Cash Shortfall & LGD – Two Sides of the Same Coin

Under IFRS 9, Expected Credit Loss (ECL) for financial instruments should be an unbiased and probability-weighted amount, which is determined by evaluating a range of possible outcomes. To meet this requirement, banks will be required to determine "Expected" default path of the financial instruments and estimate the possible "Credit Losses" along that path.

IFRS 9 defines "Credit Loss" in terms of "Cash Shortfall" or credit loss estimation through projected cash flow discounting. However, there is little explicit information available as to how "Cash Shortfall" should be computed; should it be computed separately or along with "Expected" default path of the borrower, leading to ambiguity around the subject. IFRS 9 has specifically given inputs on Probability of Default (PD) estimation based on forward-looking scenarios and computation of lifetime PD (a measure of "Expected" default path of the financial instrument). This has been discussed in detail in our previous blogs. On LGD, there are not very specific directives available. The ambiguity around the subject raises a few questions, such as:

- What is Cash Shortfall and how can it be measured?
- Can Loss Given Default (LGD) be used as a substitute for Cash Shortfall approach?
- What approaches can be taken to model or estimate LGD?
- Can regulatory estimates of LGD be used for IFRS 9 purpose?
- Can LGD developed for Basel IRB purpose be used for IFRS 9 ECL estimation? If yes, then what adjustments would it entail?

The blog explores the limits of current knowledge (theoretical and empirical), and offers some preliminary guidance on such questions.

Approaches to measure Cash Shortfall:

IFRS 9 defines "Cash Shortfall" as the difference between all contractual cash flows that are due to an entity in accordance with the contract and the cash flows that the entity expects to receive. This approach, as per IFRS9, should account for future expectations of cash flow and market related information that have influence over the future cash flows. As accurately predicting future cash flows may be challenging, IFRS 9 does allow judgmental adjustments.
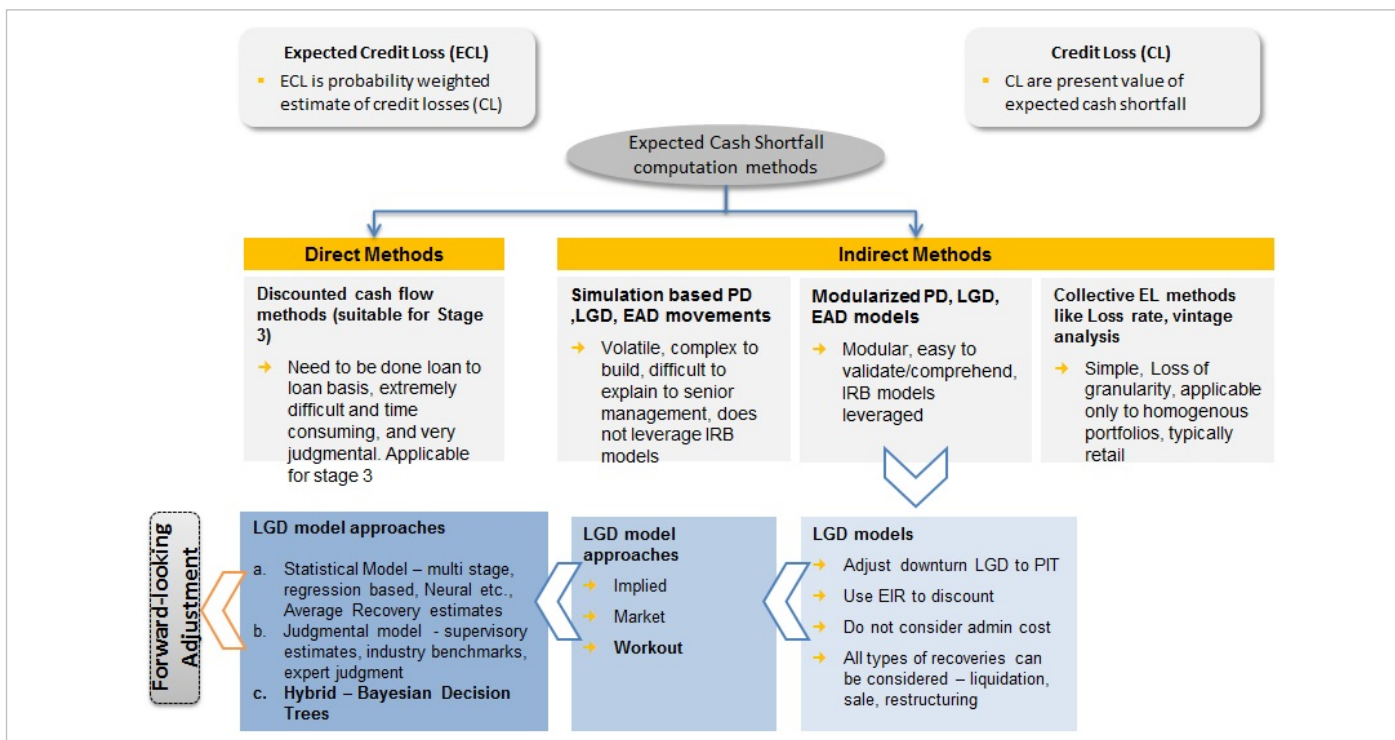
Direct methods are of the nature of discounted cash flow, wherein individual facilities' cash flows are modelled, under the assumptions of various macroeconomic scenarios and the differences from contractual cash flows are assessed. But since these are done at an individual level, this is practically possible only for select portfolios with small number of clients or for those facilities that are classified as Stage 3, due to credit quality deterioration.

