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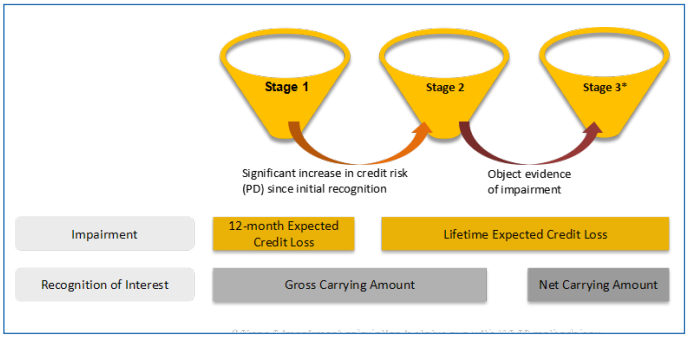
Impairment Modeling in Retail – Many Moving Parts

Financial Institutions across the globe are preparing themselves to meet the January 2018 deadline for compliance with IFRS 9. One of the most critical aspects of the new standard is the way impairment provisions have to be calculated; moving away from an Incurred Loss model to an Expected Loss model. The model is commonly referred to as the "three-stage" Expected Credit Loss model (ECL) which has been explained in the earlier blog post "Stage Assessment – Devil is in the Detail". Impairment modeling complexities can greatly differ between Corporate and Retail Portfolios and pose different challenges that financial institutions (FIs) face in ECL calculation.

This post brings to the fore, some of the main modeling challenges the IFRS 9 standard throws at FIs for the measurement of ECL for Retail Portfolios, and likely approaches that can be followed to address those challenges. The ECL model, as per the standard is based on the following construct illustrated on the right.



One of the key aspects is, at what level of granularity FIs want to analyze the Credit Risk of their retail portfolios. Retail portfolios can be analyzed either on a collective basis or, at an individual account level. The classification of retail assets into different stages requires identification of a 'significant increase' in credit risk. This may entail an assessment of the lifetime of a retail segment/pool or account. The calculations around expected credit losses also depend upon forward-looking macroeconomic information. Based on the stage assessment, a 12-month or lifetime credit loss may have to be determined.

The questions that each of these issues pose, are discussed in further detail below.

At what level should the assessment of Credit Risk for Retail Portfolios be carried out, Individual or Collective?

The assessment of Credit Risk can be done at an account level as well as at a portfolio level. A retail portfolio includes different products such as Credit Cards, Vehicle Loans, Personal loans and Mortgage Loans which are typically monitored by FIs at a portfolio/sub-portfolio level. If individual account level models are developed by FIs, then the same can be used for stage allocation as well as ECL calculations and the results can be aggregated at a cohort or segment level and finally rolled up to portfolio level. Account level models can include application PDs, behavioral PDs or bureau scores. Many FIs may struggle to have updated credit risk information at an account level for monitoring, such as internal behavioral or bureau credit scores. If such Point-In-Time (PIT) models are present, then measurement

and tracking can be possible at an account level and can serve to identify ‘significant increase’ in account level credit risk. Basis the account level information, FIs can develop term structure of loss estimates, PDs or LGDs (Loss Given Default). Survival modeling techniques (explained later in the post) are well suited in such a scenario. As granular data is available, loan information as well as borrower and macroeconomic information can be used at an account level. The downside of such an approach is that it may cause a strain on costs of model building, call for additional resources and necessitate frequent recalibration.

As an alternative to using account level models for portfolio risk assessment, FIs can assess credit risk on a collective level by splitting the portfolio across shared credit characteristics and vintage. The interpretation of the term ‘shared credit characteristics’ is at the discretion of each FI and they can use varied parameters such as ‘risk profile’ in a region or product type i.e Personal Loans. From a data availability and implementation perspective, this approach may appeal more to many FIs. Firstly, the data required is less compared to an account level assessment. This implies that lesser number of raw fields will be needed in the analysis dataset as well as future periodic implementation which in turn translates into reduced timelines for the ECL model implementation. The approach works well, if a limited number of homogenous segments are created, as separate models for each segment can be feasible to build.

