1 Stylized facts of correlation matrices
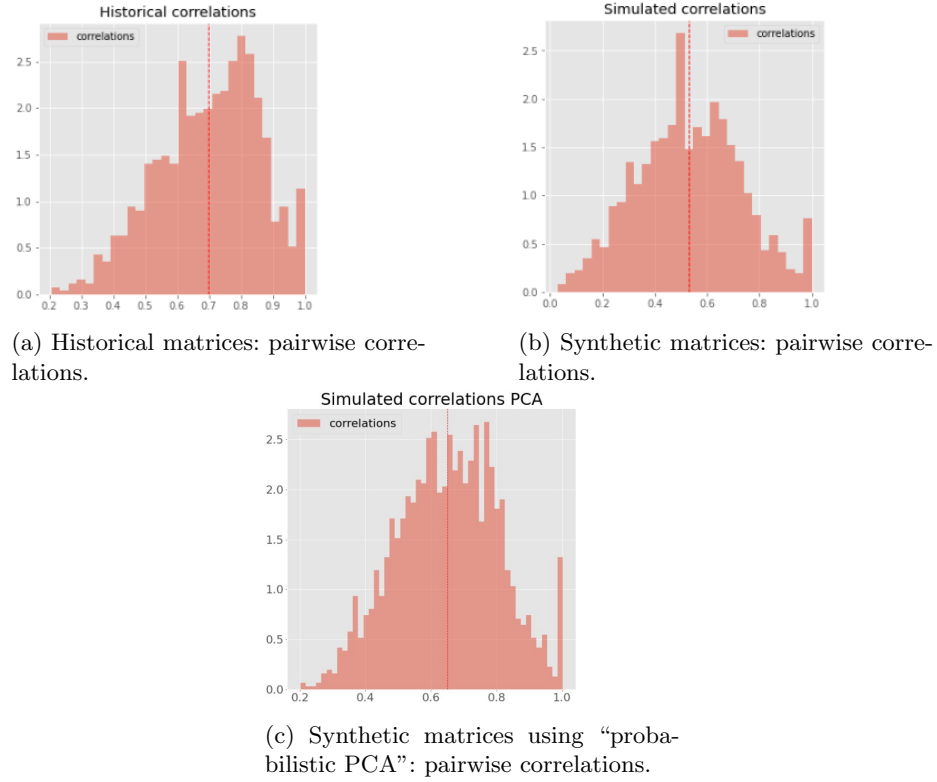

(a) Historical matrices: pairwise correlations.

(b) Synthetic matrices: pairwise correlations.

(c) Synthetic matrices using "probabilistic PCA": pairwise correlations.

Fig. 1: Distribution of pairwise correlations is significantly shifted to the positive

(a) Historical matrices: Marchenko-Pastur eigenvalues distribution.

(b) Synthetic matrices: Marchenko-Pastur eigenvalues distribution.

(c) Synthetic matrices using "probabilistic PCA": Marchenko-Pastur eigenvalues distribution.
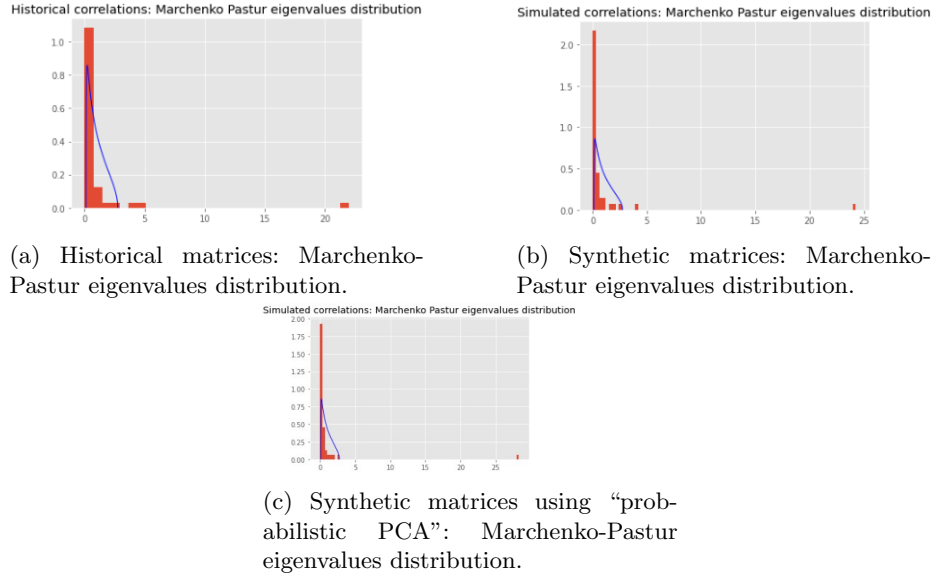
Fig. 2: Eigenvalues are compatible with the Marchenko–Pastur distribution (that describes the spectrum of a random matrix), with the exception of a very large first eigenvalue and a couple of other large eigenvalues.

(a) Historical matrices: Perron-Frobenius property.

(b) Synthetic matrices: Perron-Frobenius property.

