Measuring Lifetime Expected Credit Losses Using PIT/TTC Dual Ratings to Support IFRS9

IFRS9 Workshop – 2nd Edition of Credit Risk Modelling for IFRS9

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Point-in-Time Methodology & IFRS9 Challenges

Agenda

• Overview – Key Points – PIT IFRS9 Challenges & Historical Background

• Overview - PIT-TTC Framework & Methodology Required for Developing PIT Measures
  ➢ Systematic Credit Cycles, PIT/TTC Measures, Model Calibration & Batch Processing
  ➢ Utilizing PIT Measures to Project ‘ECL’ for IFRS9 for Retail, Commercial & Wholesale

• Summary – Integrated IFRS9 & Stress test Architecture & Key Points in the Presentation
Point-in-Time Methodology & IFRS9 Challenges

Key Points in this PIT/TTC Dual Ratings IFRS9 Challenges

1) Systematic Credit Cycles Exist & Can be Measured – Motivates PIT-TTC Distinctions

2) Evolving Regulatory Agenda – TTC for Basel II – PIT for IFRS9 & Stress Testing

3) IFRS9 Modelling – Commercial, Corporate & Retail Require Different Approaches

4) Substantial Accuracy Implications Motivate PIT – Wholesale ECLs can vary across the credit-cycle between starting at a peak or trough by a factor of 3-5 times !!!

5) IFRS9 & Stress Testing Require One Integrated Batch Solution & Architecture
1. Regulatory Compliance:
   - Support portfolio-wide PIT/TTC methodology development
   - Provide integrated & unified IFRS9 & Stress Testing solutions
   - E2E support for internal model governance & regulatory approval

2. Know Your Risk:
   - E2E PIT/TTC implementation
   - Dual PIT/TTC ratings framework
   - Advanced Credit Cycle Measures
   - Integrated PD/LGD/EAD Solution

3. Increase Returns:
   - Batch Processing: competitive advantage
   - Accurate Asset Valuations/Early Warning
   - Optimize Model accuracy & Capital Costs

4. Multiple Business Objectives:
   - Capital (TTC)
   - IFRS9/Provisioning (PIT)
   - Stress Testing (Stress PIT)
   - Risk Appetite (TTC)
   - Sanctioning (TTC)
   - Pricing (PIT)
   - Early Warning (PIT)
   - CVA (PIT)
Primary PIT/TTC Drivers - Risk Ratings & Regulatory Evolution

Dual Ratings & Credit Benchmarking – Represent New Paradigms in Risk Management

- Basel I
- Basel II (TTC)
- Stress Testing (PIT)
- IFRS 9 (PIT)

Regulatory Evolution

Dual Ratings Required

Internal AIRB Models Determine TTC Rating

Post B2 – ‘RW Conundrum’ Leads to ‘AERB’ Model Calibrations

Credit Benchmarking Across Bank’s Internal Ratings

Full External & Internal Benchmarking

90s 2002-07 2014 2015-20
‘Point-in-time risk parameters (PDpit and LGDpit) should be forward looking projections of default rates and loss rates and capture current trends in the business cycle. In contrast to through-the-cycle parameters they should not be business cycle neutral. PDpit and LGDpit should be used for all credit risk related calculations except RWA under both, the baseline and the adverse scenario. Contrary to regulatory parameters, they are required for all portfolios, including STA and F-IRB.’

