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Efficient Likelihood Estimation in State Space Models

Abstract: Motivated by studying asymptotic properties of the maximum likelihood estimator in stochastic volatility models, in this paper, we investigate likelihood estimation in state space models. We first prove, under some regularity conditions, there is a consistent sequence of roots of the likelihood equation that is asymptotically normal with the inverse of the Fisher information as its variance. With an extra assumption that the likelihood equation has a unique root for each n , then there is a consistent sequence of estimators of the unknown parameters. If, in addition, the supremum of the log likelihood function is integrable, the maximum likelihood estimator exists and is strong consistent. Edgeworth expansion of the approximate solution of likelihood equation is also established. Several examples, including Markov switching models, ARMA models, (G)ARCH models and stochastic volatility models, are given for illustration.