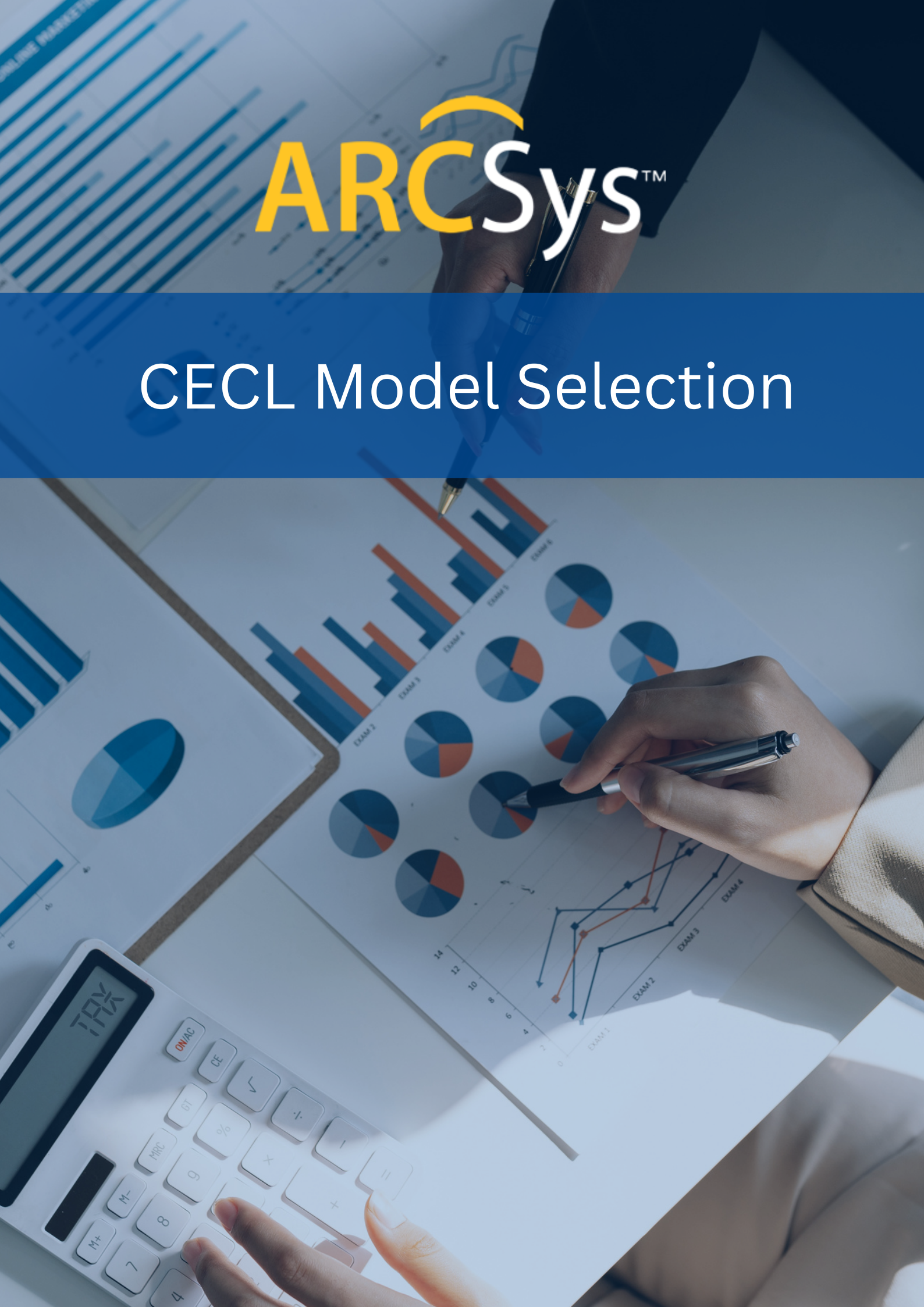
ARCSys™

CECL Model Selection



CECL Model Selection

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Introduction

After selecting and adjusting historical data, an institution must choose which CECL model best reflects their estimate for future losses. This decision is made for each pool. An institution should consider multiple models to determine which model best represents expected credit loss. Having multiple models is imperative because each pool's data is different; for example, the volume of charge-offs , the volume of defaults, the number of large outliers all can have an effect on how well a model predicts. This whitepaper will give an overview of the different CECL models, explain how the calculations work, and guide you in determining the best fit for your data.

Overview of Models Utilized by ARCSys

Discounted Cash Flow

Discounted Cash Flow (DCF) for CECL is a method of valuing an asset or investment, using the concepts of the time value of money. In a DCF model, projected cash flows adjusted for charge-offs, prepayments and amortization or accretion are discounted to their present value using the Effective Interest Rate (EIR), which reflects the time value of money and the risk associated with the cash flows. This means that the DCF model takes into account the fact that money (cash) is worth more in the present than in the future, and that the value of an investment or asset can vary depending on the risk involved.