Indirect methods use methodologies such as vintage analysis, transition matrices etc. which compute cash shortfall as a percentage of the outstanding based on historical numbers. LGD is not assessed separately in such cases. These methods, while simpler to use, may not be applicable for all portfolios. Also, auditors may want to see more statistical rigor while computing ECL.

Another Indirect method is the Simulation Based PD, LGD, and EAD, wherein movements in PD, LGD, and EAD are simulated simultaneously. Since there are multiple recovery options, default and recovery paths can get complicated and quite convoluted, both from an algorithm logic perspective as well as in terms of computation power needed. The approach, however, offers a few advantages. First, the expected loss component is inherently included in this approach as it assumes possible "default paths" and computes expected loss directly. Secondly, the approach is applicable for financial instruments under all credit quality assessment stages (regardless of credit deterioration). This is because the approach assumes possible default scenario first, and then goes on to project cash flow and computation of credit losses.
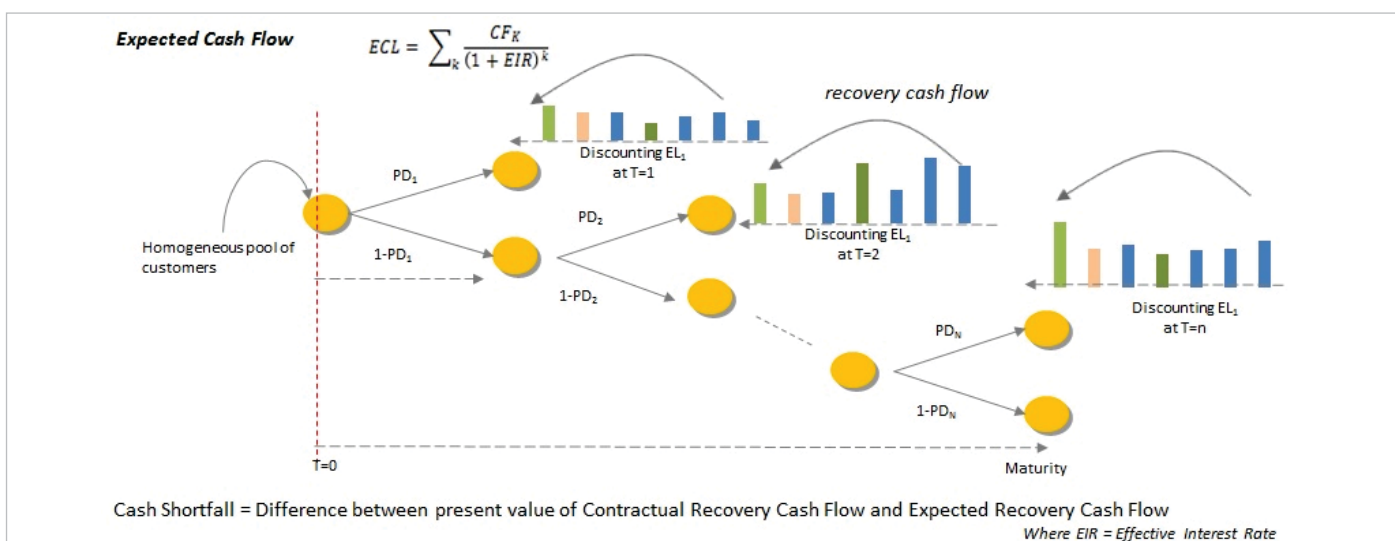
Since this approach requires coverage of all future potential default paths that a loan may take, it may be appropriate to derive these paths through mathematical simulations. For these simulations, one may need to simulate the potential paths a performing or a non-performing loan may take, and the associated estimates of cash flows across each of those paths. A trigger for each potential path can be taken from historical behavior of borrowers, migration from non-default states to delinquent states, and observed recovery in the event of default. Moreover, each of these paths also depends on quantified impact of macroeconomic or loan-specific factors. Along with defaults, estimates of cash flows are also simulated. Each of these simulation paths for a loan is then probability weighted to arrive at an average path that a loan may take. A comparison of expected cash flow (through simulation) and contractual cash flow is carried out to compute cash shortfall, which in turn is used to derive Expected Credit Loss (ECL). Since historical data is the primary driver of simulations, the approach relies on past experience significantly. Also, given that the approach requires simulation of both default events and cash flow post default, it may be prone to multiplicative error because of potential noise in each of the simulation components (defaults and cash flow). This is alleviated to some extent for assets under Stage 3, since the default event has already happened and what is needed to be simulated is just the expected recovery. Thus, the need for simulating loan path for default is eliminated.

