Measures of Model Performance

FRB Modeling Symposium

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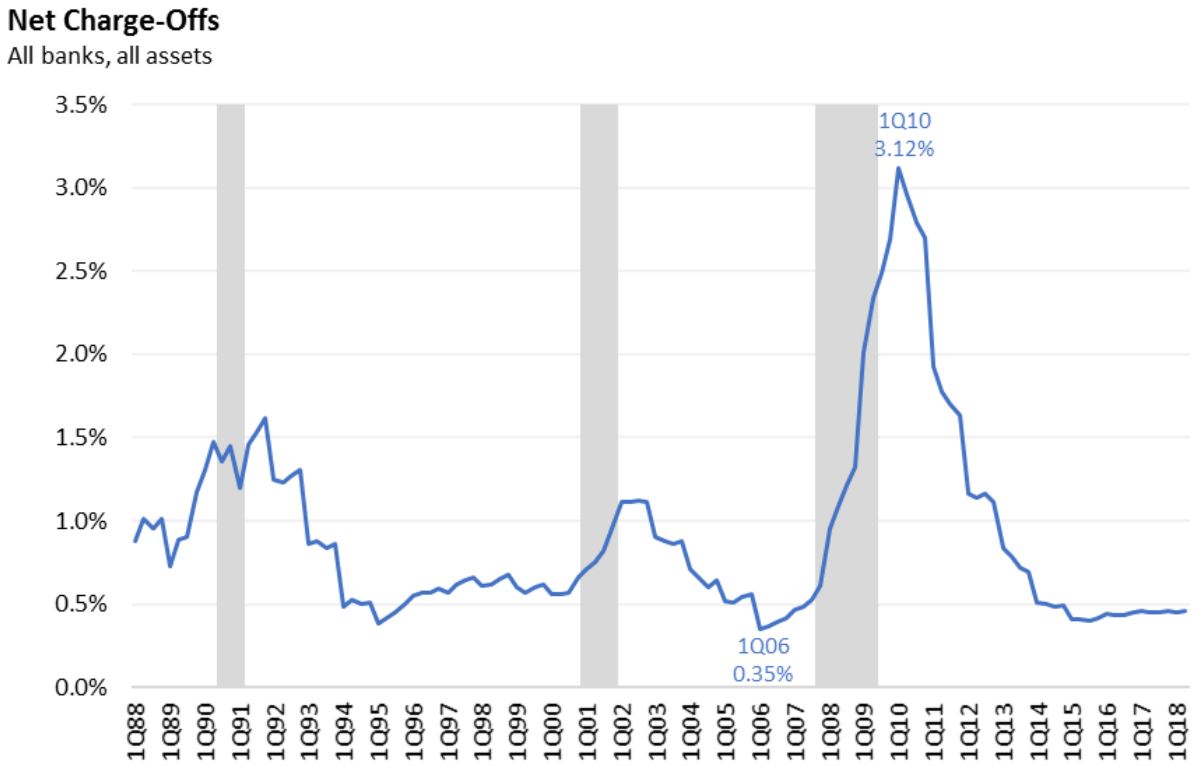
Net Charge-Offs