Many banks have as part of their journey towards Basel II compliance, invested in IRB approaches which group retail portfolios into pools. These pooling strategies could be based on either of the approaches mentioned above or even a combination of the two. Banks on IRB approach are currently grappling with the question; can the pooling criteria be used in IFRS 9 ECL calculations? Significant resources have been invested by banks in creating the necessary infrastructure for the same and banks will look to leverage it to carry out ECL modeling activities.

Through the course of this post, ECL calculation methodologies using both the approaches will be highlighted.

How to measure the timeframe over which ECL is to be calculated?

Let us understand the need to have a ‘lifetime view’ of financial instruments in the IFRS 9 ECL calculations. First, the assessment of ‘significant increase’ can take a relative measurement approach wherein the Lifetime Expected PDs upon initial recognition are compared against remaining Lifetime PDs at observation point. Thus Lifetime PDs may be needed for stage allocation. Second, for the assets that are classified as Stage 2, the ECL calculations which use loss rates or PD-LGD-EAD (Exposure at Default) are done over the remaining lifetime of those assets.

- **Installment Loans**

The standard states that, for installment loans, the period over which the entity is exposed to credit risk is the maximum contractual period over which an entity has a present contractual obligation to extend credit. However, as on a reporting date, to estimate remaining lifetime of a pool, it may require historical analysis of accounts and their prepayment patterns across different products. Thus, for installment loans we can consider:

Behavioral Lifetime = Contractual Lifetime – Prepayments

- **Revolving Retail Credit**

Paragraph 5.5.20 of the standard states that:

"Some financial instruments include both a loan and an undrawn commitment component and the entity's contractual ability to demand repayment and cancel the undrawn commitment does not limit the entity's exposure to credit losses to the contractual notice period. For such financial instruments, and only those financial instruments, the entity shall measure expected credit losses over the period that the entity is exposed to credit risk and expected credit losses would not be mitigated by credit risk management actions, even if that period extends beyond the maximum contractual period."

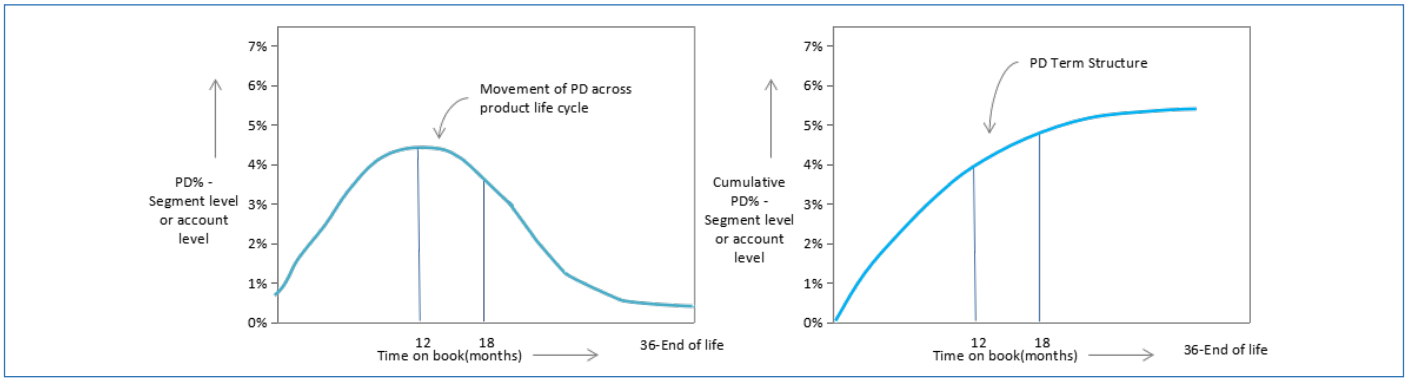
One approach that can be followed is to define ‘End of Lifetime’ events, such that, post the event there is no exposure to credit risk for the instrument (as defined in the standard). Some credit risk management actions that can be considered for the identification of ‘End of Lifetime’ are; deactivation of credit card due to inactivity, charge-off, customer initiated termination and legal or settlement actions upon evidence of impairment.

