NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS

Date: 8/27/25

Virtual Meeting

RISK-BASED CAPITAL INVESTMENT RISK AND EVALUATION (E) WORKING GROUP
Monday, September 8, 2025
12:00 – 1:30 p.m. ET / 11:00 a.m. – 12:300 p.m. CT / 10:00 – 11:300 a.m. MT / 9:00 – 10:30 a.m. PT

ROLL CALL

Philip Barlow, Chair	District of Columbia	Tadd Wegner	Nebraska
Thomas Reedy, Vice Chair	California	Jennifer Li	New Hampshire
Wanchin Chou	Connecticut	Bob Kasinow/William B. Carmello	New York
Carolyn Morgan	Florida	Dale Bruggeman/Tom Botsko	Ohio
Matt Cheung	Illinois	Rachel Hemphill	Texas
Roy Eft	Indiana	Doug Stolte	Virginia
Carrie Mears/Kevin Clark	Iowa	Steve Drutz/Katy Bardsley	Washington
Fred Andersen	Minnesota	Amy Malm	Wisconsin
William Leung/Danielle Smith	Missouri		

NAIC Support Staff: Julie Gann/Maggie Chang

AGENDA

1. Consider Adoption of its June 23, 2025 Minutes—*Philip Barlow (DC*) — Attachment 1

2. Hear an Update from the American Academy of Actuaries (Academy) on the Structured Securities Risk-Based Capital (RBC) Project — Attachment 2
   —Philip Barlow (DC)

3. Discuss Any Other Matters Brought Before the Working Group
   —Philip Barlow (DC)

4. Adjournment

Draft: 6/30/25

Risk-Based Capital Investment Risk and Evaluation (E) Working Group
Virtual Meeting
June 23, 2025

The Risk-Based Capital Investment Risk and Evaluation (E) Working Group of the Capital Adequacy (E) Task Force met June 23, 2025. The following Working Group members participated: Philip Barlow, Chair (DC); Thomas Reedy, Vice Chair (CA); Wanchin Chou (CT); Ray Spudeck and Carolyn Morgan (FL); Carrie Mears, Kevin Clark, and Mike Yanacheak (IA); Matt Cheung (IL); Roy Eft (IN); Ben Slutsker (MN); William Leung and Danielle Smith (MO); Andrea Johnson (NE); Jennifer Li (NH); Bob Kasinow and William B. Carmello (NY); Dale Bruggeman and Tom Botsko (OH); Rachel Hemphill (TX); Doug Stolte (VA); Steve Drutz and Katy Bardsley (WA); and Amy Malm (WI).

1. Adopted its Spring National Meeting Minutes

Drutz made a motion, seconded by Reedy, to adopt the Working Group's March 24 minutes *(see NAIC Proceedings – Spring 2025, Capital Adequacy (E) Task Force, Attachment Five).* The motion passed unanimously.

2. Received Comments on the ACLI's RBC Principles for Bond Funds Presentation and the NAIC's Memorandum of Bond Funds Reported in 2023 Annual Statement Filings

Barlow said that during the Working Group's Feb. 11 meeting, the Working Group exposed the American Council of Life Insurers' (ACLI's) risk-based capital (RBC) principles for bond funds presentation and the NAIC's memorandum of bond funds reported in 2023 annual statement filings. The Working Group received three comment letters, which were discussed during the Spring National Meeting. As a result of the discussions, the Working Group directed NAIC staff to draft a formal RBC proposal for the life RBC formula only. Since then, the Working Group has received nine additional comment letters. The majority of the commenters support aligning the RBC treatment of Securities Valuation Office (SVO)-designated funds across all types of businesses.

Siddharth Chakravarty (Coaction Specialty Insurance) presented his comment letter (Attachment XX). Chakravarty said Coaction Specialty Insurance is a small insurance company that commonly uses funds as investment vehicles. The comment letter expressed support for the alignment of RBC treatment as in the ACLI's presentation but requested that such treatment be applied for both life and non-life insurers.

Matt Hill (Premera Blue Cross) presented his comment letter (Attachment XX). Hill said Premea Blue Cross is a small insurance company with less than $5 billion in assets under management. He said his company commonly uses funds to gain access to certain asset classes and views the current RBC treatment for funds as less advantageous for non-life insurance companies. As such, his comment letter expressed support for the alignment of RBC treatment for fund types across all types of business.

Jeannine Heal (PineBridge Investments—PineBridge) presented a comment letter on behalf of Helen Remeza (PineBridge) (Attachment XX). Heal said PineBridge Investments manages 120 insurer portfolios globally, with $45 billion in assets under management. She said the topic of bond fund RBC alignment is important to her clients. Heal pointed out how this topic is especially important to her property/casualty (P/C) insurer clients, who are primarily small insurance companies that heavily use funds as investment vehicles. The letter expanded on PineBridge's initial comment letter presented in March and provided further details on how the current RBC treatment has created a disproportionate burden for non-life insurers, and therefore, PineBridge expressed support for promoting consistent RBC treatment for bond funds across all insurer types.

Joe Engelhard (Alternative Credit Council—ACC) presented his comment letter (Attachment XX). Engelhard said the ACC represents over 250 asset managers globally who oversee over $2 trillion in assets under management. The ACC's March comment letter presented during the Spring National Meeting strongly supported the ACLI's presentation. Engelhard said the ACC believes the principles identified by the ACLI are equally applicable to non-life insurers and submitted another comment letter to express support for broadening the scope of the harmonization to all insurer types.

Keith Bell (Travelers) presented his comment letter (Attachment XX). Bell said the comment letter laid out differences between life and P/C RBC formulas and presented impact analysis for a non-life insurer with a well-balanced portfolio of directly held investments. He concluded that the proposed RBC alignment for this insurer would be minor or even negligible. Due to this finding, Travelers does not support the presentation. That said, Bell acknowledged that the RBC impact would be meaningful should the company own its investments through fund structures, which is typically the case for smaller insurers who rely on asset managers to manage their portfolios. Given this, Bell requested that the Working Group allow optionality should the alignment project be applied to all types of business.

Chou said that while he understood the current RBC disparity may have more impact on the smaller insurers, he believed cost and benefit analysis should be performed to ensure changes are truly justifiable. He recalled that this topic was first discussed in 2018, and an analysis was performed at that time that suggested alignment was unnecessary. He requested a refreshed analysis to help the Working Group proceed.

Barlow asked if Bell could provide examples of optionality in RBC formulas. Bell said the catastrophe risk charge calculation allows filers' discretion. Bell said Travelers would like to have optionality because it interpreted the proposal as mandating insurers to file investments with the SVO. Mears clarified that mandatory filing with the SVO is neither the intent of the proposal nor the current practice with life insurers. Mears said filing with the SVO is optional, and the proposal for life insurers is to allow risk charges commensurate with the risk as represented by the SVO designations. Without any SVO designations, the investment will simply be treated as it currently is. Julie Gann (NAIC) concurred. She supplemented with another scenario of optionality: NAIC staff were made aware in the past that certain insurers did not report their investments as SVO-designated, even though SVO designations were obtained. Despite potential inconsistencies in reporting, it is not likely that anything will be enforced against that, as the filers potentially face more conservative capital charges and, therefore, do not pose a concern for the regulators.

