Today’s Speakers

» **Dr. Shirish Chinchalkar** is a Managing Director in the Economics and Structured Analytics group.

» Responsible for the Portfolio Analyzer platform for analyzing the credit risk of US residential mortgages, US auto loans, Asset-Backed Securities, and UK and Dutch residential mortgages

» Prior to joining Moody’s, he was an Assistant Professor at IIT Bombay and a researcher at Cornell University

» PhD from Cornell University

» **Dr. Cristian deRitis** is a Senior Director in the Economics and Structured Analytics group.

» Conducts economic analysis and develops econometric models for a variety of clients

» Analysis and commentary on consumer credit, housing, and the broader economy appear on the firm’s Economy.com web site

» Named on two US patents for credit risk modeling techniques

» PhD from Johns Hopkins University

» **Anna Krayn** is a Senior Director and Team Lead, responsible for solution structuring across Moody’s Analytics products and services focusing on impairment, stress testing, and capital planning solutions.

» Prior to her current role, she was with Enterprise Risk Solutions as engagement manager leading projects with financial institutions across Americas in loss estimation, enhancements in internal risk rating capabilities and counterparty credit risk management.

» Ms. Krayn holds a B.S. and MBA from Stern School of Business at New York University.

**Moderator**

» **Dr. Shirish Chinchalkar** is a Managing Director in the Economics and Structured Analytics group.

» Responsible for the Portfolio Analyzer platform for analyzing the credit risk of US residential mortgages, US auto loans, Asset-Backed Securities, and UK and Dutch residential mortgages

» Prior to joining Moody’s, he was an Assistant Professor at IIT Bombay and a researcher at Cornell University

» PhD from Cornell University
Welcome!

Moody's Analytics CECL Webinar Series:
Expected Credit Loss Quantification

Introduction to CECL Quantification
Tuesday, February 14, 2017 | 1:00PM EST

CRE CECL Methodologies
Tuesday, February 28, 2017 | 1:00PM EST

C&I CECL Methodologies
Tuesday, March 14, 2017 | 1:00PM EDT

Retail CECL Methodologies
Tuesday, March 28, 2017 | 1:00PM EDT

Structured Assets CECL Methodologies
Thursday, April 20, 2017 | 1:00PM EDT

To find out more about Moody’s Analytics perspectives on CECL and register for our webinar series visit:

www.moodysanalytics.com/cecl
Polling Instructions

1. The icon will appear in the right hand corner of the WebEx platform when it comes time for polling.

2. Please select it, so that the icon is blue (as shown).

3. Select your answers in the Polling section that appears in the right hand panel of the platform.

4. Results will display after the poll has ended.
Table of Contents

1. Overview of common CECL considerations for retail credit
2. Methodology
3. Economic scenarios
4. Lifetime definition
5. Case 1: CECL with industry-level models
6. Case 2: CECL for residential mortgages
7. Conclusions and Q&A
The CECL Revolution: Accounting, Economics, and Risk Intersect

Institutions will need to measure and record immediately all expected credit losses (ECL) over the life of their financial assets based on:

1) Past events, including historical experience
2) Current conditions
3) Reasonable and supportable forecasts

ECL recorded at origination and updated at subsequent reporting dates

Rules provide guidelines, but not specific guidance. Institutions will have significant discretion over how they measure expected credit losses.
### Key Decisions for Providing CECL Estimates for Retail

| Methodology                  | • Which methods are acceptable?  
<table>
<thead>
<tr>
<th></th>
<th>• Can I leverage existing models?</th>
</tr>
</thead>
</table>
| Economic Scenario            | • Which scenario is defensible?  
|                             | • How many?                      |
| Lifetime Definition          | • Contractual or behavioral life? |
|                             | • Life of revolving account?     |
| Benchmarking                 | • What’s required? Best practice? |
|                             | • What are options for retail credit? |
Methodology
CECL Methodology for Retail Credit

» Guidance gives banks wide discretion:
  – Loss rate, PD/LGD, vintage analysis, etc.

