Assignment 6
Structured Products

1. Case Study: Structured bond

We need to compute a different bootstrap

On the 16-feb-24 at 10:45 C.E.T., the Bank XX issues a structured bond, whose hedging termsheet is described in the annex. Consider the Structured bond issue in a single-curve interest rate modeling setting and neglecting the counterparty risk. Market parameters for (flat) Normal Cap Volatilities are:

Serve solo per Bootstrap, sempre stato così. Cercare per sicurezza

Non c'è la probabilità di default per il counterparty contract.

It is required to

a. Bootstrap the market discounts for the 16-feb-24. You should:

Date ottenute con busdate, dobbiamo inserire tutte le holiday (possibile valore vuoto per semplificare la notazione) (altrimenti fino solo ai futures)

   1. Create a complete set of swap rates (with expiry after each year from 2y up to 50y with a *modified following* convention) from the ones in the excel file. Notice that you have yearly swaps till 12 years and then 15y, 20y.
   2. To have a complete set of swaps you should first select the settlement date with a *modified following* convention (e.g. on February 2036 the 2nd of February is a Saturday, then the settlement day with this convention is Monday the 4th of February 2036).
   3. Use spline interpolation on mid rates (with act/365 yearfrac convention for the time) to obtain the swap rates.

   Calcolare per ogni anno da 2y a 50y, guardare bene quelli che sono già presenti.
   La spline interpolation, solo tra quelli già dati
   Fare l'interpolazione sui mid perchè bid ed ask potrebbero dare fluttuazioni

X% calcolato tramite l'utilizzzo dei caplet (spot vols) e poi utilizzare gli NPV

b. Determine the upfront X% [Pricing]. Solve also computing the spot vols.

Bisogna usare le spot vols (calibrate) perchè devo utilizzare la forward formula dell'ultima lezione

c. Compute Delta-bucket sensitivities [Risk measure].
d. Compute total Vega.

A bucket means every year

e. Compute Vega-bucket sensitivities.
f. Consider the course-grained buckets (0-2y; 2y-5y; 5y-10y, 10y-15y). Completely hedge with swaps the Delta risk. [Portfolio risk management]
   Hint: Select 3 swap notionals (2y, 5y, 10y,15y) s.t. the corresponding bucket deltas are zero in the hedged portfolio (start with the longest swap).
g. Hedge the Vega with an ATM 5y Cap (strike = ATM 5y Swap rate same conventions), and hedge the total portfolio as in d.
h. Consider the course-grained buckets for the vega (0-5y and 5y-15y) hedge the bucketed Vega with a 5y Cap and 15 year Cap. Start hedging the longest cap.

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Exercise Annex:

Swap Termsheet

Principal Amount (N):   50 MIO EUR

Party A: Bank XX

Party B: I.B.

Trade date: today

Start Date: 20-feb-24   settlement date del flusso di cassa

Maturity Date (t):   15 years after the Start Date, subject to the <mark>Following Business Day Convention.</mark>

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Party A pays: Euribor 3m + 2.00%   2% è come lo spread over libor, che si aggiunge ogni volta
Euribor 3m può ricadere nella non floating notation.
(guardare le feste di pasqua per possibili traslazioni)

Party A payment dates: Quarterly, subject to Modified Business Convention

Daycount: Act/360

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Party B pays @ Start Date: X% of the Principal Amount   Quantità da trovare

Party B pays @ payment dates: Coupon

Party B payment dates: Quarterly, subject to <mark>Modified Business Convention</mark>

First Quarter Coupon: 3%   Fixed already at the start date   CAPPED means that the payoff cannot overcome the 4.30%, thus is 3m 1.1% and then fixed at 4.3 if over

Next Quarter Coupons: [Up to (and including) the 5th year] € 3m+ 1.10% capped at 4.30%
[After 5y and up to (and including) the 10y] € 3m+ 1.10% capped at 4.60%
[After 10y] € 3m+ 1.10% capped at 5.10%

To start a calibration, we can assume the first caplet as constant with all the other caplets.

Use the Bachelier model to compute the caplets

Drop the 18 months volatility, only the yearly caplets

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