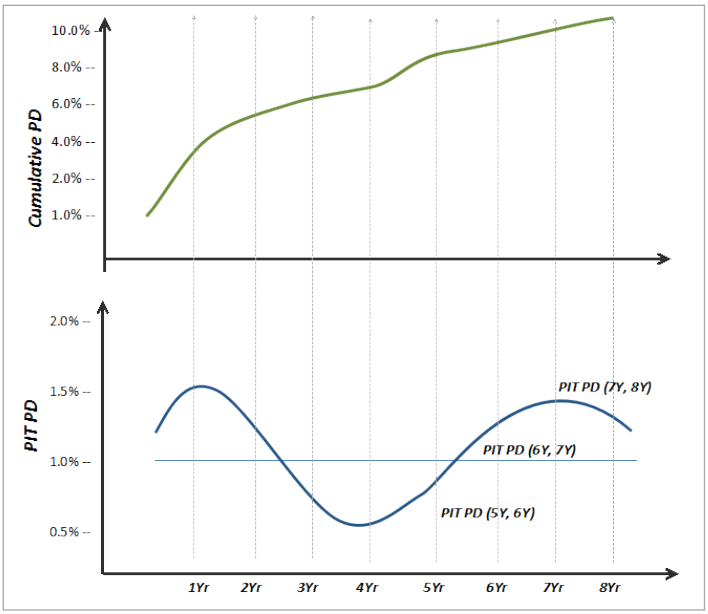
Aptivaa

Crystal Gazing - Estimating Lifetime PDs

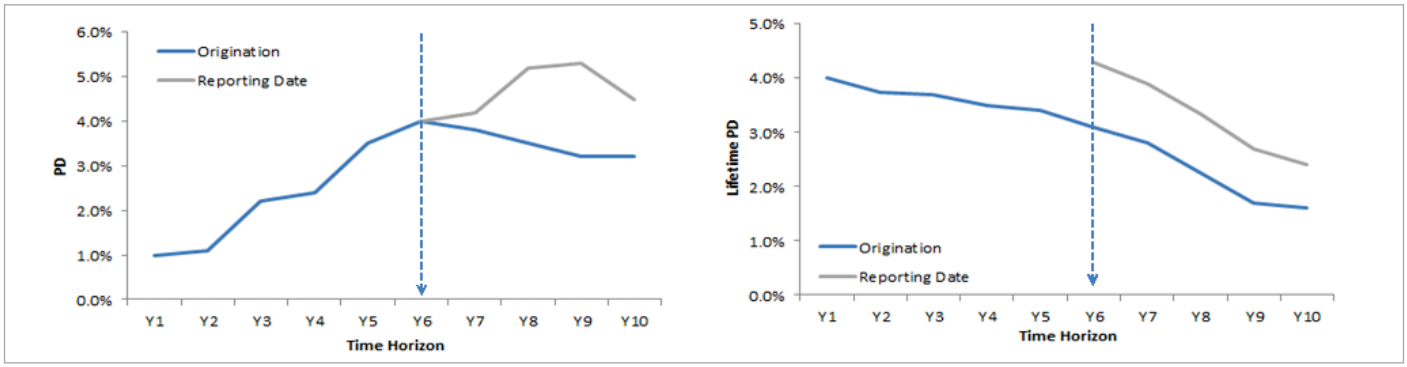
In our earlier blog, we discussed PD terminology and PD calibration approaches as applicable to the IFRS 9 framework. IFRS 9 has mandated computation of Impairment Losses, approach for which has been discussed in our 6th blog post. For computation of Expected Credit Loss (ECL), IASB expects organizations to consider forward-looking information including macroeconomic factors that are relevant to the exposure being evaluated and that must go beyond historical and current available data. BCBS strongly endorsed this requirement in its paper published on 18th December 2015 (Please refer to our white paper around BCBS Guidelines on IFRS 9) and has very clearly defined its expectations from banks in terms of consideration of supportable forward-looking information into ECL estimates. Regardless of the impairment approaches considered by a bank, (Please refer to our 6th blog post) i.e. Roll Rate, Vintage analysis, Expected Loss Model or Discounted cash flow, the ECL estimate should incorporate the expected impacts on account of forward-looking information, including macroeconomic forecasts. In this blog, we cover how PDs (point in time) can be adjusted for the mandatory 'forward-looking' requirements prescribed by IFRS 9.