» Choice of CECL methodology depends on
  – Portfolio materiality and institution size
  – Data availability
  – Development cost
    » Short-term vs. long-term investment
  – Availability of existing models

» Unlike some other asset classes, retail credit typically…
  – ...has lots of data
  – …has lots of models (origination scorecards, pricing models, stress testing, etc.)

» Industry-derived forecasts provide a low cost solution for smaller institutions
Main Methods for Retail Credit

Portfolio-level models
» Modeling losses at the asset class level is straightforward and less expensive
» Can capture broad sensitivities of performance to economic events
» Assumes consistency of portfolio profile. Ignores seasoning (or aging) of loans.

Loan-level models
» Loan-level models have the advantage of delivering loan-level forecasts and being able to control for heterogeneity within a portfolio.
» Most complex and flexible.

Vintage-cohort models
» Cohorting loans by common characteristics such as vintage, credit score, etc. can provide a happy medium between portfolio and loan level
» Identify key areas of risk within a portfolio while maintaining model stability.
» Link macroeconomic scenarios to credit risk parameters.
# Leveraging Existing Models for CECL

## Current Approach

<table>
<thead>
<tr>
<th>Loss Estimation (PD / LGD / EAD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TTC Loss Estimation</strong></td>
</tr>
<tr>
<td>✔ Incorporates historical experience</td>
</tr>
<tr>
<td>❑ Incorporates current conditions</td>
</tr>
<tr>
<td><strong>PIT Loss Estimation</strong></td>
</tr>
<tr>
<td>✔ Incorporates historical experience</td>
</tr>
<tr>
<td>✔ Incorporates current conditions</td>
</tr>
<tr>
<td><strong>Stress Testing Loss Estimation</strong></td>
</tr>
<tr>
<td>✔ Incorporates historical experience</td>
</tr>
<tr>
<td>✔ Incorporates current conditions</td>
</tr>
</tbody>
</table>

## Gap to CECL

<table>
<thead>
<tr>
<th>Loss Estimation (PD / LGD / EAD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TTC Loss Estimation</strong></td>
</tr>
<tr>
<td>❑ Incorporate forecasts</td>
</tr>
<tr>
<td>❑ Forecast life of loan ECL</td>
</tr>
<tr>
<td>❑ Segment-appropriate</td>
</tr>
<tr>
<td><strong>PIT Loss Estimation</strong></td>
</tr>
<tr>
<td>❑ Incorporate forecasts</td>
</tr>
<tr>
<td>❑ Forecast life of loan ECL</td>
</tr>
<tr>
<td>❑ Segment-appropriate</td>
</tr>
<tr>
<td><strong>Stress Testing Loss Estimation</strong></td>
</tr>
<tr>
<td>✔ Incorporate forecasts</td>
</tr>
<tr>
<td>❑ Forecast life of loan ECL</td>
</tr>
<tr>
<td>❑ Segment-appropriate</td>
</tr>
</tbody>
</table>

## Strategy

- **Enhance Strategy**
- **Replace Strategy**
Economic Scenarios
Moody’s Analytics Forecast Models

- US Macroeconomic model
- State-level models
- Metro-level models
- House price models
- Financial metric models
- Country models
How many economic scenarios do you plan to run for CECL?

a. One, baseline
b. Two, consensus
c. Multiple, probability weighted
d. Other
e. Not sure
Moody’s Macroeconomic Scenarios

Standard Simulated Scenarios

- **BL**: Baseline (50th pct)
- **S1**: Stronger Near-Term Rebound (10th pct)
- **S2**: Slower Recovery (75th pct)
- **S3**: Moderate Recession (90th pct)
- **S4**: Protracted Slump (96th pct)
- **CF**: Consensus Forecast
- **USER**: Custom/Bespoke
Range of Alternative Macro Scenarios Available

