CECL for Consumer Lending Portfolios: A Checklist

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Agenda

1. Overview
2. Questions to ask to model owners
3. The case for calibration
4. Impact ratio
5. What’s next?

1 Overview

Thought Process for CECL Modeling

Production

How quick does it need to be turnaround?

What governance procedures should be in place?

Do I have enough IT capacity for processing and frequent runs?

Qualitative Adj.

How do I determine and defend reasonable and supportable horizon?

Is management overlay allowed?

Outcome

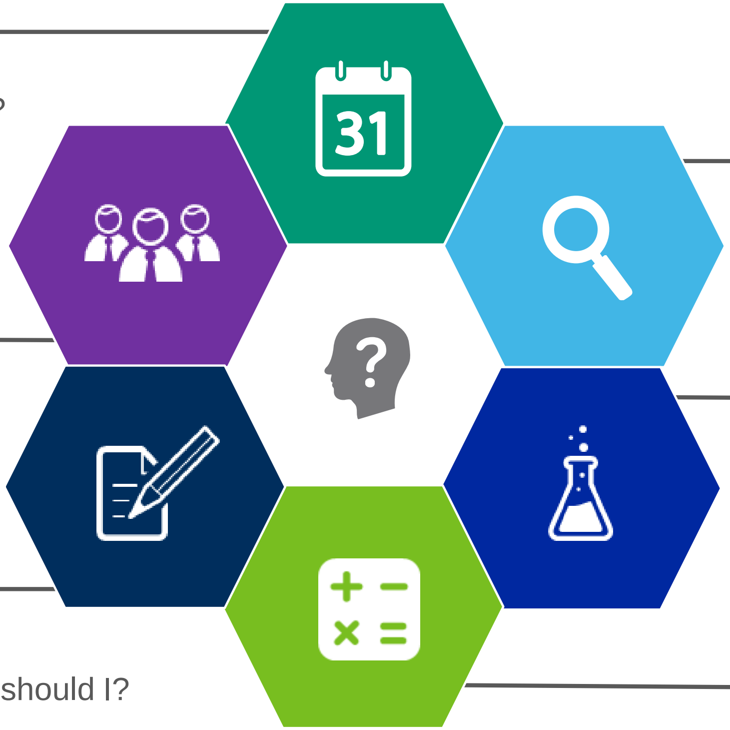
How do I assess model performance? How often should I?

What kind of validation is needed for CECL?

Are my forecasts stable?

How to perform attribution analysis?

Are all the stakeholders on same page on outcomes?



Scope

Who and what is subject to CECL?

How much should accounting to be involved in decisions?

Inputs

Do I need my own data?

Macroeconomic forecasts?

What should be the granularity of my data?

What should be the sample period?

Methodology

Segmentations?

What methodology is appropriate?

Will the models have dual use?

What drivers are needed?

Are prepayments / delinquencies necessary?

How to define / calculate lifetime?

2

Questions to Ask To Model Owners

Key Data Fields

Borrower & Loan Data

(for all retail asset classes)

- Borrower characteristics: credit history, location (state and zip code), employment status, primary/secondary income, credit quality, borrower age, debt-to-income ratio

- Loan characteristics: origination information (date, term, balance, interest rate, scheduled payment, etc.),

- Performance data: status, current balance, actual payment, modifications, etc.

Securitized Loans

(for mortgage and auto)

- Asset characteristics: product type, purchase price, occupancy/property/purpose type, current value, etc..

LGD and EAD Data

Loss Given Default

- Collateral data is needed for secured products
- Timing of recoveries is required if applying DCF method
- Should institutions include recoveries for existing and future defaults?

Exposure at Default

- Future new accounts are excluded
- Future draws on unfunded commitment are excluded if it's unconditionally cancellable (HELOCs might not be)
- Pay-down curves of revolving products are essential

Troubled Debt Restructurings (TDR)

CECL guidelines retain the concept of a TDR:

- Do not change the criteria used to determine whether a modification of a loan constitutes a TDR.
- Continue to require a TDR to be accounted for as a continuation of the original financial asset when identified.

Challenges and Changes:

- TDR impact on expected losses. Reasonably expected TDRs need to be accounted for using DCF method.
- TDR definition is important. General institution specific policy matters.
- Term extensions and interest rate concessions can complicate things, e.g. delaying prepayments and increasing behavioral lifetimes.
- The EIR on a TDR can be based on the original contract.

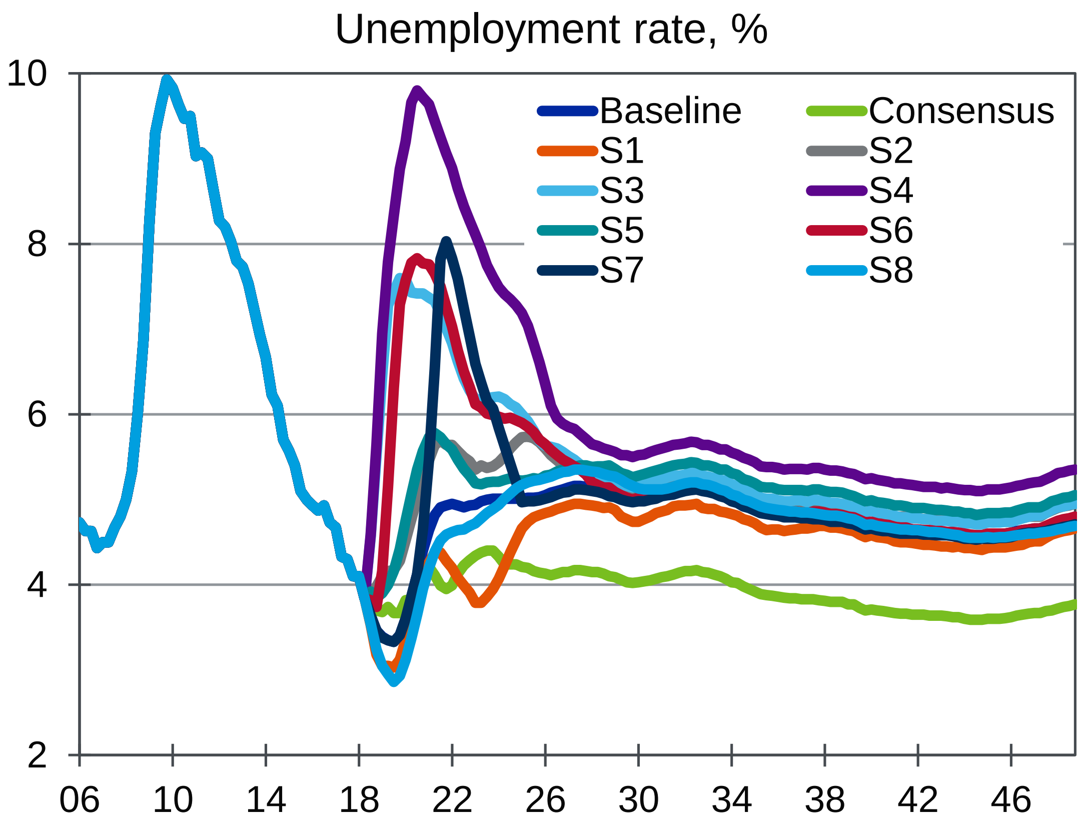
Common Product Segmentations

Auto / Recreational	Loans, Leases, New Car/Used Car, RV, Boat, Motorcycle
Card (Bank Card, Retail Card)	Promo/Non-promo, Transactors/Revolvers, New/Existing Accounts, Secured/Unsecured
Consumer Loans / Personal Finance	Secured/Unsecured, Installment/Revolving
Mortgage	First Lien/Second Lien, Fixed/ARM, Conforming/Non-conforming
Home Equity	HELOC/HELOAN, First Lien/Second Lien
Student Loan	Private/Gov't, Different Repayment Plans, Refinance, Deferment, Forbearance