EBA – ‘Methodology EU-wide Stress Test 2014’ Version 1.8, 3 March 2014, P 26
Regulatory Evolution Also Motivates Benchmarking

Dual Ratings & Benchmarking – Represent New Paradigms in Risk Management

‘Benchmarking’ - A standard by which something can be measured or judged

1990s
- Use External Agency Ratings & Default to Develop Corp PD Models ‘Agency Replication’

2000s
- Market-Based PD Models MKMV EDFs
- Credit Derivative Markets Pricing Risk Neutral PD
- Basel II Substantial focus on collecting & using Internal Credit Data for ‘Internal’ Model Calibration

2010
- AIRB Regulatory Benchmarking FSA HPE EBA/FRB Etc

2015 +
- Benchmarking Initiatives to collect & compare model calibration
- PECDC Loan Loss Data Collection ‘By Banks for Banks’ Supports LGD Benchmarking
- AERB

Point-in-Time Methodology & IFRS9 Challenges

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Systematic Credit Cycles Require PIT/TTC Distinctions

TTC Ratings for B2 are Conditionally Cycle Neutral – PIT Ratings Reflect ‘True’ Risk

Idiosyncratic Risk
(Specific to the Client)

- Primarily a function of Leverage & Cash Flow Volatility
- Assessed using financials & qualitative assessments
- Changes measured by internal models are typically infrequent

Systematic Risk
(Specific to the Economy)

- Credit Conditions deteriorate, client cash flows fall, client PDs rise
- Credit Conditions improve, client cash flows rise, client PDs fall
- Credit Conditions (assessed using equity data) change frequently
- Monthly changes according to client’s primary region and sector (PIT)
- Region and Sector values set to their long run averages (TTC)

PIT & TTC PD

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Systematic Wholesale Credit Cycles Can Be Measured

The Existence of Credit Cycles Motivates PIT/TTC Modeling Approaches

- Credit cycles are prominent in corporate defaults, losses & MKMV EDFs
- Using credit cycles in PD estimation significantly improves PIT prediction accuracy
- Empty Glass vs 20% Full Glass

Credit Cycles Indices Derived from Various PD, Rating & Loss Measures: MKMV EDFs, S&P Default Rates & C&I Loss Rates

Annualised Quarterly default rates: 3 Quarter Moving Average – S&P Corporates

Credit Cycle Index

ZGAPs: Smoothed 3 Qtr Moving Average - Corporates

Default Rate

Annualized Quarterly DR: 3-qtr Moving Average - Corporates

Predicting historical defaults improves when incorporating credit cycle measures directly in estimating PIT models

Removing the credit cycle in implementation generates correctly calibrated TTC PDs

Long run average historical default rate (TTC) required for capital (25 yrs)
Almost All Credit Models Are Blind to Credit Cycles

A Component of Credit Cycles is Predictable - Systematic Cycles in Industries & Regions

Current Credit Models Are Blind to Credit Cycles – 20% Prediction is Therefore Powerful

Source: Moody's KMV, Aguais/Forest research

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- Benchmarking Initiatives to collect & compare model calibration

PECDC
- Loan Loss Data Collection ‘By Banks for Banks’ Supports LGD Benchmarking

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Joint Projections of PIT PDs, LGDs, EADs Determine ECLs

Bond & Loan Portfolios – B2 Models & Agency Ratings Converted to PIT for IFRS9 ECL

Projected ‘ECL’ – Utilise Jointly Simulated/Correlated PIT EAD/LGD/EAD

Wholesale Basel PD models & Agency Ratings are mostly TTC — Therefore Credit Cycle Indices can be Utilised to Convert Agency Ratings or Internal Scorecard Models to Pure PIT Measures for IFRS9
PIT/TTC Approach Models Detailed Industry/Regions

Industry & Region Systematic Factors are Combined to Develop Credit Cycle Indices

Industry Sector $Z_i$
- Aerospace & Defence
- Banking
- Chemicals & Plastic Products
- Construction
- Consumer Products
- Oil & Gas
- Finance, Real Estate & Insurance
- Hotels & Leisure
- Basic Industries
- Machinery & Equipment
- Media
- Medical
- Steel & Metal Products
- Mining
- Motor Vehicle & Parts
- Retail & Wholesale Trade
- Business & Consumer Services
- Technology
- Transportation
- Utilities
- Commercial Real Estate

Spot Median $Z_{S/R}$ Gap
LR Median $Z_{S/R}$ Gap

Regional $Z_R$
(Corp/FI)
- Asia
- Continental Europe
- United Kingdom
- Latin America
- North America
- Pacific