Real GDP growth rate, % Yr/Yr

Sources: BEA, Moody’s Analytics
Lifetime Definition
## Lifetime Length Determination Depends on Asset

<table>
<thead>
<tr>
<th>CREDIT TYPE</th>
<th>EXAMPLES OF PRODUCTS</th>
<th>APPROACH FOR LIFETIME LENGTH DETERMINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NON-REVOLVING CREDIT</td>
<td>MORTGAGES</td>
<td>USE CONTRACTUAL END DATE TO IDENTIFY LIFETIME LENGTH</td>
</tr>
<tr>
<td></td>
<td>LOANS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AUTO-LOANS</td>
<td></td>
</tr>
<tr>
<td>REVOLVING CREDIT</td>
<td>CREDIT CARDS</td>
<td>USE DATE OF PERIODIC REVIEWS OR MODEL BEHAVIORAL LIFE OF PORTFOLIO</td>
</tr>
<tr>
<td></td>
<td>CURRENT ACCOUNTS</td>
<td></td>
</tr>
</tbody>
</table>
Behavioral Analysis: Industry-level Charge-offs by Age

Pct of total charge-off dollars

Sources: Equifax, Moody’s Analytics
Payment application in the real world

Outstanding balances, $

Pay down cash-advance balances first then purchases...

Sources: Moody’s Analytics
Ignoring future draws for CECL

Outstanding balances, $
Do you have sufficient data and expertise to build reasonable supportable CECL models for your retail portfolios?

a. Yes. I have lots of data and modelers. Thanks!
b. No. I have sufficient data but few modeling resources.
c. No. I have modelers but my data is insufficient.
d. No. I don’t have enough data or modelers. Help!
e. I’m not sure.
Case 1: CECL with industry-level models
Applying Standard Forecasts To A Portfolio

Suppose we have a portfolio of credit cards originated at different points in time with different credit scores:

<table>
<thead>
<tr>
<th>Product</th>
<th>State</th>
<th>Credit Score</th>
<th>Origination Quarter</th>
<th>Outstanding Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bankcard</td>
<td>CA</td>
<td>700-719</td>
<td>2009Q2</td>
<td>$100</td>
</tr>
<tr>
<td>Bankcard</td>
<td>CA</td>
<td>660-699</td>
<td>2011Q2</td>
<td>$300</td>
</tr>
<tr>
<td>Bankcard</td>
<td>CA</td>
<td>660-699</td>
<td>2013Q2</td>
<td>$500</td>
</tr>
<tr>
<td>Bankcard</td>
<td>CA</td>
<td>700-719</td>
<td>2015Q2</td>
<td>$200</td>
</tr>
<tr>
<td>Bankcard</td>
<td>CA</td>
<td>700-719</td>
<td>2017Q2</td>
<td>$700</td>
</tr>
<tr>
<td>Bankcard</td>
<td>CA</td>
<td>700-719</td>
<td>2019Q2</td>
<td>$1,000</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$2,800</strong></td>
</tr>
</tbody>
</table>
Industry-level Forecasts by Product-Vintage-Score-Geo

Default rate, % of outstanding balance

Sources: Equifax, Moody’s Analytics
CECL Forecast Look-Up Tables

» Econometric models developed on industry-level data can be applied to economic scenarios.

» Suitable for small portfolios, portfolios without much history or as a benchmark for internally built models.