While banks have been following similar forward-looking macroeconomic adjustments of PD for quite some time now under Basel IRB Probability of Default (PD) modeling, stress testing and CCAR, IFRS 9 has introduced additional complexities in the form of Lifetime ECL and Lifetime PD for Stage 2 and Stage 3 exposures. Lifetime here refers to life of the loan, the effective maturity in other words. While regulatory stress testing norms require banks to assess impact of macroeconomic factors on PD over 4 to 9 quarters (under CCAR guidelines), however, under IFRS 9 they are required to extend the macroeconomic adjustment of PD for the life of the loan, which can extend to over 20 quarters (long term project financing loans, for instance).



While banks can use their existing methodologies for forward-looking macroeconomic adjustments of PD (1 year horizon) for Stage 1 exposures, they will be required to develop methodologies to estimate the impact of macroeconomic adjustments on PD term structure for Stage 2 and Stage 3 exposures. Forecasting macroeconomic scenarios for such a long horizon and developing a stable relationship between these scenarios and PD estimates are two of the major challenges that banks may face.

The graph below shows the impact of potential economic changes on PD, especially when 12-month horizon fails to capture the potential economic change. This economic change over the life of instrument is effectively captured by lifetime PD, as evident by the right hand side graph (grey line).



At present, banks have already adopted several methodologies to mitigate these challenges. We will look at the suitability of these methodologies and an approach to improve them to comply with the IFRS 9 requirements.

Methodologies for macroeconomic adjustment of PD

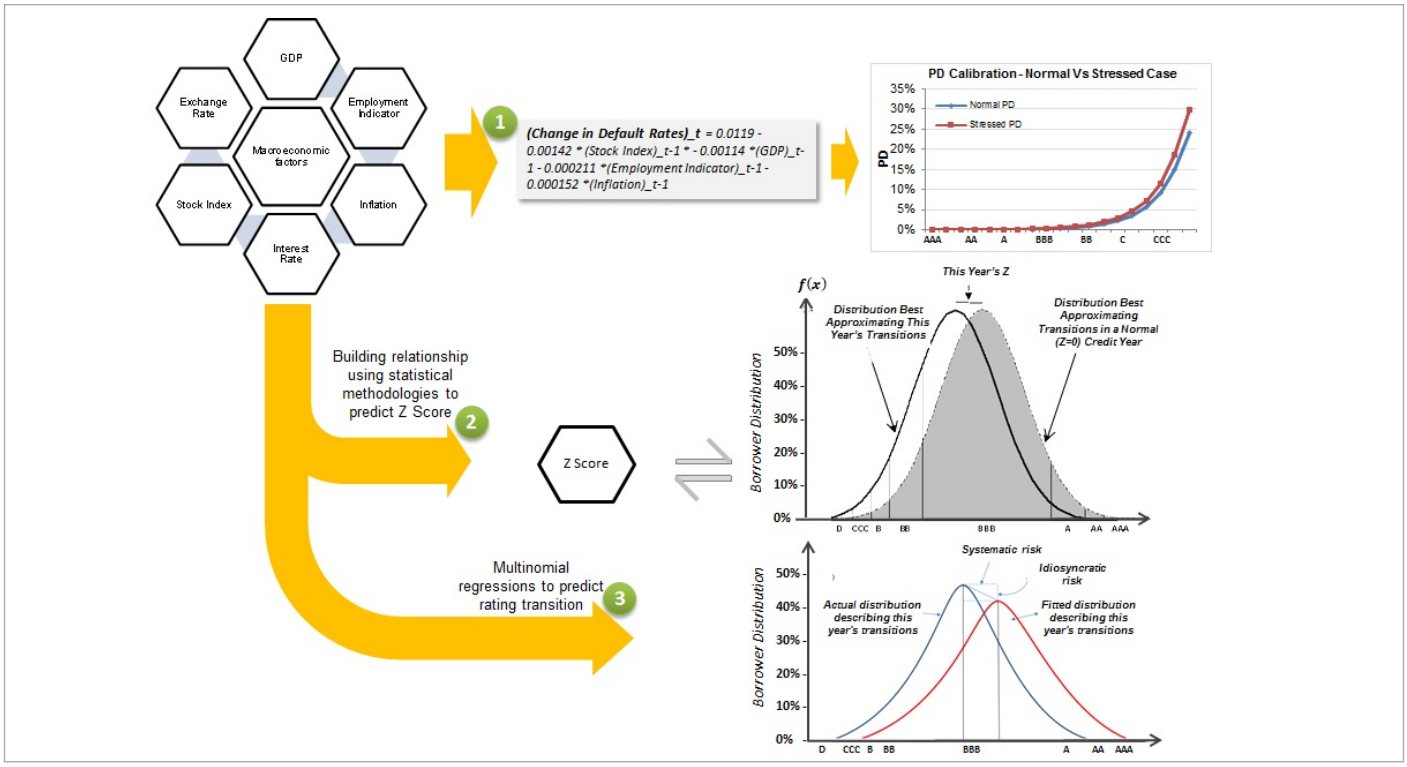
a. Macroeconomic adjustments of portfolio Central Tendency (CT):
b. Markov Chain (Z Score) Approach
c. Macroeconomic Adjustments of Rating Grade Migration Approach