For Stage 2 accounts, to calculate Lifetime ECL, the standard (paragraph 5.5.40) states that the information and experience about "the length of time for related defaults to occur on similar financial instruments following a significant increase in credit risk" shall be used when determining the period over which the entity is exposed to credit risk, for the purpose of estimating Lifetime ECL. In simple words, a separate analysis using historical data can be done to identify the average time taken from origination to ‘End of Lifetime’ as a result of credit risk mitigation actions. To be more conservative, all impaired accounts can be analyzed and the average time for the last credit risk mitigating action can be considered from this dataset to estimate the lifetime.

How to incorporate forward looking macroeconomic information into the loss models?

The standard states that forward looking information should be used for stage allocation as well as for the calculation of ECL. Econometric models using such information link the performance of retail assets to the macroeconomic factors. This modeling can be done at an account level as well as at a segment or cohort level. Also, depending on the ECL calculation approach selected by the FI, the models can link the macroeconomic factors to losses directly or to Lifetime PDs and LGDs separately.

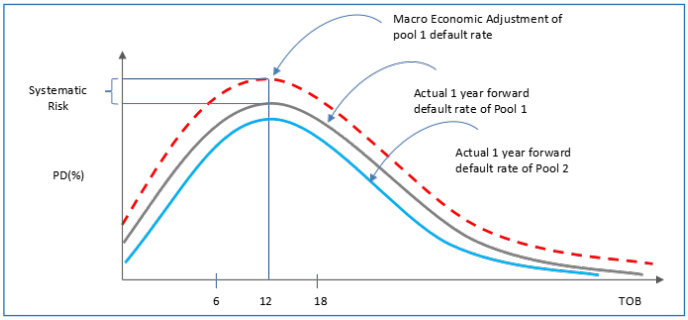
Stage allocation is dependent on the change in risk of default occurring over the expected life of the financial instrument. One of the metrics needed, is, Lifetime PD at origination. To measure the change in Lifetime PD since origination, the PDs should be evaluated relative to the age for the accounts or the 'Time on Book'. This is a critical interpretation as across the life cycle of a retail account, there is typically a non-linear relationship between PD and the time since origination. This is illustrated in the graphs below.



The blue line, which is a humped shaped curve, is the 1 year PD curve over the lifetime of the segment/account, where, as the Time on Book of the segment/account increases, the PDs first increase, and then reduce. These PDs are the 1 year marginal PDs across each observation point on the x axis which is the 'Time on Book'. Highlighted above, the 1 year PD for an account which is 18 month on book is lower than a 1 year PD for an account which is 12 months on book. This is because the risk of default occurring over the expected life usually peaks out and decreases as time passes if credit risk is unchanged and the financial instrument is closer to maturity. This representation above forms the basis of macroeconomic overlay, stage assessment as well as ECL calculations.

The marginal PD curve over the lifetime can be translated into a cumulative PD curve to calculate Lifetime PD for ECL calculations. This curve is also known as the PD Term Structure. This graph is derived using survival models which look at incremental PDs for survived accounts as they age across each month in the loan life cycle.

Let's understand how differently the macroeconomic impact is assessed for segments/pools vis-à-vis individual accounts.



For segment level analysis, retail portfolios are split basis vintages, or origination stage factors such as FICO score, and for each such vintage segment, a 1year PD curve is plotted over the lifetime. These segment level PDs are modeled against different macroeconomic parameters and the impact is assessed as a parallel upward or downward shift of the pool PD curve. This is highlighted as the red curve. Let's consider a pool of 2 customers A and B, wherein both were sourced in Q1 of 2011 and had a FICO score between 700-800.Here, both customers will be on the same curve (Pool1-Grey curve) as origination vintage as well as origination quality are similar. As on reporting date, if customer A is 6 months on book and customer B is 18 months on book, then the central tendency measure of the 2 customers will be calculated. The average 'Time on Book' of the segment is the average of customer A and B i.e. 12 months. The average PIT PD of the segment is the exposure weighted PD of different points on the PD curve of that segment.