Another Loss statistical based methodology is one wherein PD, LGD, and EAD are modularized. Their term structures are also identified separately and then they are integrated to identify the expected loss. The estimated LGD combined with PD and Exposure at Default (EAD) should then be discounted using Effective Interest Rates (EIR) to estimate ECL for all possible outcomes or default paths.
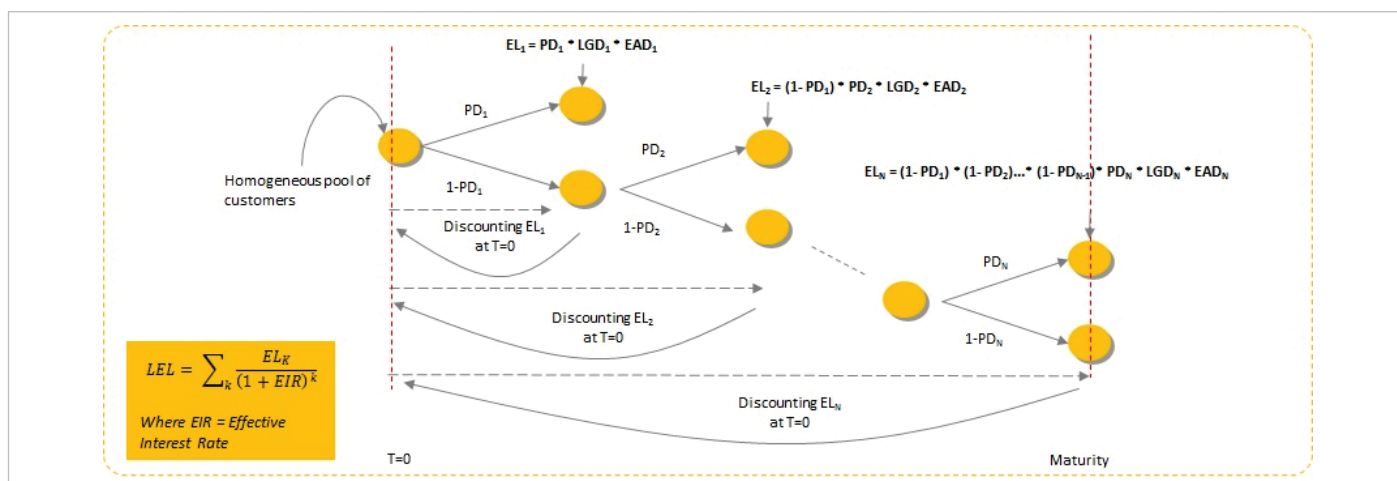
Since PD has been covered in an earlier blog, we would cover aspects related to such a modularized LGD in this blog. In order to use IRB LGD models, banks may need to make certain enhancements to IRB models. For example, futuristic view on recovery should be added to these models. This adjustment will be primarily required for Stage 2 and Stage 3 LGD estimation that demands computation of ECL over lifetime of the loan. To incorporate these futuristic views, an impact of macroeconomic parameters on recovery or loan-specific parameters should be taken into consideration. Linkage between these parameters and future recovery cash flow should then be established. Moreover, Basel IRB requires "Downturn LGD" whereas IFRS 9 talks of credit loss under forward-looking Macro Economic environment, which need not be downturn environment. Please see box titled – "*Some Differences between an IRB LGD model estimate and IFRS9 LGD model estimate*" on the next page.

