ARCSys™

Back-Testing Your First CECL Year

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In the model risk management environment, back-testing plays a crucial role in assessing the reliability and effectiveness of your CECL model. It involves comparing the estimated credit losses, including both forecasted loss rates and reversion rates utilized with the actual losses that occurred after the estimate was developed.

By conducting back-testing, financial institutions can gain valuable insights into the performance of their CECL allowance model and meet regulatory expectations. It helps determine if the forecasted allowance loss rates and prepayment rates align with the actual results, as well as assesses the accuracy of the historical reversion rates used in the model.

Short-Term Back-Testing

Back-testing is different for a CECL model because of the life-of-loan concept that was built into CECL. Back-testing involves determining if the forecast loss rate is reasonable at both the measurement date[1] and assessment date[2] and analyzing the results to determine if the overall allowance is reasonable.

The primary objective of short-term back-testing is to determine if the forecasted results are reasonable and align with the actual outcomes. By comparing the actual loss rates over the assessment period to the forecasted rates over the same period, financial institutions can assess the accuracy of their CECL model's predictions for the short-term horizon.

Short-term back-testing is a critical component of evaluating the accuracy of your CECL model's forecasts. It involves comparing the actual loss rates for a specific period and pool. For example, this test compares the actual losses during the assessment period for loans originated on or before the measurement period to the forecasted losses at the measurement date for the same period.

Analyzing Charge-Offs and Prepayments

This first example below is forecasting a charge-off rate of 0.24153%, at the measurement date through the assessment date of December 2023. The example identifies the forecasted loss rate

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[1] Measurement Date/Period: The period for which the back-testing is determining if the model inputs and calculations are representative of actual results.

[2] Assessment Date/Period: The period for which the back-test is utilizing actual results versus calculated results.

as of the December 2022 CECL allowance calculation and displays the forecasted loss rate through December 2024, a two-year loss forecast to compare to actual results. Since the assessment period is 12 months, one would look at the first 12 months of the forecast
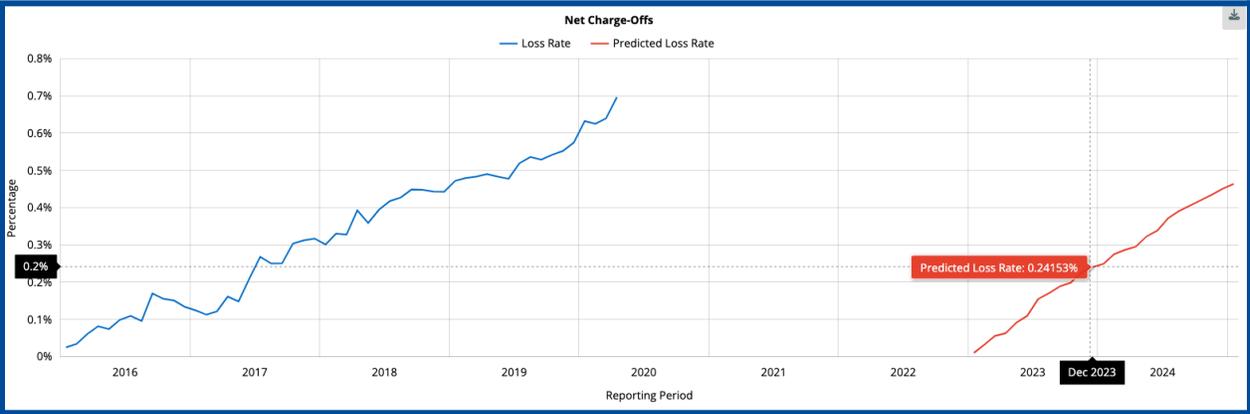
The second image below is the forecast as of the assessment period. Reviewing this can help determine if the current forecast is also in line with actual activity. The current forecast as of the assessment period is 0.20281%, slightly lower than the measurement period forecast.
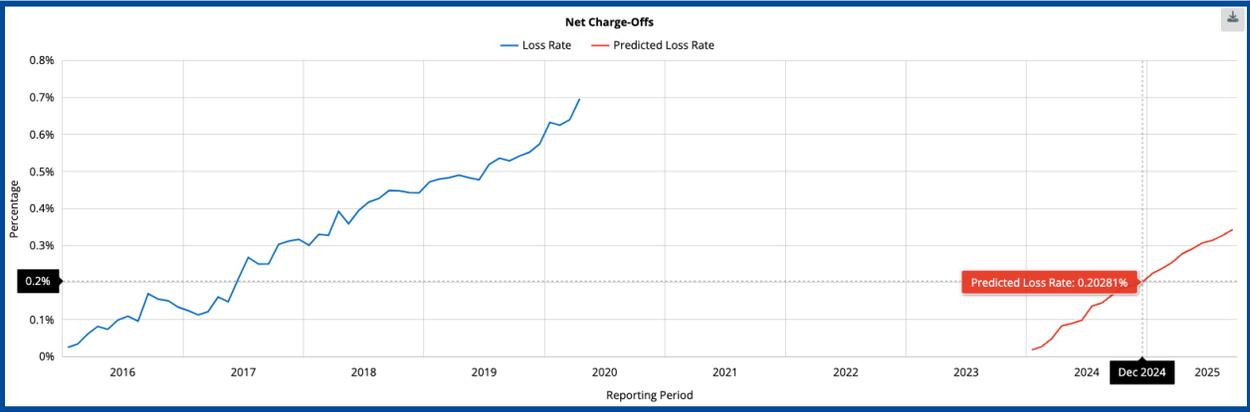
ARCSys utilizes both of these charts in determining if both the original forecast and the assessment date forecast are representative of the actual results. For example, if charge-offs have increased above expectations from the measurement date, but the model was adjusted during the assessment period, the current model may not need adjusting. This analysis will be utilized in two ways:

1. *To determine if changes have been made to the model for variances from the original forecast*

2. *To verify that the current forecast is meeting expectations*

Because the CECL calculation measures the life cycle of assets, it is important to make sure when assessing the actual activity to limit the assessment to assets that existed as of the measurement

date. For example, 12 months after the measurement date, assets may have been originated and losses on those assets can occur. These losses should not be included in the assessment but identified to see if any unusual trends are taking place that need model adjustments.

Assessment Period Loss Rate:

As of December 2022 and December 2023

	2017	2018	2019	2020	2021	2022	2023		Totals
Active Assets Remaining Balance *December 2022*	$1,661,082	$6,154,122	$17,168,127	$28,347,590	$52,957,536	$82,863,211			$189,151,668
Active Assets Remaining Balance *December 2023*	$352,493	$2,036,539	$7,934,040	$15,131,567	$31,994,086	$55,022,624	$138,337,544		$250,808,893
Average Active Assets	$1,006,788	$4,095,331	$12,551,084	$21,739,579	$42,475,811	$68,942,918			$150,811,509
Net Charge-Offs *December 2022 Forward*	-$30,747	-$35,754	-$20,193	$78,275	$237,041	$283,166	$265,396		$512,061
Weighted Average Percentage	0.67%	2.72%	8.32%	14.42%	28.16%	45.71%			100.00%
Loss Rate	-3.03%	-0.87%	-0.16%	0.36%	0.56%	0.41%			
Weighted Loss Rate 2022	-0.02%	-0.02%	-0.01%	0.05%	0.16%	0.19%			0.34%
Weighted Loss Rate 2023							0.38%		

Forecasted loss rate appears **low** compared to actual loss rates from December 2022 (0.24153%) and December 2023 (0.20281%)

The Weighted Average Loss Rate for the assessment period was 0.34%, which should be compared to the forecasted loss rates from December 2022 (0.24153%) and December 2023 (0.20281%). When comparing these rates, the forecasted loss rates appear to be *low* in comparison to the Weighted Average Loss Rate for the assessment period (0.34%) and the current assessment year (0.38%).

When this process was repeated for prepayments, the Weighted Average Prepayment Rate for the assessment period was 9.41%, which should be compared to the forecasted prepayment rates from December 2022 (11.83337%) and December 2023 (9.04353%). When comparing these rates, the forecasted prepayment rates appear to be *reasonable* in comparison to the Weighted Average Prepayment Rate for the assessment period (9.41%) and the current assessment year (7.32%).

