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Credit risk modelling of low default portfolios

Part III – Parametric approaches for PD calibration

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Low default portfolios

Regulatory findings on risk-weighted assets (RWA) variability

From European Banking Authority (EBA) recent years' benchmarking exercises on low default portfolios (LDP), probability of de fault (PD) calibration is one of the reason for RWA variability among banks.

Interquartile range of RW deviation	Advanced internal ratings-based (AIRB)		Foundation internal ratings-based (FIRB)	
	Overall RW deviation	PD effect	Overall RW deviation	PD effect
Large corporates	9%	8%	8%	5%
Sovereigns	8%	2%	3%	4%
Institutions	9%	3%	7%	5%

Source: EBA - Results from the 2020 LDP supervisory benchmarking exercise

Result interpretation

As shown from the result table above, PD parameter plays a significant role in explaining the RW deviation, especially for large corporate portfolio.

EBA mentioned that *"The variation in PD is generally not risk-based…Furthermore, a difference in the estimates may also be explained by different default experiences or different chosen scopes of the applicable rating model."* Therefore, different modelling techniques used to calibrate PD can result in diverse PD estimation.

EBA benchmarking exercise approach

EBA compared the RW of the participating banks by calculating the difference between the original RW and the benchmark (the median RW for the group of banks which the same regulatory approach is applied) for each of the bank.

To disentangle the PD parameter effect, the RWs were recalculated by replacing the maturity and loss given default (LGD) parameters with the benchmarking value while keeping PD as the actual parameter.

The calculation of the deviation is defined as follow.

$$Overall\ RW\ deviation = RW(M, PD, LGD) - RW(2.5, PD_{benchmark}, LGD_{benchmark})$$

$$PD\ effect = RW(2.5, PD, LGD_{benchmark}) - RW(2.5, PD_{benchmark}, LGD_{benchmark})$$

Interquartile range is then used to measure the spread of RW% among the participated banks.

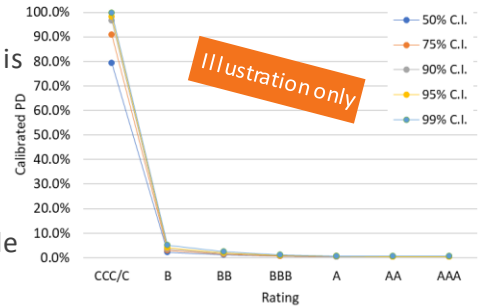
Low default portfolios

Parametric calibration approaches

Various parametric approaches can be adopted when calibrating PD for LDPs, such as Pluto – Tasche, Van Der Burgt and Quasi Moment Matching (QMM). For all the three suggested methodologies, a monotonic PD curve is assumed.

1. Pluto – Tasche method

- A PD upper bound based on a set confidence interval (CI) is identified for each rating grades.
- This approach is based on the most prudent estimate principle.
- It is highly sensitive to parameters input (i.e. CI and sample size).



- Financial institution should determine a moderate CI which can represent its portfolio characteristic. Usually, a CI less than or equal to 95% is suggested.
- The example graph shows how the increase of CI leads to PDs increase across all rating classes.

2. Van Der Burgt method

- A one-parameter closed-form function derived from the cumulative accuracy profile (CAP) (also known as power curve) is used to calibrate PDs.
- The CAP is constructed from observation and then fitting is conducted by minimizing the root-mean-square error of the CAP function.
- It is also highly sensitive to parameters input.

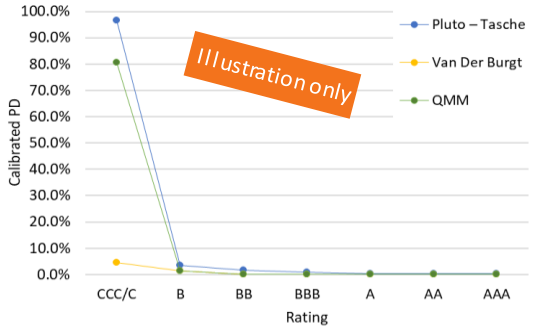
3. QMM method

- A two-parameters PD function based on target accuracy ratio (AR) and target portfolio PD (central tendency) is used to calibrate PDs.
- The AR can be calculated using an estimation sample, while target portfolio PD could be estimated by means of an econometric model.

Illustration of the three calibration approaches

- Calibration based on the three algorithms was performed using S&P global corporate (financial sector) default data of 2020.

Approach	Parameter 1	Parameter 2
Pluto – Tasche	C.I. = 90%	N/A
Van Der Burgt	AR = 90%	N/A
QMM	AR = 90%	Portfolio PD = 0.3%



- From the above example, Pluto – Tasche method gives the most conservative result.
- Financial institution could base on their available data and condition (e.g. different invariant assumptions) to choose one of the methods which suits their portfolio.

Contact

Fintegral

London ¦ Frankfurt ¦ Zurich

www.fintegral.com

Dr. Andreas Peter
Managing Partner
Fintegral Group

+49 160 583 40 66
andreas.peter@fintegral.com

Fintegral Deutschland AG
Steinweg 5
60313 Frankfurt am Main
Germany

Samuele D'Altri
Senior Manager
Fintegral UK Ltd.

+44 7494 855 102
samuele.daltri@fintegral.com

Fintegral UK Ltd.
City Tower, 40 Basinghall St.
London EC2V 5DE
United Kingdom

Polly Wong
Manager
Fintegral UK Ltd.

+44 7956 715 141
polly.wong@fintegral.com

Fintegral UK Ltd.
City Tower, 40 Basinghall St.
London EC2V 5DE
United Kingdom