<table>
<thead>
<tr>
<th>Product</th>
<th>State</th>
<th>Credit Score</th>
<th>Origination Quarter</th>
<th>Outstanding Balance</th>
<th>PD Rate</th>
<th>LGD Rate</th>
<th>ECL Rate</th>
<th>CECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bankcard</td>
<td>CA</td>
<td>700-719</td>
<td>2009Q2</td>
<td>$100</td>
<td>4%</td>
<td>99%</td>
<td>4.0%</td>
<td>$4</td>
</tr>
<tr>
<td>Bankcard</td>
<td>CA</td>
<td>660-699</td>
<td>2011Q2</td>
<td>$300</td>
<td>6%</td>
<td>95%</td>
<td>5.7%</td>
<td>$17</td>
</tr>
<tr>
<td>Bankcard</td>
<td>CA</td>
<td>660-699</td>
<td>2013Q2</td>
<td>$500</td>
<td>7%</td>
<td>90%</td>
<td>6.3%</td>
<td>$32</td>
</tr>
<tr>
<td>Bankcard</td>
<td>CA</td>
<td>700-719</td>
<td>2015Q2</td>
<td>$200</td>
<td>4%</td>
<td>85%</td>
<td>3.4%</td>
<td>$7</td>
</tr>
<tr>
<td>Bankcard</td>
<td>CA</td>
<td>700-719</td>
<td>2017Q2</td>
<td>$700</td>
<td>5%</td>
<td>95%</td>
<td>4.8%</td>
<td>$33</td>
</tr>
<tr>
<td>Bankcard</td>
<td>CA</td>
<td>700-719</td>
<td>2019Q2</td>
<td>$1,000</td>
<td>6%</td>
<td>95%</td>
<td>5.7%</td>
<td>$57</td>
</tr>
<tr>
<td>Sum</td>
<td></td>
<td></td>
<td></td>
<td>$2,800</td>
<td></td>
<td></td>
<td></td>
<td>$150</td>
</tr>
</tbody>
</table>
Case 2: CECL for residential mortgages
Data

To estimate a model:

1. Historical loan level mortgage data from non-agency securitized transactions

2. Historical whole loan performance data from lender / servicer

<table>
<thead>
<tr>
<th>LoanID</th>
<th>Period</th>
<th>OriginationDate</th>
<th>Property</th>
<th>OriginalLTV</th>
<th>MortgageType</th>
<th>FICO</th>
<th>Rate</th>
<th>Balance</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 2010</td>
<td>5/1/2005</td>
<td>S</td>
<td>80</td>
<td>30-Year Fixed</td>
<td>730</td>
<td>6.25</td>
<td>538,235</td>
<td>Current</td>
</tr>
<tr>
<td>1</td>
<td>Feb 2010</td>
<td>5/1/2005</td>
<td>S</td>
<td>80</td>
<td>30-Year Fixed</td>
<td>730</td>
<td>6.25</td>
<td>537,735</td>
<td>Current</td>
</tr>
<tr>
<td>1</td>
<td>Mar 2010</td>
<td>5/1/2005</td>
<td>S</td>
<td>80</td>
<td>30-Year Fixed</td>
<td>730</td>
<td>6.25</td>
<td>537,235</td>
<td>Current</td>
</tr>
<tr>
<td>1</td>
<td>Apr 2010</td>
<td>5/1/2005</td>
<td>S</td>
<td>80</td>
<td>30-Year Fixed</td>
<td>730</td>
<td>6.25</td>
<td>536,735</td>
<td>30DPD</td>
</tr>
<tr>
<td>1</td>
<td>May 2010</td>
<td>5/1/2005</td>
<td>S</td>
<td>80</td>
<td>30-Year Fixed</td>
<td>730</td>
<td>6.25</td>
<td>536,235</td>
<td>60DPD</td>
</tr>
<tr>
<td>1</td>
<td>Jun 2010</td>
<td>5/1/2005</td>
<td>S</td>
<td>80</td>
<td>30-Year Fixed</td>
<td>730</td>
<td>6.25</td>
<td>535,735</td>
<td>Defaulted</td>
</tr>
<tr>
<td>2</td>
<td>Jan 2015</td>
<td>12/10/2014</td>
<td>S</td>
<td>80</td>
<td>30-Year Fixed</td>
<td>634</td>
<td>4.25</td>
<td>300,000</td>
<td>Current</td>
</tr>
<tr>
<td>2</td>
<td>Feb 2015</td>
<td>12/10/2014</td>
<td>S</td>
<td>80</td>
<td>30-Year Fixed</td>
<td>634</td>
<td>4.25</td>
<td>299,800</td>
<td>Current</td>
</tr>
<tr>
<td>2</td>
<td>Mar 2015</td>
<td>12/10/2014</td>
<td>S</td>
<td>80</td>
<td>30-Year Fixed</td>
<td>634</td>
<td>4.25</td>
<td>299,600</td>
<td>Current</td>
</tr>
<tr>
<td>2</td>
<td>Apr 2015</td>
<td>12/10/2014</td>
<td>S</td>
<td>80</td>
<td>30-Year Fixed</td>
<td>634</td>
<td>4.25</td>
<td>299,400</td>
<td>Current</td>
</tr>
<tr>
<td>2</td>
<td>May 2015</td>
<td>12/10/2014</td>
<td>S</td>
<td>80</td>
<td>30-Year Fixed</td>
<td>634</td>
<td>4.25</td>
<td>299,200</td>
<td>Current</td>
</tr>
<tr>
<td>2</td>
<td>Jun 2015</td>
<td>12/10/2014</td>
<td>S</td>
<td>80</td>
<td>30-Year Fixed</td>
<td>634</td>
<td>4.25</td>
<td>299,000</td>
<td>Prepaid</td>
</tr>
</tbody>
</table>

