Master thesis: Price-based statistical arbitrage models and extensions using machine learning

Description

Factor models are widely used by academic finance researchers and in the industry. In the context of statistical arbitrage, such models are typically based on series of returns. As notable exception, Focardi et al. (2016) develop a statistical arbitrage framework that is based on a dynamic factor model of prices. Based on the model's predictions, long–short and long–only portfolios are constructed and evaluated on daily S&P500 data. The objective of the proposed thesis is to validate the results presented by Focardi et al. (2016) and develop extensions to the model. These extensions may be based on advanced machine learning techniques such as long short–term memory and autoencoding.

Approach

The project can be split into the following three steps:

1. *Reproduce literature results:* Review and implement the framework given in Focardi et al. (2016) and compare results.
2. *Develop improvements:* Based on the results from the first step, develop extensions to the price–based model. For example, the originally proposed principle–component analysis might be substituted by an autoencoder, or the predictions could be generated with long short-term memory neural networks.
3. *Validate improvements:* Integrate the improved models into a backtesting framework and evaluate financial metrics.

Prerequisites

- High degree of motivation and enthusiasm for research in financial econometrics and machine learning
- Excellent analytical skills
- Experience with programming (`Python` or `R`) or a high affinity to computer science.
- Helpful: Experience with univariate and/or multivariate time series analysis

Contact

In case you are interested, please contact Matthias Schnaubelt via matthias.schnaubelt@fau.de or stop by in room 4.174 for further details.

References

Focardi, S. M., Fabozzi, F. J., and Mitov, I. K. (2016). A new approach to statistical arbitrage: Strategies based on dynamic factor models of prices and their performance. *Journal of Banking & Finance*, 65:134–155.