For FIs, which intend to directly model losses, 1 year loss rates instead of PDs are used to carry out macroeconomic adjustments basis historical loss data across each pool. Forward looking macroeconomic adjustments can also be applied at an account level using a more granular approach. Account level PDs will be available typically from the behavioral models developed by the FI. Account level regression models can be developed, which link the macroeconomic indicators to the slope and intercept of the score to log-odds equation for each of these PDs.

If ECL is calculated using loss rates, the macroeconomic adjustment can also be applied directly to loss rates, wherein the adjacent graph is also illustrative of a loss rate curve over lifetime

The inclusion of macroeconomic variables allows the estimation of ECL under several scenarios and the generation of probability-weighted outcomes. The approach highlighted above captures both a range of forecasts and the non-linearity in the ECL calculation.

What are approaches to define 'significant increase' in Credit Risk and carry out Stage Allocation?

The standard defines 'significant increase' in Credit Risk as a *'significant change in the risk of default occurring over the expected life of the financial instrument'*. Basis the same, accounts or segments are to be classified into Stage 2. The standard does not prescribe any approach for stage allocation and FIs can decide to use different approaches depending on availability of data as well as sophistication in modeling techniques. Few such approaches are elaborated below:

Qualitative approaches and use of triggers

In the event that the FI does not have origination stage Lifetime PDs and uses qualitative policy parameters for screening and profiling risk, then expedients such as 30 DPD rebuttable presumption can be used as a backstop in addition to certain triggers such as cheque bounce rates, minimum amount due percentages for Credit Cards. The standard states that such indicators are lagged indicators and FIs should look to identify accounts into Stage 2 before accounts become past due. The lone use of the 30 DPD presumption ranks as a low quality implementation of the standard.

Quantitative approaches

1. Absolute Approach

FIs may consider absolute thresholds for change in Lifetime PD since origination as a simple metric for calculating change. For example if origination PD is 2 %, then if the PD as on reporting date is more than double i.e greater than 4% then the account or pool should be classified as Stage 2. Similarly if the risk grade reduces by 2 grades then the account or pool should be classified as Stage 2. Such an approach misses the effect of remaining 'Time on Book' of the account as on reporting date. For different remaining maturities, separate thresholds may be needed to truly reflect increased risk. Also, if the PD more than doubles, accounts or segments may still be considered as 'low credit risk' as on reporting date because their origination PDs were very low. In such a scenario, this method may not be accurate in stage allocation.

2. Relative Approach

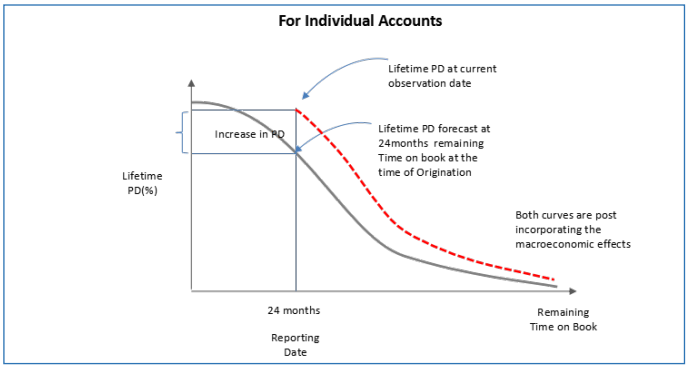
FIs may also consider relative changes in Lifetime PD for stage allocation. This will take care of low PD values at origination as an impediment. However, to consider the remaining 'Time on Book' effect FIs may face complexities as, remaining lifetime based on 'Time on Book' need to be calculated for each pool or account and the difference between Lifetime PD at origination and reporting date needs to be captured.