Measurement and Estimation of LGD

LGD is usually defined as the amount of the credit that is lost by a financial institution when a borrower defaults. Typically LGD is defined as the ratio of realized losses to the Exposure at Default (EAD). LGD includes three types of losses:

    a)   The loss of principal

    b)   The carrying costs of non-performing loans, e.g. interest income foregone

    c)   Workout expenses (collections, legal, etc.).

There are broadly three approaches of measuring LGDs for a financial instrument:

- **Market LGD:** Observed from market prices of defaulted bonds or marketable loans soon after the actual default event.

- **Implied Market LGD:** Derived from risky (but not defaulted) bond prices using a theoretical asset-pricing model. Although such methods have not yet fully migrated into the credit risk arena, they are used for fixed income products and credit derivatives.

- **Workout LGD:** The set of estimated cash flows resulting from the workout and/or collections process, properly discounted, and the estimated exposure.

Given the maturity of credit markets in most economies, Workout LGD is widely considered to be ***the most flexible, transparent and logical approach*** to build an LGD model. Workout models have explicit structures that represent real-world processes and the probabilities of certain recovery outcomes. LGD observed over the course of a workout is a bit more complicated to estimate than the directly observed Market or Implied Market LGD. Attention needs to be paid to the timing of the cash flows from the distressed asset. Measuring this timing will impact downstream estimates of realized LGD. The cash flows should be discounted, but it is by no means obvious which discount rate to apply. Issues related to discounting factor have been discussed extensively during IFRS 9 drafting stage and IASB directed institutions to use Effective Interest Rate (EIR) of the financial instrument for discounting the recovery cash flows.

Some Differences between an IRB LGD model estimate and IFRS9 LGD model estimate

There are certain differences between Basel IRB and IFRS 9 guidelines when it comes to LGD estimation and banks that are planning to use Basel IRB LGD estimates for IFRS 9 purpose, need to make sure appropriate adjustments are made to take care of these differences. In workout expense estimation, Basel allows banks to take both direct and indirect expenses associated with recovery process in credit loss estimation, whereas IFRS 9 expects banks to take only direct expenses. There are also differences in the way the carrying cost of non-performing loans need to accounted for in the credit loss estimates under these two guidelines. Typical LGD used for Basel Capital computation is Downturn LGD; however in the case of IFRS 9, PIT LGDs are more appropriate. Also, one needs to bear in mind that the LGDs are expected to be forward looking, so macroeconomic sensitivity should be ensured while developing LGD estimates. Some of the methods like simple average based LGDs or regulatory LGDs may not be amenable to macroeconomic adjustments that are deemed necessary under IFRS9. Another issue is with respect to the discounting that needs to be applied to cash shortfalls, to estimate Expected credit losses. IFRS9 is explicit in that effective interest rates (EIR) need to be used. A purist interpretation of the rules is that the LGD models developed for IFRS9 should take into account the effective interest rate for discounting the historical recovery cash flows in the modelling data set. However, traditionally, contractual or penal interest rates were used in LGD modelling historically. We feel that continuing to use contractual rates while modelling LGD would still be acceptable, as the comment from IFRS9 is more applicable for methodologies that directly assess cash shortfall. EIR is implicitly accounted for in loss statistics based methodologies.