CECL Models Should Consider Current and Future Economic Conditions

Models should include national and/or regional economic variables

- **Economic/Household Performance**
  GDP Growth, Disposable Income Growth
- **Labor Markets**
  Unemployment, Job/Wage/Salary Growth
- **Demographics**
  Population, Number of Households, Migrations etc.
- **Real Estate Markets**
  Home Prices, Home Sales, Housing Starts/ Permits
- **Financial Markets**
  Federal Reserve Interest Rates, Equity Market Indexes

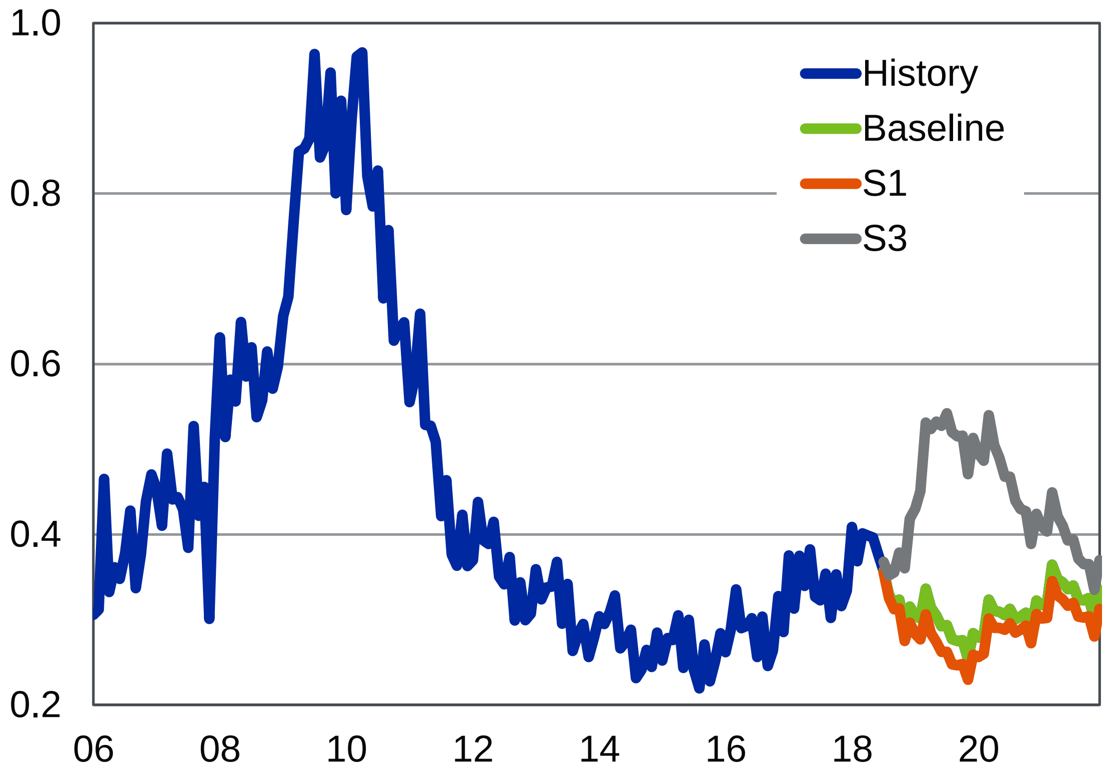


Common Drivers of Credit Loss Models

for Consumer Portfolios

- Segment
- Life Cycle / Maturation Component
- Vintage Quality Variables
- Updated Credit Quality Variables*
- Time-Varying Macro Conditions
- Segment × Macro Factor Interactions
- Seasonality Dummies + Other Dummies
- Delinquencies **

Bankcard Default Rate, % of Outstanding Balance



* These will be highly correlated with macro variables and can be used in lieu of them, e.g. Current LTV

** Could be drivers of losses, will need data support and use can be decided based on complexity of inclusion

CECL Acceptable Methodologies

FASB guidelines are not prescriptive

Primary Methodologies

» Loss rate method (Pool/cohort/vintage)

» Probability of default method (Pool/cohort/vintage, loan level analysis)

» Roll rate method (Migration analysis/Transition Matrices) (Pool or loan level analysis)

» Discounted cash flow analysis (loan level analysis)

Estimation Techniques

» Model specification is defined based on features of performance metrics (binary, continuous, bounded, etc.)

» Standard candidates include OLS, Log OLS, (multinomial) Logit, Probit, Tobit and Fractional Logit

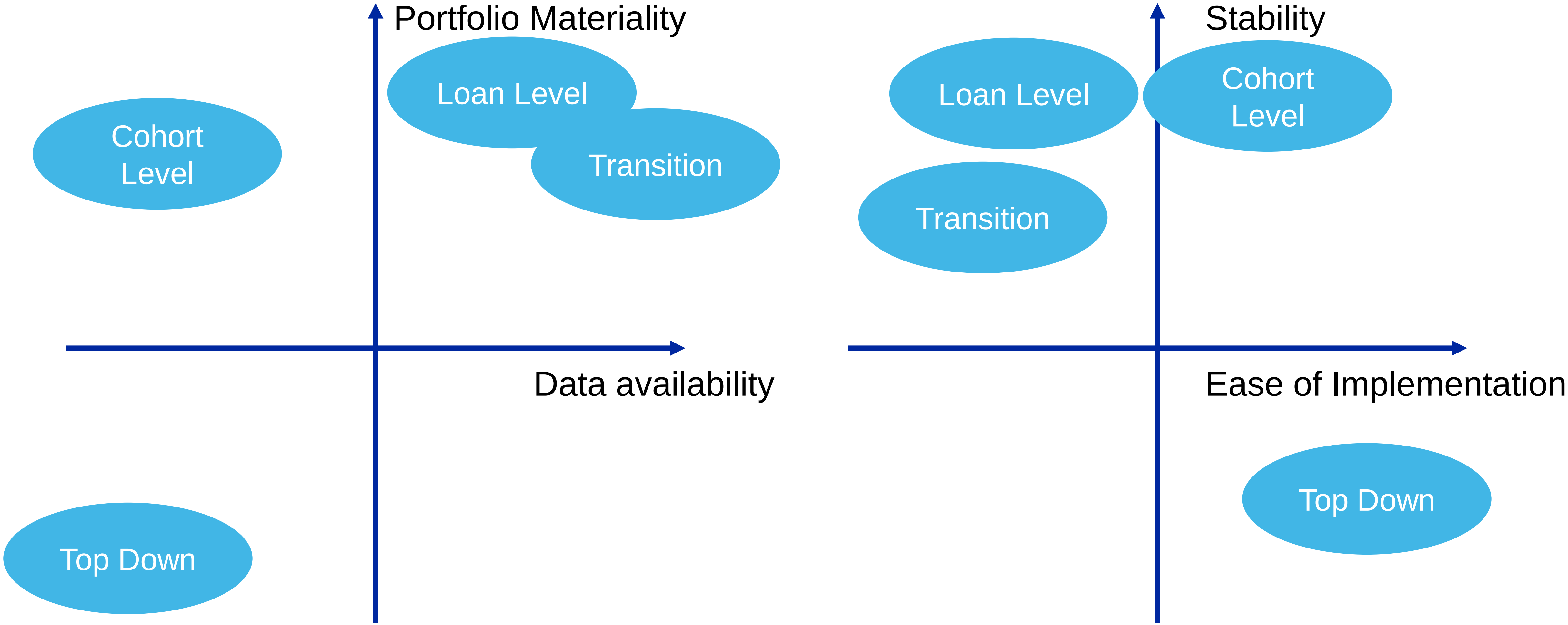
» Discrete time hazard models with or without competing risks