PIT/TTC Approach Models Detailed Industry/Regions

Deloitte
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Credit Cycle Behavior (Z) is Driven by Two Competing Influences – Mean Reversion & Momentum

Almost All Data Exhibiting Credit Cycles Shows Two Competing Empirical Influences
Industry Examples of Systematic Credit Cycles & Forecasts

Banking, Finance, Insurance & Real Estate

![Graph showing credit cycles and forecasts for Banking and Finance, Insurance & Real Estate industries. The graph includes a line for the Long Run Average and markers for Actual and Forecast.]
Industry Examples of Systematic Credit Cycles & Forecasts

Industries – Basic Industries, Steel & Metal Products, Mining, Utilities, Oil & Gas

![Graph showing industry examples of systematic credit cycles & forecasts. The graph displays data for Basic Industries, Mining, Oil & Gas, Steel & Metal Products, and Utilities. The Z Gap is plotted over time from 1991 to 2018. The graph includes a legend indicating different industries and a line for the Long Run Average.]
Regional Examples of Systematic Credit Cycles & Forecasts

Regional Corporates - Asia, North-America, Europe, Pacific, UK, Latin America

[Graph showing regional credit cycles and forecasts for different regions: Asia, North America, Europe, Pacific, UK, and Latin America. The graph includes a line for the long run average and a line for actual values.]

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Developing Multi-Year Cycle-Adjusted IFRS9 Credit Estimates

Core PD PIT Methodology Needs to Be Adapted for Different Borrowers & Models

**Retail/Consumer & Small Bus up to £1 mil**
- Dominated by Behavioral Scorecards
  - ‘Backward Looking’ PIT
- Need Forward Looking PD/LGD/EAD Term Structures

**‘Commercial’ - £1 mil to £25-50 mil Turnover**
- Dominated by Commercial Scorecards
  - Financials & Qualitatives
  - ‘Close to ‘Fully TTC’
- Need PIT Conversion & Forward Looking PD/LGD/EAD Term Structures

**‘Corporates & Banks’**
- Dominated by ‘Agency Replication’
  - ‘Mostly TTC’
- Need PIT Conversion & Forward Looking PD/LGD/EAD Term Structures
PIT/TTC Framework for Wholesale Can Be Applied to Retail

PIT & Stress Test Modelling – Model Calibration Utilizes Macro & Credit Factors

Regional Credit Cycle Indices
- GDP, Personal Income, Unemployment, House Prices
- GDP, Equity Indexes & Credit Spreads

Industry Credit Cycle Indices
- Benchmark PIT PDFs – MKMV, Kamakura, Bloomberg
- Personal Income/debt, Unemployment, House Prices, Consumer Loss Rates, Benchmark DRs

Macro Factors
- GDP, Personal Income, Unemployment, House Prices
- Industry/Region

Credit Factors
- GDP, Equity Indexes & Credit Spreads
- Portfolio/Obligor

Basel TTC Models
- PD
- LGD
- EAD

Industry/Region
- Asia
- Europe
- Great Britain
- Latin America
- North America
- Pacific
- South Africa

Portfolio/Obligor
- Ret Morts
- C Cards
- UNSEC
- Asset Fin
- Soc Hou
- SME
- CRE
- NBFIs
- Sovs
- Banks
- LG Corps
### IFRS 9 – Requires Point-in-Time Measures

**PIT/TTC Rating – Accurate (1) Assessment of Significant Deterioration & (2) Lifetime EL**

<table>
<thead>
<tr>
<th>S&amp;P Mapping</th>
<th>PD Mid-Point</th>
<th>Internal Ratings</th>
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<tbody>
<tr>
<td>AAA</td>
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<tr>
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<td>BBB+</td>
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<td>BBB</td>
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<td>BBB/BB+</td>
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<tr>
<td>BBB-</td>
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<td></td>
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<tr>
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<td></td>
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<tr>
<td>CCC+</td>
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<tr>
<td>D</td>
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**Credit Risk Improvement**