(c) Synthetic matrices using "probabilistic PCA":Perron-Frobenius property is violated.
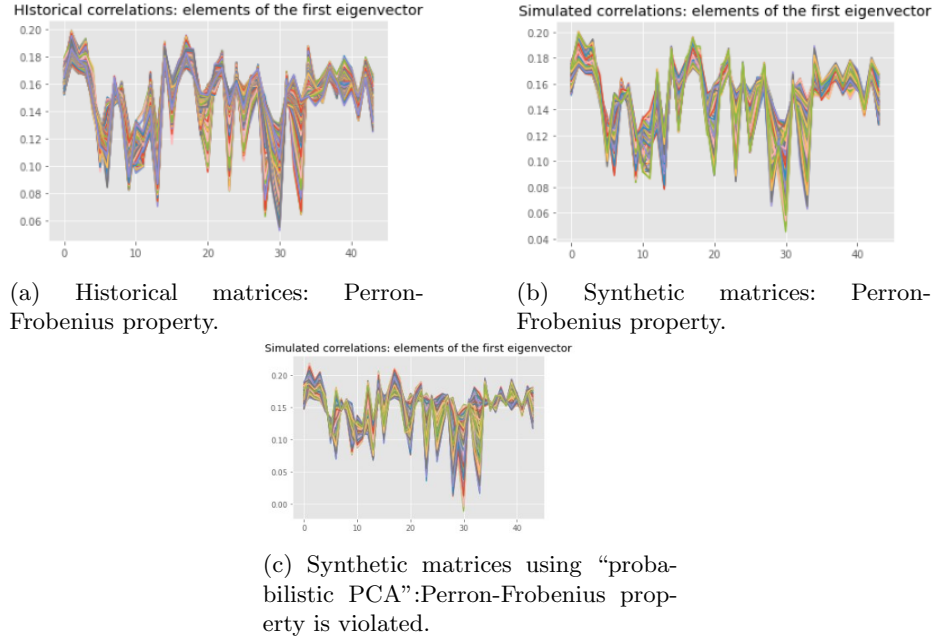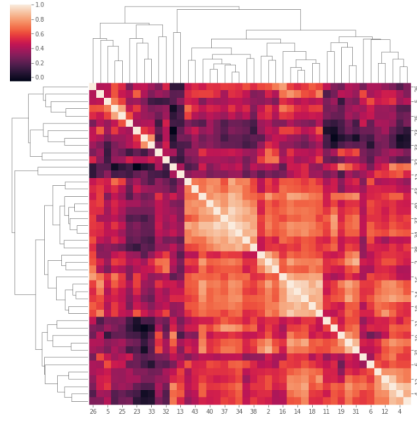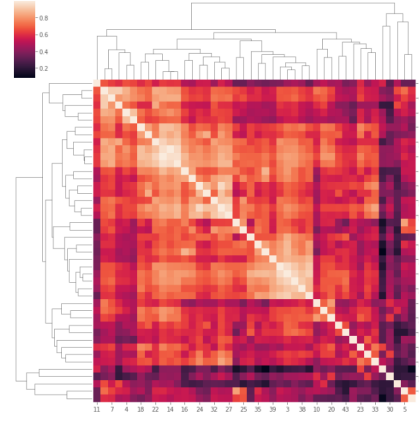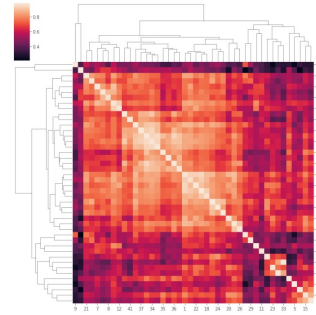
Fig. 3: Perron-Frobenius property (first eigenvector has positive entries).

(a) A randomly chosen historical matrix: heatmap and dendrogram.

(b) A randomly chosen synthetic matrix: heatmap and dendrogram.

(c) Synthetic matrices using "probabilistic PCA":A randomly chosen synthetic matrix: heatmap and dendrogram.

Fig. 4: Hierarchical structure of correlations.

(a) Historical correlations: distribution of MST degrees.

(b) Synthetic correlations: distribution of MST degrees.

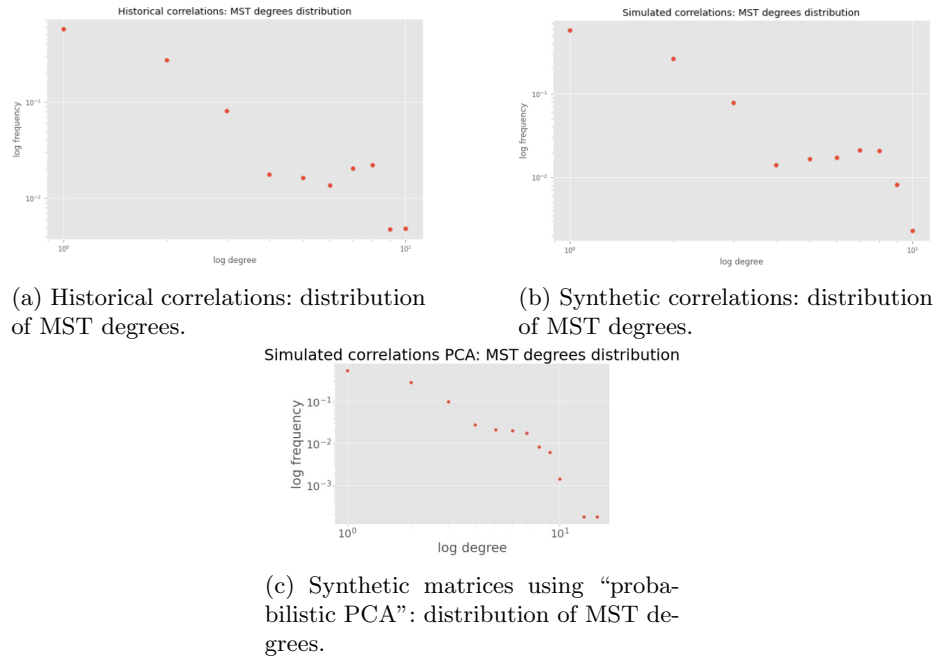(c) Synthetic matrices using "probabilistic PCA": distribution of MST degrees.

Fig. 5: Scale-free property of the corresponding MST.