Potential Model Adjustments

The actual losses were slightly higher than the forecasted losses and the prepayment forecast was reasonable. If model adjustments are needed, as in the case of charge-offs, some that may be considered are listed below:

- Review model inputs to determine if best estimate needs to be adjusted
- Consider adjusting historical data for qualitative factors
- Determine if your data needs to be lagged
- Evaluate impact of covariates used in forecasting
- Reporting period models: consider adjusting for pool loan growth

Long-Term Back-Testing

Understanding your model's long-term performance is crucial for ensuring its effectiveness and achieving regulatory compliance. Many things can happen that cause the long-term assessment to be more difficult, such as actual loss cycles may change based on underwriting and economic factors. The best way to delineate these issues is to break out the history by life cycles and origination periods.

## Delineating the Horizons - Short-Term vs. Long-Term Back-Testing

Short-term back-testing focuses on the **forecasted rate** over the forecast term of charge-offs, prepayments, and defaults, meticulously evaluating your model's ability to predict near-term fluctuations in portfolio credit risk.

Long-term back-testing shifts the focus to the **reversion rate**. This analysis scrutinizes how well your model predicts the expected lifetime losses of a loan vintage, including current economic conditions. It assesses whether your model captures the cyclical nature of credit risk and its tendency to revert to a long-term average over time.

Combining these evaluations fosters a comprehensive understanding of your model's performance, enabling you to identify both immediate areas for improvement and broader structural considerations.

When analyzing life cycles, some pools will have losses in the year of origination and some will not. Understanding when losses occur through a life cycle, the timing of the occurrence and volume are important to determine if a CECL allowance is reasonable on a whole. Therefore, remaining balances, loss cycles by year after origination can help you compare current activity to historical activity.

Understanding management's best estimate used for the model is the best starting place to understand the long-term CECL life cycle rate expected. The chart below displays the vintage loss rates through time by vintage year.
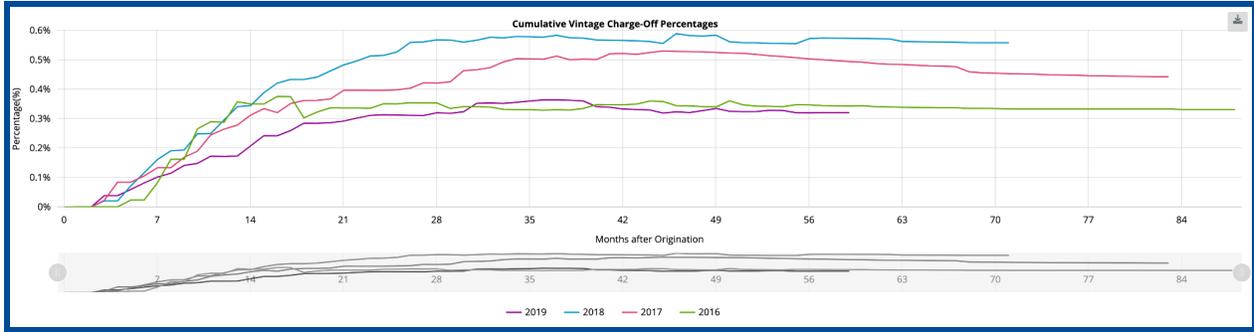
This chart displays the life cycle rate that was determined to be the best estimate and what the model is using for forecasting and the reversion rate, including increases or decreases for any qualitative factors (Q-factors).
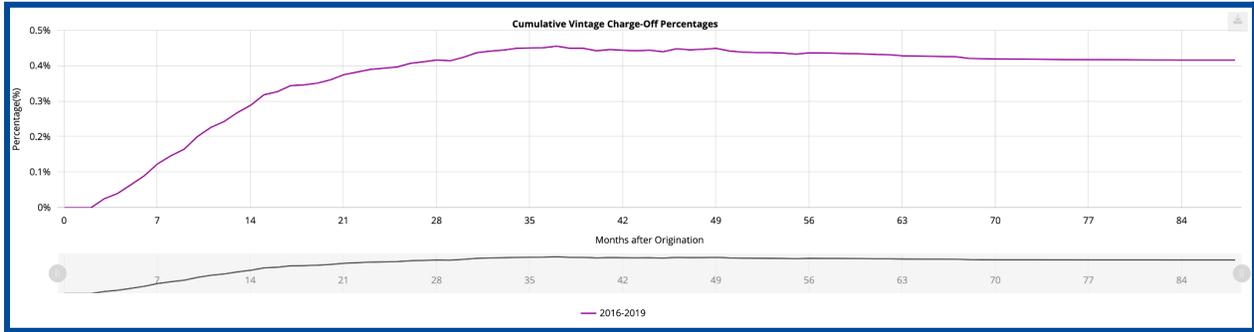
Understanding the loss cycle, when losses occur, is important to determine how the current loss cycle is behaving compared to the expected model inputs. In this case, 100% of all losses are incurred by 36 months after origination. Therefore, when we look at the losses in 2023 we have some expectation of what we should see.

