FINA4803 Group 5

Cyclic Factor Investment

Live Trading Results

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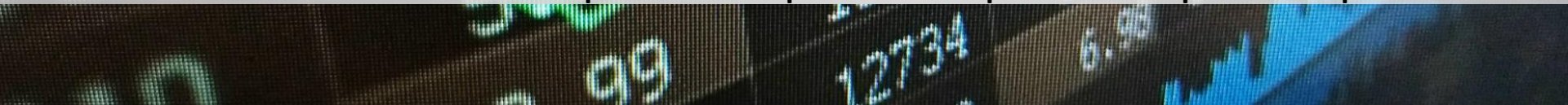
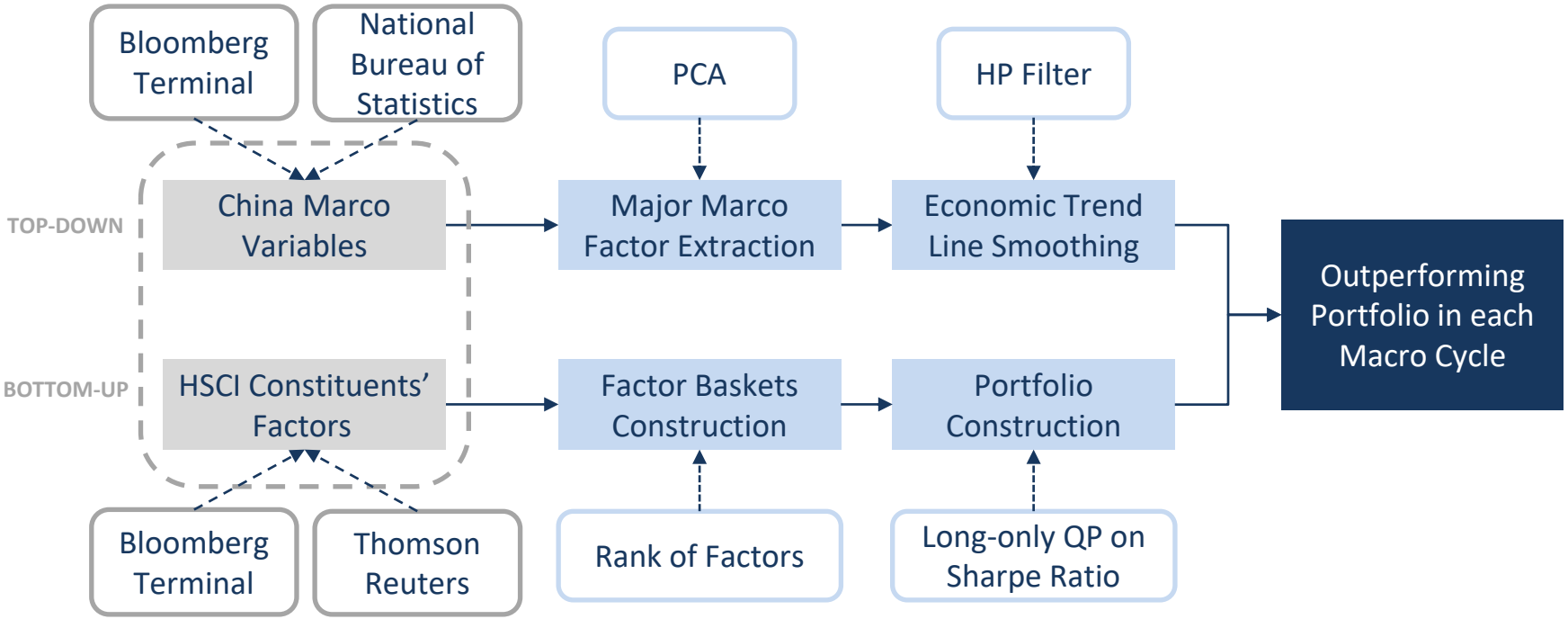