When selecting data for a Discounted Cash Flow (DCF) model, one would select the best estimate of charge-offs and recoveries expected for the respective pool. Once this is decided upon, the model will forecast the data using economic or employment data.

Future cash flows, as evidenced by the forecasted loan amortization schedule, are adjusted for potential charge-off and prepayment activity and result in a revised cash flow stream. The model cash flow adjustments consist of historically observed net charge-off and prepayment rates which are aggregated by loan pool and are selected by either months after origination or selected reporting periods. These periods are selected to represent the best estimate of the activity cycle. Once calculated, the predicted rates are applied to the forecasted cash flows of all loans within the respective pool and then an historical Reversion Rate is applied to the periods outside of the forecast.

Using the present value of the adjusted cash flow stream generated by the DCF model, the loan level allowance is calculated as:

$$DCF\ Loss\ =\ NPV,\ Discounted\ using\ the\ EIR\ -\ Current\ Amortized\ Cost\ Basis$$

For a loss to be estimated, the Net Present Value (NPV) of the cash flows must be less than the Amortized Cost Basis (ACB).

Probability of Default

Probability of Default (PD) is a measure of the likelihood that a borrower will default on an asset or other financial obligation. Default typically refers to the failure to make scheduled payments on an asset. The Probability of Default is an important factor in credit risk analysis and is often used by lenders to assess the risk of lending to a particular borrower through time.

ARCSys utilizes a through-the-life-cycle approach to calculating the long-term average default rate. ARCSys considers two different calculations for Probability of Default - Probability of Dollar Default and Probability of Unit Default. The Probability of Dollar Default (PDD) model is based on the balance of loans past due to the balance of loans remaining in a static pool through-the-life-cycle; the Probability of Unit Default (PUD) model is based on the number of loans past due to the number of loans remaining in a static pool through-the-life-cycle. The PDD and PUD models are applied at the individual loan level as of the current reporting period. For loans that are delinquent more than 90 days are no longer probable of default, but are in default; therefore, their individual PD is 100%.

When considering Probability of Default, one needs to also consider Loss Given Default (LGD). Loss Given Default (LGD) is a measure of the expected loss on a loan or asset in the event of default by the borrower. In other words, LGD is the amount of loss expected when the loan is charged-off to the remaining balance before charge-off. LGD is adjusted down through time for recoveries.

The simplified Probability of Default allowance is calculated as:

$$PD\ Loss\ =\ PD\ \%\ *\ LGD\ \%\ *\ ACB$$

Open Commitments

Under CECL, an off-balance sheet item refers to the remaining portion of a financial asset that is unused and is not recorded on the balance sheet of a financial institution as of the measurement date. This means that the asset is not included in the calculation of the institution's total assets or liabilities, and therefore does not impact its balance sheet ratios or overall financial position.

Examples of off-balance sheet items under CECL include commitments to extend credit, such as undrawn portions of revolving credit facilities or unused lines of credit, and other financial assets with off-balance

sheet risk, such as standby letters of credit or guarantees. The CECL standard requires financial institutions to estimate and provide for credit losses on these off-balance items, just as they do for on-balance sheet assets, in order to more accurately reflect the expected credit losses over the life of the asset. However, if management determines that the financial assets are unconditionally cancelable then the allowance may be excluded under CECL.

The open commitments model estimates the likelihood of a future increase in the credit utilization of a pool's unused credit. The expected increase in the expected use of the available credit is then applied at a loss rate based on the respective pools' loss history. In cases where the forecasted likelihood of utilization is below the current utilization, no allowance would be calculated. The model leverages the available credit and credit utilization percentage observed as of a given reporting period. It can be calculated as:

$$Open\ Commitments\ Loss\ =$$

$$Available\ Credit\ *\ (Highest\ Predicted\ Credit\ Utilization\ \%\ -\ Current\ Credit\ Utilization\ \%)\ *\ Reversion\ Loss\ Rate$$

Model Selection Process

1. **Complete an initial model selection questionnaire:**

Set initial expectations for the CECL modeling process by understanding the underlying data issues and model input considerations to ensure that models will operate properly and produce reasonable and supportable results. Questions that should be considered are as follows:

- Does the selected data have at least 30 charge-off or recovery events?
- Is charge-off activity sparse, meaning activity may not be recorded each month or even each quarter?
- Does the data selected include outliers?
- Is there sufficient loan level data through the charge-off cycle?
- Is there days past due or next due date as part of the loan level data?
- Does the data have a sufficient amount of delinquency activity through the period selected (i.e. are delinquencies common and consistent)?
- Does the life cycle period selected exceed four years?
- Does the PD period selected encompass a complete charge-off cycle?
- Does the life cycle period selected encompass a complete charge-off cycle?
- Does your institution generate a new loan/account number for charge-off and recovery activity?

- Does the data selected encompass summary data?
- Does the reporting period selected encompass a complete charge-off cycle?

This analysis may eliminate certain models, because the data is missing or inadequate to provide sound model results. For example, if the data does not include days past due or has significant amounts of summarized data, the use of a PD model may be limited without referring to third-party results.