Qualitative Factors

Qualitative factors can add another level or dimension to the analysis based on how they are applied, either as a direct adjustment of the historical data feeding the model or as an add-on to the model calculation once calculated.

The add on method is more difficult to assess, because these values are not part of the forecast or reversion rates applied. The larger the Q-factors are to the overall allowance percentage, the more likely it is that the model input data is not reflective of the actual losses expected to be incurred. Therefore, the short-term analysis needs to consider these adjustments. The larger the Q-factors are, the more underlying and continued documentation and reasonable and supportable evidence is necessary. Excessive Q-factors create a significant hurdle in back-testing the allowance and may cause your allowance to drop, unless losses start to appear.

The diagram below shows a decision matrix to follow based on how you apply Q-factors. If

Q-factors are applied on top of the allowance calculation, you must decide how much of the Q-factor should be included in the short-term assessment and how much in the long-term assessment. This means clearly documenting your reasoning for the adjustment, which is also required in the CECL standard.

If you apply your Q-factors on top of the allowance calculation, and your Q-factors are a significant portion of the loss percentage, management should consider changing model inputs as the historical data utilized is not representative of expected results.
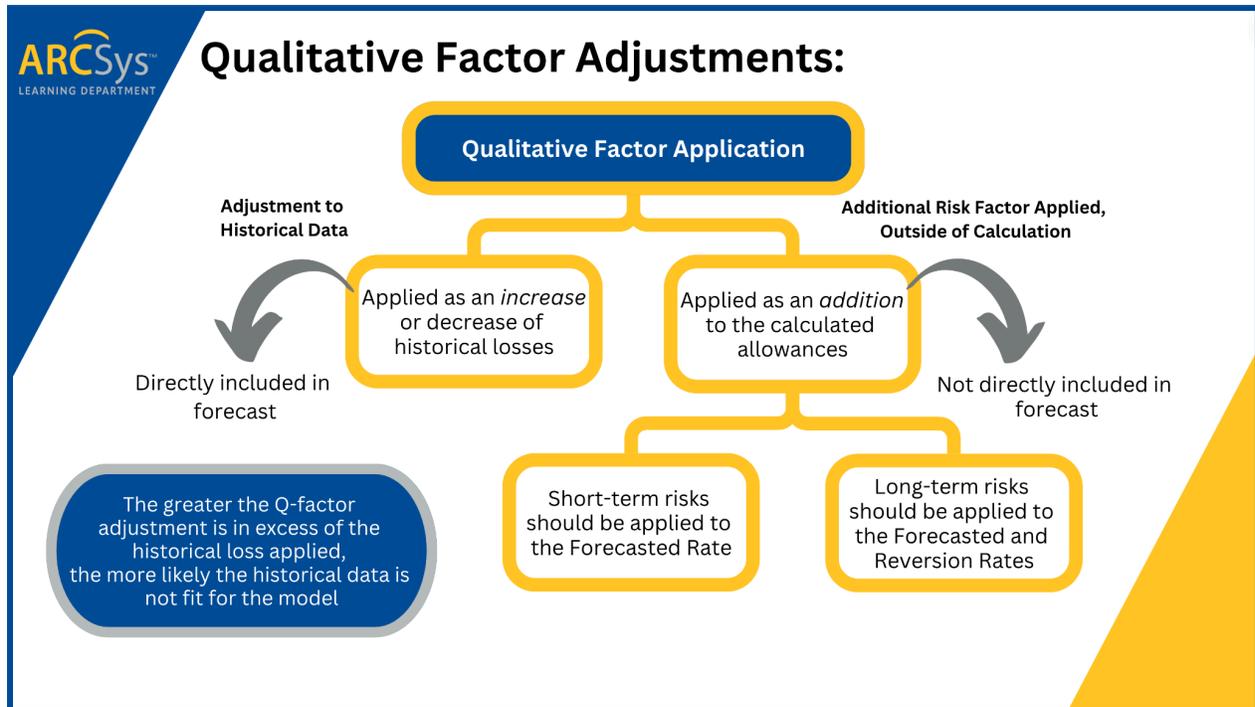
Determination of Reasonability