» Markov chain credit migration

» Machine learning

Pros and Cons

By key factors

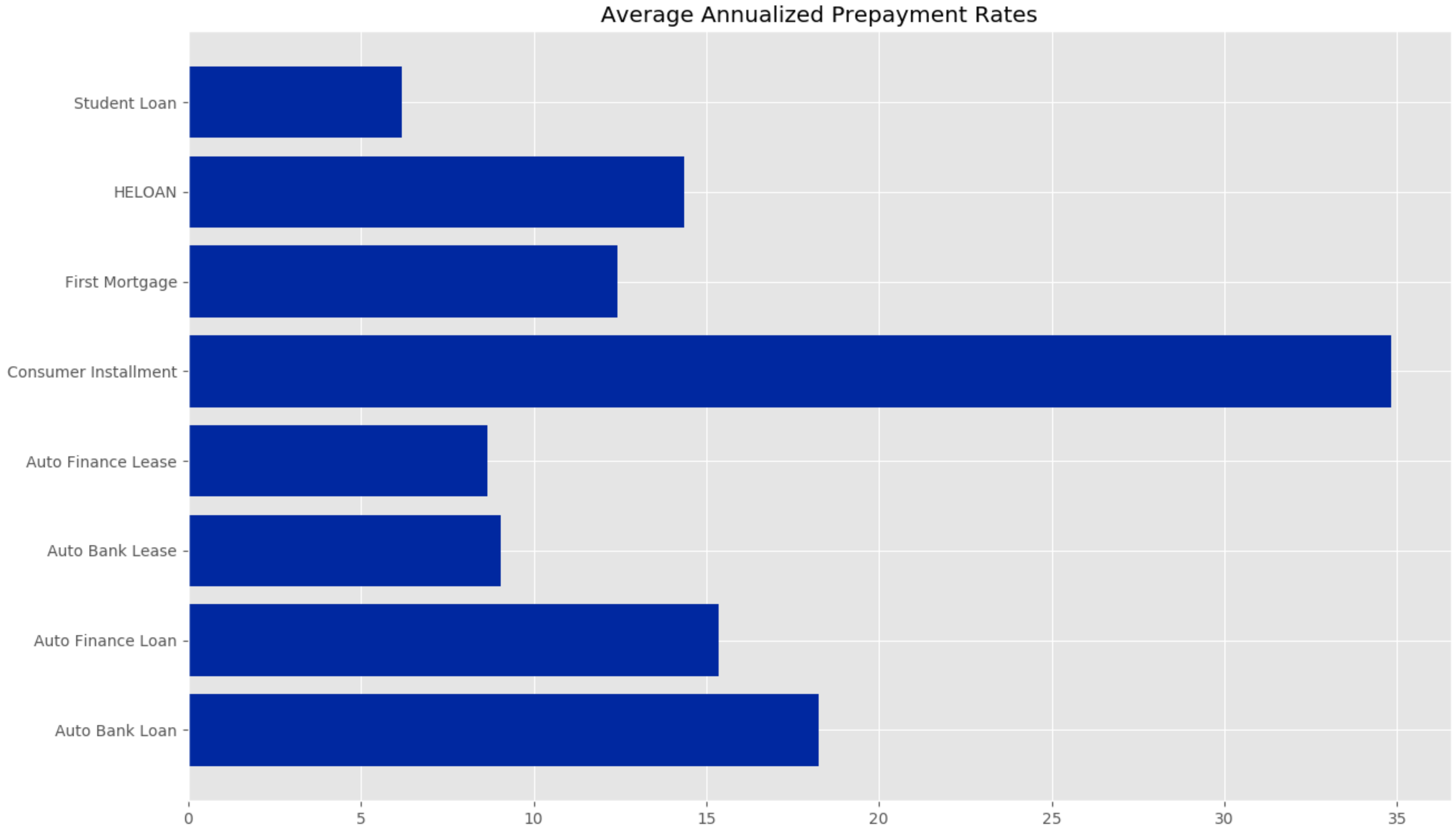


Pros and Cons of Different Approaches

	Top-down Loss Rate	Cohort Vintage	Transition	Loan Level
Portfolio	• Only suitable for homogeneous portfolio • Be cautious about applying to material portfolios	• Can be applied to portfolio of different sizes and segments	• Can be applied to portfolio of different sizes and segments	• Can be applied to portfolio of different sizes and segments
Data requirement	• Low: historical loss rates at aggregated level + latest snapshot(s) at cohort level • Quarterly or monthly	• Medium: historical performance data at cohort level + latest snapshot at cohort level • Quarterly or monthly	• High: historical performance data at loan level + latest snapshot at loan level • Monthly for stage transition; quarterly or monthly for score transition • Score transition requires scores being refreshed at a frequency not lower than data frequency • Data should be reasonably populated with minimal or no skipping or truncation issues	• High: historical performance data at loan level + latest snapshot at loan level • Quarterly or monthly • Data should be reasonably populated with minimal or no skipping or truncation issues
Estimation	• Easy to estimate • High maintenance due to relatively low stability • Re-estimation required if there are substantial changes in lending policy or portfolio mix	• Moderate • High stability • RE-estimation required if pooling strategy changes	• Complex • Captures all intermediate and final stages within one framework • Trade-off between consistency and granularity	• Complex • High stability • Results can be assessed at account level, segment level, or portfolio level
Other use cases	• Stress testing	• Stress Testing, Planning	• Stress testing, pricing and planning	• Stress testing, pricing and planning
Implementation / Production	• Easy to Moderate	• Moderate	• Complex	• Complex
Attribution & Disclosure	• Moderate • Attributions analysis are limited • Disclosure pools	• Complex • Multiple runs required to track model / segment changes • Light calibration required when modeling segmentation differs from disclosure pooling	• Easy; results can be aggregated and compared at any level	• Easy; results can be aggregated and compared at any level

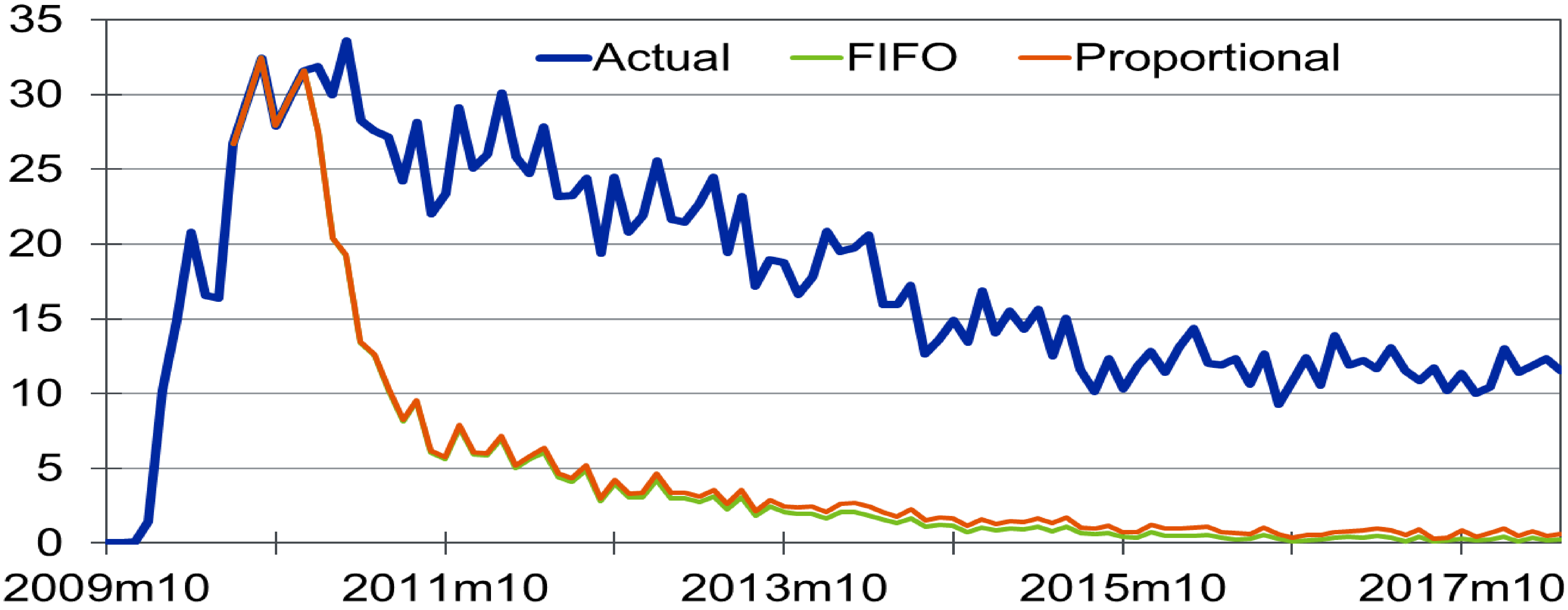
Industry Prepayment Rates (%)

