

- [Sabir Jana (2020)]

  - 16.5% CAGR



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Literature Review

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Further References

- https://numpy.org/doc/stable/reference/
- https://www.investopedia.com/terms/p/pairstrade.asp
- https://www.statsmodels.org/dev/generated/statsmodels.tsa.stattools.coint.html
- https://seaborn.pydata.org/generated/seaborn.heatmap.html
- https://scikit-learn.org/stable/modules/generated/sklearn.preprocessing.MinMaxScaler.html
- https://www.statisticshowto.com/cointegration/
- https://www.linkedin.com/pulse/momentum-reversion-poor-mans-trading-strategies-adam-darmanin-vhrif

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Proposed Timeline

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Dates	Objective
Jan 30 - Feb 6	Begin writing Python code and have a functioning code for the screening process, data collection, and pre-selection measures.
Feb 6 - Feb 13	Write code for cointegration testing and technical indicators.
Feb 13 - Feb 20	Backtest
Feb 20 - Feb 27	Continue backtesting and refining model parameters

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