Basis Curve Construction Explained

Yield Curve

- Basis curve is defined as the relationship between the basis zero rate and it's maturity.

- Basis curves are used as the forecast curves for pricing interest rate products.

- Typical basis curves are 1-month LIBOR, 6-month LIBOR or 12-month LIBOR, FedFund and Prime Rate curves.

- The increase in basis spreads has resulted in large impacts on non-standard instruments.

- Basis curve is constructed from a set of market quotes of some liquid market instruments

- Normally a basis curve is divided into two parts. The short end of the term structure is determined using LIBOR rates. The remaining is derived using basis swaps.

- A basis swap is quoted on the spread of the basis leg as follows

$$r_t^{basis} = r_t^{base} + s_t$$

where

r_t^{basis} the zero rate of the basis curve at time t.

r_t^{base} the zero rate of the base curve at time t.

s_t the quoted spread of the basis swap at time t.

- The objective of the bootstrap algorithm is to find the zero yield or discount factor for each maturity point and cash flow date sequentially so that all basis curve instruments can be priced back to the market quotes.

- All bootstrapping methods build up the term structure from shorter maturities to longer ones.

Basis Curve

- Assuming that we have had all the yields of a 6-month LIBOR curve up to 4 years and now need to derive up to 5 years.

  - Let x be the yield at 5 years.

  - Use an interpolation method to get yields at 4.5 years as Ax

  - Given the 5 year market basis swap spread, we can use a root-finding algorithm to solve the x that makes the value of the 5 year inception basis swap equal to zero.

  - Now we get all yields or equivalent discount factors up to 5 years

- Repeat the above procedure till the longest basis swap maturity.

Basis Curve

- Popular interpolation algorithms in curve bootstrapping are linear, log-linear and cubic spline.

- The selected interpolation rule can be applied to either zero rates or discount factors.

- A root finding algorithm is also needed to match model price to market quoted price.

- Popular root finding approaches include Newton-Raphson, Levenberg-Marquardt, etc.

Thank You

You can find more details at