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More is not always better: back to the Kalman filter in Dynamic Factor Models

by

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Abstract

In the context of dynamic factor models (DFM), it is known that, if the cross-sectional and time dimensions tend to infinity, the Kalman filter yields consistent smoothed estimates of the underlying factors. When looking at asymptotic properties, the cross-sectional dimension needs to increase for the filter or stochastic error uncertainty to decrease while the time dimension needs to increase for the parameter uncertainty to decrease. In this paper, assuming that the model specification is known, we separate the finite sample contribution of each of both uncertainties to the total uncertainty associated with the estimation of the underlying factors. Assuming that the parameters are known, we show that, as far as the serial dependence of the idiosyncratic noises is not very persistent and regardless of whether their contemporaneous correlations are weak or strong, the filter uncertainty is a non-increasing function of the cross-sectional dimension. Furthermore, in situations of empirical interest, if the cross-sectional dimension is beyond a relatively small number, the filter uncertainty only decreases marginally. Assuming weak contemporaneous correlations among the serially uncorrelated idiosyncratic noises, we prove the consistency not only of smooth but also of real time filtered estimates of the underlying factors in a simple case, extending the results to non-stationary DFM. In practice, the model parameters are unknown and have to be estimated, adding further uncertainty to the estimated factors. We use simulations to measure this uncertainty in finite samples and show that, for the sample sizes usually encountered in practice when DFM are fitted to macroeconomic variables, the contribution of the parameter uncertainty can represent a large percentage of the total uncertainty involved in factor extraction. All results are illustrated estimating common factors of simulated time series.

*** Joint work with Pilar Poncela.**

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