Assignment 6
Structured Products

1. Case Study: Structured bond

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:

It is required to

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

b. Determine the upfront X% [Pricing]. Solve also computing the spot vols.
c. Compute Delta-bucket sensitivities [Risk measure].
d. Compute total Vega.
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:

Indicative Terms and Conditions as of 16-feb-24

Swap Termsheet

Principal Amount (N):	50 MIO EUR
Party A:	Bank XX
Party B:	I.B.
Trade date:	today
Start Date:	20-feb-24
Maturity Date (t):	15 years after the Start Date, subject to the Following Business Day Convention.

Party A pays:	Euribor 3m + 2.00%
Party A payment dates:	Quarterly, subject to Modified Business Convention
Daycount:	Act/360

Party B pays @ Start Date:	X% of the Principal Amount
Party B pays @ payment dates:	Coupon
Party B payment dates:	Quarterly, subject to Modified Business Convention
First Quarter Coupon:	3%
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%