Varies by product



CECL Credit Card Paydown Methodology

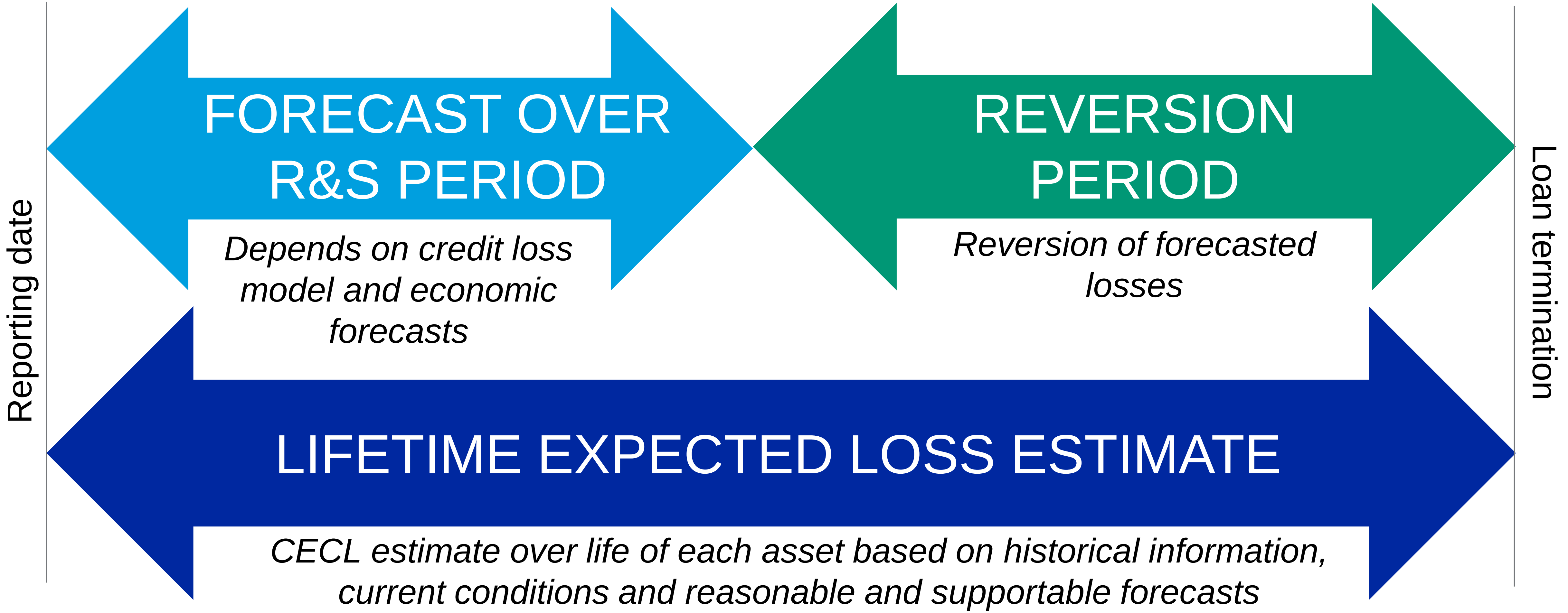
$ mil, 09Q4 Booking and 10Q2 Balance Sheet



Sources: CFPB, Equifax, CreditForecast.com, Moody's Analytics

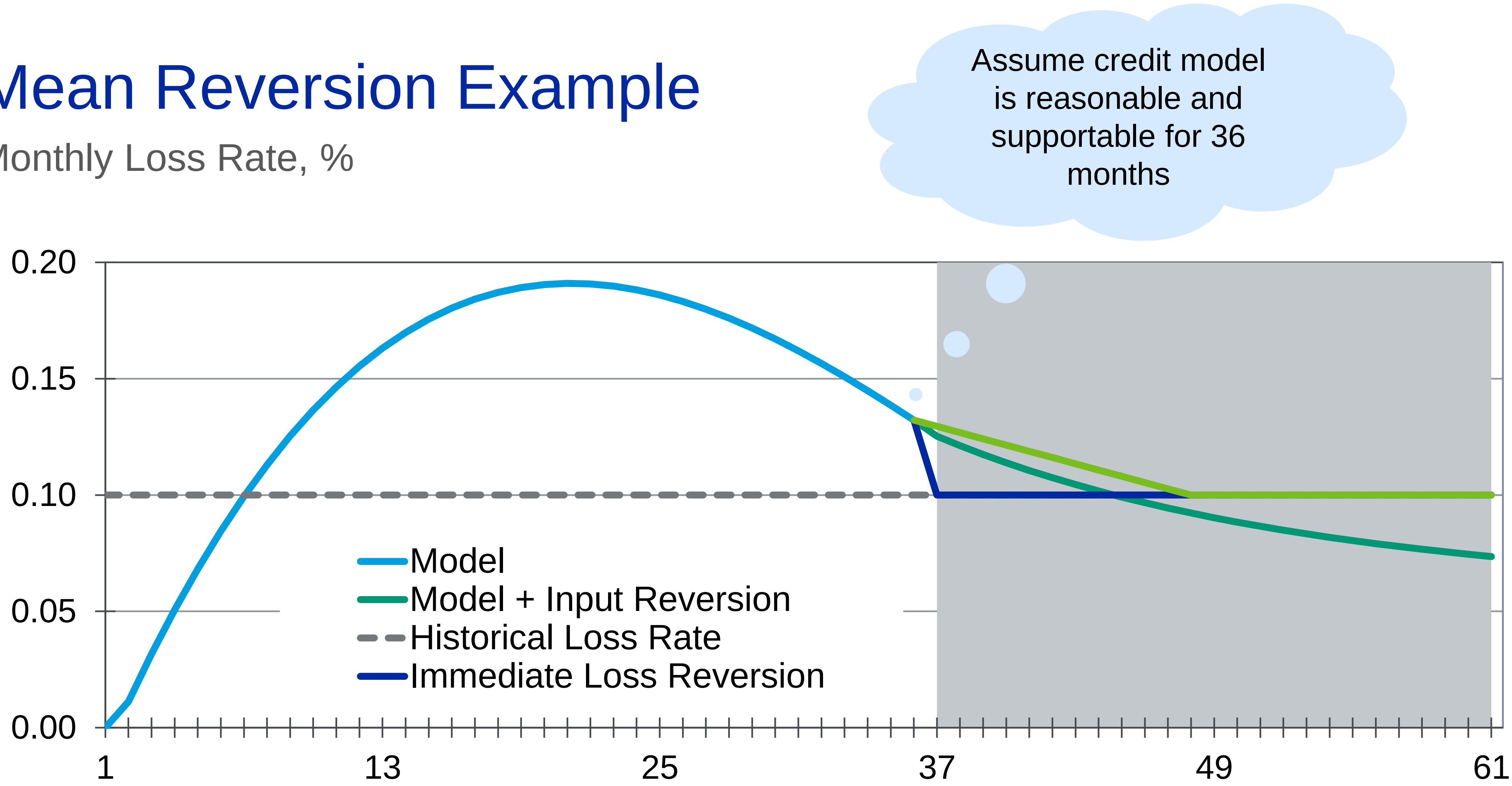
What about the Forecast Horizon?

