Empirical Gram Matrix Estimation Using High-Frequency Data for Portfolio Optimization and Gross Exposure: Evidence from Emerging Stock Markets

Esra Ulasan* A.Özlem Önder †

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Abstract

We consider nodewise regression with lasso penalty to cope with the singularity problem of the high-dimensional sample covariance matrix estimation on the traditional Markowitz mean-variance portfolio optimization framework in emerging stock markets. We propose an approximate inverse, also called relaxed inverse, instead of the non-invertible sample covariance matrix of asset returns. This technique promotes sparsity in the approximate inverse matrix that reduces the number of parameters that best explain the data to be estimated when the number of assets p exceeds the number of observations n, $p >> n$. This study aims to estimate the portfolio variance and the gross exposure of the constructed portfolios. Simulation results illustrate and verify the smaller estimation errors in optimal portfolio variance and gross exposure. We also demonstrate the comparative analysis of the existing approaches in the finance literature through an empirical out of sample forecast exercise in terms of portfolio performance criteria such as out-of-sample variance and Sharpe ratio for different investment horizons.

Keywords: high-dimensionality, penalized estimator, precision matrix, portfolio optimization
JEL Classification: C61, C13, G11, G15

*Department of Economics, Ege University, Email: esra.ulasan@ege.edu.tr
†Department of Economics, Ege University, Email: ozlem.onder@ege.edu.tr.