

Interest rate modeling and forecasting methods

Handling negative interest rates in the CIR framework

Viktória Tanács

Abstract

In this thesis we are interested in the short-term interest rate modeling techniques and forecasting methods and their accuracy. We calibrate the historical data-based CIR model using the Czech short-term and LIBOR interest rates. First, we use the ordinary least squares method and then use its output as a good initial value for the optimization of the maximum likelihood function. We introduce a method to handle negative interest rates and simulate yield curves. The main idea is to assume, that we can build the yield curves as a difference of 2 independent CIR processes. We show that from the solution of the Riccati equations we can calculate the price of a zero-coupon bond. We aim to minimize the error between the simulation and the real values, so we parameterize the model by optimizing the error function on a space, where the mean and mean-reversion speed of the processes are nonnegative and the Feller condition is also fulfilled. We test this method on two datasets, the ECB euro area yield curve contains negative values, while the US Treasury zero-coupon yield curve is strictly positive. We compare the result of the market and model prices, the t-forward rates, and the mean and variance of the rates, and conclude that we achieve better performance for ECB euro area data, where we have negative values also.