Bayesian Random Trees for Calibrating State Price Densities of Financial Options

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Abstract

Option-implied densities, also known as state price densities (SPD) or risk-neutral densities, have been applied in various empirical applications, such as volatility forecasting, asset pricing, and risk management. The importance of understanding this density has led to a competing number of approaches for estimating the SPD. Semi- and nonparametric methods are preferable because they are free of model misspecification. However, most of existing methods are only applicable to European options. We propose an easy-to-implement Bayesian random tree approach to calibrate the SPD of American options. To the best of our knowledge, our approach is the first that is able to calibrate SPD of European and American options simultaneously. We asses the performance of the proposed model in terms of in-sample fitting, out-of-sample prediction, and hedging performance, via extensive empirical studies.