For loss forecasting:

Current whole loan portfolio
Modeling Framework

Competing Risk Framework

» Survival models – The baseline or nominal hazard rate is a function of the loan age and captures the lifecycle of the loan.

» Defaults and prepayments are mutually exclusive events that compete with each other.

» The default and prepayment models are estimated as a function of the loan and borrower characteristics and macroeconomic factors.

» The models are separately estimated and used in a multi-period setting. The models produce the conditional hazard rate (default or prepayment) at any point in time.

» When running projections in a multi-period setting, the cash flows, principal & interest payments, and losses incorporate defaults as well as prepayments.

» Therefore, the cash flows that are generated automatically account for the expected life of the mortgage even though they are calculated over the contractual life of the mortgage.
Loan level models in a competing risk framework

Panel logit model linking default and prepayment probabilities to loan-level and borrower-level attributes and macro-economic variables

Model Coefficients

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.2378</td>
</tr>
<tr>
<td>FICO</td>
<td>-0.1234</td>
</tr>
<tr>
<td>UpdatedCLTV</td>
<td>0.2519</td>
</tr>
<tr>
<td>Unemployment</td>
<td>0.7856</td>
</tr>
<tr>
<td>Property_SF</td>
<td>-0.1947</td>
</tr>
<tr>
<td>Purpose_P</td>
<td>-0.0829</td>
</tr>
<tr>
<td>Occupancy_P</td>
<td>0.0045</td>
</tr>
<tr>
<td>FullDoc</td>
<td>0.0000</td>
</tr>
<tr>
<td>PartialDoc</td>
<td>0.5219</td>
</tr>
<tr>
<td>NoDoc</td>
<td>1.3675</td>
</tr>
</tbody>
</table>
Projecting Cash Flows and Calculating Expected Loss

- Rate Resetting for Adjustable Rate Mortgages. Consider reset terms, margin, underlying index, and reset frequency.
- Amortization. Consider loan rate, maturity. Calculate scheduled payments.
- Credit Models – default and prepayment probabilities, Loss Given Default (LGD)
- Expected cash flows – Principal, Interest, Loss, and Recovery
- Discount cash flows to obtain present value of expected loss
Generating Cash Flows

Scheduled Cash Flows

Balance(i-1) → Principal(i) → Interest(i) → Balance(i) → ...

f(i-1) f(i-1)p(i) f(i-1)d(i) f(i) f(i) f(i)

Expected Cash Flows

Balance(i-1) → PrepayAmt(i) → DefaultAmt(i) → Principal(i) → Interest(i) → Balance(i) → ...