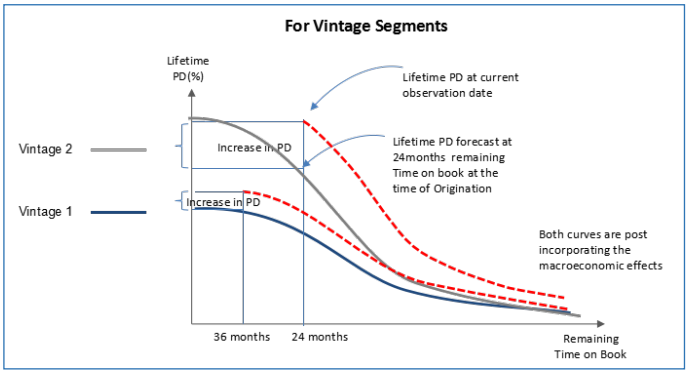
3. Capturing Time on Book-Maturity Effect

For the two approaches mentioned above, the critical component of 'Time on Book' effect is missing. This effect looks at the 'remaining Time on Book' at the reporting date (let's assume its 24 months), Lifetime PD as on reporting date and compares it with Lifetime PD forecast at origination, of the account reaching 24 months remaining to maturity.

For Individual accounts, the remaining 'Time on Book' as on reporting date is calculated, and the vertical distance between the 2 curves is assessed against thresholds to determine significant increase in Credit Risk for that account at that 'remaining Time on Book'. The thresholds may be different at 24 months remaining Time on book, and, for 36 months remaining Time on book.

For segment/pool level analysis, vintage pools are created and the Lifetime PD curves for each segment are compared by looking at the vertical distance between curves at the point which is the average 'remaining Time on Book' for that segment. The image to the right highlights that different vintage segments can have different PDs at the same 'remaining Time on Book' and the nuances of this effect need to be considered in developing thresholds for





segment level stage allocation. As the portfolio is composed of different segments, for each segment, as on the reporting date, the 'remaining Time on Book' will be different. Hence for Vintage 1 and 2, different graphs and different points are referred on the x-axis for stage allocation thresholds.

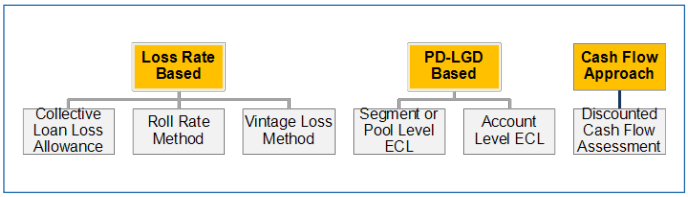
Other Key considerations

1. Depending upon the sophistication of modeling approaches followed, as an additional overlay, backstops such as 30 DPD are recommended to be used across all quantitative approaches.

2. The PDs used across all analyses, be it macroeconomic overlay, stage allocations, ECL 12-month calculations or Lifetime ECL calculations, should be unbiased Point-In-Time (PIT) estimates and not Through-The-Cycle (TTC) estimates. Banks that use 12-month TTC PDs for Basel compliance can calibrate their TTC models to 12-month PIT models for use in IFRS 9 Stage 1 calculations. Our earlier blog "PD Calibration – A Delicate Balancing Act" explains in great detail different PD calibration methodologies and how they can be aligned to IFRS 9.