Barlow asked Bell if the clarifications helped. Bell said the optionality helps, and his company can also rely on others' SVO filings to obtain better RBC treatment. He said the extra work to identify those instances and ensure correct filing is also manageable.

3. Exposed Proposal 2025-12-IRE (SVO Funds Alignment Project)

Barlow said a formal proposal 2025-12-IRE was drafted for life RBC only. He asked if the Working Group has an opinion on expanding the scope to include non-life formulas. Leung stated his support. Chou expressed reservations, especially because the proposal was drafted specifically for life. Barlow said he is indifferent about having referral(s) sent to health and P/C RBC working groups versus a centralized effort, and he sought Working Group members' opinions. Drutz said that as the chair of Health Risk-Based Capital (E) Working Group, he has no issue with exposure, but he seeks to ensure the health RBC changes are aligned with life's, preferably with the Health Risk-Based Capital (E) Working Group's participation. Botsko agreed. He said that as chair of the Property and Casualty Risk-Based Capital (E) Working Group, he would appreciate the Working Group's participation in weighing up all the positive and negative feedback gathered so far.

Hearing no objection from the Working Group members, interested regulators, or interested parties, Barlow exposed proposal 2025-12-IRE for a 30-day public comment period ending July 23. He also directed NAIC staff to send formal referrals to the Health Risk-Based Capital (E) Working Group and Property and Casualty Risk-Based Capital (E) Working Group, which will go through due processes when deliberating the applicability of the RBC alignment project to the respective RBC formulas.

4. Discussed Other Matters

Barlow said the Working Group is not planning to meet in person at the Summer National Meeting. The Working Group plans to receive an update from the American Academy of Actuaries (Academy) on the topic of the collateralized loan obligation (CLO) RBC project Sept. 8.

Having no further business, the Risk-Based Capital Investment Risk and Evaluation (E) Working Group adjourned.

SharePoint/NAIC Support Staff Hub/Committees/E CMTE/CADTF/2025-2-Summer/IRE/RBCIREWG 06-23-25 SPGNM Minutes TPR'd.docx

Attachment 2

C1SC Update on CLO C-1 Factors Modeling

September 8, 2025

Stephen Smith, MAAA, FSA, CFA

Chairperson, Academy C-1 Subcommittee

American Academy of Actuaries

About the Academy

Mission:
To serve the public and the U.S. actuarial profession

Community:
Serving over 20K MAAAs & public stakeholders for 60 years

Standards:
Setting qualification, practice, and professionalism standards

Impact:
Delivering over 300 insight-driven publications & resources annually

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Introduction

- The C1 Subcommittee & the NAIC's Structured Securities Group (SSG) have collaborated to build a working model for CLO C-1.
- CUSIP-level *hypothetical* C-1 factors are shown, but these are only generated as an intermediate step—the ultimate goal is to produce factors based on comparable attributes, not to model each individual CLO on an ongoing basis.
- These early results are broadly consistent with work done by SSG in the CLO Ad Hoc group, showing low risk for senior tranches but potential cliff risk for junior tranches.
- Key modeling decisions are still under review, and we are showing six deals—results are likely to evolve as the model is refined and applied to the broader universe of CLOs owned by life insurers.

Methodology Summary

- Objective: define several risk buckets for CLOs according to comparable attributes and then assign a C-1 factor to each bucket.
- CLO collateral credit modeling is largely consistent with C-1 corporate bond modeling.
- Projection of CLO cash flows is largely consistent with SSG modeling in the CLO Ad Hoc group, with the primary exception being the CLO collateral credit modeling.
- Conversion of CLO cash flows into C-1 factors is consistent with C-1 corporate bond methodology where possible, with additional modeling to address the fact that missed payments on CLOs do not necessarily trigger defaults.

Summary of Results* for 6 Sample CLOs

After-Tax C-1 / Tranche Rating	Average	Minimum	Maximum
AAA	0.00%	0.00%	0.00%
AA	0.00%	0.00%	0.00%
A	0.12%	0.00%	0.26%
BBB-	2.09%	0.47%	3.50%
BB-	25.93%	14.61%	35.17%

*Results are preliminary and subject to change. This presentation discusses modeling choices that are being reviewed. This is only 6 deals—results may change when all CLOs held by life insurers are included.

Anticipated Project Timeline

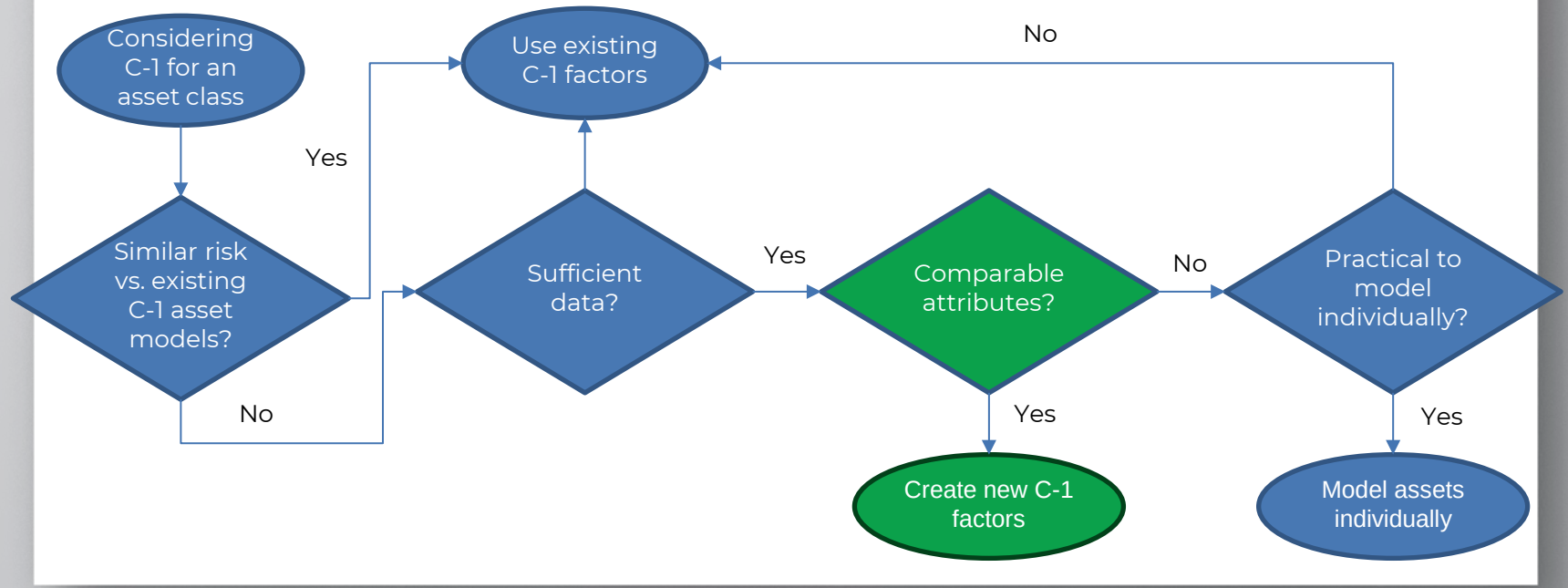
- Sept. 8, 2025—initial presentation of model
- Late 2025/Early 2026—presentation of portfolio adjustment factor, model refinements, identification of potential comparable attributes, and resulting factors
- Q1 2026—incorporation of modifications requested by regulators, if any
  - Expectation is that any structural RBC changes required would be known at the time that comparable attributes are identified (Late 2025/Early 2026)
- Q2 2026—If significant changes are not requested by regulators, expectation is for final factors to be available for exposure by April 30, 2026