Overview of the Cyclic Factor Model



Macro and Factor Data Used in the Analysis

Macro Data

- Retail sales
- Industrial production
- Fixed asset investment
- Export

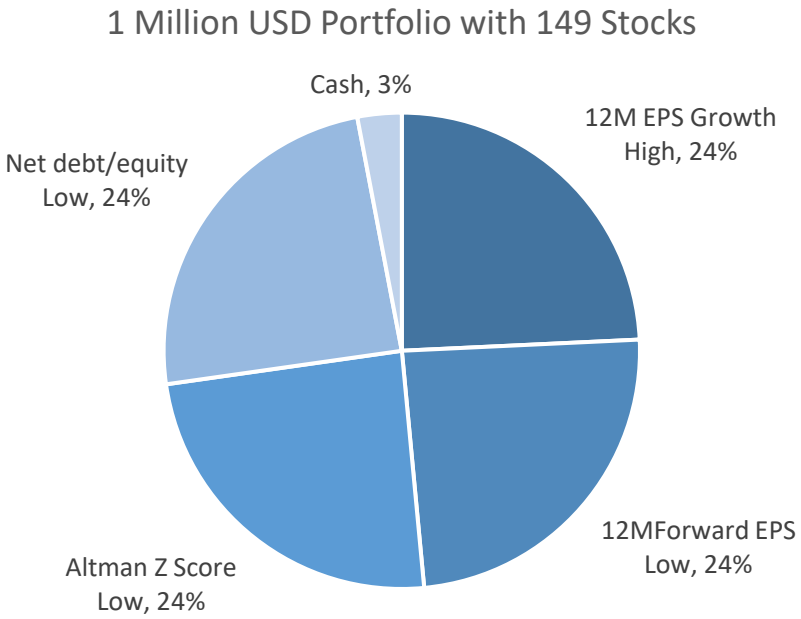
Factor Data

Factor	Implemented Factor
Momentum	1) 2Y Beta to China Industrial Production 2) 11M Price Momentum
Growth	1) 12M EPS Growth 2) 12M Dividend growth
Value	1) Forward 12M EPS 2) Forward 12M Growth 3) Trailing 12M P/B
Strong Balance Sheet	1) Altman Z-score 2) Net Debt-to-Equity Ratio
Dual Beta	1) 2Y Beta to HSCI 2) 2Y Beta to China Industrial Production
Sharpe Ratio	1) Trailing 6M Sharpe Ratio
Buyback	1) 1 Year Buyback Yield
Short Interest	1) Short Interest Days

Live Trading Summary

Investable Universe	**Hang Seng Composite Index (HSCI) with 494 Constituents**
Portfolio Size	**1 Million USD**
Inception Date	**23 Apr 2019 (Morning Trading Hours)**
Order Type	**Market Order**
Trading Platform	**Interactive Brokers**
Planned Duration	**10 Years (A Long Term Macro Driven Investment Strategy)**

Portfolio Summary After First Trade on Apr 23



	Original	After First Trade
Cash (USD)	1,000,000	31,224
Stocks (USD)	0	966,998
Net Asset Value (USD)	1,000,000	998,222

Rebalancing Details

Rebalance Frequency	**Monthly (Upon the monthly release of macro data)**

Step 1: Updating Signals

Update the macro and factor data at the start of the trading day
(Note: ~15 minutes needed to process the data)

Step 2: Rebalancing Algorithm

Construct the factor baskets and select favorable baskets indicated by the latest macro cycle, then run the optimization to produce a new portfolio with updated weights
(Note: ~15 minutes needed to optimize the portfolio)

Step 3: Rebalancing Execution

Compare the new portfolio with current portfolio, calculate the number of shares we need to buy or sell. Market orders are sent out to sell stocks that is no longer in the portfolio, buy stocks new in the portfolio, and adjust the weighting of the held stocks with at least 30 minutes delay before trading commence