LGD(i) 1 – LGD(i)

Loss(i) Recovery(i)

d(i) = Default probability, p(i) = Prepayment probability, LGD(i) = Loss Given Default
f(i) = Survival probability after period i
f(i) = f(i-1) * (1 – p(i) – d(i))
Data Challenge: Calibrating to short time history

If the model is to be calibrated to data with a short time history, we retain sensitivities to macro variables and estimate other coefficients.

Model Coefficients

- Constant: 0.1127
- FICO: -0.2912
- UpdatedCLTV: 0.2519
- Unemployment: 0.7856
- Property_SF: -0.06
- Purpose_P: -0.1
- Occupancy_P: 0.0555
- FullDoc: 0.0000
- PartialDoc: 0.6345
- NoDoc: 1.123

Graphs showing realized versus predicted default rates for different variables over time.
Other Data Challenges

» Limited number of fields: For example, historical performance data is available, but borrower documentation, property type, and a few other fields are missing.
  – Remedy: Set the coefficients of those variables to zero and re-estimate the other coefficients. The other coefficients will adjust to calibrate the model to the available data.

» No loan level historical data: For example, historical performance is known for different FICO, LTV, and vintage buckets, but no loan level data to execute the loan level models.
  – Remedy: Construct “replines” or representative loans for each bucket and calibrate the model to those buckets

» Limited loan level data for model execution or forecasting: For example, reliable data for occupancy and loan purpose is not available and lifetime losses have to be forecast.
  – Remedy: Use typical values of these variables to account for the missing data.
Retail Credit Challenges for CECL

» Number of elements to consider when bringing macroeconomic drivers into forecasting models. **Scenario selection** is one.

» **Lifetime length determination** straight-forward for non-revolving credit, but the approach for revolving credit requires some thought.

» Can **adapt existing loss forecasting, Basel, or stress testing models** for CECL. Alternatively, a forecasting approach can provide all metrics required for CECL impairment.

» **Custom** or **industry-wide, “off-the-shelf” models** are options based on portfolio size and data availability. Cohort- and loan-level approaches are available.

» **Benchmarking** results is a best practice.

» **Process is evolving.** Accountants and regulators will weigh in and clarify rules.
Welcome!

Moody’s Analytics CECL Webinar Series: Expected Credit Loss Quantification

Introduction to CECL Quantification
Tuesday, February 14, 2017 | 1:00PM EST

CRE CECL Methodologies
Tuesday, February 28, 2017 | 1:00PM EST

C&I CECL Methodologies
Tuesday, March 14, 2017 | 1:00PM EDT

Retail CECL Methodologies
Tuesday, March 28, 2017 | 1:00PM EDT

Structured Assets CECL Methodologies
Thursday, April 20, 2017 | 1:00PM EDT

To find out more about Moody’s Analytics perspectives on CECL and register for our webinar series visit:

www.moodysanalytics.com/cecl
© 2017 Moody’s Corporation, Moody’s Investors Service, Inc., Moody’s Analytics, Inc. and/or their licensors and affiliates (collectively, “MOODY’S”). All rights reserved.