Acknowledgments

- ACLI—use of C-1 corporate bond model developed by Moody's for ACLI
- Moody’s—access to CLO deal data, collateral data, historical default rate data, and CDOnet
- S&P—historical recovery data and frequent discussions with structured finance analytical professionals
- Bridgeway Analytics—frequent discussions on credit modeling, structured finance, and help in understanding the ACLI & Moody's corporate bond model
- SSG—modeling advice and running CDOnet
- NAIC accounting staff—guidance on CLO statutory accounting

Overview of Modeling Framework

C-1 Modeling Framework Flowchart



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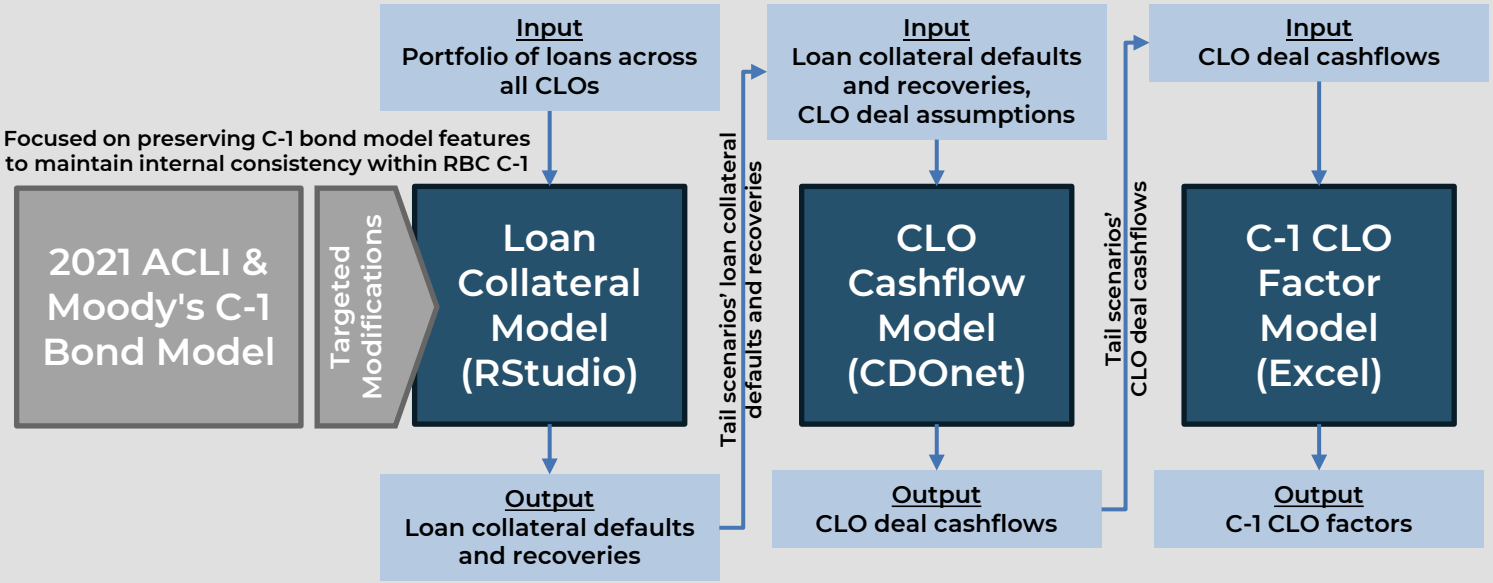
Overview of C-1 CLO Factors Approach

Create new C-1 factors



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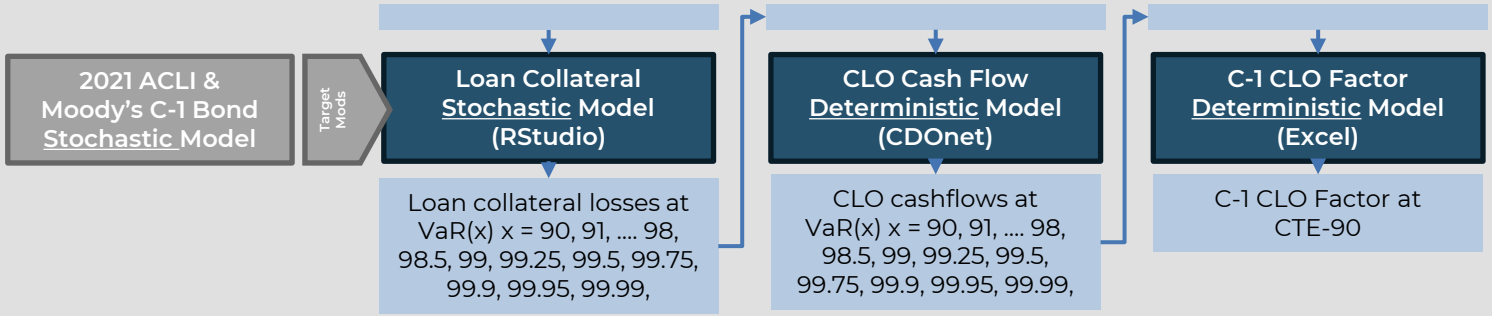
CTE-90 Tail Metric for C-1 CLO Factors

Create new C-1 factors



The CLO cash flow and the C-1 CLO Factor Models use deterministic inputs; CTE is estimated from VaR metrics selected using a scenario compression method to manage computational time