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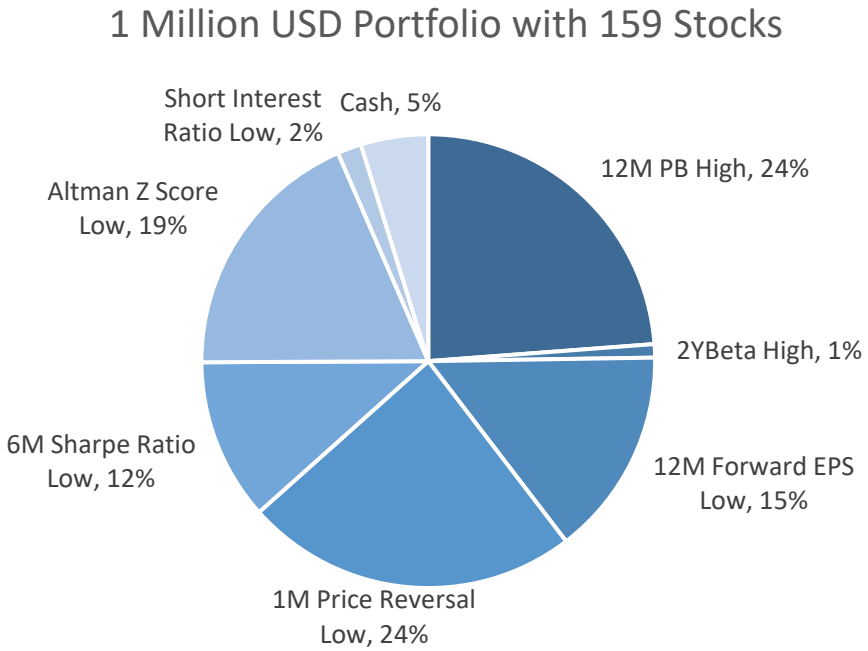
Step 2: Rebalancing Algorithm	Construct the factor baskets and select favorable baskets indicated by the latest macro cycle, then run the optimization to produce a new portfolio with updated weights (Note: ~15 minutes needed to optimize the portfolio)
Step 3: Rebalancing Execution	At least 30 minutes delay might diminish our return against competitors with similar strategy

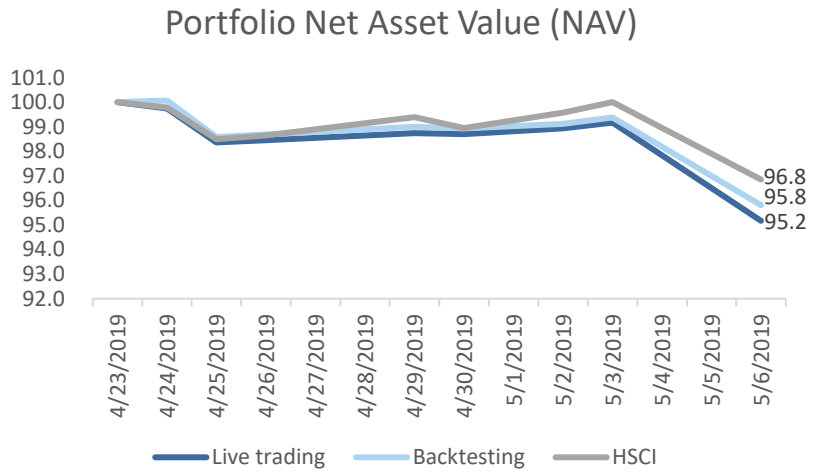
Portfolio Summary After Rebalancing on May 6

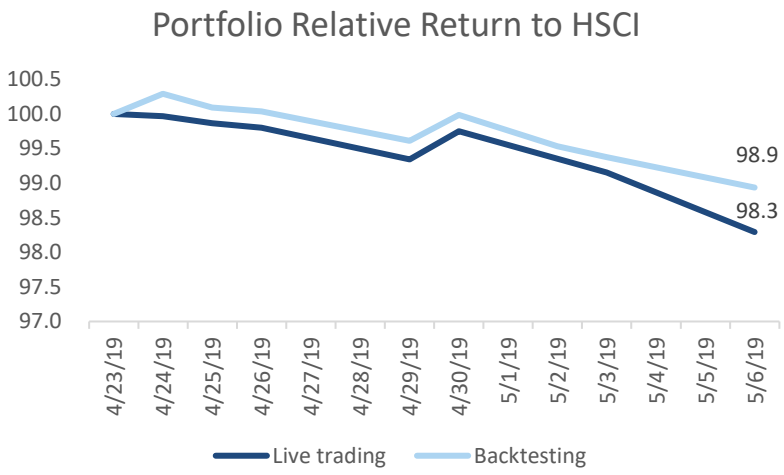


	After first trade (Apr 23)	Before rebalancing (May 3)	After rebalancing (May 6)
Cash (USD)	31,224	31,894	45,800
Stocks (USD)	966,998	959,766	906,474
Net Asset Value (USD)	998,222	991,660	952,274

On average, **49%** of our portfolio (market cap) is replaced with new stocks. We **sold 65** stocks, **bought 75** stocks and **hold 84** stocks. The manual order input took additional 2 hours.

