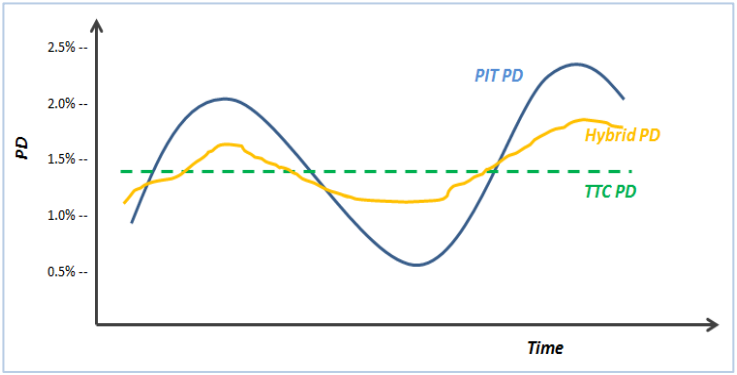
Aptivaa

# PD Calibration- A Delicate Balancing Act

As discussed in our previous blog, PIT PD describes an expectation of the future, starting from the current situation and integrating all relevant cyclical changes & all values of the obligor idiosyncratic effect with appropriate probabilities. A PIT PD mimics the observed default rates over a period of time. TTC PDs, in contrast, reflect circumstances anticipated over an extremely long period, and thus nullify the effects of the credit cycle.

**Need for calibration:**

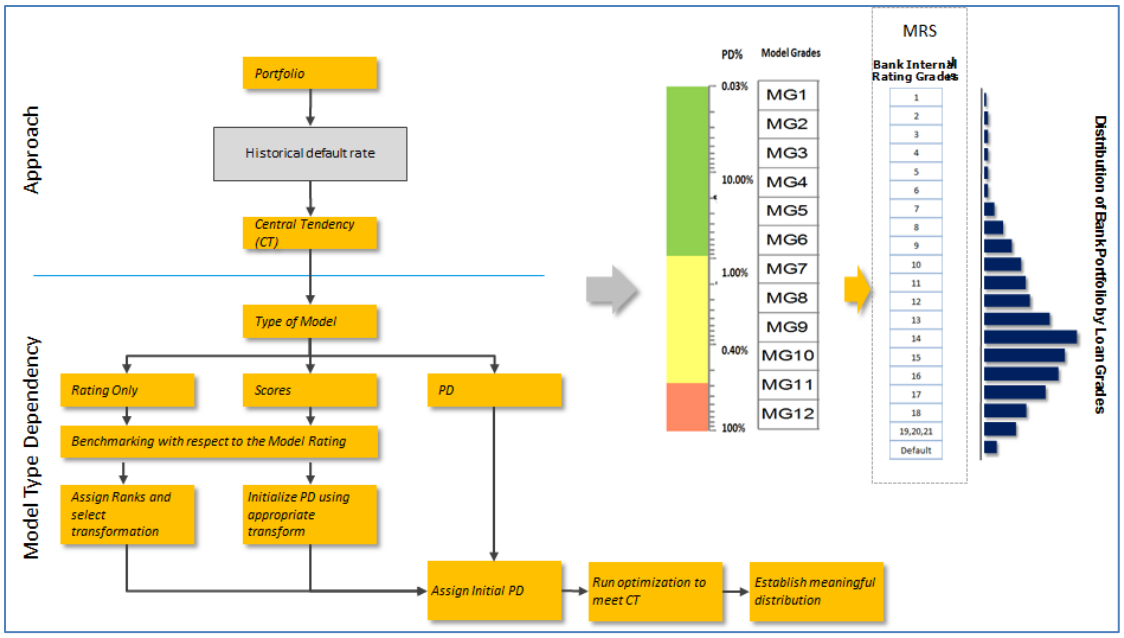



Deriving a rating model that mimics PIT or TTC rating philosophy is a constant effort across all banks. A rating model that has both idiosyncratic and macroeconomic factors is said to follow PIT philosophy, while a model that has only idiosyncratic factors is said to follow TTC philosophy. However, in reality, in spite of the level of sophistication adopted for methodologies or richness of data, such a “pure” PIT or TTC model is not feasible. A TTC based model will always have some indirect effect, no matter how insignificant, of macroeconomic factors and vice versa for PIT based model. Thus, generally banks end up developing a hybrid PIT and TTC model instead. Because of such hybrid nature of the model, at each economic cycle, banks might observe that default rates tend to deviate from cycle implied PIT or TTC PD. Such a condition necessitates calibration of both PIT and TTC PDs.

Frequency of calibration and the philosophy for which a model needs to be calibrated also depends upon the nature of the model. If one assumes that a model could be developed as pure PIT or pure TTC, then such a model would require calibration for only one of the philosophies. For example, in case of a pure PIT model, portfolio's observed default rate will perfectly align with PIT PDs over the economic cycle. For such a model, only TTC PD calibration would be required. Similarly, when a model perfectly accounts for economic stress factors, only PIT PD calibration would be required. Under either philosophy, it is essential that the model being calibrated is validated for its effectiveness first. Calibration for a model that has poor performance and rank order breaks will not yield the desired outcome. For a validated model having minor performance challenges, calibration can serve as a good alternative to rebuilding the model.

**PD Calibration:**

PD Calibration includes computation of central tendency (both PIT and TTC) and shift in assigned rating grade PDs, such that the rating grades reflect the current economic scenario implied portfolio PDs (PIT) or long run historical average portfolio PDs (TTC).