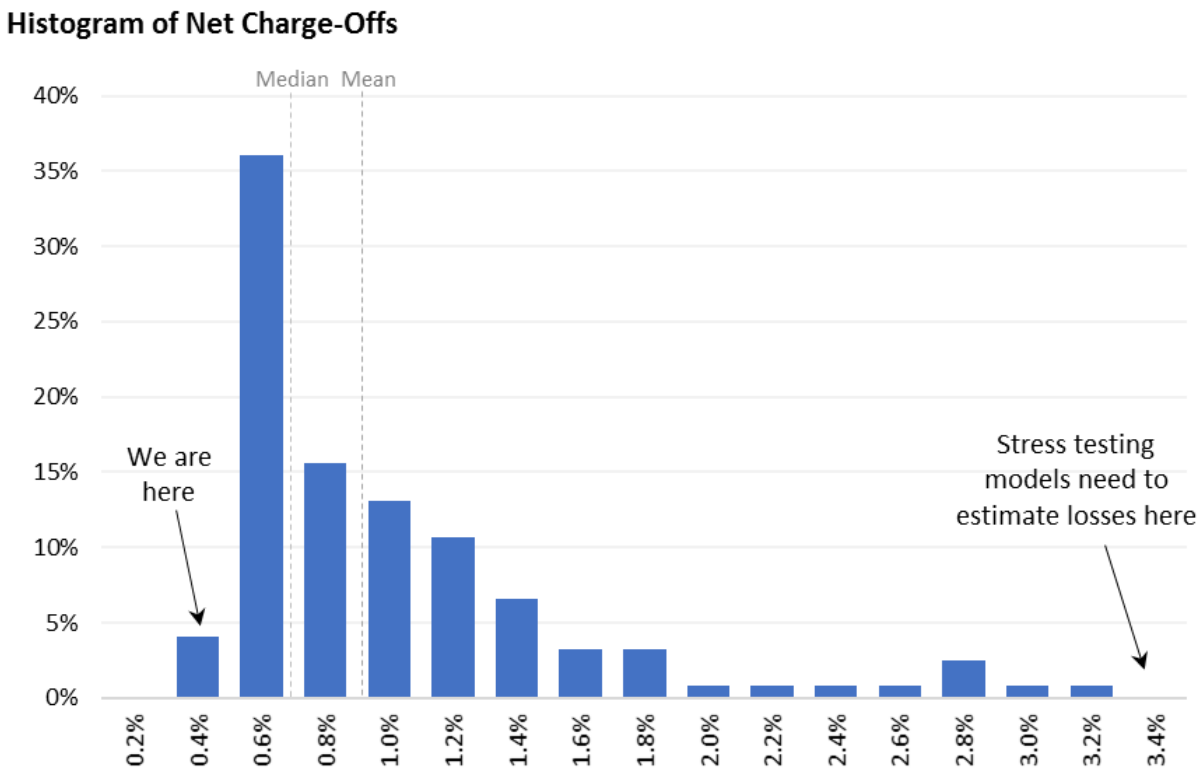


Source: Federal Reserve Economic Data

1Q88 to 2Q18	
Quarters	122
Max	3.12%
Min	0.35%
Mean	0.91%

3Q14 to 2Q18	
Quarters	16
Max	0.49%
Min	0.40%
Mean	0.44%

Net Charge-Offs



- How do you assess model performance in benign conditions when the models are used to estimate losses at the other end of the loss distribution?
- Is a model that performs well under current conditions fit for use under stress conditions?
- Does “recalibrating” a model under benign conditions make it “more fit for use” in stress?

Measures of Model Performance

How do you measure stress testing model performance under benign economic conditions?

Goal: Models that are appropriately sensitive to macroeconomic factors.

- How do you assess model performance in benign conditions when the models are used to estimate losses at the other end of the loss distribution?
  - Measures may go beyond the usual RMSE, MAPE, etc.
  - Underlying assumptions of the model may have changed

- Is a model that performs well under current conditions fit for use under stress conditions?
  - Not necessarily; 12-month rolling average may work just as well as more complex model in benign conditions
  - 12-month rolling average will not work in stress testing
  - Remember the goal

- Does “recalibrating” a model under benign conditions make it “more fit for use” in stress?
  - Not necessarily; if model is robust, adding one year of benign data should not materially change the model parameters
  - Recalibrating a model may create a better fit to current conditions but may actually hurt the model under stress conditions
  - Remember the goal

