
# CREDIT RISK MODELLING
# [225+ hours]

## EXCEL + PYTHON

## 1. Basic Understanding

- **1.1** Understanding Loan Lifecycle
- **1.2** Scorecards vs Basel vs IFRS9 vs Stress testing models
- **1.3** Excel and Python hands-on – Data Preparation for Model development using MENTOS

## 2. Scorecards

- **2.1** Application Scorecard vs Behavioural Scorecard
- **2.2** Understanding Bad definition
- **2.3** Excel hands-on - Roll Rate Analysis (to incorporate bad flag) on Fannie Mae Mortgage data
- **2.4** Understanding concepts of Snapshot, Observation Period & Performance Period
- **2.5** Excel hands-on - Vintage analysis to identify Performance Window
- **2.6** Segmentation techniques, criteria and validation checklist (Excel)
- **2.7** Variable Selection using PCA clustering and Information value (Excel)
- **2.8** Fine Weight of Evidence Binning and Coarse Weight of Evidence Binning (Excel)

- **2.9** Excel and Python hands-on – Building Application Scorecards using Logistic Regression

- **2.10** Behavioural variables creation – utilisation, payment and delinquency

- **2.11** Deciding cut off by maximizing Revenue or profit or minimizing risk (Excel)

- **2.12** Thinking beyond Statistics - Policy rules, Overrides, Reject Inferencing (Excel)

## 3. Loss Modelling

- **3.1** Excel hands-on - Modelling Losses through Age Period Cohort Analysis

- **3.2** Excel hands-on – Modelling Losses using Flow Rate Analysis

## 4. Modelling Probability of Default

- **4.1** Excel hands-on -Calculating PD using Logistic Regression

- **4.2** Calculating PD using Machine Learning Techniques (Excel)

## 5. Modelling Loss given Default

- **5.1** Calculating workout LGD (Excel)
- **5.2** Handling incomplete workouts using Chain Ladder Method (Excel)
- **5.3** Tobit, Fractional Logit & Beta Regression for LGD Modelling (Excel)
- **5.4** LGD modelling using Survival analysis (Excel)
- **5.5** Component based approach for LGD modelling (Excel)

## 6. Modelling Exposure at Default

- **6.1** Modelling EAD using CCF (Excel)
- **6.2** CCF data preparation using Fixed & Variable Horizon, Cohort approach (Excel)
- **6.3** CCF Regression (Excel)

## 7. Cure Modelling

- **7.1** Instant Cure vs Probationary Cure (Model design)
- **7.2** Loss given Cure modelling (Excel)

## 8. Basel Capital Charge

- **8.1** RWA & Capital Adequacy Ratio calculations (Excel)
- **8.2** Using Vasicek formula to convert TTC PD to Worst Case PD
- **8.3** Excel and Python hands-on - Calculating Capital as per Basel IRB Approach

## 9. IFRS 9 Introduction

- **9.1** TTC PD in Basel vs PIT PD in IFRS
- **9.2** 12 months PD calculation vs lifetime PD calculation
- **9.3** Understanding Concepts of Staging – Stage 1| Stage 2 | Stage 3

## 10. IFRS 9 PD Calculation

- **10.1** Understanding Conditional PD Vs Unconditional PD
- **10.2** Excel and Python hands-on – Converting TTC PD to PIT PD using Scalar approach
- **10.3** Excel and Python hands-on – Converting TTC PD to PIT PD using Log Odds shift

- **10.4** Calibration & Smoothening techniques (Excel)
- **10.5** Excel and Python hands-on – Converting TTC PD to PIT PD using z score
- **10.6** Excel and Python hands-on – Converting TTC PD to PIT PD using multi state Transition matrices
- **10.7** Building PD term structure for lifetime under 2 states and multi state framework (Excels)

## 11. CECL techniques

- **11.1** Discrete Time Hazard Models (Excel)
- **11.2** Snapshot/Open Pool Method (Excel)
- **11.3** WARM Model (Excel)
- **11.4** Vintage analysis (Excel)

