

Subject

Volatility smile analysis in the interest rate derivatives market

Supervisors, contact, place of research

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Project Description

One of the most pervasive features of virtually all options markets is the implied volatility smile/skew i.e. the dependence of option implied volatility on option strike. Documented first after the infamous October 1987 stock market crash, the smile soon challenged the practice of pricing options using the Black and Scholes (1973) model with a constant volatility as different options on the same underlying suddenly began trading at prices which implied different dynamics of the underlying instrument. This inconsistency sparked a growing body of literature on pricing and hedging derivatives in the presence of the smile. One of the most successful avenues of research in this regard was the class of so called local volatility models originated by Derman and Kani (1994) and Dupire (1994) and later extended in multiple directions.

Despite some shortfalls, such as poor predictive power with respect to the forward volatility and forward smile dynamics, Dupire-style local volatility models have been widely used in equity and FX markets. However, despite the fact that interest rates have grown to be by far the dominant underlying instrument for options globally (over 70% of exchange traded options and close to 90% OTC options settle to the value of some interest rate instrument, according to BIS data), the transposition of local volatility models to interest rate space proved elusive.

The recently developed method of Jablecki, Gatarek and Qu (2018) seems to be promising. The candidate's task will be the numerical implementation of this approach. The candidate should provide deep knowledge of probability theory and numerical methods.

Bibliography

1. Dupire, B. 1994. "Pricing with a Smile." *Risk* 7 (1): 18–20.
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3. Gatarek, D., J. Jablecki, and D. Qu. 2016. "Non-Parametric Local Volatility Formula for Interest Rate Swaptions." *Risk*, 20–124.

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