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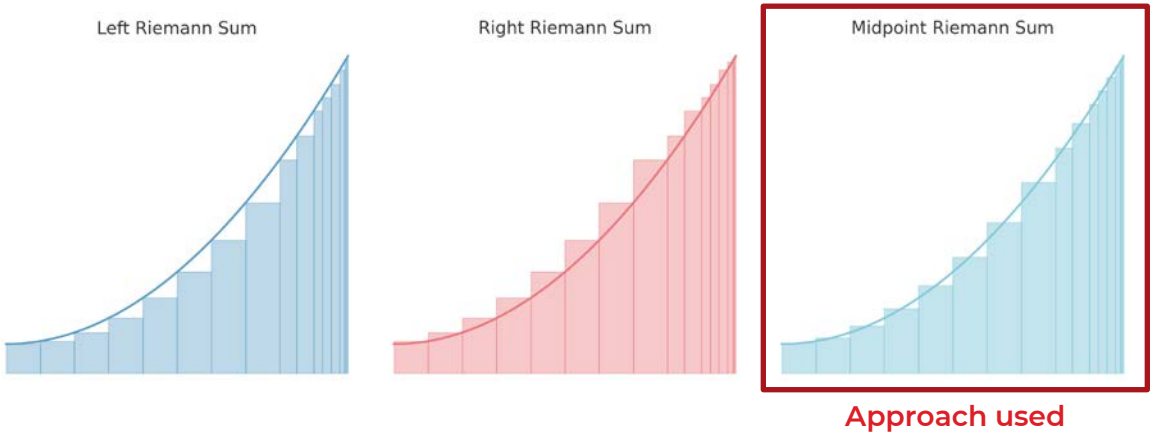
Scenario Compression for CTE-90 Estimation

- Breaks percentiles into 16 buckets
- Percentiles get closer together at the right tail as the RBC charges increase more steeply



Approach used

	Weights		
Percentile	Left	Right	Midpoint
99.99	0.5%		0.3%
99.95	0.5%	0.5%	0.5%
99.90	1.5%	0.5%	1.0%
99.75	2.5%	1.5%	2.0%
99.50	2.5%	2.5%	2.5%
99.25	2.5%	2.5%	2.5%
99.00	5.0%	5.0%	3.8%
98.50	5.0%	5.0%	5.0%
98.00	10.0%	10.0%	7.5%
97.00	10.0%	10.0%	10.0%
96.00	10.0%	10.0%	10.0%
95.00	10.0%	10.0%	10.0%
94.00	10.0%	10.0%	10.0%
93.00	10.0%	10.0%	10.0%
92.00	10.0%	10.0%	10.0%
91.00	10.0%	10.0%	10.0%
90.00		10.0%	5.0%

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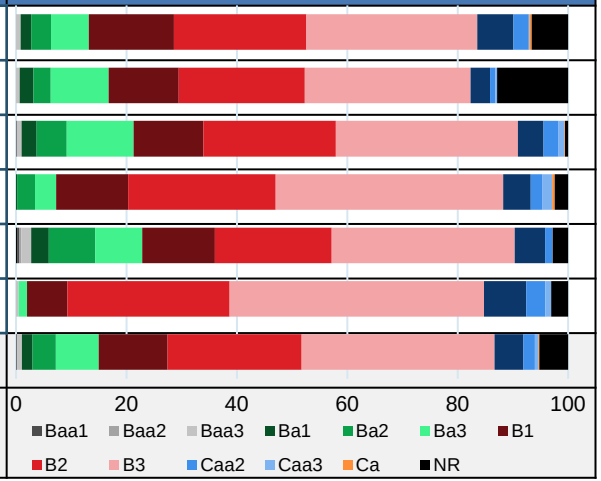
Scope of Sample CLO Deals

As of 9/30/24	Balance ($mn)	Loans (#)	Unique Issuers (#)	Issuer* Rating Distribution
867331201	496.9	474	381	
867578342	598.6	499	435	
867567170	436.8	307	268	
830960738	684.3	365	329	
830871594	424.7	348	295	
867931338	389.6	171	153	
Sample Deals	3,030.9	1,660	933	
Total Moody's CLO Universe	**744,181.3**	**27,802**	**2,021**	



*Issuer rating shown. When comparing issuer and loan rating, S&P ratings are the same for 98% of the balance. Moody's ratings are the same for 57% and within 1 notch for 94% of the loan balance.

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Loan Collateral Model (RStudio)

Attachment 2

Targeted Modifications—Loan Collateral Model Parameters

Model Parameter	ACLI & Moody's C-1 Bond Model	Loan Collateral Model
Simulations	10,000	Kept the same
Projection Years	10 years	Kept the same
Time Step	Annual	Monthly
Target Risk Metric	VaR(96), selected based on the greatest PV of losses in excess of accumulated risk premium	VaR(x) where x =90, 91, ... 98, 98.5, 99, 99.25, 99.5, 99.75, 99.9, 99.95, 99.99, selected based on the PV of losses*
Discounting	Discount Rate = 3.47% (pre-tax) 2.74% (post-tax)	Kept the same pre-tax*
Output	C1 bond factors = PV of losses in excess of risk premium / Amount exposed	Undiscounted defaults and recoveries by deal and by credit rating

*Discounting only used to identify the scenario at the Target Risk Metric.

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Targeted Modifications—Loan Collateral Model Assumptions

Model Assumption	ACLI & Moody's C1 Bond Model	Loan Collateral Model
Default Rates	Empirical distribution by issuer rating based on Moody's data	Kept the same
Recovery Rates	Empirical distribution by economic state based on Moody's data for senior unsecured bonds	Empirical distribution by payment priority (sr. unsecured, sr. secured, 2nd lien) based on S&P data
Economic State Transition Matrix	Based on original Academy's work	Not used
% Variance Explained by Systematic Error	10%	Kept the same, results in implicit diversification benefit
Tax Adjustment	Tax Rate = 21% Recovery Rate = 80%	Not used*
Reinvestment	Surplus used to purchase identical bond after default	Modeled to align with reinvestments in CLO cash flow Model (CDOnet)

*Tax Adjustment used in a downstream step of the overall CLO model process

Reinvestments in Loan Collateral Model

Reinvestment modeling
is a key methodological choice that impacts credit losses

- Credit losses may occur from existing loans or from future reinvestments.
- The tail scenarios are selected in the loan collateral model (RStudio), before modeling the CLO cash flows.
- To maximize alignment between collateral modeling and CLO cash flow modeling, loan collateral losses are modeled consistent with CDOnet assumptions:
    a) Only maturities and recoveries from default are reinvested (i.e., no prepayments)
    b) Reinvestment distributions are
        30% B1 | 30% B2 | 40% B3
        92.5% Sr. Secured | 7.5% Sr. Unsecured

Loan Collateral Model (RStudio)

