

REACFIN TRAINING – TABLE OF CONTENT

Introduction to Interest Rates risks modeling (High-level table of content)

1 day training

1. Why do we need interest rates models?

- i. Fair value assessments & Pricing
- ii. Projections and risk analysis
- iii. ALM
- iv. Macro-economic applications

2. Monte Carlo techniques and Random numbers generation

- i. Concepts
- ii. Key requirements of robust Monte Carlo simulations
- iii. Example of application: pricing of financial derivatives
- iv. Pseudo-random number generation & particular distributions
- v. Choleski decomposition
- vi. Practical algorithm - exercise

3. Deterministic bond

- i. Concepts & definitions
- ii. Constant rate models
- iii. Zero-Coupon term structure
- iv. Calculating Zero-Coupon rates using bootstrapping techniques
- v. Interpolation methods
 - a. Linear interpolations
 - b. Cubic Splines
- vi. Yield Curve models
 - a. Polynomial functions
 - b. Nelson-Siegel
 - c. Other models
- vii. Practical cases : Real life bonds portfolio pricing

4. Stochastic interest rates

- i. What are relevant characteristics
- ii. Concept of short rate models
- iii. Other models

5. Ho and Lee model

- i. Model specifications
- ii. Properties
- iii. Advantages and disadvantages
- iv. Practical exercises and case study in Excel an R

6. General continuous model with one factor

- i. Concepts
- ii. Key assumptions
- iii. Main steps
 - a. Obtaining the process P 's dynamics from Itô formula,
 - b. Define a market price of risk,
 - c. Show that this market price of risk does not depend on the maturity,
 - d. Use a change of numeraire to obtain the price of the ZC in a stochastic world.

7. Vasicek model

- i. Model specifications
- ii. Properties
- iii. Simplified example: Zero-Coupon price in a Vasicek Model
- iv. Simulating the Vasicek model
- v. Euler scheme
- vi. Dependencies between different maturities rates
- vii. Advantages and disadvantages
- viii. Applications for other risk drivers
- ix. Practical exercises and case study in Excel an R

8. Cox Ingersoll Ross model

- i. Model specifications
- ii. Properties
- iii. Simulating the CIR model
- iv. Advantages and disadvantages
- v. Practical exercises and case study in Excel an R

9. Hull-White model

- i. Model specifications
- ii. Properties
- iii. Simulating the HW model
- iv. Using Nelson-Siegel to model the Yield-Curve in a HW model
- v. Advantages and disadvantages
- vi. Practical exercises and case study in Excel an R

10. Black-Karasinski model

- i. Model specifications
- ii. Properties
- iii. Simulating the Black-Karasinski model
- iv. Using displacement factors to model negative rates
- v. Advantages and disadvantages
- vi. Practical exercises and case study in Excel an R

11. G2++ model

- i. Concept of 2 factors models
- ii. Model specifications
- iii. Properties
- iv. Calibration issues
- v. Advantages and disadvantages
- vi. Practical exercises and case study in Excel an R
- vii. Other 2 factors models overview

12. Example of application: Pricing options on zero coupon

13. The Diebold-Li model

- i. Econometric approach & parametric fitting
- ii. Parsimony principle
- iii. Auto-regressive models of the ARMA type
- iv. Model specifications
- v. Examples and properties
- vi. Calibration
- vii. Advantages and disadvantages
- viii. Practical exercises and case study in Excel an R