The charts below delineate the changes in losses, from the measurement period through the assessment period, by vintage year. This assessment is necessary to understand changes in loss cycles and how those cycles evolve through different economic periods. These charts also compare the expected loss rate percentage by months after origination to the actual losses incurred after the measurement date. In this example, COVID reduced the losses in the early periods; however, the later origination cycles have higher losses.

The overall loss rate is also evaluated and compared for reasonableness in the last chart. When evaluating the analysis, current losses on loans originated during the assessment period should be considered to determine if current model adjustments are necessary. In all, understanding the activity through life cycles is the easiest way to determine if the allowance is reasonable and supportable.

Change in Balances Over Loss Cycle:

	2017	2018	2019	2020	2021	2022	Totals	2023
Gross ACB Dollars Originated	$48,365,240	$103,835,569	$135,209,219	$109,162,801	$109,269,560	$98,511,781	$604,354,170	$160,379,404
Remaining Balance of Active Assets, Measurement Period	$1,661,082	$6,154,122	$17,168,127	$28,347,590	$52,957,536	$82,863,211	$189,151,668	
% of Loans Remaining, Measurement Period	3.43%	5.93%	12.70%	25.97%	48.47%	84.12%		
Remaining Balance of Active Assets, Assessment Period	$352,493	$2,036,539	$7,934,040	$15,131,567	$31,994,086	$55,022,624		$138,337,544
% of Loans Remaining, Assessment Period	0.73%	1.96%	5.87%	13.86%	29.28%	55.85%		86.26%

Measurement Period - December 2022
Assessment Period - December 2023

Loss History Comparison:

	2019	2020	2021	2022	Totals	2023
Total Net Vintage Losses, as of the Measurement Period	$454,282	$245,498	$70,151	$145,982	$461,631	
Total Net Vintage Losses, as of the Assessment Period	$434,089	$323,773	$307,192	$429,148	$1,060,113	$265,396
Losses Incurred, During Assessment Period	-$20,193	$78,275	$237,041	$283,166	$598,482	
% of Loss to Loans Originated, as of Measurement Period	0.34%	0.22%	0.06%	0.15%		0.17%
% of Loss to Loans Originated, as of Assessment Period	0.32%	0.30%	0.28%	0.44%		
% of Gross Net Loss Incurred, During Assessment Period	-4.65%	24.18%	77.16%	65.98%		
Model Input (2016-2019) Average Vintage Loss %, by 12-Month Cycle Period	-3.54%	-3.54%	8.90%	33.00%		58.10%
Comments	Losses on track	Losses above average	Losses above average	Losses above average		Losses below average?

Measurement Period - December 2022
Assessment Period - December 2023

ARCSys is Here to Help!

At ARCSys, we understand the importance of robust CECL models and the crucial role of back-testing in ensuring their effectiveness. Our team of experts is here to assist your institution

with back-testing your CECL model, providing valuable insights to strengthen your model and meet regulatory expectations. Probability of default models require similar analysis, but they also need to compare life cycle PD rates.

Our Back-Testing Services:

- Short-Term Back-Testing: We analyze your model's ability to predict near-term fluctuations in portfolio credit risk by comparing forecasted rates with actual.
- Long-Term Back-Testing: We assess your model's ability to capture the cyclical nature of credit risk and predict expected lifetime loan losses/prepayments, considering historical data and economic factors.

In addition to our back-testing services, ARCSys offers a wide range of solutions, including benchmarking, sensitivity analysis, AVM modeling, commercial concentration risk statistical assessments, training, and ongoing support. We are committed to helping your institution navigate the complexities of model risk management and achieve success.