Assignment 8
Structured Products

Case study: Certificate Pricing.

On the 15th of February 2008 at 10:45 C.E.T., consider Bank XX possible issue described in Annex 1 and the hedging swap in the Annex 2.

Use in the valuation a NIG model (suppose that interest rates and EURO STOXX dynamics are independent). For the NIG parameters use the ones obtained in the calibration of previous assignment (if not available use $(\sigma, \kappa, \eta) = (17.4\%, 45.3\%, 10.2)$ and discount factors of Assignment 2.

Questions:

a. Value the upfront X% that the bank should receive under mid-market conditions.
b. Model selection: in order to price this issue is it possible to use a different model? How much is the upfront in this case?
c. Which would be the error using Black model (e.g. using the implied volatility for the strike of interest)?
d. If the structured bond is with a three-year expiry, with the same payoff for the first year repeated also on the second one and Early redemption option at the end of first two years, is the alternative of point b. still available?
e. [facultative] Value X% of point d. under the hypothesis of same NIG parameters, same dividend yield of point a. and discount factors as in Assignment 2? [Hint: consider the dynamics for the underlying corresponding to the forward].

Exercise: Swaption Pricing via Hull-White.

On the 15th of February 2008, using Euro market data (versus Euribor 3m), price a 2y8y and a 5y5y ATM swaptions (Strike equal to the corresponding Forward rate) within a single curve framework. Consider a 1-factor Hull-White model with $a = 10\%$, $\sigma = 1\%$.

a. Price with Jamshidian formula;

b. Price via a tree (equally spaced in time) for the underling OU process [2]: it is suggested to insert a variable that controls for the precision (e.g. number of steps in each interval).

Compare the results.

Hint.
Implement the tree for the zero mean OU variable.

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Annex 1:

Indicative Terms and Conditions as of 15th February 2008

Issue Termsheet

Principal Amount:	100 MIO EUR.
Issue date:	15 Feb 2008
Issue price:	At par
Start Date:	19 Feb 2008
Maturity Date:	2 years after the Start Date.
Bank XX pays:	Coupon
Coupon:	Payable annually on a 30/360 (mod. foll. adjust.) day basis: Year 1: 4% if Stoxx50 < Strike at Coupon Reset Date Last Year: 2%. The Coupon shall be subject to the Early Redemption and Final Coupon clauses.
Coupon Reset Dates:	2 Business Days prior to the respective Coupon Payment Date (i.e. **in arrears**).
Strike	3200
Coupon Payment Dates:	Annually, subject to the Following Business Day Convention.
Early Redemption:	If on a respective Coupon Reset Date, the Coupon reset is such that the Cumulative Coupon Accrual would be equal or above the Trigger Level, the Notes will automatically redeem early on the respective Coupon Payment Date at a price of 100% of Par.
Trigger Level:	4%.
Cumulative Coupon Accrual:	The Previously Paid Coupon Percentage plus the originally scheduled Coupon payment based off the respective Coupon reset on the respective Coupon Reset Date ignoring the Trigger Level clause (expressed as a percentage of the Principal Amount).
Previously Paid Coupon Percentage:	For a respective Coupon period, the sum of all previously paid Coupon payments on the previous Coupon Payment Dates expressed as a percentage of the Principal Amount.

Annex 2:

Indicative Terms and Conditions as of 15th February 2008

Swap Termsheet

Principal Amount:	100 MIO EUR.
Party A:	Bank XX
Party B:	I.B.
Trade date:	today
Start Date:	19 Feb 2008
Maturity Date:	2 years after the Start Date.

Party A pays:	Euribor 3m + 1.20% The Swap shall be subject to the Early Redemption and Final Coupon clauses.
Party A payment dates:	Quarterly, subject to Modified Business Convention
Daycount:	Act/360

Party B pays @ Start Date:	X%
Party B pays:	Coupon
Coupon:	Payable annually on a 30/360 (mod. foll. adjust.) day basis: Year 1: 4% if Stoxx50 < Strike at Coupon Reset Date Last Year: 2%. The Swap shall be subject to the Early Redemption and Final Coupon clauses.
Coupon Reset Dates:	2 Business Days prior to the respective Coupon Payment Date (i.e. **in arrears**).
Strike	3200
Coupon Payment Dates:	Annually, subject to the Following Business Day Convention.
Early Redemption:	If on a respective Coupon Reset Date, the Coupon reset is such that the Cumulative Coupon Accrual would be equal or above the Trigger Level, the Swap will be automatically cancelled.
Trigger Level:	4%.
Cumulative Coupon Accrual:	The Previously Paid Coupon Percentage plus the originally scheduled Coupon payment based off the respective Coupon reset on the respective Coupon Reset Date ignoring the Trigger Level clause (expressed as a percentage of the Principal Amount).
Previously Paid Coupon Percentage:	For a respective Coupon period, the sum of all previously paid Coupon payments on the previous Coupon Payment Dates expressed as a percentage of the Principal Amount.