***A. Central tendency:***

Central tendency is computed from the default rates of the portfolio, over the economic cycle. This default rate is computed by taking into consideration the number of obligors defaulting, out of total number of obligors in the portfolio. Central tendency for TTC model is essentially a long run economic cycle average default rate observed for the portfolio. This central tendency of the portfolio would be identical to TTC PD for pure TTC model. However, given the hybrid nature of rating models, there could be a mismatch between the long run average and TTC PD, and thus TTC calibration would be needed.

Similarly, central tendency for PIT is one year forward looking PD based on present economic cycle position. For a perfect PIT rating model, this central tendency of the portfolio would be identical to PIT PD. However, again a PIT calibration would be required because of deviation from ideal PIT model conditions.

In the industry, several methods are followed to compute PIT central tendency and TTC central tendency. Following are some of the most widely used methods depending upon the availability of defaults and size of the portfolio:

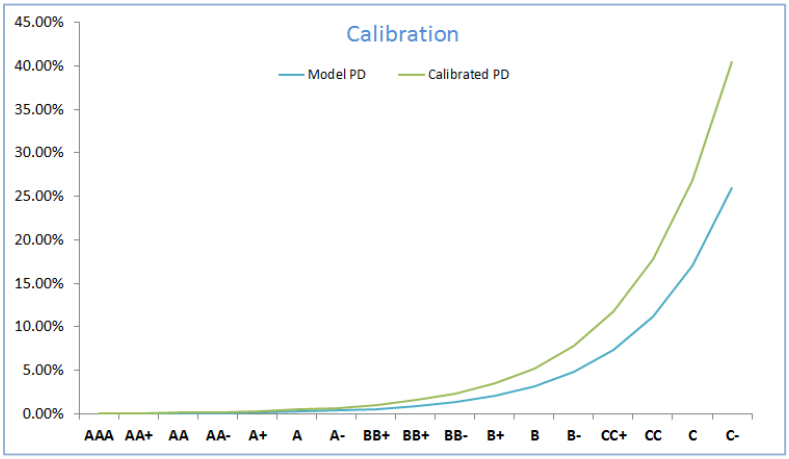
i) ***External Benchmarking:*** External Benchmarking entails benchmarking the portfolio default rate with a peer group default rate, external rating agencies, or macroeconomic factors. Central tendency is computed using a suitable benchmark.

ii) ***Macroeconomic Analysis:*** Macroeconomic analysis requires identifying relationship between macroeconomic factors and portfolio PDs, followed by forecasting macroeconomic factors, and thus PDs.

iii) ***Fowles Delphi Method:*** Fowles Delphi Method is an expert judgment based approach to arrive at range of PIT/TTC PDs, portfolio distribution, and central tendency.

### *B. Calibration of rating scale:*

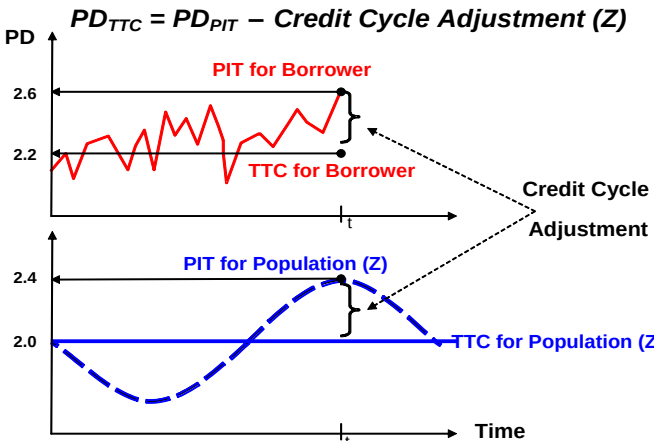
Calibration of rating scale involves aligning the PDs of the rating scale such that the calibrated portfolio PD matches with the target central tendency. Optimization routine with goal seeking algorithm is one of the most suitable algorithm to carry out such a transformation. This algorithm involves computation of initial PDs (as given by the model), central tendency to shift PD curve of rating grade, such that the portfolio average PD matches with the target central tendency. The shift in calibrated curve can be carried out in two ways: either by doing parallel shift or by changing shape of the calibrated PD curve.




Besides its wide usage and advantages in calibration, the optimization routine has a few limitations. For instance, it can provide multiple solutions for the given goal of meeting central tendency. Because of this limitation, the optimization routine of the calibration requires right set of constraints on the solutions. Some of these constraints are to ensure the logical shape of the PD curve, restricting major shift in distribution of the obligors across grades, and lowering concentration at single rating grade.

### PIT to TTC and TTC to PIT PD Conversion:

For a bank, it would be useful to understand whether their model derived PDs are pure PIT PDs, TTC PDs, or Hybrid PDs. Such an interpretation will help in identifying transition from PIT to TTC and vice versa. For example, a pure PIT model can directly be used for conversion of PIT PDs to TTC PD and vice versa for a pure TTC model. For a hybrid model, either the PIT or TTC PD would be calibrated using optimization routine and conversion from PIT to TTC and vice versa would be carried out subsequently.




The approach to make such conversion is called Z-score approach. Essentially, the PIT PDs differ from calibrated TTC PDs by a factor known as Credit Cycle Adjustment (z-score). To obtain TTC PD, one needs to subtract this component from the PIT measure. Similarly, to obtain PIT PD, one needs to add this component to the TTC measure.

The optimization routine discussed in this blog relates to 12-month forward looking PDs. However, in addition to 12-month PDs, IFRS9 requires lifetime PD that is derived from PD term structure. This PD term structure is in turn derived by adjusting best estimates of macroeconomic scenarios. We will be discussing these adjustments in detail in our upcoming blog.