CREDIT RATINGS ISSUED BY MOODY’S INVESTORS SERVICE, INC. AND ITS RATINGS AFFILIATES (“MIS”) ARE MOODY’S CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES, AND CREDIT RATINGS AND RESEARCH PUBLICATIONS PUBLISHED BY MOODY’S (“MOODY’S PUBLICATIONS”) MAY INCLUDE MOODY’S CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES. MOODY’S DEFINES CREDIT RISK AS THE RISK THAT AN ENTITY MAY NOT MEET ITS CONTRACTUAL, FINANCIAL OBLIGATIONS AS THEY COME DUE AND ANY ESTIMATED FINANCIAL LOSS IN THE EVENT OF DEFAULT. CREDIT RATINGS DO NOT ADDRESS ANY OTHER RISK, INCLUDING BUT NOT LIMITED TO: LIQUIDITY RISK, MARKET VALUE RISK, OR PRICE VOLATILITY. CREDIT RATINGS AND MOODY’S OPINIONS INCLUDED IN MOODY’S PUBLICATIONS ARE NOT STATEMENTS OF CURRENT OR HISTORICAL FACT. MOODY’S PUBLICATIONS MAY ALSO INCLUDE QUANTITATIVE MODEL-BASED ESTIMATES OF CREDIT RISK AND RELATED OPINIONS OR COMMENTARY PUBLISHED BY MOODY’S ANALYTICS, INC. CREDIT RATINGS AND MOODY’S PUBLICATIONS DO NOT CONSTITUTE OR PROVIDE INVESTMENT OR FINANCIAL ADVICE, AND CREDIT RATINGS AND MOODY’S PUBLICATIONS ARE NOT AND DO NOT PROVIDE RECOMMENDATIONS TO PURCHASE, SELL, OR HOLD PARTICULAR SECURITIES, NEITHER CREDIT RATINGS NOR MOODY’S PUBLICATIONS COMMENT ON THE SUITABILITY OF AN INVESTMENT FOR ANY PARTICULAR INVESTOR. MOODY’S ISSUES ITS CREDIT RATINGS AND PUBLISHES MOODY’S PUBLICATIONS WITH THE EXPECTATION AND UNDERSTANDING THAT EACH INVESTOR WILL, WITH DUE CARE, MAKE ITS OWN STUDY AND EVALUATION OF EACH SECURITY THAT IS UNDER CONSIDERATION FOR PURCHASE, HOLDING, OR SALE.

MOODY’S CREDIT RATINGS AND MOODY’S PUBLICATIONS ARE NOT INTENDED FOR USE BY RETAIL INVESTORS AND IT WOULD BE RECKLESS AND INAPPROPRIATE FOR RETAIL INVESTORS TO USE MOODY’S CREDIT RATINGS OR MOODY’S PUBLICATIONS WHEN MAKING AN INVESTMENT DECISION. IF IN DOUBT YOU SHOULD CONTACT YOUR FINANCIAL OR OTHER PROFESSIONAL ADVISER.

ALL INFORMATION CONTAINED HEREIN IS PROTECTED BY LAW, INCLUDING BUT NOT LIMITED TO, COPYRIGHT LAW, AND NONE OF SUCH INFORMATION MAY BE Copied OR OTHERWISE REPRODUCED, REPACKAGED, FURTHER TRANSMITTED, TRANSFERRED, DISSEMINATED, REDISTRIBUTED OR RESOLD, OR STORED FOR SUBSEQUENT USE FOR ANY SUCH PURPOSE, IN WHOLE OR IN PART, IN ANY FORM OR MANNER OR BY ANY MEANS WHATSOEVER, BY ANY PERSON WITHOUT MOODY’S PRIOR WRITTEN CONSENT.

All information contained herein is obtained by MOODY’S from sources believed by it to be accurate and reliable. Because of the possibility of human or mechanical error as well as other factors, however, all information contained herein is provided “AS IS” without warranty of any kind. MOODY’S adopts all necessary measures so that the information it uses in assigning a credit rating is of sufficient quality and from sources MOODY’S considers to be reliable including, when appropriate, independent third-party sources. However, MOODY’S is not an auditor and cannot in every instance independently verify or validate information received in the rating process or in preparing the Moody’s Publications.

To the extent permitted by law, MOODY’S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability to any person or entity for any indirect, special, consequential, or incidental losses or damages whatsoever arising from or in connection with the information contained herein or the use of or inability to use any such information, even if MOODY’S or any of its directors, officers, employees, agents, representatives, licensors or suppliers is advised in advance of the possibility of such losses or damages, including but not limited to: (a) any loss of present or prospective profits or (b) any loss or damage arising where the relevant financial instrument is not the subject of a particular credit rating assigned by MOODY’S.

