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Efficient Principal Components Estimation of Large Factor Models

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Abstract : This paper proposes a constrained principal components (CnPC) estimator for efficient estimation of large-dimensional factor models when errors are cross sectionally correlated and the number of cross-sections (N) may be larger than the number of observations (T). Although principal components (PC) method is consistent for any path of the panel dimensions, it is inefficient as the errors are treated to be homoskedastic and uncorrelated. The new CnPC exploits the assumption of bounded cross-sectional dependence, which defines Chamberlain and Rothschild's (1983) approximate factor structure, as an explicit constraint and solves a constrained PC problem. The CnPC method is computationally equivalent to the PC method applied to a regularized form of the data covariance matrix. Unlike maximum likelihood type methods, the CnPC method does not require inverting a large covariance matrix and thus is valid for panels with $N \geq T$. The paper derives a convergence rate and an asymptotic normality result for the CnPC estimators of the common factors. We provide feasible estimators and show in a simulation study that they are more accurate than the PC estimator, especially for panels with N larger than T, and the generalized PC type estimators, especially for panels with N almost as large as T.

Keywords : high dimensionality, unknown factors, principal components, cross-sectional correlation, shrinkage regression, regularization, pseudo-out-of-sample forecasting
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