Methodologies for development of term structure of PDs

a. Binomial Approach
b. Markov Chain (Z Score) and Rating Grade Migration Approach
c. Mapping to External Rating Agency Term Structure

Methodologies for Macroeconomic Adjustment of PD:

Macroeconomic adjustment of PD can be carried out through 3 key approaches as discussed in this section.



1) Macroeconomic adjustments of portfolio Central Tendency (CT):

Under this approach, historical data of portfolio Point-in-Time (PIT) PD is used to arrive at 1-year forward-looking central tendency (CT) for the portfolio and a link between forward looking macroeconomic parameters and 1-year forward-looking CTs are established. The derived macroeconomic adjusted CT is then used to calibrate PIT PDs for each rating grade.

Macroeconomic adjustment of portfolio Central Tendency (CT) approach is more relevant when a rating model is based on TTC Rating philosophy. Under TTC Rating Philosophy, rating models include only idiosyncratic factors, as a result, the rating grade generated by these models do not reflect changes in macroeconomic factors and the transition matrices developed for this type of model is likely to remain stable through the business cycle. However, due to change in macroeconomic factors, the likely default frequency in each rating grade will change. Adjusting the portfolio CT for macroeconomic scenarios and recalibrating the model's rating grade to the new PIT PDs, allows to incorporate the impact of macroeconomic factors in PIT PD estimates.

2) Markov Chain (Z Score) Approach:

Under this approach, linkage is established between 1-year transition matrix and forward-looking macroeconomic parameters. Historical transition matrices are converted into z-scores, which in turn are linked with forward-looking macroeconomic parameters.

3) Macroeconomic Adjustments of Rating Grade Migration Approach:

Under this approach, linkages are established between 1-year migration probabilities of each rating grade with macroeconomic parameters.

Rating Grade Migration i-j = f (macroeconomic factors)

Where, Rating Grade Migration i-j is the migration probability of a rating grade i going to rating grade j within 1-year time horizon.

Both Markov Chain (Z Score) and Macroeconomic Adjustments of Rating Grade Migration methodologies are more applicable when the internal-rating model of the bank is developed based on PIT Rating Philosophy. Under PIT rating philosophy, rating models include both idiosyncratic and macroeconomic factors. As a result rating grade generated by these models will change due to macroeconomic factor and consequently, the probability of migration of borrowers from one rating grade to another (captured in transition matrix) will vary depending on the macroeconomic scenarios (business cycle).

Though both approaches mentioned above establish relationship between macroeconomic parameters and the rating movement (upgrade/downgrade), Macroeconomic Adjustments of Rating Grade Migration approach is likely to be more sensitive to macroeconomic factors and closer to real life situation, since the effect of macroeconomic factors are assessed at individual rating grade level migration. In the Markov Chain (Z Score) approach, the entire transition matrix is converted into a single dependent variable and effect of macroeconomic parameters are assessed on that variable. As a result, the migration effect of macroeconomic parameters will be uniform across rating grade.

