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High-dimensional covariance matrix estimation in approximate factor models

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The variance--covariance matrix plays a central role in the inferential theories of high-dimensional factor models in finance and economics. Popular regularization methods of directly exploiting sparsity are not directly applicable to many financial problems. Classical methods of estimating the covariance matrices are based on the strict factor models, assuming independent idiosyncratic components. This assumption, however, is restrictive in practical applications. By assuming sparse error covariance matrix, we allow the presence of the cross-sectional correlation even after taking out common factors, and it enables us to combine the merits of both methods. We estimate the sparse covariance using the adaptive thresholding technique as in Cai and Liu [J. Amer. Statist. Assoc. 106 (2011) 672--684], taking into account the fact that direct observations of the idiosyncratic components are unavailable. The impact of high dimensionality on the covariance matrix estimation based on the factor structure is then studied.

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