Approaches for calculating ECL for Retail Portfolios

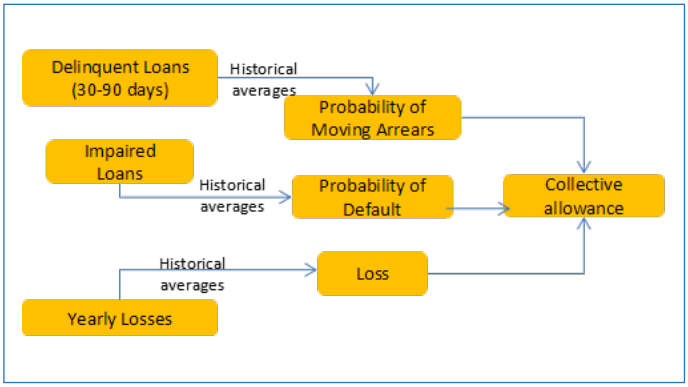
Fis can calculate ECL for Retail portfolios either directly using loss rates on a collective basis or using PD-LGD approaches for Stage 1 and Stage 2 accounts. Discounted Cash flow approach is also an available method. However, it is suited to Stage 3 accounts which are declared as impaired.



Loss Rate Based Approaches

1. Collective Loan Loss Allowance

Collective provisioning is purely based on historical averages of default and actual losses. Under this approach, loans are segregated basis product types and using historical data, loss rates across one year, and over lifetime are calculated. The historical data also shows proportion of portfolio moving into arrears, default and losses to set collective provisioning thresholds. Expert Inputs could be taken for forward looking macro-economic adjustments. A scalar factor can be computed and the losses can be adjusted based on this factor. Loss rate can also be modeled for macroeconomic factors in order to compute the expected loss.



2. Roll Rate Method

The roll rate method is the most commonly used modeling practice for loss forecasting and is done at a portfolio level. The entire portfolio balance is segmented by various buckets e.g. Current, 1-30 DPD, 31-60 DPD, 61-90 DPD, 91-120 DPD etc. The same is highlighted in the example below. Roll rate technique is a forecast in which the flow of outstanding from one level of delinquency (lower) to another (higher) is applied to the current portfolio outstanding mix. This technique follows the flow from 'Current' through all the delinquency buckets to 'charge-off'. Once historical net roll rates by bucket have been calculated, their patterns over time are examined and future roll rates are estimated. The losses are determined as a product of flow rates from the bucket to the final bucket of 180+. In the example highlighted, the loss rate arrived at is 0.24%. This technique is commonly used for monitoring retail portfolios and forecast delinquent accounts by bucket as input for debt management strategies.

As highlighted in the figure below, for the "Current" book, gross losses can be calculated by applying the Loss rates on the outstanding balances. The outstanding balance of the current book as on January is $100,000 and using the loss

Balance

	January	February
Current	100000	105000
1-30	3000	3500
31-60	500	600
61-90	280	300
91-120	200	210
121-150	140	160
151-180	130	135
181 new	120	128
180+	3000	3120

Roll Rate

	January	February
Current	-	-
1-30	-	3.50%
31-60	-	20.00%
61-90	-	60.00%
91-120	-	75.00%
121-150	-	80.00%
151-180	-	96.43%
181 new	-	98.46%
180+	-	-

Loss Rate

	January	February
Current	-	0.24%
1-30	-	6.84%
31-60	-	34.18%
61-90	-	56.97%
91-120	-	75.96%
121-150	-	94.95%
151-180	-	98.46%
180+	-	100.00%

Loss Rate(current) -
*3.50% * 20% * 60% * 75% * 80% * 96.43 * 98.46% = 0.24%*

rate of 0.24% a figure of $240 ($100,000*0.24%) is arrived at. To calculate Net Provisions, one needs to take into account recovery rates. Accounts that go into loss status (180+ DPD) can be partly (or fully) recovered in the future as an outcome of internal collections or debt sales. FIs predominantly calculate and forecast recovery rates using recovery curves, representing recoveries post charge-off (180+ in our example) across different charge-off vintages. Let us assume the recovery rate is 50%, in which case the net provision is $120 ($240*50%).

The macroeconomic adjustments can be made judgmentally or through modeling approaches where roll rates and loss rates can be separately modeled through regression analysis basis economic scenarios. However, Lifetime PDs may still be needed for stage allocation.

