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Covariance Matrix

Sample covariance is non-parametric estimate and can be used for portfolios with few assets. Sample covariance matrices are not stable due to volatility clustering (jumps in stock prices). This instability causes daily changes to covariance weights which leads to a high turnover rate. PCA can be used to improve covariance stability but is generally better for portfolios with a large number of assets.

Project Notes

- Transforming data into log returns (first difference) eliminates autocorrelations in stock market data. Some moving average relation may still exist however.
- There is no need to use PCA if your portfolio only has 10 assets but if you do use PCA with 10 assets, you should wind up with about 2 PCs.
- If you use a specifics distribution to model the data, justification must be given in the form of a hypothesis test (Shapiro-Wilks, Kolmogorov-Smirnoff tests for normality) for using the distribution chosen. Each asset must be follow the same distribution in order to use a specific distribution.
- Calculate maximum draw down from the entire portfolio's time series of returns.
- Turnover rate can be calculated using formula (9) on page 13 of this paper.

R functions

`ks.test` can be used to test if data follows a specific distribution.
`apply` allows the same function can be applied to every vector in a matrix.