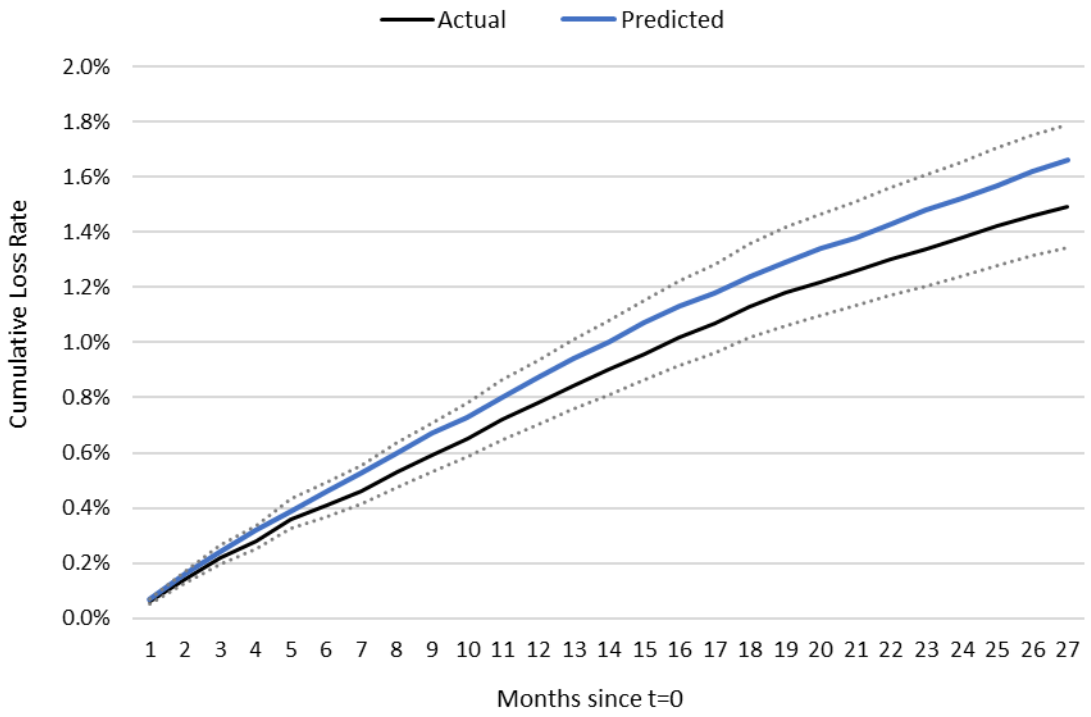
Performance in Benign Conditions

Actual vs Model

- Choose out-of-time launch point such that forecast horizon has at least 9 quarters of actual loss rates (Dec 2015 in this example)
- Run model over 9 quarters with actual macroeconomic factors
- Plot actual vs modeled cumulative default rates
- Assess model performance
- Model over-predicts by 11% over 9 quarters
- ***However, this does not mean the model is suitable for stress testing.***

  Why? Because it's being tested under benign conditions.

Cumulative Loss Rates Over 9 Qtrs

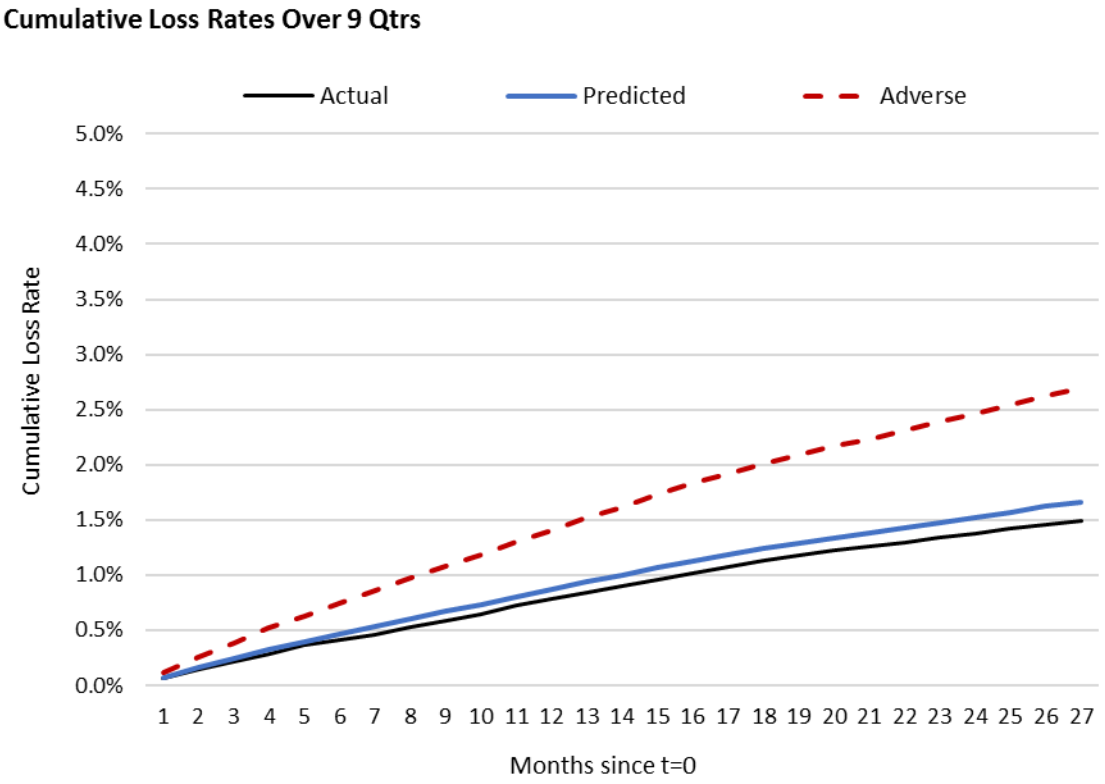


Cumulative 9 Quarters	
Actual	1.49%
Predicted	1.66%
Error	0.17%
% Error	11.41%

Performance in Benign Conditions

Add Adverse

- Using same launch point, run model over 9 quarters with macroeconomic factors from the *adverse* scenario
- Plot actual, model and adverse cumulative default rates
- Assess model performance
- Adverse increases loss rate to 2.7%
- Provides context to modeled rates with actual macroeconomic factors
- Is this model fit for use in stress testing?



