A multiple-curve CVA interest rate model

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Since the crisis, a variety of spreads have developed, notably Libor-OIS swap spreads and basis swap spreads. Moreover, counterparty risk and funding costs have become major issues in OTC derivative transactions. This paper studies the valuation of CSA interest rate derivatives in a multiple-curve setup. By CSA interest rate derivatives, we mean a portfolio of OTC interest rate derivatives between two defaultable counterparties, connected by the means of a legal agreement called a credit support annex (CSA) regulating the counterparty risk related cash-flows. The first step consists in the counterparty clean valuation of the portfolio, namely the valuation in a hypothetical situation where the parties would be risk-free, yet accounting for the post-crisis discrepancy between an OIS discount curve, and a Libor fixing curve. To this end, we develop a shifted L\'evy HJM multiple-curve model driven by a two-dimensional NIG process. The HJM framework yields an automatic fit to the initial Libor and OIS term structures and the dynamic parameters of the model are obtained by calibration to the 3m and 6m cap prices.

In the second step, the counterparty clean value process of the portfolio is used as an underlying to an option called contingent credit default swap (CCDS), which prices the correction in value known as the total valuation adjustment (TVA) to the portfolio due to the counterparty risk under funding constraints. We follow a reduced-form methodology through which the problem of pricing and hedging counterparty risk and funding costs can be reduced to low-dimensional Markovian pre-default TVA BSDEs, or equivalent semi-linear PDEs. As an example we study the case of a basis swap, for which we compute the TVA and its decomposition into credit and liquidity funding components.