Attachment 2

Reinvestment Methodologies Considered

Approach used

	Reinvestment Amount at t	Loss from Reinvestment	Modeled Loan Universe	Pros	Cons
1	Deterministic	Deterministic empirical distribution	[933 x 3] existing loans at t=0	• Simple	• Understates tail risk, loss curve is an average scenario, not Xth percentile • The systematic error is not captured in the reinvestments
2	Based on stochastic scenario	Deterministic average of stochastic simulations, staggered to start at time t	[933 x 3] existing loans at t=0	• Simple	• Overestimates tail risk by compounding of Xth percentile on top of Xth percentile • Misalignment of systematic error, which should follow time from projection t • Exacerbates misalignment in VaR(X) for deal A vs. VaR(X) for deal B
3	Based on stochastic scenario	Stochastic simulation	[933 x 3] existing loans at t=0 + [933 x 3 x 120] hypothetical loans for t=0 through 120	• Most mathematically accurate	• Most computationally expensive • Creates an open-ended universe of loans and issuers, which may introduce unwarranted diversification benefits

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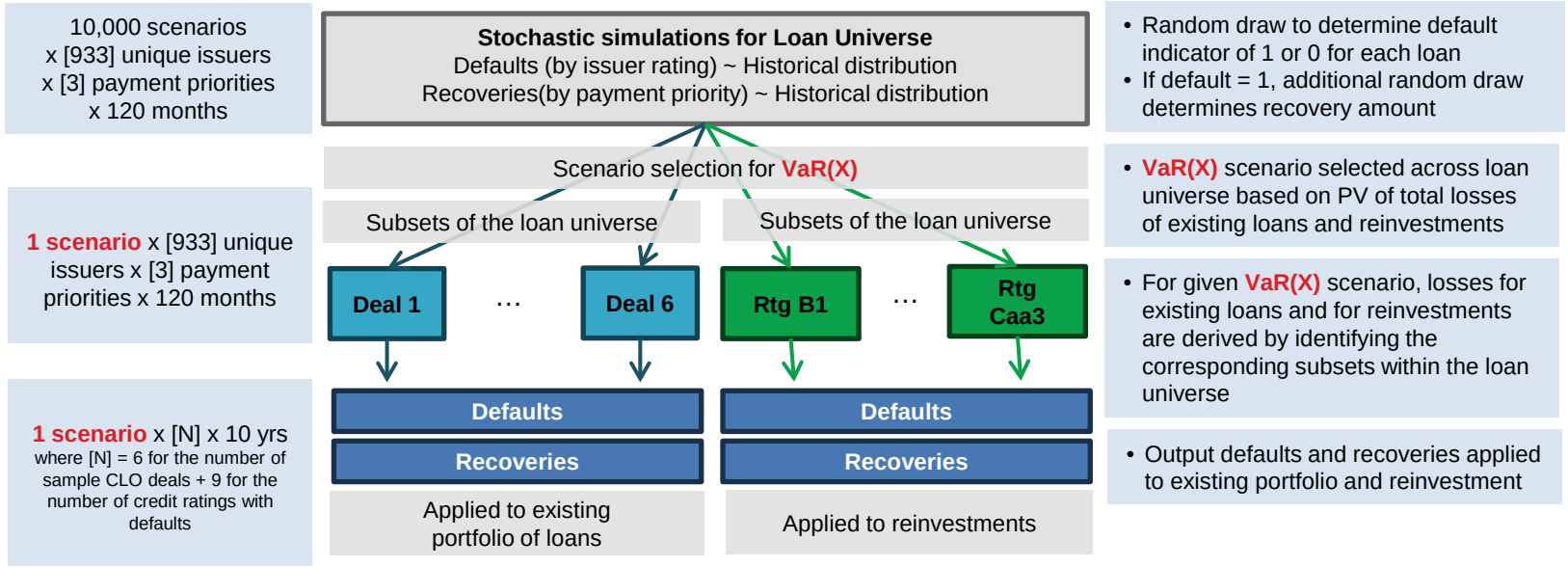
Reinvestment Methodologies Considered

	Reinvestment Amount at t	Loss from Reinvestment	Modeled Loan Universe	Pros	Cons
4	Based on stochastic scenario	Deterministic, average of stochastic simulations, aligned by projection year, based on original credit rating at t=0	[933 x 3] existing loans at t=0	• Computationally feasible • Alignment of systematic error • Closed-ended universe of loans and issuers	• Does not account for credit migration that happens between t=0 and reinvestment time t • Reinvestments limited to existing pool of loans and issuers that have not defaulted at time t
5	Based on stochastic scenario	Deterministic, average of stochastic simulations, aligned by projection year, based on simulated credit rating at t=t	[933 x 3] existing loans at t=0, each with a simulated credit rating at each time step t	• Same as approach 4 • Addresses credit migration limitation in approach 4	• Introduces model risk by modeling credit migration from complexity and reliance of credit migration data • Same as above, reinvestments limited to existing pool of loans and issuers that have not defaulted at time t

Step-by-Step Description of Loan Collateral Model



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CLO Cashflow Model Assumptions & Parameters

Model Assumption/Parameter	SSG Approach in CLO Ad Hoc Group	Academy Approach
Collateral Prepayment	No prepay, consistent with rating agencies	Kept the same
Collateral Reinvestment Price	At par, consistent with rating agencies	Kept the same
Reinvestment Timing & Quality	Reinvestments are made into existing collateral pool specific to each deal	Reinvestments made into newly issued loans, quality not deal-specific
Recovery Lag	6 months	Immediate recovery, consistent with S&P recovery data
Default Vectors	10 default & recovery scenarios, weighted to minimize difference between CLO C-1 and collateral C-1 across deals	17 tail scenarios drawn from loan collateral model (10,000 total scenarios) to inform an estimation of CTE-90; CLO/collateral C-1 equivalence not enforced
All Other CDOnet Parameters	Various less impactful modeling choices that need to be made	Kept the same

Converting CLO Cash Flows Into C-1 Factors

Objectives	Approach	
	Consistency with C-1 Bond Factors	Prioritizing Estimation of Portfolio Tail Events
• Consistency with C-1 bond factors approach except for risk measure (CTE-90 vs. VaR-96) • Prioritize estimating risk consistent with a portfolio tail event instead of estimating each security's specific tail risk	• 10-year projection • Risk premium by CLO tranche rating equal to C-1 bond factor risk premium • Statutory losses (simplified SSAP 43 impairment modeling used for CLOs) • Greatest present value of accumulated deficiency (GPVAD) • Difference: tax loss occurs at the earlier of a full impairment or a tranche defaulting at maturity (in bond model, tax loss always occurs at time of default)	• Rank order of scenarios determined based on PV of losses on the combined collateral pool instead of being reordered for each CLO or each CLO tranche • Leads to greater dispersion of modeled C-1 factors across CLOs, but averages across deals will represent risk of a diversified CLO portfolio • Updates to Portfolio Adjustment factor for CLOs will be considered in next steps

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Simplified SSAP 43 Impairment Modeling—Details

