Reacfin
Know-How to Risk

REACFIN TRAINING – TABLE OF CONTENT

Residential mortgage valuations and European market overview (with a focus on Belgium & the Netherlands)

Typically a 3 to 4 days training often articulated as follows:

1. **Introduction**
    a. Scope of the training, proposed focus and objectives
    b. Typical approach for Mortgages valuation:
        i. General principles
        ii. Main building blocks
    c. High-level introduction to bank's valuation approach
    d. High-level introduction to insurers valuation approach
    e. Why banks and insurers approach differ and which opportunity this may create for insurers
    f. Typical models used by Belgian Insurers

2. **Description and typology of the product**
    a. General features (market sizes & real estate market evolution) & how the Belgian and Dutch market compares to other European markets
    b. Specificities of the Belgian market
        i. Mortgages typology
        ii. Volumes
        iii. Prepayments
        iv. Defaults
    c. Specificities of the Dutch market
        i. Mortgages typology
            - Before 1st of January 2013
            - Since 1st of January 2013
        ii. Volumes
        iii. Prepayments
        iv. Defaults
            - Specific focus on NHG
    d. Specificities of other European markets
        i. Mortgages typology
        ii. Volumes
        iii. Prepayments
        iv. Defaults

3. **Basel II/III, Solvency II and accounting treatment**
    a. Treatment of Mortgages under Basel II/III
        i. Treatment under the standard approach

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ii. Particularities of IRB approaches compared to commercial loans (no foundation vs. advanced)
iii. IRB models: differences in risk-weights between European countries and banks
iv. Model Life-Cycle Management
    - Overview of concept
    - Typical practices in Europe (with a specific focus on Belgium and the Netherlands)
v. Recent regulators initiatives to harmonize Risk Weights
    - The March 2016 EBA consultation
    - Add-ons – the example of the Belgian Market
    - Floors – the example of the Swedish market
vi. Applying for IRB models
    - Main requirements under CRD IV
    - Example of application file (NBB)
    - Typical real life process
    - Practical consequences on internal organization, governance and systems
vii. Mathematical models
    - Logistic Models
        - Basic logit and probit regression
            - Practical case study using R or Matlab
        - GLM models using logistic terms
            - Practical case study using R or Matlab
    - Other Methods
        - Models based on Principal Components Analysis
            - Practical case study using R or Matlab
        - Classification trees
            - Practical case study using R
        - Regression trees
            - Practical case study using R
        - Advanced Statistical Machine learning techniques
            - Random Forest Algorithms with practical case study using R
            - Introduction to Neural Networks Algorithms with practical case study using R
    - Which mathematical models are used where in Europe and by which types of banks
viii. Usual explanatory variables
    - Overall in Europe
    - Particularities of Belgium
    - Particularities of the Netherlands
ix. Data management

- Typical IT architecture
- Data collection
- Data storage and extraction
- Data Validation

x. Accounting for expert judgement – European market practices with a focus on Belgium and the Netherlands
- During model design & model review phase
- During calibration phase
- During testing phase
- During deployment & exploitation phase

xi. Other Market Standards (Rating classes granularities, time series considered)
- In Belgium
- In the Netherlands
- In the rest of Europe

b. Treatment of Mortgages under Solvency II
   i. General overview
   ii. Specificities of the Standard Formula
   iii. Particularities of some internal models
   iv. Handling NHG under Solvency II

c. Accounting treatment
   i. IFRS treatment
   ii. Hedge Accounting considerations
   iii. Belgian GAAP treatment
   iv. Impairments

4. Valuation of Mortgages – Part I

a. Introduction
   i. Overview of the valuation approach
   ii. Different ways to account for credit risk on cash flows
   iii. Simplified examples and exercises
   iv. When to use which approach

b. Cash Flow projections and applicable interest rates

c. Determining the discount rate
   i. The rate New Business approach
   ii. The decomposition approach
   iii. Law of one price
   iv. Discount rate components
- Risk Free rates
  - Relevant curve(s)
  - Deposit rates
  - Future prices
  - Swap rates
  - Multiple curves approach
  - Practical considerations
- Liquidity Spread
  - Overview of methods
  - RMBS method
  - CDS negative-basis method

- Covered Bonds method
- Structural Model method
- Historical comparison of the different methods

v. Discount rate components (ctd)
- Credit Spreads
  - Overview
  - Definition of default
  - Cost of credit defaults
  - Expected Loss
  - Credit cycles
- Other components (servicing fees, commercial margin, brokerage commissions)

vi. Practical exercise: Valuing mortgages disregarding their optional components

7. Valuation of Mortgages - PART II

a. Embedded options

i. What is an option

ii. Typology of options embedded in Mortgages
- Caps
- Floors
- Caps & Floors: practical examples
- Caps & Floors: Belgian Floating Rates mortgages specificities
- Prepayment options
  - In Belgium
  - In the Netherlands

iii. Option Pricing Theory
- Risk Neutral Pricing
- Simplified concept: Binomial trees
  - Case study in Excel & VBA
- Merton-Black-Scholes
- Closed Form Solutions
  - Case study in Excel & VBA
- Trinomial trees
  - Case study in Excel & VBA
- Monte-Carlo Simulations
  - Case study in Excel & VBA
- Additional practical exercises

iv. Global Caps & Floors
- Intrinsic vs. Time Value
- Global Caps & Floors : definition & pay-off
- Valuation using the Black 76 formula
  - Practical modeling example in Excel and VBA

v. Valuation of Explicit Options: Local Caps & Floors

- Global Caps & Floors : definition & pay-off
- Valuation using Monte-Carlo Simulations
    - Practical modeling example in Excel and VBA

