F3 Curve Building OIS & CTD

FINCAD

F3 enables you to build, manipulate, and use multiple types of curves for discounting in a number of different currencies and collateral agreements. The curves can be constructed from a variety of market instruments, interpolation methods and parametric representations.

Single Currency Portfolio & CSA

The choice of discount curve is governed by the collateralization in the Credit Support Annex (CSA). Collateralized cash flows are discounted using the Overnight Index Swap (OIS) curve, and non-collateralised cash flows are discounted using the appropriate issuer curve based on Libor.

Dual Libor/OIS Discounting

Under OIS discounting, F3 builds two discount curves in each relevant currency: an OIS discount curve tagged with the collateral agreement implying full cash collateralization, and a discount curve implied from LIBOR (plus or minus a spread) tagged with a collateral agreement implying zero collateral.

Discount Curves

The Libor curve can be bootstrapped directly from any combination of cash deposit rates, futures, FRAs, and vanilla interest rate swaps, using tenor basis swaps where appropriate and discounted under OIS. The OIS curve can be bootstrapped from OIS swaps. Both curves can be interpolated using a choice of interpolation methods.

Alternatively, either curve can be constructed parametrically and calibrated to a user-defined set of market instruments, with configurable constraints, calibration methods and accuracy.

Forward Curves

The overnight rate is implied from the OIS discount curve. The forward Libor rate is constructed from the Libor discount curve using the OIS discounting assumption.

Example: OIS Discounting in USD

The forward curve for 3-month Libor is calibrated using the Futures and IRS quotes in the model. In the process, the convexity curve is built with configurable convexity adjustment. Curves for 1-month, 6-month and 12-month Libor are calibrated using the appropriate basis swap quotes.

The discount curve implied by Libor (plus or minus a spread) is built from the forward 3-month Libor curve.

The following curves are present in this model: Discount Curve (collateralized), Discount Curve (uncollateralized), Overnight Rate Curve, LiborUSD1m forward curve, LiborUSD3m forward curve, LiborUSD6m forward curve and LiborUSD12m forward curve.

Multi-Currency Portfolio & Single-Currency CSA

When working with multi-currency nettings sets, certain subtleties arise when the CSA dictates that collateral is posted in a single currency. For example, when the collateral earns interest at US Fed Funds, not only do you need a domestic OIS discount curve for each currency for determining the correct Libor rate, but you also need an FX-adjusted US Fed Funds discount curve for discounting the foreign flows collateralized in USD.

For most liquidly traded cross-currency swap market data, both legs of the swap are collateralized in a single currency. A legacy approach would be to solve for a foreign discount factor curve that prices the cross-currency swap market data to par. However, this discount factor should be calculated directly from the US Fed Funds discount curve and the FX Forward curve.

To correctly handle the subtleties of collateral agreements, your curve building framework needs to be able to decouple the discount factor curve used for discount foreign cash flows from the curve used to imply the FX forward rates. With this capability and with a generic calibration framework, the curve used to determine the FX forward rates should be the target of the calibration, as it is the only true unknown in the equation.

Cheapest-to-Deliver Curves

Some Credit Support Annexes (CSAs) allow a counterparty to choose the currency in which the collateral can be posted. This optionality has to be priced in and managed appropriately.

The choice of currency of collateral introduces complexity into building the discount curve, the "Cheapest-to-Deliver" curve that is used to price derivatives governed by multi-currency CSAs.

Multi-Curve Calibration

To manage multi-currency CSAs, the flexible nature of F3's generic calibration framework is applied to a multi-curve, dimension-switching OIS-Libor curve bootstrapping problem.

A list of groups of market instruments is supplied to F3, with the instruction to bootstrap two OIS discount curves, two Libor curves and a cross-currency curve; and F3 does the rest.

Flexibility

Specifically, F3 is able to figure out:

1. The appropriate points on each curve to set.
2. The fact that some trades only depend on one curve, while others depend on both.
3. The need to leave one curve alone when the calculation switches to a single, one-curve instrument priced to par; and
4. A shift to a multi-dimensional/ simultaneous bootstrap of multiple curves from sets of instruments, each depending on all the curves.

The calibration is highly configurable, allowing control of the root-finding algorithm, curves used as initial guesses, whether to choose the last known good calibration as an initial guess, arbitrary curve parameterizations and much more.

Generality

The same framework is used for any calibration problem in F3, from SABR vol cubes to hybrid correlation. In addition, detailed diagnostic information is available for any calibration, including per-iteration values as the optimization or root-finding algorithm finds a solution.

Simplicity

It is worth noting the compact nature of the calibration setup. Even though it uses a generic calibration framework, the setup fits comfortably within a few F3 function calls.

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