There is no single Workout LGD model development strategy that can be used across banks, and in most cases, not even in the same bank. The choice of the right model development strategy depends on various factors such as:

- Bank-specific policies: Internal policies at each bank will play a critical role in understanding the most suitable LGD methodology
- Region:
  - Local regulations in several economies may have a direct impact on the way defaults are recognized and managed
  - The costs associated with recovery of a loan and the recovery process itself could potentially be notably different in different regions
- The portfolio(s) within the scope of a particular LGD model:
  - A corporate LGD model could be structured significantly different from a retail or an SME LGD model

- o Each portfolio / sub-portfolio within a specific bank could use differing strategies to LGD modeling
- Finally, data availability plays one of the most crucial roles in deciding on the most effective LGD modeling strategy

A. Statistical LGD Estimation Methodologies

There are several options among statistical LGD estimation methodologies; however, the applicability of most of the available methodologies on portfolios is severely constrained by data availability.

a) **Multivariate Linear Regression** methodology is most straightforward technique for modeling recoveries. A continuous recovery rate variable is regressed on explanatory variables. Methodology allows for incorporating forward-looking macroeconomic factors (IFRS 9 requirement) as explanatory variables, and accounts for the inter dependencies among some of these variables. The major drawback of this method is that the predicted values can be outside the range and output may need to be moderated based on expert judgment (allowed under IFRS 9).

b) **Nonparametric regression trees for modeling recoveries on bank loans:** The advantage of this technique is its interpretability, since tree models resemble 'look-up' tables containing historical recovery averages. Furthermore, because the predictions are given by recovery averages, they are inevitably bounded to the unit interval.

c) **Econometric methodology** is specifically developed for modeling proportions, such as the (nonlinear) fractional regression estimated using quasi-maximum likelihood methods.

d) **Prediction of Loan recoveries with Neural Networks:** The results indicate that the variables which the neural network models use to derive their output coincide to a great extent with those that are significant in parametric regression models. Out-of-sample estimates of prediction errors suggest that neural networks may have better predictive ability than parametric regression models, provided the number of observations is sufficiently large.

Statistical methods are **preferred when recovery data** is available in **abundance;** exhibits a relatively **smooth, homogenous structure** with no obvious segmentation; and is unquestionably representative of:

- the relevant collateral being modelled;
- the Portfolio at hand;
- the recovery processes that are associated with the relevant collateral classes;

Additionally, the **data must be representative of future processes.** If the assumptions underlying the data change, then data must be used more selectively, or adjusted in some way.

B. Judgmental LGD Estimation Methodologies

Banks may use pure expert judgment based LGD estimates, or rely on supervisory estimates for the LGD values. Banks may use regulatory LGD in case there is insufficient or no data for LGD modeling. IFRS 9 has not given any specific guideline on use of regulatory LGD for estimation of ECL. If at all regulatory LGD can be used for IFRS 9 purpose, then it may be more suitable for Stage 1, in which horizon for ECL computation is 12-months. However, whether regulatory LGD can be used for Stage 2 or Stage 3 that extends to lifetime of facility is unsettled. Supervisory estimates like guidance under Foundation IRB approaches of Basel can only be benchmarks in our opinion, and the banks would have to demonstrate applicability of these supervisory estimates. Use of external data sources may be an option in absence of sufficient internal default history data. However, the level of adjustments that should be carried out on the external data may remain an unknown factor, since LGD is driven by bank specific factors and contractual terms.