**IFRS 1 Year Credit EL**

**Stable Credit Risk**

**IFRS ‘Significant Deterioration’**

**PIT Cycle Adjusted PD Term Structures**

**IFRS Lifetime Credit EL**

**Balance of 5-Year Facility/Borrower Term**

- Origination
- 1 Yr Later
- + 1 Year

**Time**
Accurately Assessing IFRS ‘Significant Deterioration’ Requires PIT Risk Measures

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PIT Ratings Changes Driven Only by Systematic Industry/Region Credit Cycles

- ‘BBB’ Mapping for ‘Good Times’ PIT Credit Conditions
- ‘BBB’ Mapping for LR Average Credit Conditions
- ‘BBB’ Mapping for ‘Bad Times’ PIT Credit Conditions

AIRB TTC Models Designed for Capital – IFRS

‘Significant Deterioration’ Assessment Requires PIT Measures to be Accurate
Assessing IFRS ‘Significant Deterioration’ Requires Multiple PIT Risk Assessments

**Requirements:**
An entity shall use the change in the risk of a default occurring over the expected life of the financial instrument instead of the change in the amount of expected credit losses (IFRS 9 5.5.9)

**Options:**
1. Lifetime Point In Time PD term structure
2. 12m PIT PD
3. Other data based triggers (Ref IFRS 9 B5.5.17)
4. Expert Overlay
5. Combined Waterfall / Hierarchy of Application

**Ascertain Threshold Levels considering:**
1. Model Error bands
2. Volatility of Stage Allocation
3. Existing Credit processes

**Methodology to annualize PD Term Structures:**
1. Lifetime annualized PD (LAPD)
2. Levelized marginal PD (LMPD)
3. Levelized forward PD (LFPD)

All PIT PD Term structures are same ones used in ECL calc

**Implementation in Production Solution:**

![Graphs showing changes in cumulative and marginal term structures over years]
PIT PD/LGD/EAD Conversions - Critical to IFRS9 Accuracy

Depending on the Start Point – BB 5-Yr Loss Predictions Can Vary by a Factor of 5 Times

IFRS9 Accuracy Requires Both PIT Grades & PIT Prospective Credit Conditions

- See below PD outlook for a TTC BB counterparty starting respectively with the credit cycle at TTC, a trough (Z=-2.5), and a peak (Z=2.5)
- TTC model produces the TTC line under all cyclical circumstances, whereas PIT model produces the more accurate estimates sensitive to initial & prospective credit conditions
- PD term structures are prospective by using a mean reversion momentum model

Top-to-Bottom Accuracy Swing is Substantial

BB Rated Cumulative 5-Year PDs

Portfolio PD

AVG BB PD

TTC Starting Point

Cycle PIT Trough Starting Point

Cycle PIT Peak Starting Point

IFRS9 Life Time Horizon

Horizon

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**IFRS 9 Loss Inaccuracy Can Be Significant by Not Using PIT**

**IFRS9/ECL **Accuracy Improvements **Using PIT PDs Are Substantial**

- ECL estimates that arise from TTC grades & a fixed, TTC matrix will be accurate only under the special circumstances that the credit cycle is at TTC and expected to remain there
- In other cases, the ECLs will be inaccurate, especially so at credit-cycle troughs and peaks (see below)
- Bottom line: need both PIT grades & a PIT forward-looking outlook

<table>
<thead>
<tr>
<th>Case</th>
<th>Spot Status</th>
<th>TTC Grade</th>
<th>Spot Grade</th>
<th>Credit Cycle Status</th>
<th>Prospective PDs</th>
<th>PV ECL/Limit</th>
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<td>PIT</td>
<td>BB</td>
<td>BBB+</td>
<td>2.50</td>
<td>0.10</td>
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PIT outlook accounts for Z projections and Z sensitivities of PIT PDs, LGDs, and EADs.

