Credit Model Calibration – Post-Basel II – Maximising Data & Model Accuracy

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1. Aggregate credit & default data to develop/calibrate wholesale credit models & support regulatory capital management remains problematic.

2. Industry & regulators moving toward aggregate benchmarking given data limitations – AIRB vs ‘AERB’.

3. PD models & benchmarks have tended to exhibit over-prediction or ‘conservatism’ in recent years.

4. PDs & defaults also exhibit substantial, systematic variation across time – 20% of this is predictable motivating Dual Ratings – PIT vs TTC.

5. Model development objectives should always focus on developing the most accurate, unbiased predictions relative to observed realisations to support advanced risk management.

Primary Regulatory & Market Drivers

Dual Ratings & Formal Credit Benchmarking – Represent Evolving Paradigms

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

Regulatory Evolution

Single Internal Rating
Internal AIRB Models Determine TTC Rating

Credit Benchmarking Across Bank’s Internal Ratings
Post B2 – ‘RW Conundrum’ Leads to ‘AERB’ Model Calibrations

Full External & Internal Benchmarking

90s
2002-07
2014
2015-20
Last 25 Years - Credit Risk Data Initiatives & Sources

Dual Ratings & Formal Credit Benchmarking – Represent Evolving Paradigms

‘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

2010
- Basel II Substantial focus on collecting & using Internal Credit Data for ‘Internal’ Model Calibration
- AIRB Regulatory Benchmarking FSA HPE EBA/FRB Etc

2015 +
- Credit Benchmark: Initiative to collect & distribute Bank’s AIRB PDs

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

AERB
Focus on Wholesale PD Credit Model Development & Calibration

PDs can Vary Substantially….. Accurate Models Requires ‘Richer’ Models

- External ratings & PDs used extensively for benchmarking
- But defaults & Pds can vary by:
  - Obligor type – corps vs FIs etc.
  - Can be subject to ‘structural change’ & excessive ‘conservatism’ – asymmetric ‘penalty factors skew ratings toward ‘bot wanting to be too low’
  - Vary systematically across time – PIT vs TTC views of PDs
Post Basel II Implementation – The ‘Risk-Weight Conundrum’

AIRB Model Calibration – Internal, Limited Model Calibration Data Falls Short

- Regulators are applying model constraints to create comparable risk measures
- Outlying banks need accurate benchmarking to reach the ‘level playing field’ & ‘manage’ regulatory compliance

RWs Vary Widely – Under ‘AERB’ - Some Banks Gain, Some Lose

1 Risk Weight is a function of the Client PD & transaction LGD and Maturity
An ‘A’ is not an ‘A’ is not an ‘A’…..

Agency Default Rates Vary by Obligor Type – Use of Different Underlying Curves

- Models can replicate alphabet ratings by calibrating to agency default rates – which are different for different obligor types!
- ‘Regulatory friendly’ given 20 year time series = ‘long run’
- But most banks calibrate PD models to a single global curve

![Graph showing observed defaults vary across obligor types]
Agency Corp Benchmarks Have Changed Substantially in Recent Years

Corp Default Rates - Adjusted for the Credit Cycle – By Agency Rating Grade

DRs Expressed Relative to ‘True’ TTC Measures – Substantially Lower for a Given Agency Grade


Source: S&P, Moody’s, Forest/Chawla/Aguais research

Agency Corp Benchmarks Have Changed Substantially in Recent Years

FI Default Rates - Adjusted for the Credit Cycle – By Agency Rating Grade

FI Default Curve Has Flattened


Source: S&P, Moody’s Forest/Chawla/Aguais research
‘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
Dual Ratings – PIT vs TTC Measures are Required

A Systematic Component of Credit Cycles is Predicable – By Industry & Region

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

Source: Moody's KMV,
Existence of Systematic Credit Cycles Motivates Dual PIT/TTC Ratings 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

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)
Dual Ratings – PIT vs TTC Measures are Required

PIT View of Agency Ratings Varies Substantially Across the Credit Cycle

MKMV EDFs for S&P BBB Rated Companies (Non-FIs)
-- NA, EU&UK and APAC

Source: S&P & Moody’s KMV,
Internal & External Rating Measures – Mostly ‘Hybrid’

‘Hybridness’ of Ratings: Implies Not Comparable & Don’t Support Business Objectives

Fully Benchmark ALL Credit Indicators – Internal Ratings, Agency Ratings & Vendor Models

PIT (100%)  What makes a model PIT or TTC?  Hybrid (~70/30%)  TTC (100%)

MKMV Public Firm Model

Agency Ratings

Internal Models

Credit Cycle Index

Time
Dual PIT TTC Ratings – Supports Comparability & Satisfies Bus Objectives

Credit Cycle Adjustments – Allow Credit Measure Comparisons on an Equal Footing

Measuring credit cycle conditions allows banks to benchmark different indicators on a consistent PIT and TTC basis.
Examples of Industry Systematic Credit Cycle Factors

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

Source: Moody's KMV,
Stress Testing Framework – Fits Nicely in Dual PIT TTC Ratings

Portfolio Wide Stress Testing – Applied to PD, LGD & EAD

Industry/Region Systematic Factors - ‘Bridge’ from Macro Factors to Conditional PIT PDs

- Developed & applied portfolio-wide or more narrowly for industries, regions or obligor types
- Converts ‘unconditional’ PIT PDs into ‘conditional’ PIT PDs to most accurately stress PDs
- Utilizes forecasts of macro risk factors (currently GDP & Equity Indexes) to summarize implications of a ‘stress’ macro scenario on portfolio credit conditions broadly
- Estimates statistical models between ‘Macro-Z’ factors & Z-industry/regions
- Applies a ‘Macro-Merton’ approach – therefore it is consistent with corporate PD modelling
- Develops conditional, ‘stress’ PIT PD term structures on a multi-year basis
- Implemented in ‘batch mode’ – sits right on top of the normal PIT PD batch process

Macro Scenarios (GDP, Equity) → Macro DD = L/V = f₁ (GDP, Equity) → Macro Z = f₂ (Macro DD) → Industry/Region Z = f₃ (Macro Z) → Conditional Stressed PIT PD = f₄ (Obligor’s internal assessment, Stress Industry/Region Z)
Stress Testing Framework – Fits Nicely in Dual PIT TTC Ratings

History & Stress Simulation for UK Macro ‘Z’ – Two Different Stress Scenarios

Portfolio Stress Tests – Conditional ‘Stress’ PIT Measures – Macro/Industry/Regions/Obligors
Accurate Credit Models are Required to Support Multiple Objectives

Developing & Implementing Dual PIT TTC Ratings – Key Objective for Large Banks

1. Regulatory Compliance:
   - Reduce portfolio risk weight variance: benchmarking
   - Calibrate models to LR agency defaults – ‘AERB’ Model Accuracy
   - IFRS 9 multi-year EL provisioning & Stress Testing require PIT

2. Know Your Risk:
   - Client Classifications
   - Dual PIT/TTC ratings framework
   - Credit Cycle Measures
   - Accurate PD Benchmarking

3. Increase Returns:
   - Batch Processing: competitive advantage
   - Accurate Asset Valuations/Early Warning
   - Optimise Capital Costs

4. Multiple Business Objectives:
   - Capital (TTC)
   - Provisioning (PIT)
   - Stress Testing (Stress PIT)
   - Risk Appetite (TTC)
   - Sanctioning (TTC)
   - Pricing (PIT)
   - Early Warning (PIT)
   - CVA (PIT)
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