C. Hybrid Methodology - Bayesian Decision Tree-based Approach

This is an approach we feel is apt for banks that have limited data but wish to develop LGD estimates having a sound and objective basis. Decision tree-based LGD models have certain advantages in environments where data is limited. In this approach, the recovery process is validated and all possible

recovery scenarios are rendered within the model. 'Open' and modular structure of the Decision Tree could be used to model any of the nodes independent of the other nodes of the Tree. The Decision Tree based structure allows the estimation of parameters without a universal data set, i.e., separate pieces of the fragmented information & data could be used for estimating the parameters simultaneously.
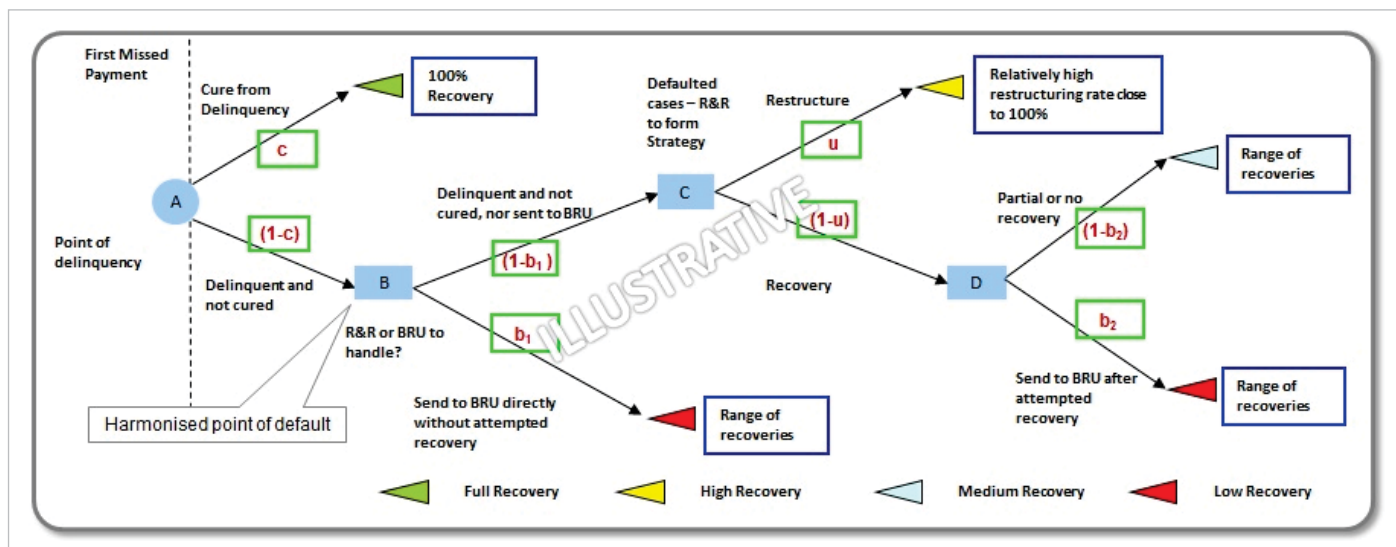

The main challenges to Decision Tree based LGD modeling with limited data include:

- Issues with **data quality, quantity, relevance;**
- Difficulty of **finding and utilizing relevant external benchmarks** – logical conservative assumptions may need to be used in transforming available benchmarks;
- **Working with expert opinion** as a surrogate for data – accounting for biases that are inherent in eliciting expert views is very critical;
- Modeling in a **conservative, yet balanced manner** – local regulators typically penalize model outputs that fail to build in conservatism reasonably.

Given that most model parameters have to be estimated in the absence of sufficient data, the **Bayesian Framework** is typically our recommended approach for parameter estimation under Decision Tree based approach. The framework has **proven to withstand regulatory reviews** given the structural robustness of the statistics that are the building block to the estimation methodology.

There are several advantages to the utilization of a Bayesian approach for parameter estimation:

- Stabilization of the parameter estimation process on small samples, reducing the risk of over-fitting and the excessive influence of idiosyncratic patterns in the data;
- Integration of secondary sources of statistically-relevant information - that is not the core data - into the parameter estimation process;
- Transparent, measurable decomposition of the separate drivers of parameter estimation;
- Quantification of conservatism within the LGD framework;
- Bayesian 'updating': a process whereby marginal information can dynamically update model parameters
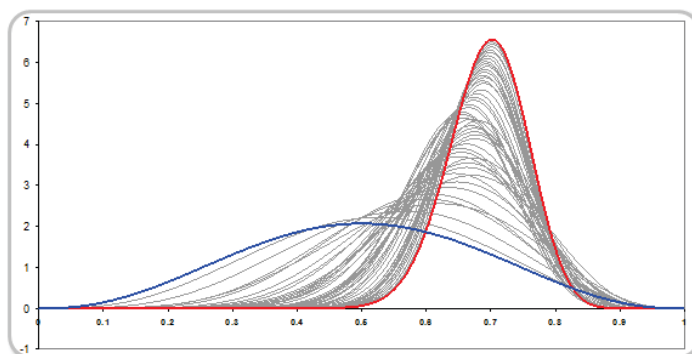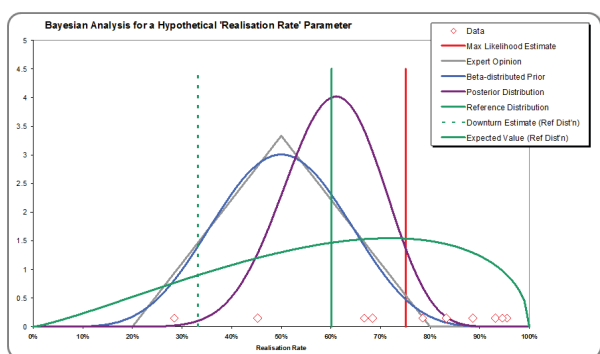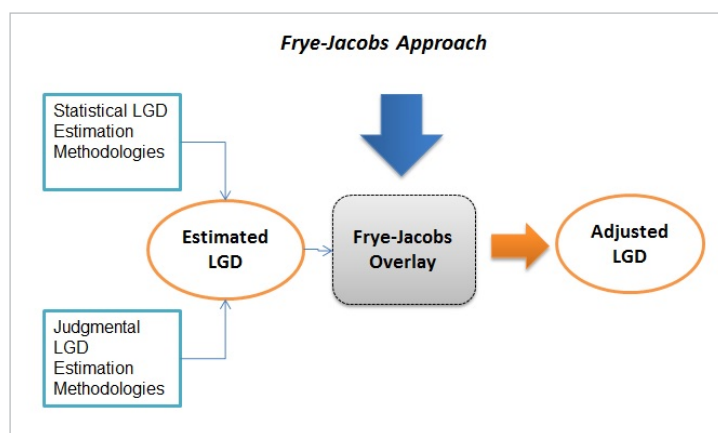
Another perceived challenge for Decision tree based approach is development of recovery decision tree and identification of parameters. In reality, bank-specific policies strictly regulate the recovery practices and will help avoid unnecessary complexities in this. The following inputs from policies and procedural guidelines can translate to logical identification of Decision Tree structure and parameters:

- Types of collateral considered against loans;
- The LTV and related characteristics of collateral that are regulated;
- Handling of cases that undergo restructuring as opposed to recovery;
- Identifying accounts or products that may qualify for a specific "recovery path";
- Details of product-specific recovery processes, including stipulations on time periods associated with attempted recoveries; and,
- Expectations regarding the redemption value of the associated collateral.

Forward-looking adjustment of estimated LGD

As discussed earlier, unlike IRB LGD model, for IFRS 9 the LGD should account for forward-looking adjustments to best estimates of expected LGD. The estimated LGD (eLGD), derived either statistically or judgmentally or by both (as suggested in sections A and B above), is inherently the first part of a two-step process. This estimated LGD can be adjusted over a lifetime of the facility using overlay approach given by the Frye Jacobs methodology. Under this approach, the impact of macroeconomic factor is linked to PD, which in turn is linked to LGD through Frye-Jacobs function. The approach assumes that the asymptotic distributions of default and the loss are co-monotonic. Thus Frye-Jacobs approach essentially produces an adjustment to an expected LGD based on expected probability of default as implied by macroeconomic factors over the lifetime of the facility.

To summarize, in order to meet IFRS 9 requirements to compute ECL, a bank that has sufficient data available with significant history of default may choose from a myriad of approaches. Among these choices, the simulation based approach or the DCF based methods, although sounds promising theoretically, may be prone to mathematical complexity and may not be feasible to implement as per bank-specific factors discussed in this blog. Among these choices such banks may be better off with a modular LGD model development or IRB LGD model enhancement approach with forward-looking adjustments on LGD.

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

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