**Estimates for a five-year, corporate, revolving facility with a TTC default grade of BB equivalent, expected utilization of 60%, and DT LGD of 40%**.
Developing ‘Best Estimates’ of ‘Expected Credit Losses’- ‘ECL’

Calculate ECL Using Counterparty, Facility, Model & Z Credit Factors

- Extract from source systems the relevant, categorical data (region, industry, asset class) & PDs, LGDs, and EADs for all facilities,
- Apply the Z credit factors in converting, where necessary, the PD, LGD, and EAD measures from source systems to spot, PIT ones,
- Run Monte Carlo simulations of the credit factors and apply those credit-factor scenarios together with the spot, PIT measures and the transition, LGD, and EAD models in creating joint, PD, LGD, and EAD scenarios for each facility; and,
- **Combine & average those scenarios & thereby produce ECLs over the life of each facility.**

Note that to get the completely unbiased estimates anticipated under IFRS 9, will need to eliminate upward biases from regulatory, credit models; 2013 study of Pillar 3 filings found that the regulatory models of large banks over-estimate losses by about 50% on average.
Developing ‘Best Estimates’ of ‘Expected Credit Losses’- ‘ECL’

Calculate ECL Using Counterparty, Facility, Model & Z Credit Factors Using Simulations

• Draw random effects & run Z scenarios:

• Enter $z (=\Delta Z)$ into conditional, transition models and Z into LGD and EAD models and produce joint, PD, LGD, EAD, and thereby ECL scenarios; bold = average = unconditional ECL:
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‘Macro-Merton’ Credit Cycle Stress Test Framework

- View GDP & equity measures as asset-value proxies
- Project macro debt on the basis of trends in asset-value proxies
- Treat Debt/GDP & Debt/Equity as leverage measures
- Derive macro DDs (‘Default-Distance’) as ratios of leverage to historical, leverage volatility
- Convert macro DDs to macro Zs (by normalising mean & variance)
- Use bridging relationship to derive industry-region Zs from macro Zs
- Enter industry-region Zs into the PD, LGD, and EAD models and derive stress losses

Macro Scenarios (GDP, Equity) → Macro DD = L/V = f_1 (GDP, Equity)
Macro Z = f_2 (Macro DD)
Industry/Region Z = f_3 (Macro Z)

Conditional Stressed PIT PD = f_4(Obliquor’s internal assessment, Stress Industry/Region Z)
Integrated PIT/TTC & Stress Test Solution

IFRS9 & Stress Testing – Integrated Batch Architecture – Unconditional vs Conditional

Methodology - A Single Unified Framework Across IFRS9 & Stress Testing

Integrated Stress Test ‘Stress PIT’
Batch Analytics
Retail – Commercial - Wholesale

Integrated IFRS9 ‘PIT’ Batch Analytics
Retail – Commercial - Wholesale

Basel AIRB PD-LGD-EAD Models

Enabling Batch Automation Data/Architecture/Financial Data/CP – Static Data

‘CONDITIONAL SCENARIO BASED’
- Batch Analytics
- E2E Implementation
- E2E Governance & Regulatory Sign-off
- Custom Model Calibration

‘UNCONDITIONAL SIMULATION BASED’ – BUT ‘CONDITIONAL ON CORRECT CYCLE STARTING POINT’

Batch Processing
Leverages All Basel II PD/LGD/EAD Models

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1) **Systematic Credit Cycles Exist & Can be Measured – Motivates PIT-TTC Distinctions**

2) **Evolving Regulatory Agenda – TTC for Basel II – PIT for IFRS9 & Stress Testing**

3) **IFRS9 Modelling – Commercial, Corporate & Retail Require Different Approaches**

4) **Substantial Accuracy Implications Motivate PIT – ECLs can vary across the credit-cycle between starting at a peak or trough by a factor of 3-5 times !!!**

5) **IFRS9 & Stress Testing Require One Integrated Batch Solution & Architecture**