Multi-Factor Portfolio Optimisation with Machine Learning

Examining the efficiency of the Hong Kong stock market

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Abstract

In this research project, the feasibility of applying machine learning methods in financial portfolio construction and optimisation is examined, while simultaneously testing the market efficiency of the Hong Kong stock market.

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1 Introduction

The finance industry is one of the major driving forces of Hong Kong. Portfolio construction and optimisation has always been a tedious work for discretionary asset managers and individual investors. With the increasing integration and popularity of machine learning techniques in various industries, the finance industry provides an experimental field with great incentives.

To narrow down the scope of research, a multi-factor model is used to constrct a stock-only portfolio, focusing on the Hong Kong stock market.

2 Disclaimer

The information presented in this research is not intended as, and shall not be understood as financial advice to enter in any security transactions or to engage in any of the investment strategies.

3 Methodology

3.1 Tools

A customised backtest system is created for this research project. The system is written in lorem and the source code can be found at lorem.

3.2 Data

The trading universe includes stocks presented in the Hong Kong market (HKEX) from 2006 to 2019 (June 30). Both fundamental and price data are used.

3.3 Evaluation Metrics

Sharpe ratio, maximum drawdown and win rate are the major evaluation metrics, while other metrics such as volatility and drawdown duration are considered as well.

3.3.1 Sharpe Ratio

Sharpe ratio was first introduced by Sharpe 1966. It measures the expected return gained per unit of risk taken for a zero investment strategy. According to the definition in Sharpe 1994, assume R_{Pt} as a t-period return series, R_{ft} as the risk-free rate series over the same period. Then the Sharpe ratio S_h from $t = 1$ to $t = T$:

$$
\begin{aligned}
S_h &\equiv \frac{\overline{D}}{\sigma_D} \\
\text{where } D &\equiv R_{Pt} - R_{ft} \\
\overline{D} &\equiv \frac{1}{T}\sum_{t=1}^{T} D_t \\
\sigma_D &\equiv \sqrt{\frac{\sum_{t=1}^{T}(D_t - \overline{D})^2}{T-1}}
\end{aligned}
$$

Reference

[1] William F. Sharpe. “Mutual Fund Performance”. In: *The Journal of Business* 39.1 (1966), pp. 119–138.

[2] William F. Sharpe. “The Sharpe Ratio”. In: *The Journal of Portfolio Management* 21.1 (1994), pp. 49–58.