2. **Estimate the expected allowance to set an initial perspective:**

If management selects a certain vintage year cycle or a range of reporting periods as the best estimate of future losses, then this selection for each pool sets the baseline for expected future losses. For example, if the vintage cycle 2016 to 2018 was selected for a pool with a 60-month average contractual term, the cumulative losses incurred for loans originated in 2016 to 2018 would be the initial estimate of possible losses. This estimate may need to be adjusted for loan growth, changes in expected prepayments, and qualitative factors. For more information about qualitative factors and adjusting historical data, see the course in the ARCSys Learning Portal titled Adjusting Your Historical Data Under CECL.

3. **Review the allowance calculation for each model for the selected pool:**

Consider eliminating allowance calculations that are too high or too low based on expectations. A DCF model may produce higher results because of the impact deferred fees and costs have in a DCF model and effective rate of return utilized in the present value calculation.

4. **Review forecast charts and graphs for expectations and reasonableness:**

Determine if the forecast meets expectations. Forecast charts should be initially reviewed for expected results and the reasonableness of the results. For example, if the chart shows the forecast prepayment rate doubling over the historical data utilized, consider if that meets expectations or looks reasonable based on actual results today. If a forecast's results do not appear reasonable, consider adjusting model inputs to achieve a forecast that would better meet expectations if needed and possible. Sometimes due to limited data, adjustments may not materially change the outcome. It may not meet expectations due to limited data or other data issues like outliers. Review the forecast charts for charge-offs, prepayments, Probability of Dollar Defalt, and Probability of Unit Default. Eliminate models where the forecast does not meet expectations or those that are affected by data issues such as quantity of data, outliers, or other data inconsistencies.

5. **For remaining models, review the forecast graphs and reversion percentages for model accuracy using statistical evaluation tools:**

At ARCSys, accuracy is calculated with two different evaluation metrics. The “root mean square error” (RMSE) and “relative root mean square error” (RRMSE) are utilized for all of ARCSys’ non-linear and linear models. Understanding these results helps ensure that the forecasted results meet general statistical guidelines for evaluation.

The differences in predicted and actual values are the focus of the RMSE metric. The RMSE value is dependent on the number and value of dependent variables such as charge-offs which become actual observations, compared to forecasted values (forecasted charge-offs). The difference between the RMSE results and the RRMSE results is that the RMSE has no set scale, whereas the RRMSE has a set scale of ranges that defines the quality of the value. Therefore, determining the results of the RMSE evaluation is more subjective and requires additional assessments.

ARCSys provides both the RMSE and RRMSE to provide additional support for model accuracy. When they are within expected parameters, the model should be considered as fit for purpose. Train RMSE and Train RRMSE describe how well the model predicts data it has already seen. Test RMSE and Test RRMSE describe how well the model predicts new data. These results are used together to check the accuracy of the statistical model. In simplistic terms, the model selects 80% of the data points to “train” the model and 20% of the data points to “test” the model. When the “train” and “test” are significantly different in relation to the gross being measured, the model may be over or under fit. This means it may not be functionally usable and the model should be excluded from final selections.

In general, ARCSys recommends that both RMSE and RRMSE, or any other statistical evaluation tool utilized, are determined to be fit for purpose in order to use a model output. However, discretion may need to be applied when one metric is out of fit and the other is not. The more a specific metric is out of fit, the more likely the model forecast should not be used.

6. **Final model documentation and determination:**

When making the final decision of which model to select for a pool's CECL allowance for a pool, it is important to consider all the information gathered so far. These documents together should help develop and support a memo of the conclusions for allowance decisions. Maintain documentation of all the accumulated knowledge, including:

Documentation:	Support From ARCSys:
Segmentation and external covariate assessment	ARCSys Annual Statistical Analysis
Initial model selection assessment	ARCSys Model Selection Guide
Model inputs, including historical life cycle charge-off data	Model Summary page in the ACL Calculator
Remaining terms	Allowance Analysis graphs in the ACL Calculator
Periodic Forecast and Reversion Rates review	Forecasting Results charts in the ACL Calculator
Initial model selection by allowance calculator	Summary Allowance report in the ACL Calculator
Final forecast review	RMSE and RRMSE calculations in the ACL Calculator

For the remaining models that are producing reasonable and expected results and the RMSE and RRMSE are showing good fit, judgment is required to determine which model calculation is the best expected estimate for the pool; there is no one correct answer. In some cases with significant volume and activity, all models may produce results with good fit, but the balances for the allowance may be different. Using judgment is part of the process, which is then supported by the documentation above. There are, however, some models that will not result in appropriate fit, generally due to data issues; those models should not be used.

Earn CPE Credit:

To learn more about this topic and earn CPE credit at the same time, follow the link below to view our on-demand course in the ARCSys Learning Portal: CECL Model Selection

How ARCSys Can Help:

ARCSys can assist your institution with modeling decisions and documentation. ARCSys can perform Back-Testing and Benchmarking Analyses to support your institution's overall model calculations.

Contact ARCSys today!