- Per previously identified principles, capital is downstream from accounting
- C-1 corporate bond model assumes statutory losses occur only upon default
- For most CLOs, default only occurs at maturity when the final payment cannot be made
- However, in many cases it is clear years before that a default will occur—in this case, a statutory loss may result from an impairment prior to default
- This model's simplistic approach is to check for an impairment any time an interest payment is missed (in other words, any time the CLO PIKs)
- At that time, the model assumes the insurer has full knowledge of future cash flows and performs a perfectly accurate impairment analysis (in the tail scenarios that drive C-1 results, this effectively pulls statutory losses forward in time in the model)
- If a security's book yield is significantly higher than the C-1 discount rate and the C-1 risk premium is low, this approach could underestimate C-1. If book yield is low relative to risk premium, this approach could overestimate C-1
- This is all a practical expedient—the Academy has been unable to identify a more realistic way of conducting an "inner loop" impairment analysis, and we estimate the effect of this simplification to be minor

Selected Model Decisions to be Reconsidered

Model Assumption/Parameter	Potential Change	Potential Impact
% Variance Explained by Systematic Error	May reduce from 10% to reflect below-IG nature of collateral (e.g., 5%)	Reduce C-1 factors
Collateral Reinvestment Price & Prepay	Allow for prepayment and reinvestment at less than par	Reduce C-1 factors
Projection Horizon	Adjust results for tranches that pay off in less than 10 years (senior tranches)	Reduce the difference between C-1 factors for senior and junior tranches (less slope)
Statistical Safety Level	Showing results for CTE-90, but the level is for regulators to decide	Depends on direction of change, if any
Relationship between default rates and severities	Change correlation between defaults and severities from zero to positive	Increase C-1 factors
Reinvestments—General Approach	Detailed earlier in the presentation	Reduce C-1 factors (for most alternatives considered)
Reinvestments—Aligning with Reinvestment Period	Stop reinvesting recovered principal after 2-3 years when generating default vector	Increase C-1 factors (by better aligning rank order of collateral scenarios with CLO losses, per below)
Rank Order of Collateral Scenarios	Identify patterns of default timing that result in greater CLO losses	Increase C-1 factors
Risk Premium	Derive risk premia from CLO loss distribution instead of from bond factors	Increase C-1 factors (if based on VaR or standard deviation)

Questions

Contact:
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barrymoilanen@actuary.org

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Appendix A
Loan Collateral Model

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Moody's C1 Bond Model Summary

Inputs	Calculations	
	Stochastic Simulations	C1 Bond Factors
• Default rates by rating and tenor, from Moody's historical study 1983-2020 • Recovery rates by economic state, from Moody's historical study 1987-2020 • Economic states transition matrices with starting state of contraction	For simulation *i*, year *t*: • 1 of 4 discrete economic states sampled from Markov-Chains • Default indicator sampled from a distribution by issuer rating and tenor, with a Gaussian Copula function where 90% of the variance is idiosyncratic and 10% is systematic • Loss rate = 1 – recovery rate, sampled from a discrete distribution by economic state	• C1 bond factor = VaR(96) PV of simulated C1 losses • PV of simulated C1 losses = NPV of simulated C1 losses over 10 yrs discounted at a flat 2.74% post-tax rate • Simulated C1 loss for year *t* = simulated post-tax loss – risk premium where risk premium = expected loss + 0.5*std dev by issuer rating, representing losses covered in reserves Losses expressed as a % of t=0 book value

Moody's C1 Bond Model Validation

	C1 Bond Model Rerun												Original C1
	Seed 1	**Seed 2**	**Seed 3**	**Seed 4**	**Seed 5**	**Seed 6**	**Seed 7**	**Seed 8**	**Seed 9**	**Seed 10**	**Avg**	**Std Dev**	**Model Output**
Aaa	**0.158%**	0.163%	0.149%	0.148%	0.152%	0.170%	0.159%	0.158%	0.158%	0.152%	0.157%	0.007%	**0.158%**
Aa1	**0.271%**	0.274%	0.271%	0.256%	0.271%	0.280%	0.261%	0.272%	0.269%	0.266%	0.269%	0.007%	**0.271%**
Aa2	**0.419%**	0.439%	0.435%	0.431%	0.440%	0.440%	0.425%	0.434%	0.429%	0.430%	0.432%	0.007%	**0.419%**
Aa3	**0.545%**	0.539%	0.520%	0.521%	0.530%	0.537%	0.531%	0.537%	0.516%	0.540%	0.532%	0.010%	**0.523%**
A1	**0.683%**	0.670%	0.659%	0.669%	0.675%	0.643%	0.649%	0.677%	0.651%	0.649%	0.663%	0.014%	**0.657%**
A2	**0.800%**	0.824%	0.815%	0.833%	0.806%	0.815%	0.816%	0.823%	0.807%	0.818%	0.816%	0.010%	**0.816%**
A3	**1.023%**	1.007%	0.999%	0.997%	1.004%	1.005%	1.026%	1.012%	0.993%	0.997%	1.006%	0.011%	**1.016%**
Baa1	**1.226%**	1.242%	1.241%	1.237%	1.222%	1.217%	1.235%	1.220%	1.213%	1.201%	1.225%	0.014%	**1.261%**
Baa2	**1.553%**	1.527%	1.512%	1.556%	1.558%	1.529%	1.544%	1.540%	1.549%	1.580%	1.545%	0.019%	**1.523%**
Baa3	**2.186%**	2.183%	2.172%	2.174%	2.173%	2.136%	2.168%	2.112%	2.182%	2.209%	2.170%	0.027%	**2.168%**
Ba1	**3.168%**	3.181%	3.187%	3.154%	3.143%	3.136%	3.206%	3.143%	3.177%	3.179%	3.167%	0.023%	**3.151%**
Ba2	**4.619%**	4.651%	4.614%	4.630%	4.562%	4.741%	4.613%	4.571%	4.640%	4.652%	4.629%	0.050%	**4.537%**
Ba3	**5.680%**	5.874%	5.864%	5.862%	5.853%	5.871%	5.799%	5.868%	5.853%	5.882%	5.841%	0.061%	**6.017%**
B1	**7.268%**	7.352%	7.453%	7.389%	7.337%	7.400%	7.409%	7.373%	7.380%	7.275%	7.364%	0.058%	**7.386%**
B2	**9.290%**	9.497%	9.688%	9.361%	9.198%	9.543%	9.512%	9.221%	9.365%	9.274%	9.395%	0.159%	**9.535%**
B3	**12.307%**	12.509%	12.290%	12.612%	12.471%	12.423%	12.358%	12.372%	12.315%	12.606%	12.426%	0.120%	**12.428%**
Caa1	**16.360%**	16.804%	16.562%	16.771%	17.181%	16.815%	16.855%	16.785%	16.647%	16.707%	16.749%	0.212%	**16.933%**
Caa2	**23.458%**	23.451%	23.822%	23.355%	23.535%	23.333%	23.648%	23.524%	23.838%	23.404%	23.537%	0.180%	**23.798%**
Caa3	**32.762%**	32.490%	32.605%	33.417%	33.069%	33.056%	32.883%	33.030%	33.289%	32.927%	32.953%	0.286%	**32.975%**