Live Trading Results from Apr 23 to May 6





From Apr 23 to May 6,
the live trading portfolio absolute return is **-4.8%,** and relative return to benchmark HSCI is **-1.7%**,
while the backtesting portfolio absolute return is **-4.2%**, and relative return to benchmark HSCI is **-1.1%**.

Live Trading Results

Live Trading Results – Apr 23 to May 6

Changes in NAV	Total
Starting Value	**1,000,000**
Mark-to-Market	(44,375)
Dividends	751
Interest income (expense)	(481)
Commission and transaction fees	(3,623)
Other FX translations	2
Ending Value	**952,274**

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Back Testing Trade Results – Apr 23 to May 6

Changes in NAV	Total
Starting Value	**1,000,000**
Mark-to-Market	(42,642)
Dividends	751
Interest income (expense)	0
Commission and transaction fees	0
Other FX translations	0
Ending Value	**958,109**

5,835 USD Trading Cost

Huge Trading Cost

Our trading cost takes up 12% of the total loss as of May 6

Trading Cost Factors

1 **Commission and transaction fees – 62% of trading cost**

0.1827% of trade value (0.08%, stock trade fee, 0.1% government stamp duty, 0.0027% SFC transaction levy)

2 **Interest expense on HKD – 8% of trading cost**

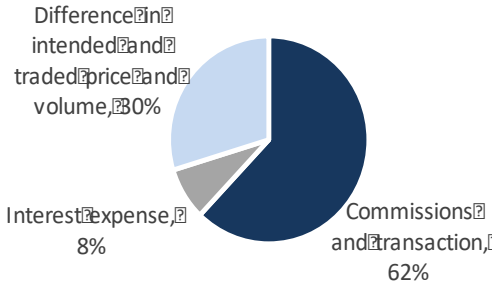
3% annual interest expense on HKD borrowed

3 **Board lot in Hong Kong exchange market – 30% of trading cost**

Difference in intended purchase shares and actual purchase shares

4 **Difference in last price and traded price – 30% of trading cost**

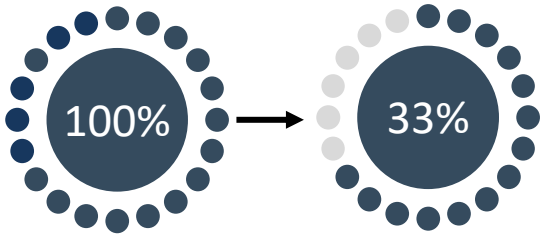
Market order, trade market impact, bid ask spread;



Trading Cost – Commission Fees

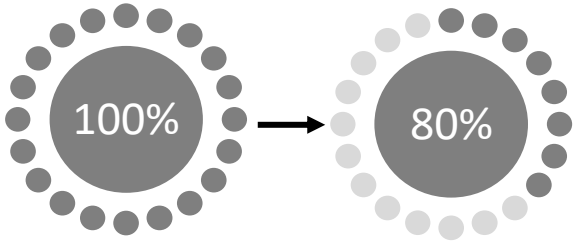
Reduce Trade Frequency

- Change trade frequency from monthly to quarterly
- Risk: negative events last long



Set Equal Weighting

- Set equal weight for the selected baskets to reduce the number of trades for adjusting the weights
- Risk: portfolio is not optimized



Trading Cost – Board Lot

Reduce number of Stocks

- Choose fewer factor baskets to invest in the portfolio: from 1/2 to 1/3
- Reduce the number of stock in each factor baskets: from top 10% to top 5%
- Risk: compromise optimization efficiency

Enlarge the Portfolio

- Enlarge the portfolio from 1million to 100million
- Risk:
  Market risk - affect stock price
  Liquidity risk - hard to sell and buy