CECL requires a LIFETIME estimate composed of a forecast and reversion period



Mean Reversion Example

Monthly Loss Rate, %



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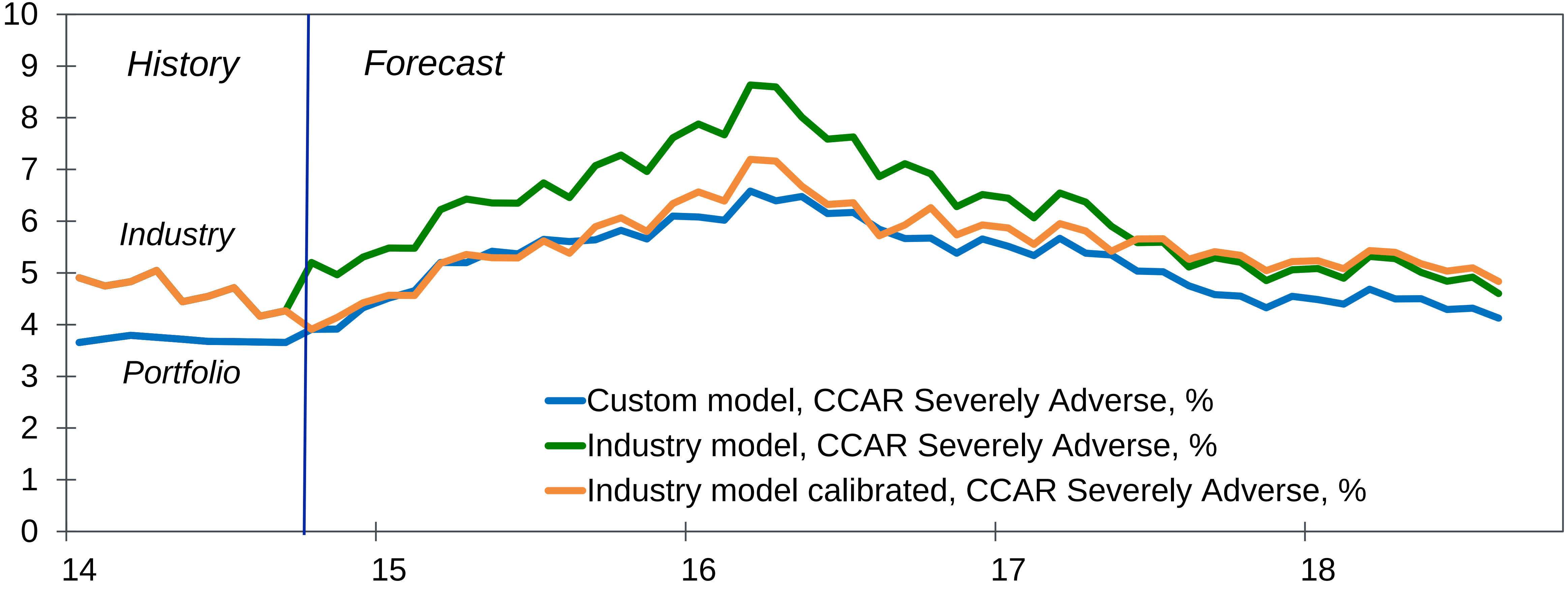
The case for calibration

Loss Forecasting Based on Industry Trends

Conditional loss rate, % of balance, annualized

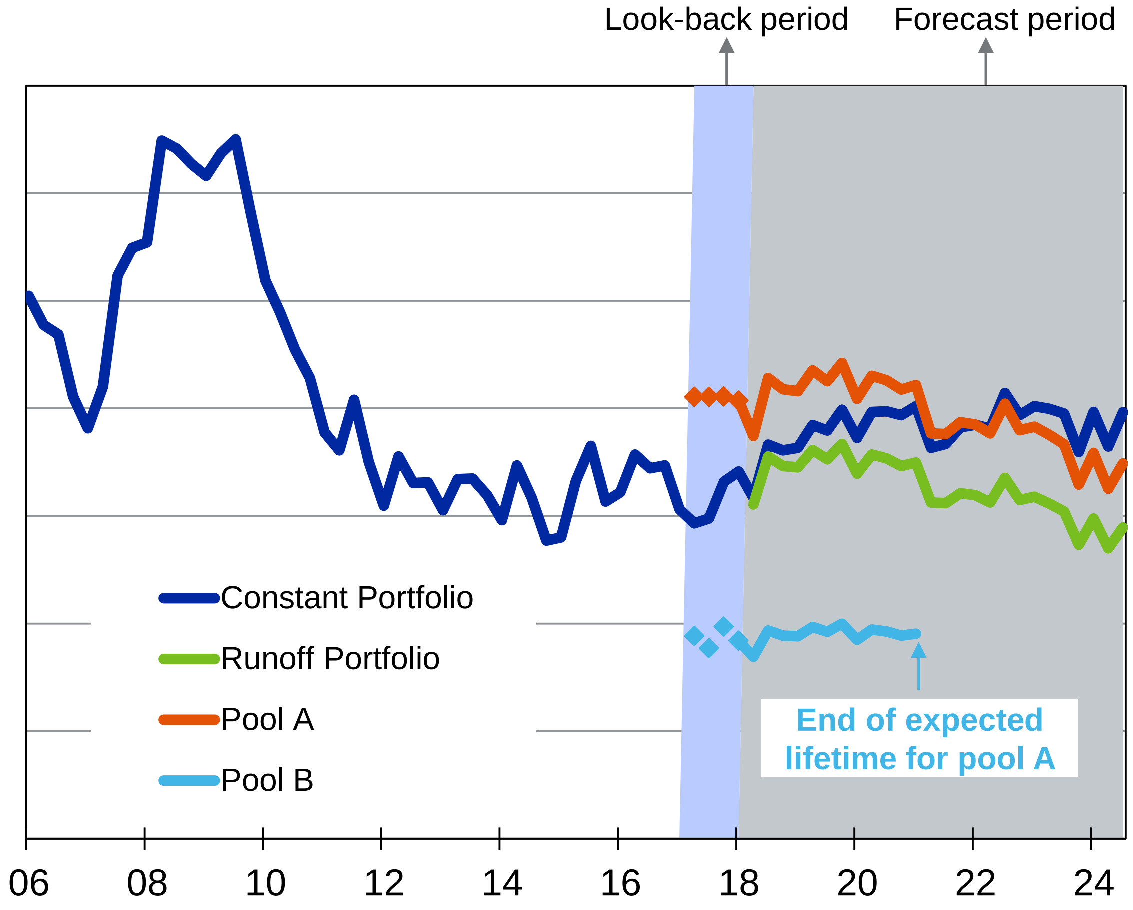


Sources: Moody's Analytics

Top Down Approach

For small institutions, immaterial and/or young portfolios

- The approach requires
  - Historical loss rates at aggregate level
    - Banks' and credit unions' historical loss rates are available through Moody's call report forecasts and credit union forecasts
    - Adjust loss rate forecasts to reflect the nature of run-off portfolios
  - Recent performance data at pool / account level: origination & maturity dates, balance, credit score, LTV, etc.
    - Select a reasonable "look-back" period
- Adjust top down loss forecasts for each pool by considering recent experience and future conditions



Loss rates calibration example. For illustration purposes only.