## 12. Actuarial Credit Risk Models

- **12.1** Survival analysis (Excel)
- **12.2** Cox Regression, Accelerated Failure Time models (Excel)
- **12.3** Age Period Cohort Analysis (Excel)

## 13. APC Extensions

- **13.1** Validating APC - Alternating Vintage Diagrams, Moran's D (Excel)
- **13.2** Bayesian APC (Excel)
- **13.3** Quantifying Adverse Selection by Vintage (Excel)
- **13.4** Adverse Selection through Fixed and Random effects (Excel)

## 14. IFRS 9 LGD & EAD Calculation

- **14.1** PIT forward looking term structure of LGD as a function of Collateral value (Excel)
- **14.2** PIT forward looking term structure of LGD using Regression (Excel)
- **14.3** Calculating PIT LGD using Jacob Frye model (Excel)
- **14.4** EAD Term structure for credit cards using PIT CCF Modelling (Excel)
- **14.5** EAD Term structure for loans using amortisation schedule (Excel)
- **14.6** Modelling prepayments and incorporating in amortisation schedules (Excel)

## 15. IFRS 9 Staging criteria

- **15.1** Staging decision tree using quantitative and qualitative criteria
- **15.2** Staging Validation (Excel)

## 16. Wholesale Models

- **16.1** Understanding Transition Matrices
- **16.2** Building Transition Matrix using Cohort Approach (Excel and Python)
- **16.3** Building Transition Matrix using Duration Approach (Excel and Python)
- **16.4** Excel and Python hands on - Converting TTC Transition Matrix to PIT Transition matrix
- **16.5** Validating Transition Matrices (Excel)
- **16.6** Building Wholesale scorecards using Quantitative and Qualitative scores

## 17. Low Default Portfolios

- **17.1** Bayesian approach to handle LDP (Excel)
- **17.2** Pluto Tasche Approach (Excel)
- **17.3** Van Der Burgt Method (Excel)
- **17.4** QMM Method (Excel)

## 18. Stress Testing

- **18.1** Top Down vs Bottom Up stress Testing (Excel)
- **18.2** Understandings CCAR vs DFAST requirements
- **18.3** Modelling ARIMA & ARIMAX (Excel)
- **18.4** Regression modelling and assumption handling (Excel)
- **18.5** Variable selection pipeline for macro-economic models
- **18.6** Excel and Python hands-on – Building CCAR models using multiple regression and VECM
- **18.7** Excel hands-on – Perform 9 quarter In Sample & Out of Sample Back testing

## 19. Model Validation

- **19.1** Evaluating Discriminatory Power of Model (Excel)
- **19.2** Evaluating Accuracy of Model and Calibration (Excel)
- **19.3** Performing Stability analysis (Excel)
- **19.4** Margin of Conservatism (Excel)
- **19.5** Validating Scorecards and Basel Capital Models (Excel)
- **19.6** Validating Transition Matrices (Excel)
- **19.7** Validating PIT IFRS 9 models including staging criteria (Excel)

- **19.8** Validating Stress Testing Models (Excel)
- **19.9** Validating LGD and EAD models (Excel)
- **19.10** Model Risk Management using SR 11-07 checklist

## 20. Pricing Loans

- **20.1** Optimizing Yields using Solver (Excel)
- **20.2** RAROC based pricing (Excel)

## 21. Corporate Credit Models

- **21.1** Merton & KMV Models (Excel)
- **21.2** Credit Plus Models (Excel)
- **21.3** Credit Portfolio View (Excel)
- **21.4** Credit Metrics Model (Excel)

## 22. Machine Learning for credit risk

- **22.1** Supervised Learning – LDA, SVM, Decision trees, XG Boost, Neural Network (Excel)
- **22.2** Unsupervised Learning – PCA, Clustering (Excel)