CHARLES UNIVERSITY
Faculty of mathematics
and physics

Kateřina Vaňková, B.Sc. Thesis

Parameter choice in portfolio optimization problems based on out-of-sample performance

Referee Report

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This bachelor theses studies portfolio choice based on out-of-sample performance, using three mean-risk models, namely Mean-Variance, Mean-CVaR and the Mean-MAD. The thesis in the first part summarizes these models and applies them on real data in the second part. My impression is that the empirical part is somewhat simplistic, the author runs portfolios with different choice of the model parameters and empirically concludes what would have been the best choice, but these conclusions have a very limited value for constructing forward looking portfolios. The whole methodology used in the thesis is mostly backward looking as illustrated in the following points.

There are several issues that should have been discussed in more detail:

- What is the logic of selecting the stocks in Table 2.1? This seems to be an ad hoc choice, and the data check is from March 23, 2019. For investment decisions, this choice must be made at the starting period, which is January 30, 1999. A reasonable pick would be take a random collection of 10 stocks out of some index at that time (like NASDAQ100), which would have included some stocks that went bankrupt in the meantime. Selecting stock from the current composition (especially those with a high present market cap) means implicitly a biased winning selection. Like picking AAPL in retrospect seems a great choice, but this was not obvious in 1999.

- The use of IID tests are argued to pick up trends in the returns. What would happen if the returns are heteroskedastic, which is another type of IID violation?

- The composition of the portfolios in terms of the weights are not documented, at least for a small number of selected portfolios. In particular, computing

weights in the mean-variance portfolios can be quite tricky as the estimates of the covariance matrix are known to be dominated by estimation errors to the point that the resulting matrix may not even be positively definite. It would be good to see how the weights evolve for illustration purposes (say for one selected portfolio). It is not clear to me how the portfolio can be initiated on January 30, 1999 – that's only the point when the data stream starts and the first estimated values should appear only at the end of the monitoring period.

- Comparison the the performance of the stock index (SP500 or NASDAQ100) is missing, my impression is that the studied portfolios over perform them. It would be good to have some discussion here. I believe that he superior performance is precisely due to the selection bias problem.

Summary: I would rank the thesis as an average due to the shortages listed above. If the defense is successful and the points made here are addressed, I would recommend that the thesis is **accepted as bachelor thesis.**

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