vi. Model choices and calibration

- Handling basis risk
    - Ignoring Sovereign-IRS basis
    - Assuming constant spread
    - Ratio models
    - Spread models
    - Hedged Monte-Carlo's
    - Practical deployment
- Model calibration
- Choosing the model
- Assessing the models effectiveness by simulating a "Hedging Contest"
- Examples using Excel & VBA

vii. Prepayment options

- Overview of modeling approaches
- The CPR approach
    - Case study in Excel
- Prepayment models
    - Model development
        - Data collection
        - Explanatory analysis
        - Building the model
    - Option pricing model
        - Case study in Excel
    - Hybrid models
        - Case study in Excel
    - Empirical models
        - Case study in Excel
- Exercises using Excel

ii. Other embedded options

- Origination (or "Pipe-line") option
    - Model choices
    - Model development
    - Model calibration
    - Case study: Pipe-line option model in R
    - Market practices in Europe (with a specific focus on Belgium and the Netherlands)
- Other 'option-like' consequences of customers behaviors and evolution in preferences
    - Model choices

- Model development
- Model calibration
- Examples in R

b. Overview of some typical market practices in Europe
   i. Mortgages Lending Value
   ii. Loan-To-Value standards
   iii. Other key ratios
      - Loan-To-Income
      - Debt-Servicing Ratio
   iv. Funding Mix
   v. Banker's income-focused approach
      - Concept of FTP
      - Practical applications of FTP mechanisms
      - Issues with market consistency
      - Specific cases observed in the Netherlands and in Belgium
   vi. Insurers' integrated approach
      - Typical characteristics of mortgage valuation models
         - In Belgium
         - In the Netherlands
      - The evolution in the Netherlands
      - The evolution in Belgium
   iii. Transferring Mortgages books from the originator to the investment portfolio of an insurance company
      - Reconciliation of Bank & Insurers valuation approaches
      - Estimating the Fair Market level of the spread
      - Transfer of Mortgages from Banks to Insurers under Whole-Loans transactions
      - Assessing cost of transaction for the bank
      - Assessing the net excess spread for insurers
      - Some key concerns of European Regulators
   vii. Modeling & calibrating Mortgages in Economic Scenario Generators
      - Typical applications
         - Strategic Asset Allocations
         - Solvency II internal models
         - Risk Management projections
      - Usual stochastic models considered
      - Modeling relation with other asset classes
      - Data & calibration aspects
         - Relevant data sources
         - Accounting for the particularities of the mortgage book to be modeled
         - Calibration process – typical market practices
      - Model validations
         - Under Real World assumptions

- Under Risk Neutral world assumptions

10. ALM - interest rates hedging on Mortgage books

a. Concept of hedging
b. Interest rates risks mitigation approaches
c. The IR derivatives market
d. FRA's
e. Interest Rates Swaps
f. Valuation & assessment
   - Bootstrapping
   - Continuously compounding rates
   - Linear vs. cubic spline interpolation
   - IRS valuation principles
   - Using Bloomberg to value swaps
g. Mitigating IR risks using swaps
h. Important market conventions
i. Optional products on Interest Rates
   - Caps, caplets, floors and floorlets
   - Valuation of caplets and floorlets
   - CMS caps & floors
     - Concept
     - Hedging IR risks with CMS options
     - Example of option combinations
       - Collars
         i. Concept
         ii. Evolution in time
       - Floored & Capped collars
       - Spreads
       - Contingent premium structures
   - Swaptions
     - Concept
     - Market standard
     - Valuation principles
     - Hedging IR risks with swaptions
   - Market depth and other practical considerations when considering large hedging transactions

11. Introduction to the Residential Mortgage securitization market

i. Structural overview and definitions
   - Mechanic of a securitization
   - Concept of Waterfall
     - Principal Waterfall
     - Interest Waterfall

        - Post-enforcement Combined P&L Waterfall
    - Structure of a generic RMBS transaction
    - The several parties involved in a securitization
    - Cash vs. synthetic securitizations
    - Value drivers of RMBS

ii. Market sizes in Europe and main issuers
    - Sizes on the European RMBS primary and secondary market
    - Specificities of European RMBS and main difference vs. the US
    - Specificities of European RMBS:
        - Call date redemption
        - Valuation models
        - Collateral data
        - CDR & default predictors
        - Loss Severity
        - Waterfalls (attachment & detachment points, ratings)
    - Practical case: Comparing Dutch, UK and US RMBS

iii. Typical features of European RMBS
    - Mains building blocks of RMBS Cash-Flow Analysis
    - Pay-down: slug, controlled amortization, hard & soft bullet
    - Excess Spread
    - Principal deficiency ledger
    - Reserve Fund
    - Over-collateralization
    - Embedded Interest Rates hedging through Interest rates swaps (plain vanilla and exotics)

iv. Typical Residential Mortgage securitization process and time-line
    - Why & when to bank consider securitization of Mortgage portfolio's
    - Decision that will need to be taken by the originator
    - Key elements looked at by rating Agencies
    - Typical rating process
    - Time-line of a cash Residential Mortgage Securitization
    - Points of attention to be considered at each steps in the securitization process

v. Specificities of Dutch RMBS's
    - Typical structural features
    - Particularities of the collateral
        - Housing market in the NL
        - Accounting for NHG Guarantee in RMBS's valuation

    - Amortization mismatch
    - Criteria's non-compliance rate
    - WEW related risk
- Practical case studies: modeling and valuing different recent real-world Dutch RMBS's in Excel
- Practical case studies: Building Dutch RMBS's in R