MARKET-BASED APPROACH TO MODELING DERIVATIVES PRICES

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Abstract. Most classical models for derivatives prices focus on prescribing the time evolution of the underlying stochastic factors. The prices of derivatives are then computed, for example, via the risk-neutral expectations. As markets developed and many derivative contracts became liquidly traded, it appeared necessary, in order to avoid creating arbitrage opportunities and to fully exploit the information given by the market, to calibrate such models so that they reproduce the observed derivatives prices. However, the calibration results may vary significantly from day to day, implying that none of the calibrated models can be used to describe the future time evolution of the derivatives prices and, in particular, study the risks associated with them.

The idea of the market-based approach is to model the derivatives prices directly, as the prices of generic financial assets. This approach allows to start a model from an arbitrary combination of derivatives prices currently observed in the market, without having to change (recalibrate) the model. In this presentation, I will outline the main problems associated with the construction of a market-based model and will present the general methodology which provides solutions to these problems. I will also give an overview of the existing constructions of the market-based models, starting with the famous Heath-Jarrow-Morton theory, and show how these results agree with the general method. Finally, I will illustrate the theory by constructing (both mathematically and numerically) a family of market-based models for the European call options of multiple strikes and maturities.