Though the second approach seems more accurate, it requires more data and needs substantial modeling efforts. For instance, for a 8 point Internal Rating Grade, under first approach a bank will be required to develop one model; however as per the second approach, a bank will be required to develop 64 models (8x8).

We believe that banks may use any of the above 3 approaches for macroeconomic adjustments of PD (PIT) under IFRS 9, depending on the rating philosophy followed for development their internal rating model. However, if banks are currently doing these macroeconomic adjustments for PD (TTC), they will be required to repeat the exercise for PD (PIT) adjustments for IFRS 9 compliance.

Methodologies for Development of PD Term Structure:

1) Binomial Approach:

Under the Binomial approach, credit deterioration is assumed to be a two state process: Default and Non Default. The approach does not recognize the deterioration of credit quality to intermediate rating grades. Under this methodology, PD term structure can be created using cumulative PD methodologies.

PDCumm(i)= PDFD(i-1) + {(1-PDFD1) * ……(1-PDFD(i-1))}*PDFDi

Where,

PDCumm(i) = Cumulative PD at the end of year i

PDFDi = Forward PD in the year i

(1-PDFD(i-1)) = Non Defaulted Portfolio percentage at the beginning of year i

To create PD term structure using Binomial method, forward PDs need to be estimated by making macroeconomic adjustments to portfolio Central Tendency (CT) accounting for future macroeconomic scenarios, and then recalibrating PDs of various rating grades based these macroeconomic adjusted CTs. Once the forward PDs are estimated, the same can be used in Binomial approach to the create PD term structure.

Some banks, instead of estimating forward PDs based on future macroeconomic scenarios, only use 1-year PD estimates to create cumulative PD using Binomial approach. The basic assumption in this approach is that forward PDs will remain same as current 1 year PD. This assumption is valid in case the banks are developing cumulative PD for PD (TTC) term structure, as 1 year PD (TTC) is likely to remain stable across the business cycle. However, forward PD (PIT) will change with future macroeconomic scenarios and hence, to generate PD (PIT) term structure using Binomial approach based on 1 year PD (PIT) estimate may not be right approach. Banks would need to estimate forward PIT PD based on future macroeconomic scenarios.

2) Markov Chain (Z Score) and Rating Grade Migration Approach:

PD (PIT), adjusted for macroeconomic parameters using either Markov Chain (Z Score) or Rating Grade Migration approach, can easily be used to develop PD (PIT) term structure by applying matrix multiplication techniques.

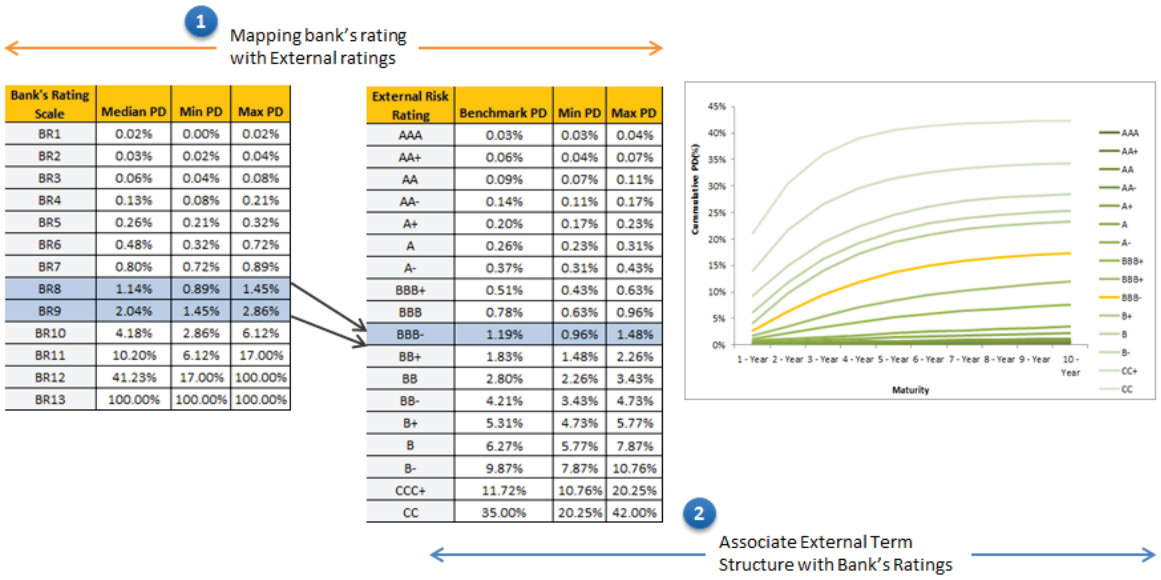
Banks may estimate the effect of macroeconomic factors on transition matrix in the 1st year and use the same to create PIT PD term structure. Like the Binomial approach, to generate PD (PIT) term using 1-year rating migration (transition matrix) information may not be right approach, as rating migration probabilities will change over time based on future macroeconomic conditions. To create PD (PIT) term structure using above approaches, it is important that future 1 year rating migration probabilities are estimated and used in matrix multiplication process.