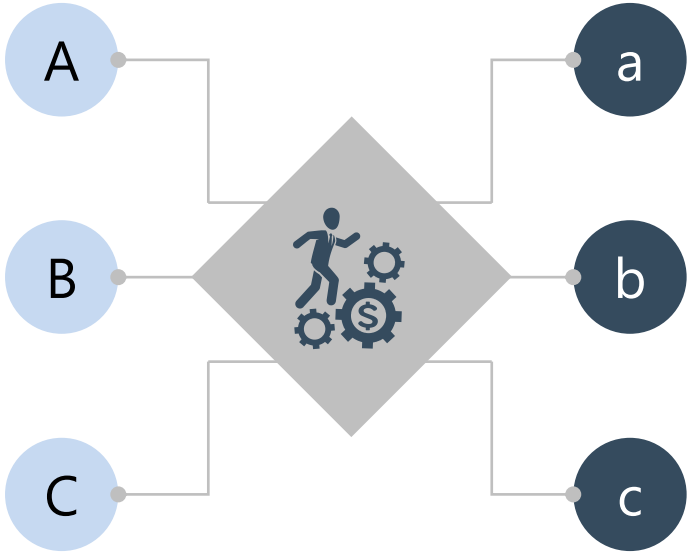
Difference in Last Price and Traded Price

Issues

Market order
Traded price uncontrollable; Suffer loss when market drop fast

Bid ask spread
Expose to implicit loss when bid ask spread widens.

Trade impact
Huge trade amount would impact security price in the market



Solution

Algorithm trade
Use vwap, twap, etc. to obtain a controllable price

Avoid low liquidity stocks
Restrict the investable universe to high liquidity stocks

Split order
Split order into pieces to mitigate the impact of huge trades

Reflection – Project Design

Macro Variables Selection	**Problem** • Macro data subject to strong seasonality effect, but the series are not seasonally adjusted **Resolution** • Used YoY data to normalize our data **Alternatives** • Research more into Seasonality Adjustment methods, and explore other unofficial data sources from vendors/researchers
Macro Variables Transformation	**Problem** • Combine the 4 macro variables into an indicator to show macroeconomic state **Resolution** • PCA was used to decorrelate, normalize and combine the given data • However, PCA produces data that lost its fundamental sense, and PCA is deterministic in nature (the output macro state will not change given same input) • With only the first PC explains high variance, cross checking with itself is impossible **Alternatives** • Explore nondeterministic methods such as clustering based on L^n-distances or Pearson's R • Try linear combinations of the 4 variables to combine them and retain fundamental sense

Reflection – Project Implementation

Free Parameter Tuning	**Problem** • Important variables exists including: the cutoff of stocks used in factor basket forming phase, the number of baskets used in portfolio construction phase, and maximum weight for each factor basket in the portfolio **Resolution** • Common sense was applied to ensure each factor baskets and portfolios in automated testing are different, and the portfolios did not overweight any factors too much **Alternatives** • Maximum Likelihood estimators, albeit hard to define, can be used to maximize the performance and inferential power of our model with different combination of free parameters
Macro Cycle Computation	**Problem** • Macro data is published in an up to 3 months lag, with unknown market reaction impact or rate • Difficulty in predict macro state due to it being a principle component of 4 highly nonstationary TS **Resolution** • Based on the notion macro environment persists for months, we applied an interval constraint (e.g. bimonthly, quarterly) and use the consensus to predict the upcoming cycle **Alternatives** • Use an hidden Markov Model with stock returns as the input to predict the current macro state • Use alternative real time data like <Median spending on JD/TMall per customer> to substitute traditional data like Retail Sales (as suggested by hedge funds like Point72/Citadel)

Reflection – Risk Management

Beta Exposure Management	**Problem** • Due to high dimensionality in our data, optimizing the portfolio always leads to overfitting and numerical instability (slight variance in the dataset gives rise to completely different result) **Resolution** • Introduced a long-only constraint to portfolio construction to reduce overfitting and instability, which leads to portfolio with generally high beta, making the portfolio susceptible to market crashes **Alternatives** • Introduce a beta constraint to our portfolio in the Langragian optimization process • Relax the constraint to include a small level of short positions to reduce the beta exposure • Tune the additional free parameters
Loss Management Mechanisms	**Problem** • Fluctuations will affect short term return, and from a practitioner's PoV, investor's confidence **Resolution** • No measures were deployed for stop loss purposes **Alternatives** • Use technical or statistical indicators for price movements to set stop loss limits • Set up different scenarios for forward looking factors (e.g. growth) given analysts' estimates • Redo portfolio construction given different scenarios, and introduce limits for allocation in baskets