Moody's C1 Bond Model Validation

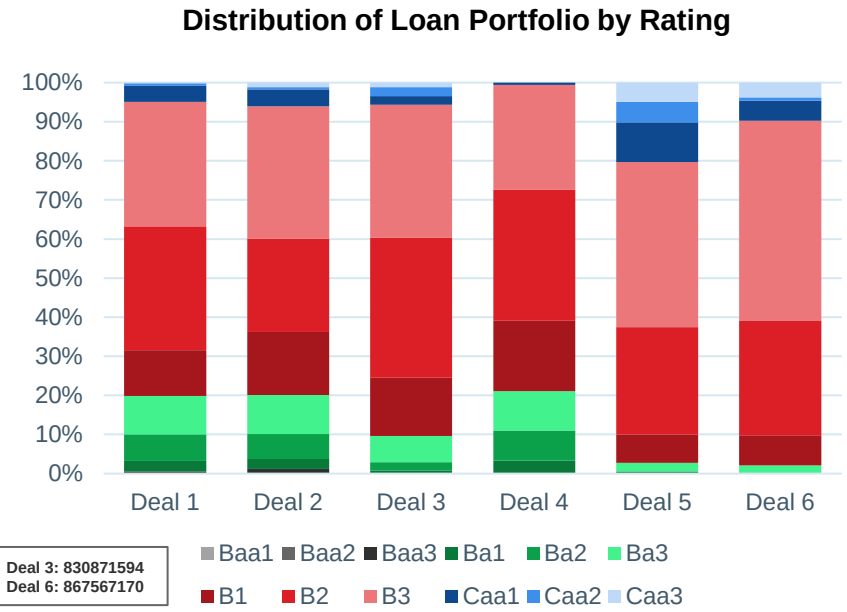
	C1 Bond Model Rerun – Original C1 Model Output											Original C1
	Seed 1	**Seed 2**	**Seed 3**	**Seed 4**	**Seed 5**	**Seed 6**	**Seed 7**	**Seed 8**	**Seed 9**	**Seed 10**	**Avg**	**Model Output**
Aaa	**0.000%**	0.005%	-0.009%	-0.010%	-0.006%	0.012%	0.001%	0.000%	0.000%	-0.006%	-0.001%	**0.158%**
Aa1	**0.000%**	0.003%	0.000%	-0.015%	0.000%	0.009%	-0.010%	0.001%	-0.002%	-0.005%	-0.002%	**0.271%**
Aa2	**0.000%**	0.020%	0.016%	0.012%	0.021%	0.021%	0.006%	0.015%	0.010%	0.011%	0.013%	**0.419%**
Aa3	**0.022%**	0.016%	-0.003%	-0.002%	0.007%	0.014%	0.008%	0.014%	-0.007%	0.017%	0.009%	**0.523%**
A1	**0.026%**	0.013%	0.002%	0.012%	0.018%	-0.014%	-0.008%	0.020%	-0.006%	-0.008%	0.006%	**0.657%**
A2	**-0.016%**	0.008%	-0.001%	0.017%	-0.010%	-0.001%	0.000%	0.007%	-0.009%	0.002%	0.000%	**0.816%**
A3	**0.007%**	-0.009%	-0.017%	-0.019%	-0.012%	-0.011%	0.010%	-0.004%	-0.023%	-0.019%	-0.010%	**1.016%**
Baa1	**-0.035%**	-0.019%	-0.020%	-0.024%	-0.039%	-0.044%	-0.026%	-0.041%	-0.048%	-0.060%	-0.036%	**1.261%**
Baa2	**0.030%**	0.004%	-0.011%	0.033%	0.035%	0.006%	0.021%	0.017%	0.026%	0.057%	0.022%	**1.523%**
Baa3	**0.018%**	0.015%	0.004%	0.006%	0.005%	-0.032%	0.000%	-0.056%	0.014%	0.041%	0.002%	**2.168%**
Ba1	**0.017%**	0.030%	0.036%	0.003%	-0.008%	-0.015%	0.055%	-0.008%	0.026%	0.028%	0.016%	**3.151%**
Ba2	**0.082%**	0.114%	0.077%	0.093%	0.025%	0.204%	0.076%	0.034%	0.103%	0.115%	0.092%	**4.537%**
Ba3	**-0.337%**	-0.143%	-0.153%	-0.155%	-0.164%	-0.146%	-0.218%	-0.149%	-0.164%	-0.135%	-0.176%	**6.017%**
B1	**-0.118%**	-0.034%	0.067%	0.003%	-0.049%	0.014%	0.023%	-0.013%	-0.006%	-0.111%	-0.022%	**7.386%**
B2	**-0.245%**	-0.038%	0.153%	-0.174%	-0.337%	0.008%	-0.023%	-0.314%	-0.170%	-0.261%	-0.140%	**9.535%**
B3	**-0.121%**	0.081%	-0.138%	0.184%	0.043%	-0.005%	-0.070%	-0.056%	-0.113%	0.178%	-0.002%	**12.428%**
Caa1	**-0.582%**	-0.138%	-0.380%	-0.171%	0.239%	-0.127%	-0.087%	-0.157%	-0.295%	-0.235%	-0.193%	**16.933%**
Caa2	**-0.340%**	-0.347%	0.024%	-0.443%	-0.263%	-0.465%	-0.150%	-0.274%	0.040%	-0.394%	-0.261%	**23.798%**
Caa3	**-0.213%**	-0.485%	-0.370%	0.442%	0.094%	0.081%	-0.092%	0.055%	0.314%	-0.048%	-0.022%	**32.975%**

Potential Model Simplification—Average by Rating

We explored a model simplification:

simplified portfolio losses = weighted avg of losses by rating

where losses by rating are generated by pooling loans across all 6 CLO deals by rating



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Potential Model Simplification—Average by Rating

Comparison Explicit Model vs. Model Simplification

Difference in First Year Aggregate Losses % of Principal

Pct	Deal 1	Deal 2	Deal 3	Deal 4	Deal 5	Deal 6
25%	-0.01%	-0.10%	-0.07%	0.04%	-0.16%	0.00%
50%	-0.04%	-0.07%	-0.04%	-0.04%	-0.15%	-0.03%
75%	-0.07%	0.02%	0.03%	-0.07%	-0.06%	0.02%
90%	-0.13%	0.11%	0.11%	-0.10%	0.01%	-0.08%
96%	-0.13%	0.27%	0.11%	0.00%	0.14%	0.03%
99%	0.03%	0.70%	0.37%	0.10%	0.43%	-0.22%

The model simplification overestimates tail losses in most cases

Deal 1: 830960738 Deal 2: 867578342 Deal 3: 830871594
Deal 4: 867331201 Deal 5: 867931338 Deal 6: 867567170

