

# On generalized expectation-based estimation of a population spectral distribution from high-dimensional data

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**Abstract** This paper discusses the problem of estimating the population spectral distribution from high-dimensional data. We present a general estimation procedure that covers situations where the moments of this distribution fail to identify the model parameters. The main idea is to use generalized functional expectations as a substitute for the moments. Beyond the consistency, we also prove a central limit theorem for the proposed estimator. Simulation experiments illustrate the implementation of the estimation procedure. An application to the analysis of the eigenvalues of the sample correlation matrix of S&P 500 daily stock returns is proposed.

**Keywords** Large sample covariance matrix · Eigenvalues distribution · Population spectral distribution · Empirical spectral distribution · Generalized expectation estimation