3. Vintage Loss Method

Under the vintage loss approach, the portfolio is segmented by various origination vintages. As a part of the modeling practice, the loss rate (for an example) can be tracked over time through full lifecycle for each of the vintages. Factors influencing vintage segment performance can be conceptually divided into three classifications: the factors indicating the quality of a vintage (this can include origination vintage as well as further classification basis quality of origination), the characteristics of the current economic environment and the account's 'Time on Book'. An examination of each of these effects is done in isolation to understand the multidimensional nature of the data and the models used to forecast it. This approach can be applied on a data set of marginal default rates/loss rates (the humped shaped curve) and can help estimate 12-month and Lifetime ECL.

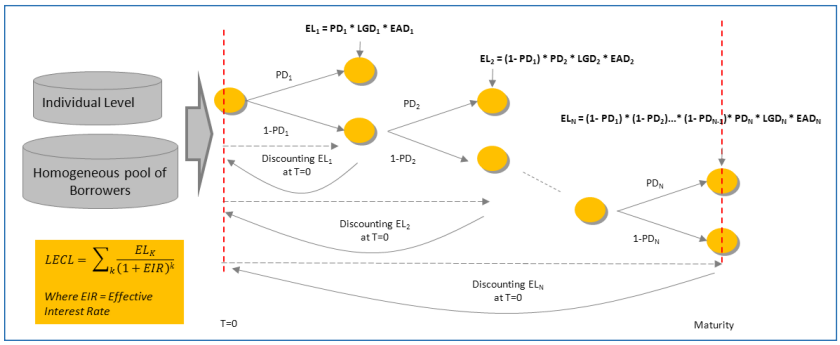
Simply put three separate regression analyses with Losses as the dependent variable are performed, and the effect of each of them is added to arrive at an overall loss rate measure.

PD-LGD-EAD Approaches

1. Segment or Pool based Approach

Lifetime ECL calculation at a pool level requires a term structure of PD and Lifetime LGD for each of the pools to be created at each point of time till maturity. For PD modeling homogeneous pools are created basis origination month or quarter as well as origination stage factors such as FICO score, LTV etc. This approach has been mentioned earlier in the section covering forward looking macroeconomic information.

The calculation is basis survival modeling technique which makes use of the PD term structure to calculate ECL over the remaining life of the pool. The same is illustrated for simplicity to the right:



Basis the 'Time on Book' of the pool as on reporting date, the PDs are picked up from the term structure. Lifetime LGD is calculated, using cumulative recovery rate curve basis historical recovery data. Similar to Basel models, the lifetime recoveries are discounted to the default date for LGD calculation. A macroeconomic adjustment of LGD is done to incorporate economic scenarios in final ECL calculation. The macroeconomic impact can be linked to LGD through a statistical function such as the 'Frye Jacobs function'. Pool level LGD is the probability weighted LGD of all accounts in a pool. The pools present for LGD computation may be different than the pools for PD computation.

To estimate EAD of retail segments, key considerations include payment terms, tenure of exposure and the point of time at which default is expected, or actually occurs. For segments, maturing over a longer time horizon and requiring a forward looking view, such as Stage 2 segments, the projection of exposure will need to consider prepayments and possibility of drawdown from undrawn portion under forward looking macroeconomic scenarios as in the case of Credit Cards. The

prepayment estimation can be done using methods such as 'Standardized Prepayment Path method' and 'Cumulative Prepayment Rate Method'. CCF modeling and estimation for segments can be done using methods such as Decision tree-based approach, Linear and Logistic regression modeling and Direct Value approach which relies on regulatory prescribed CCF. Each of these methods is described in detail in the previous blog "Exposure at Default: IFRS 9 Ramification".

