Long-memory covariance matrices and their use in portfolio allocation

David Morton de Lachapelle ⋆,1,2, Olivier Lévèque 2, Matteo Marsili 3

1. Swissquote Bank, Ch. de la Crétaux 33, 1196 Gland (Geneva Office), Switzerland
2. Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland
3. Abdus Salam International Center for Theoretical Physics, Trieste, Italy

Weighted covariance and correlation matrices exploit the time-clustering of events to improve the quality of forecasters used in financial risk assessment and portfolio allocation. The underlying idea is to put more weight on recent events, as the latter are better predictors of the near future than events that occurred far in the past. Econophysicists recently showed that standard weighted estimators using exponentially decreasing profiles (EMA) could lead to noisy and ill-conditioned matrices as the dimensionality of the estimator (i.e. the number of assets) was increased. To overcome this shortcoming, we introduce a new class of weighted covariance and correlation matrices C with adjustable long-memory profiles. Extending a famous result of Random Matrix Theory by Marčenko and Pastur, we show how to preserve the conditioning and spectral noise band of C, while at the same time taking advantage of the clustered dynamics of the volatility for better covariance forecasts. We apply our results to improve Markovitzs well-known Mean-Variance Optimization scheme.

⋆ Corresponding author: david.morton@epfl.ch, david.mortondelachapelle@swissquote.ch