3314429/33144291 - Ausgewählte Themen der Stochastik (M27**): Interest rate modelling and derivate pricing**

Abstract:

In this lecture we discuss the modelling of interest rates and the pricing of interest rate derivatives. The guiding example will be the pricing and risk management of Bermudan swaptions, one of the most actively traded exotic interest rate derivatives in the market. Along the way we will present the various building blocks which are relevant for derivative pricing in general.

The lecture is structured in three blocks. In the first block we focus on the modelling of interest rates. We start by introducing quantities for static yield curve modelling and pricing of linear products. Then we derive the basic pricing models for Vanilla interest rate options (caps and European swaptions). This is supplemented by an analysis of the classical SABR model. In a next step we analyse the basic principles of term structure models in the Heath-Jarrow-Morton framework. This allows us to specialise to the classical Hull White interest rate model which will be discussed in detail. We also present relevant pricing methods applicable for Bermudan swaptions.

The second block is dedicated to the calibration of interest rate models. We discuss the resulting optimization problems for static yield curve construction and Hull White model calibration. Moreover, we eleborate on the numerical sulution methods for the optimization problems in question. This discussion includes various aspects for improving computational efficiency and robustness of the algorithms relevant in practice.

In the third block we analyse sensitivity calculation. This is particularly important in practice since Delta and Vega sensitivities are the building blocks for hedging and risk management. We discuss the pro's and con's of the still widely-used finite difference approximation methods. Then we present the basic methodologies from Algorithmic Differentiation which become more and more applied in the financial industry.

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Sebastian Schlenkrich is Principal in the Valuation unit at d-fine, a leading consultancy company specialised in risk and finance. In this role he manages and delivers client projects on current valuation and risk management topics.

Previously, in the Macro Valuation Methodologies Team at UBS Investment Bank, London he held responsibilities for methodology and tool development of pricing model validation. A focus of his research and work are valuation methodologies for interest rate, FX and hybrid derivatives. Furthermore he works in the field of Algorithmic Differentiation and its application in finance. Sebastian holds a PhD in Mathematics from Technische Universität Dresden and a MSc in Mathematical Finance from University of Oxford.