4

Impact Ratio

How Will CECL Impact a Bank's Loss Allowance?

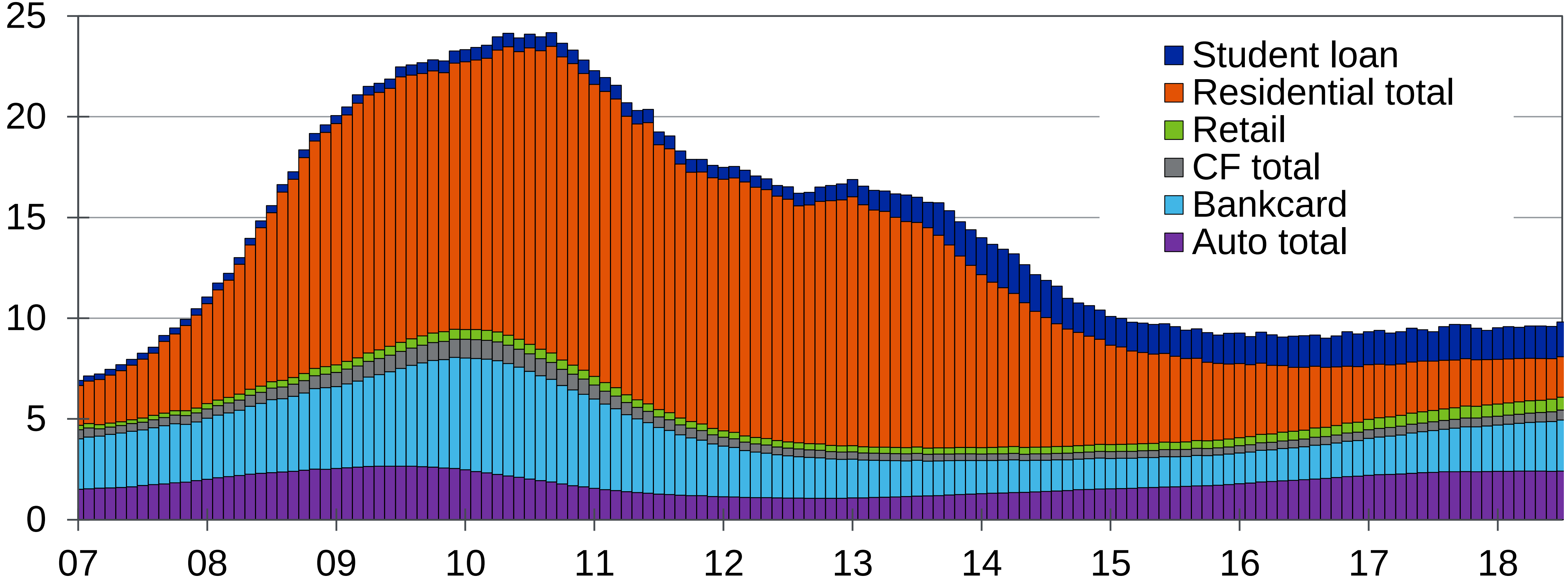
"Prediction is very difficult, especially if it is about the future." Niels Bohr

Depends on a number of factors including but not limited to:

- Contractual term of loans / Lifetime assumption / Methodology for paydown
- Reasonable and supportable period / Mean reversion technique
- Credit quality
- Geography
- Scenario assumptions
- LGD assumptions
- Stage of economic and product credit cycle
- Modeling methodology
- Size and concentration of institution
- Qualitative adjustments
- Current incurred loss method (forward, backward/look-back period)

History of Consumer Default Volumes by Product

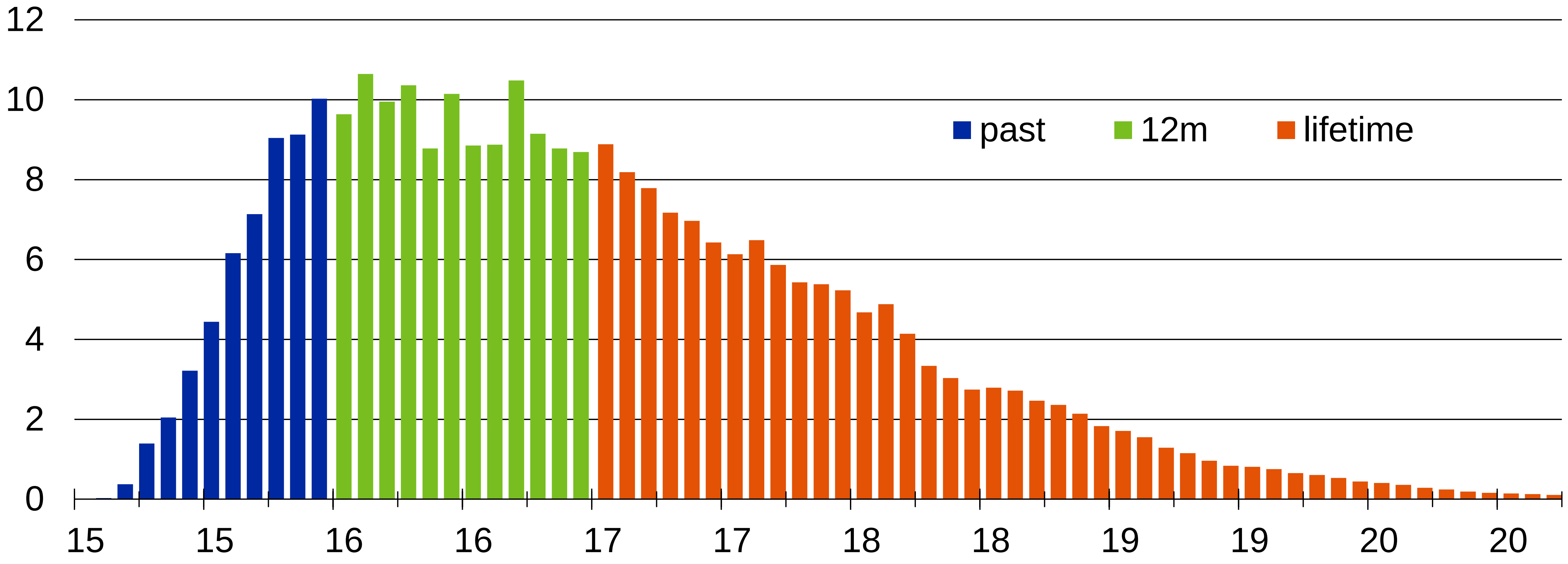
Default balances, $ bil, 12-mo MA



Sources: Equifax, Moody’s Analytics

Single Auto Cohort CECL Example

Gross Losses, 2015Q1, Near Prime, 60m term loans, Million $



Sources: CreditForecast.com, Moody's Analytics

Key Assumptions that Would impact CECL

Comparison by model types

	Top-down Loss Rate	Cohort Vintage	Transition	Loan Level
Estimation Approach	Yes	Yes	Yes	Yes
Scenario Conditioned	Yes	Yes	Yes	Yes
Lifetime Assumption	Yes	Yes	Yes	Yes
Reasonably and Supportable Period	Yes	Yes	Yes	Yes
Qualitative Adjustment	Yes	Yes	Yes	Yes
Segmentation	Yes	Yes	Yes	Yes
Default Definition	Yes	Yes	Yes	Yes
Recovery Window	No	Yes	Yes	Yes
Look-back period	Yes	Yes if using off-the-shelf models	Yes if using off-the-shelf models	Yes if using off-the-shelf models

5

What’s Next?