3) Mapping to External Rating Agency Term Structure:

An alternative that many banks are considering over the extensive data-driven computation methodologies discussed earlier, is to use the PD term structure provided by external global rating agencies. This alternative approach requires banks to map their internal rating grades with rating grades provided by global rating agencies and adopt the PD term structures corresponding to rating grades benchmarked with global rating agencies. While this approach may sound logical, it does entail a few issues.

Global rating agencies follow TTC rating philosophy, and term structure published by them is PD (TTC) term structure. If the bank's internal rating model also follows TTC rating philosophy, then this is a good approach to create PD (TTC) term structure.

If bank's internal rating model follows a PIT rating philosophy, then the PD mapping between banks Internal rating grade and external rating grade will not be stable over time and mapping exercise needs to be conducted frequently (at minimum once a year). At a more fundamental level, mapping of 1 year PD (PIT) estimate of the internal rating model to PD (TTC) of external rating agency's rating grade, then estimate PD (TTC) term structure of the internal rating grade using PD (TTC) term structure of external rating agency will under or overestimate PD (TTC) term structure of the internal rating grade, depending on the current state of the business cycle when mapping is conducted.



Thus before using external rating agency's PD (TTC) term structure as it is for IFRS 9 purpose, banks will have to find a way to convert rating agency PD (TTC) term structure into PD (PIT) term structure and incorporate macroeconomic adjustments to it. Several options to make such transition possible are being researched across industry. One of such research talks about transforming TTC PD term structure to PIT PD term structure in two steps: first, use Nelson-Siegel function to estimate TTC PD term structure using historical default rates; second, apply one-factor Merton model and transform TTC PD term structure to PIT PD term structure with macroeconomic adjustments. Moreover, global rating agency's PD (TTC) term structure is mostly based on its default experience of large publicly rated borrowers mainly located in developed economies. Thus, its applicability in case of portfolio consisting of Small and Medium Enterprise borrowers and borrowers from emerging market economy is questionable.

In addition to complexities associated with adjustment of PD (PIT) for forward looking macroeconomic scenarios and development of PD (PIT) term structure, banks also need to be cognizant of the challenges in developing methodology for forecasting of macroeconomic scenarios. To mitigate these challenges, IFRS9 has given following flexibilities:

- Judgmental override on long-term macroeconomic forecasts can be carried out with valid justifications.
- Instead of single forward-looking scenario, banks may generate multiple forward-looking scenarios and use them to generate multiple PD (PIT) estimates for a facility/instrument.

While these flexibilities help in mitigating challenges of long term macroeconomic forecast, establishing a stable relationship between macroeconomic scenarios and PD (PIT) will still remain a big obstacle.

Feel free to send your IFRS-9 related queries to:

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About Aptivaa

Aptivaa is a vertically focused finance and risk management consulting and analytics firm with world-class competencies in Credit Risk, Market Risk, Operational Risk, Basel III, IFRS-9, Risk Analytics, COSO, ALM, Model Risk Management, ICAAP, Stress Testing, Risk Data and Reporting. Aptivaa has emerged as a leading risk management solutions firm having served over 100 clients across 22 countries comprising of highly respected names in the financial services industry.

Aptivaa's LEO suite of proprietary tools & frameworks are designed to accelerate IFRS-9 implementation in areas such as classification, stage evaluation, PIT-PD Calibration, Lifetime-PD, LGD, EAD and Lifetime ECL.

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