To the extent permitted by law, MOODY’S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability for any direct or compensatory losses or damages caused to any person or entity, including but not limited to by any negligence (but excluding fraud, willful misconduct or any other type of liability that, for the avoidance of doubt, by law cannot be excluded) on the part of, or any contingency within or beyond the control of, MOODY’S or any of its directors, officers, employees, agents, representatives, licensors or suppliers, arising from or in connection with the information contained herein or the use of or inability to use any such information.

NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE ACCURACY, TIMELINESS, COMPLETENESS, MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OF ANY SUCH RATING OR OTHER OPINION OR INFORMATION IS GIVEN OR MADE BY MOODY’S IN ANY FORM OR MANNER WHATSOEVER.

Moody’s Investors Service, Inc., a wholly-owned credit rating agency subsidiary of Moody’s Corporation (“MCO”), hereby discloses that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by Moody’s Investors Service, Inc. have, prior to assignment of any rating, agreed to pay to Moody’s Investors Service, Inc. for appraisal and rating services rendered by it fees ranging from $1,500 to approximately $2,500,000. MCO and MIS also maintain policies and procedures to address the independence of MIS’s ratings and rating processes. Information regarding certain relationships that may exist between directors of MCO and rated entities, and between entities who hold ratings from MIS and have also publicly reported to the SEC an ownership interest in MCO of more than 5%, is posted annually at www.moodys.com under the heading “Investor Relations — Corporate Governance — Director and Shareholder Affiliation Policy.”

Additional terms for Australia only: Any publication into Australia of this document is pursuant to the Australian Financial Services License of Moody’s Investors Service, Inc. for appraisal and rating services rendered by it fees ranging from JPY200,000 to approximately JPY350,000,000 (as applicable). This document is intended to be provided only to “wholesale clients” within the meaning of section 761D of the Corporations Act 2001. By continuing to access this document from within Australia, you represent to MOODY’S that you are, or are accessing the document as a representative of, a “wholesale client” and that neither you nor the entity you represent will directly or indirectly disseminate this document or its contents to “retail clients” within the meaning of section 761G of the Corporations Act 2001.

MOODY’S credit rating is an opinion as to the creditworthiness of a debt obligation of the issuer, not on the equity securities of the issuer or any form of security that is available to retail investors. It would be reckless and inappropriate for retail investors to use MOODY’S credit ratings or publications when making an investment decision. If in doubt you should contact your financial or other professional adviser.

Additional terms for Japan only: Moody’s Japan K.K. (“MJJK”) is a wholly-owned credit rating agency subsidiary of Moody’s Group Japan G.K., which is wholly-owned by Moody’s Overseas Holdings Inc., a wholly-owned subsidiary of MCO. Moody’s SF Japan K.K. (“MSFJ”) is a wholly-owned credit rating agency subsidiary of MJJK. MSFJ is not a Nationally Recognized Statistical Rating Organization (“NRSRO”).

Therefore, credit ratings assigned by MSFJ are Non-NRSRO Credit Ratings. Non-NRSRO Credit Ratings are assigned by an entity that is not a NRSRO and, consequently, the rated obligation will not qualify for certain types of treatment under U.S. laws. MJJK and MSFJ are credit rating agencies registered with the Japan Financial Services Agency and their registration numbers are FSA Commissioner (Ratings) No. 2 and 3 respectively.

MJJK or MSFJ (as applicable) hereby disclose that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by MJJK or MSFJ (as applicable) have, prior to assignment of any rating, agreed to pay to MJJK or MSFJ (as applicable) for appraisal and rating services rendered by it fees ranging from JPY200,000 to approximately JPY350,000,000. MJJK and MSFJ also maintain policies and procedures to address Japanese regulatory requirements.

Moody’s Analytics

CECL Quantification: Retail Portfolios 38