Conclusions

How to select appropriate methodologies

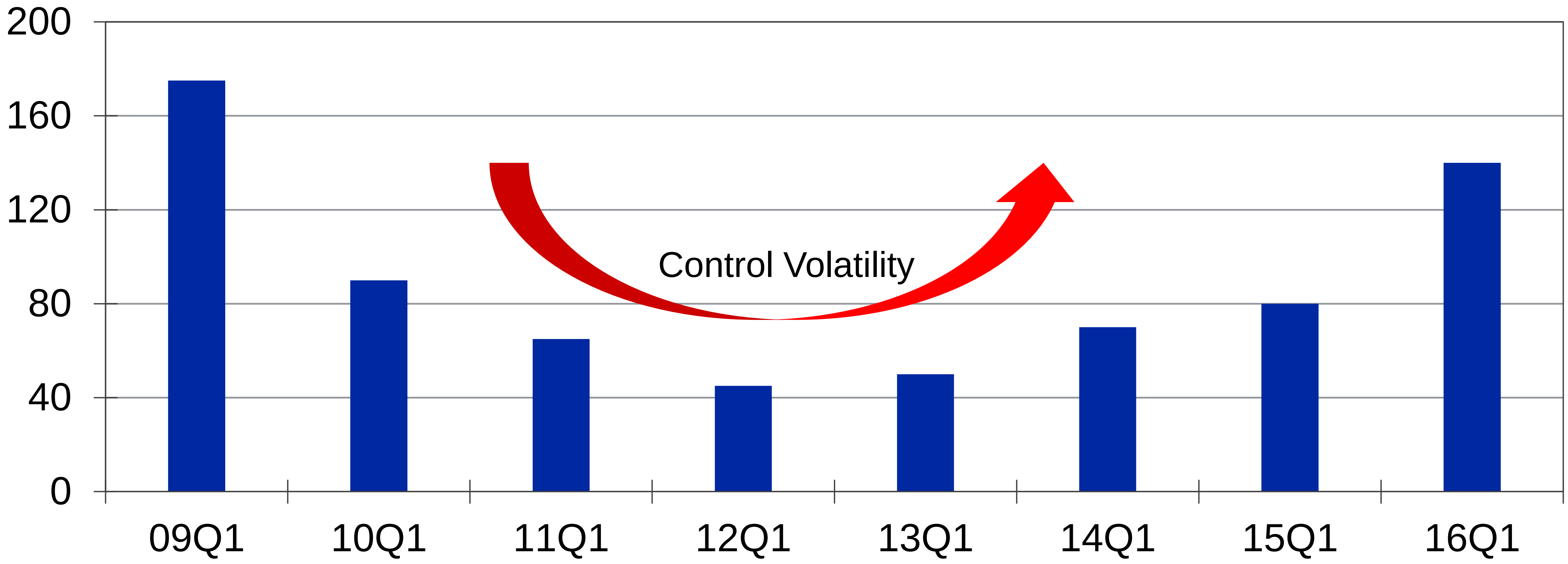
- CECL standards are not prescriptive
- Institutes should evaluate all components before making a decision
- Choosing the best methodology depends on many parameters: data availability, size and complexity of a portfolio, business needs, development, implementation and production cost, etc.
- Unified solutions across portfolios are not necessary but might be desired to help with auditors/validators (will need to justify reasons for differences)
- Attribution of the loss variations and loss stability need be closely monitored

What’s Next?

- Sensitivity analysis?
- Validation?
- Buy-in from other departments?
- How will results impact underwriting standards? Pricing? A holistic view.
- Linking loss forecasting with originations
- Volatility of reserves quarter over quarter, monitoring results
- Attribution analysis, other disclosures

Major Concern: CECL Model Output Stability

CECL by Reporting Dates, for Illustration Purposes Only ($ Mil.)



For More Information…

www.moodysanalytics.com/cecl


MOODY'S ANALYTICS

WHITEPAPER

How Much Will CECL Impact Reserves for First Mortgage Portfolios?

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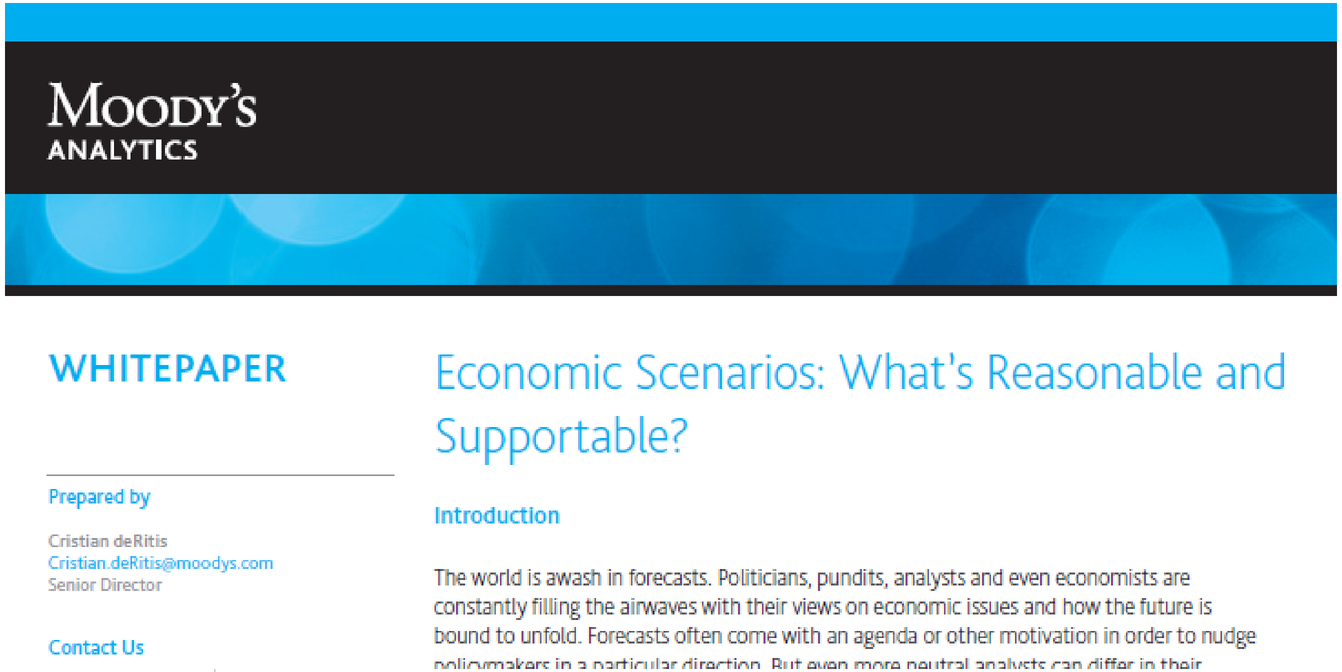
Ever since the Financial Accounting Standards Board announced that accounting standards for loss reserves will move from an incurred-loss method to a forward-looking approach there has been much speculation on how lending institutions will be impacted. To the best of our knowledge, there has been no study that quantifies this impact in a rigorous manner for the industry as a whole, although a few individual lending institutions have conducted their own analysis.


MOODY'S ANALYTICS

WHITEPAPER

Economic Scenarios: What's Reasonable and Supportable?