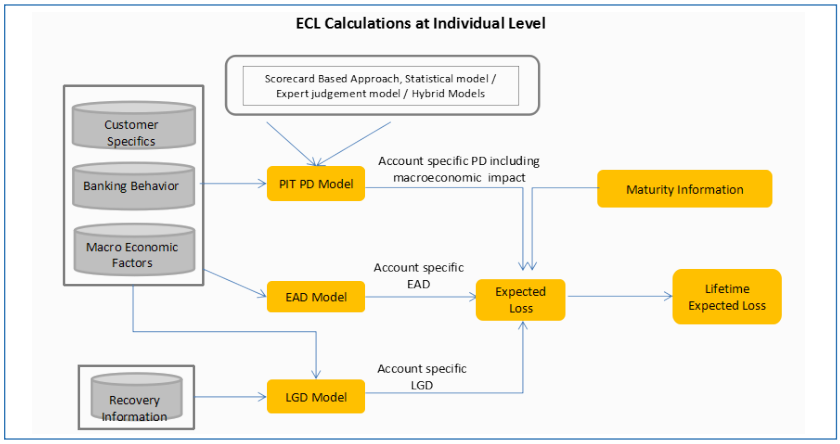
Using the survival approach depicted in this section, subsequent period ECLs are calculated till the 'end of lifetime' of the pool. The ECL calculated in each period is discounted to the reporting date using the Effective Interest Rate (EIR) as a discount factor to have the Lifetime ECL as on reporting date.

The Lifetime ECL is required to be calculated for only Stage 2 and Stage 3 identified portfolio segments. For Stage 1 portfolio, a 12-month ECL is required.

For Stage 1 portfolio, FIs have the possibility to leverage existing Basel methodologies for ECL calculation. If a bank has 12-month PIT Basel PD models or 12-month TTC models with an easily extractable PIT component, then the Basel Models can be used for ECL calculations. For FIs where PIT PD models such as behavioral PDs are not available, similar to the lifetime approach as described in this post, we recommend a vintage based data modeling approach to estimate 12-month ECL.

2. Individual Approach

Lifetime ECL calculation at an account level requires a term structure of PD and Lifetime LGD for each account. The ECL calculation methodology is a survival methodology as described in the pool-based approach. The PD-LGD and EAD are modeled at an account level under this approach using same techniques as highlighted in the pool-based approaches. For Retail portfolios, the process of calculating ECL at an account level may be complex and highly data intensive, resource intensive as well as costly. The ECL calculated at an account level can then be aggregated at segment level for monitoring and decision making. The advantage of account level analysis is that the results are more robust as more granular data has been considered.



Discounted Cash Flow Assessment

The Discounted cash flow method looks at the cash flows emanating at an account level and these cash flows are discounted to the observation date to arrive at expected cash shortfall. This method is judgmental and involves extensive computations. As cash flows are directly evaluated, the accounts behavioral characteristics related to default are ignored and the may render this method as highly inaccurate for non-impaired portfolios. Hence, this method is more applicable to Stage 3 accounts. Cash flows can be modeled for macroeconomic factors using OLS regression and ARIMA approaches.

The post has addressed several key considerations in the modeling and implementation of IFRS 9 Standard for retail portfolios. Possible interpretation of the guidelines and portfolio assessment approaches through segment/vintage-level models and account-level models has been provided. The standard does leave many areas to interpretation and it leads to the final question of this post;

Will FIs implement the standard as envisaged or will they just look to meet minimum compliance norms?

The methodology a FI uses for stage assessment will have a direct impact on the provisioning amount and volatility of the FIs income statement. FIs will have to closely monitor stage 2 population, as well as movement of accounts between stage 1 and stage 2. Decisions on reduction in business across certain risk segments may also follow for some FIs due to high impact on provisions due to higher EADs for these segments. Policy teams may have to tie portfolio monitoring to constituents of Stage 2 exposures as an ongoing key risk indicator.

Fis can very well look to rely on qualitative rules and backstops such as 30 DPD rebut as the primary criteria for stage allocation. Through the use of models, all non-delinquent accounts/segments classified as Stage 2 over and above 30 DPD accounts will have to demonstrate higher ECLs over lifetime to justify their Stage 2 allocations. Such simulation studies on finding the right and stable definition will have to be carried out by FIs before they finalize their ECL approach.

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

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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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