

Statistical inference for the EU portfolio in high dimensions

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May 2020

Abstract

In this paper, using the shrinkage-based approach for portfolio weights and modern results from random matrix theory we construct an effective procedure for testing the efficiency of the expected utility (EU) portfolio and discuss the asymptotic behavior of the proposed test statistic under the high-dimensional asymptotic regime, namely when the number of assets p increases at the same rate as the sample size n such that their ratio p/n approaches a positive constant $c \in (0, 1)$ as $n \rightarrow \infty$. We provide an extensive simulation study where the power function and receiver operating characteristic curves of the test are analyzed. In the empirical study, the methodology is applied to the returns of S&P 500 constituents.

Keywords: Finance; Portfolio analysis; Mean-variance optimal portfolio; Statistical test; Shrinkage estimator; Random matrix theory.

1 Introduction

Following the mean-variance approach of Markowitz (1952), which is considered to be one of the most popular portfolio choice strategies, the weights of an optimal portfolio are obtained by minimizing the portfolio variance for a predefined level of the portfolio expected return. This set of optimal portfolios determines the efficient frontier in the mean-variance space. The Markowitz approach formalizes the advantages of portfolio diversification and has become a benchmark for both researchers and practitioners in portfolio management.

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