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Introduction

The world is awash in forecasts. Politicians, pundits, analysts and even economists are constantly filling the airwaves with their views on economic issues and how the future is bound to unfold. Forecasts often come with an agenda or other motivation in order to nudge policymakers in a particular direction. But even more neutral analysts can differ in their

7 Appendix

Moody's Analytics ECCL

A cohort level solution that couples user inputs with industry data and models

- ECCL (Expected Consumer Credit Losses) is an extension of CreditForecast.com, a Moody's Analytics and Equifax joint product
  - Extends the forecast to encompass the life of the loan
  - Computes lifetime ECL values for user inputted portfolio footprint (Risk Score X Origination Vintage X Geography)
  - Users have the flexibility to use industry standard settings or override with their own assumptions for necessary parameters (e.g. LGD and the expected life of the loan)

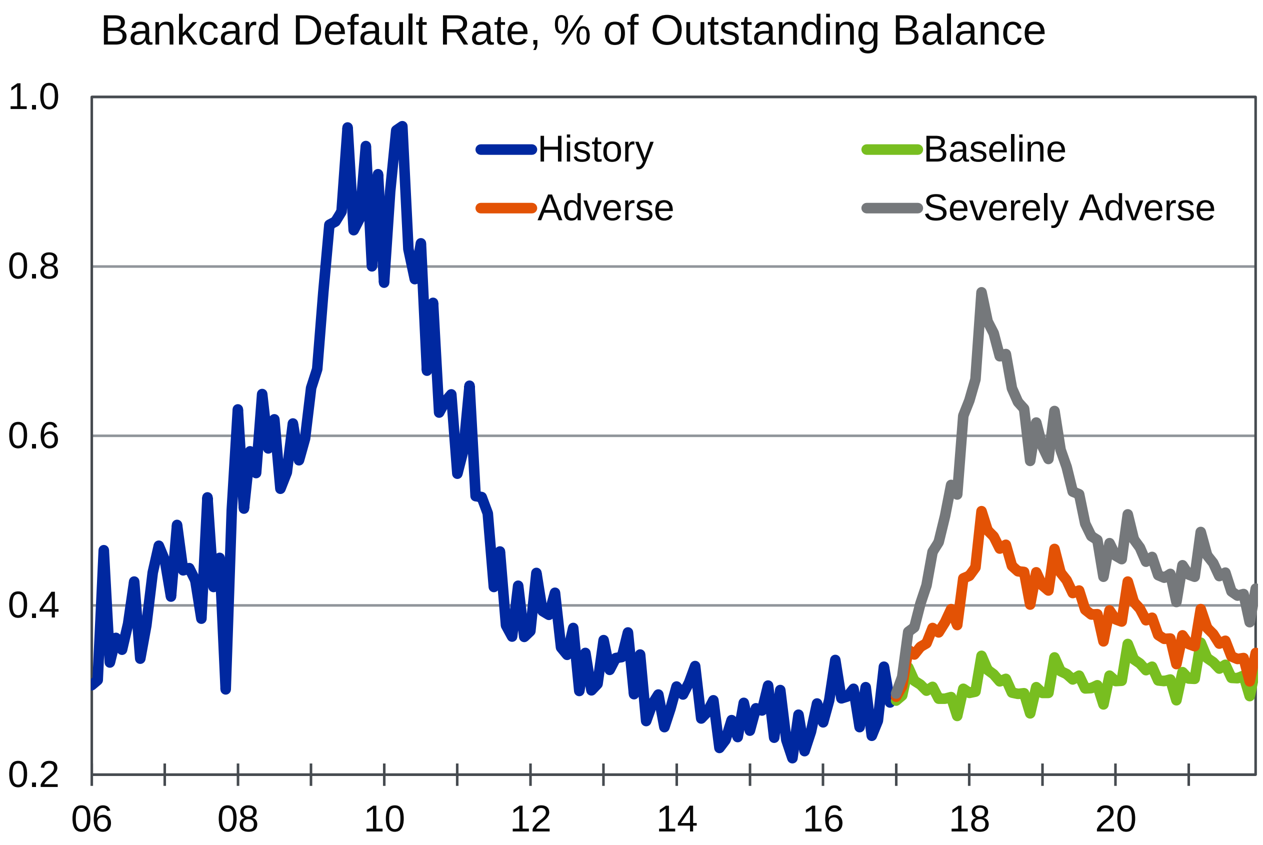
User inputs				Underlying industry model	Industry/User defined assumption		
State	Orig. Score	Orig. Quarter	Outstanding Balance	PD*	LGD	ECL Rate	ECL
CA	700-719	2009Q2	$100	4%	40%	1.6%	$1.6
CA	660-669	2011Q2	$300	6%	40%	2.4%	$7.2
CA	660-669	2013Q2	$500	7%	40%	2.8%	$14.0
CA	700-719	2015Q2	$200	4%	40%	1.6%	$3.2
CA	700-719	2017Q2	$700	5%	40%	2.0%	$14.0
CA	700-719	2017Q3	$1000	6%	40%	2.4%	$24.0
CA	700-719	2017Q4	$800	4%	40%	1.6%	$12.8
…	…	…	…	…	…	…	

*PD is the cumulative probability of default over the industry default/user supplied assumed remaining life of loan.
For illustration purposes only.

Moody's Credit Cycle Standard Model

Loss forecasting models based on CreditForecast.com

- Cohort/Vintage Pooled time series
- Fractional logit models of default rates
- Primary Model Drivers
  - Life Cycle/Maturation Component
  - Vintage Quality Variables
  - Time-Varying Macro Conditions
  - Seasonality Dummies
  - Delinquency Roll Rates/Daisy Chain
  - Segment × Macro factor interactions



Moody's Portfolio Analyzer™

A loan level solution that fits various data availabilities

- Loan-level econometric models for default, prepayment, and severity for various types of mortgages including HELOCs and HELOANs, and Auto
- Macro-economic factors at national, state, and MSA levels
- Built-in vintage effects, lifecycle, and business cycles
- Calculates contractual and credit-risky cash flows over the life of the loan
- Provides discounted cash flows using the effective interest rate

Off-the-shelf	Calibrated	Custom
Used when no history available	Off-the-shelf models back-tested on historical performance data	Models built using client data only
Limited knowledge of underlying models	Models calibrated across different segments	Full transparency of underlying methodology

Moody's Analytics LGD Solutions

Solution	Asset Class and Granularity	Key Model Inputs
Fannie Mae/Freddie Mac Mortgage	Loan level fixed-rate mortgage	Default balance, sales proceeds, expenses, MI and non-MI recoveries, age, credit score, LTV, geo, macroeconomic condition
MPA/APA	Loan level mortgage and home equity loans / lines Loan level auto loans	LTV, liquidation balance, time to liquidation, property and occupancy information, geo, lien position
AutoCycle	Auto data at 11-digit VIN level	Vehicle characteristics, style types, macroeconomic condition
CRF	Bank call report data at firm level, all asset classes	Charge-offs, macroeconomic condition
Credit Union Forecasts	Credit union call report data at firm level, all asset classes	Charge-offs, macroeconomic condition

Consensus Scenario

This scenario is designed to incorporate the central tendency of a range of baseline forecasts produced by various institutions and professional economists.

- » The probability that the economy will perform better than this consensus is equal to the probability that it will perform worse.
- » The consensus scenario is based on a review of publicly available baseline forecasts of the U.S. economy. These sources include:
  - – Congressional Budget Office
  - – Social Security Administration
  - – Federal Open Market Committee members’ range of forecasts
  - – Federal Reserve Comprehensive Capital Analysis and Review baseline
  - – European Commission U.S. baseline
  - – U.K. Prudential Regulation Authority U.S. baseline
  - – Philadelphia Federal Reserve Survey of Professional Forecasters

Note: Assumptions for all other MA scenarios available

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