Cumulative 9 Quarters	
Actual	1.49%
Predicted	1.66%
Error	0.17%
% Error	11.41%
Adverse	2.69%
% Increase to Adverse	162%

Performance in Benign Conditions

Add Severely Adverse

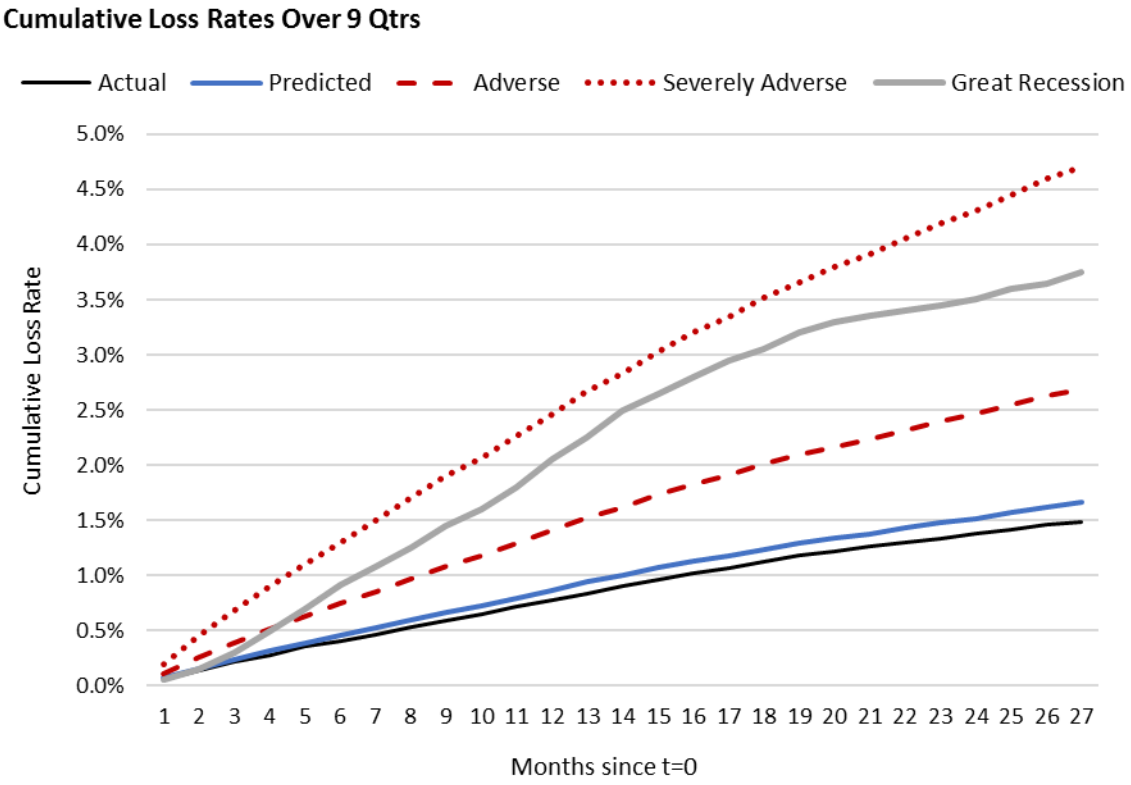
- Using same launch point, run model over 9 quarters with macroeconomic factors from the *severely adverse* scenario
- Plot actual, model, adverse and severely adverse cumulative default rates
- Assess model performance
- Severely adverse loss rate goes to 4.7%
- Provides further context to modeled rates with actual macroeconomic factors
- Is this model fit for use in stress testing?

Cumulative 9 Quarters	
Actual	1.49%
Predicted	1.66%
Error	0.17%
% Error	11.41%
Adverse	2.69%
% Increase to Adverse	162%
Sev Adverse	4.70%
% Increase to Sev Adverse	283%

Performance in Benign Conditions

Extra Bonus Feature

- Add the historical loss from the *Great Recession*
- Plot actual, model, adverse, severely adverse and Great Recession cumulative default rates
- Assess model performance
- Great Recession loss rate was 3.8%
- Provides even further context to modeled outputs and scenarios
- Is this model fit for use in stress testing?



Cumulative 9 Quarters	
Actual	1.49%
Predicted	1.66%
Error	0.17%
% Error	11.41%
Adverse	2.69%
% Increase to Adverse	162%
Sev Adverse	4.70%
% Increase to Sev Adverse	283%

Great Recession
3.75%

Conclusions

- Stress testing models should be appropriately sensitive to macroeconomic factors
- Model performance under the current benign economic conditions may not be useful in assessing if the model is fit for use in stress conditions
- Need to consider other non-quantitative measures: portfolio composition, acquisitions, underlying assumptions, etc.

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