Explicit Model of Full Loan Portfolio

First Year Aggregate Losses % of Principal

Pct	Deal 1	Deal 2	Deal 3	Deal 4	Deal 5	Deal 6
25th	0.88%	1.07%	1.12%	0.65%	1.99%	1.55%
50th	1.67%	1.85%	2.01%	1.36%	3.43%	2.76%
75th	2.86%	3.00%	3.28%	2.40%	5.31%	4.32%
90th	4.38%	4.43%	4.82%	3.72%	7.50%	6.31%
96th	5.86%	5.77%	6.36%	4.95%	9.44%	7.98%
99th	7.98%	7.70%	8.49%	6.94%	12.17%	10.91%

Model Simplification Weighted Avg by Rating

First Year Aggregate Losses % of Principal

Pct	Deal 1	Deal 2	Deal 3	Deal 4	Deal 5	Deal 6
25th	0.86%	0.96%	1.06%	0.68%	1.82%	1.55%
50th	1.63%	1.79%	1.97%	1.32%	3.29%	2.73%
75th	2.79%	3.02%	3.31%	2.33%	5.24%	4.33%
90th	4.26%	4.54%	4.92%	3.62%	7.50%	6.23%
96th	5.72%	6.04%	6.48%	4.95%	9.58%	8.01%
99th	8.01%	8.40%	8.86%	7.04%	12.60%	10.69%

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Potential Model Simplification—Average by Rating

Comparison Explicit Model vs. Model Simplification

Difference in 10-Year Aggregate Losses % of Principal

Pct	Deal 1	Deal 2	Deal 3	Deal 4	Deal 5	Deal 6
25%	-0.10%	-0.39%	-0.15%	-0.09%	-0.05%	0.21%
50%	-0.04%	-0.08%	-0.03%	-0.01%	-0.04%	0.07%
75%	0.18%	0.27%	0.16%	0.07%	-0.02%	0.06%
90%	0.35%	0.76%	0.30%	0.10%	0.08%	-0.04%
96%	0.47%	1.07%	0.40%	0.14%	0.14%	-0.15%
99%	0.69%	1.41%	0.42%	-0.10%	-0.10%	-0.46%

The model simplification overestimates tail losses in most cases

Deal 1: 830960738 Deal 2: 867578342 Deal 3: 830871594
Deal 4: 867331201 Deal 5: 867931338 Deal 6: 867567170

Explicit Model of Full Loan Portfolio

10-Year Aggregate Losses % of Principal

Pct	Deal 1	Deal 2	Deal 3	Deal 4	Deal 5	Deal 6
25th	15.76%	16.13%	17.12%	14.74%	20.14%	19.11%
50th	18.41%	18.55%	19.80%	17.30%	23.32%	22.16%
75th	21.17%	21.23%	22.63%	20.10%	26.70%	25.28%
90th	23.87%	23.67%	25.31%	22.83%	29.72%	28.22%
96th	26.02%	25.71%	27.44%	25.01%	32.10%	30.55%
99th	28.56%	28.22%	30.09%	27.96%	35.16%	33.46%

Model Simplification Weighted Avg by Rating

10-Year Aggregate Losses % of Principal

Pct	Deal 1	Deal 2	Deal 3	Deal 4	Deal 5	Deal 6
25th	15.66%	15.74%	16.97%	14.65%	20.09%	19.32%
50th	18.38%	18.47%	19.77%	17.29%	23.28%	22.23%
75th	21.35%	21.50%	22.79%	20.17%	26.68%	25.34%
90th	24.22%	24.43%	25.61%	22.93%	29.80%	28.18%
96th	26.50%	26.78%	27.84%	25.15%	32.23%	30.40%
99th	29.26%	29.63%	30.51%	27.86%	35.07%	33.00%

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Appendix B
CLO Cash Flow Model

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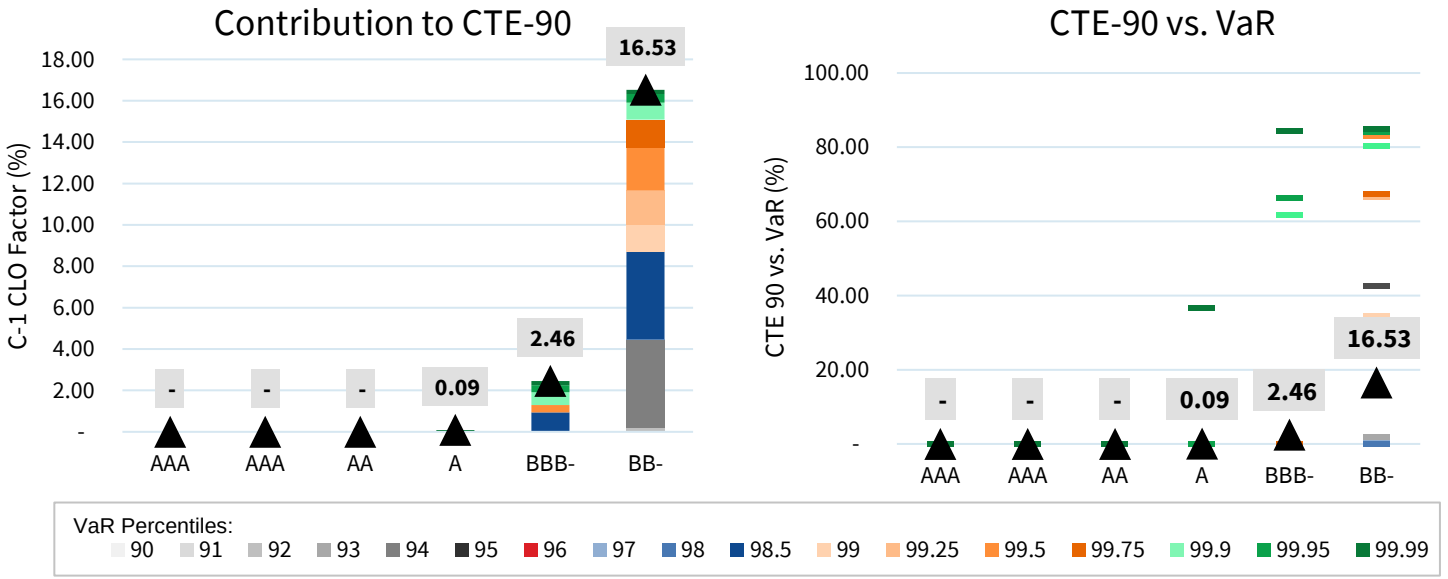
Further Details on CLO Cashflow Modeling in CDOnet

Except where otherwise noted in this presentation, CDOnet parameters and assumptions are set according to the methodology described on the SSG CLO webpage:

https://content.naic.org/industry/structured-securities/collateralized-loan-obligations

Appendix C
Detailed Results for 6 Sample CLOs

Hypothetical Results for Strata II, Deal ID#867931338



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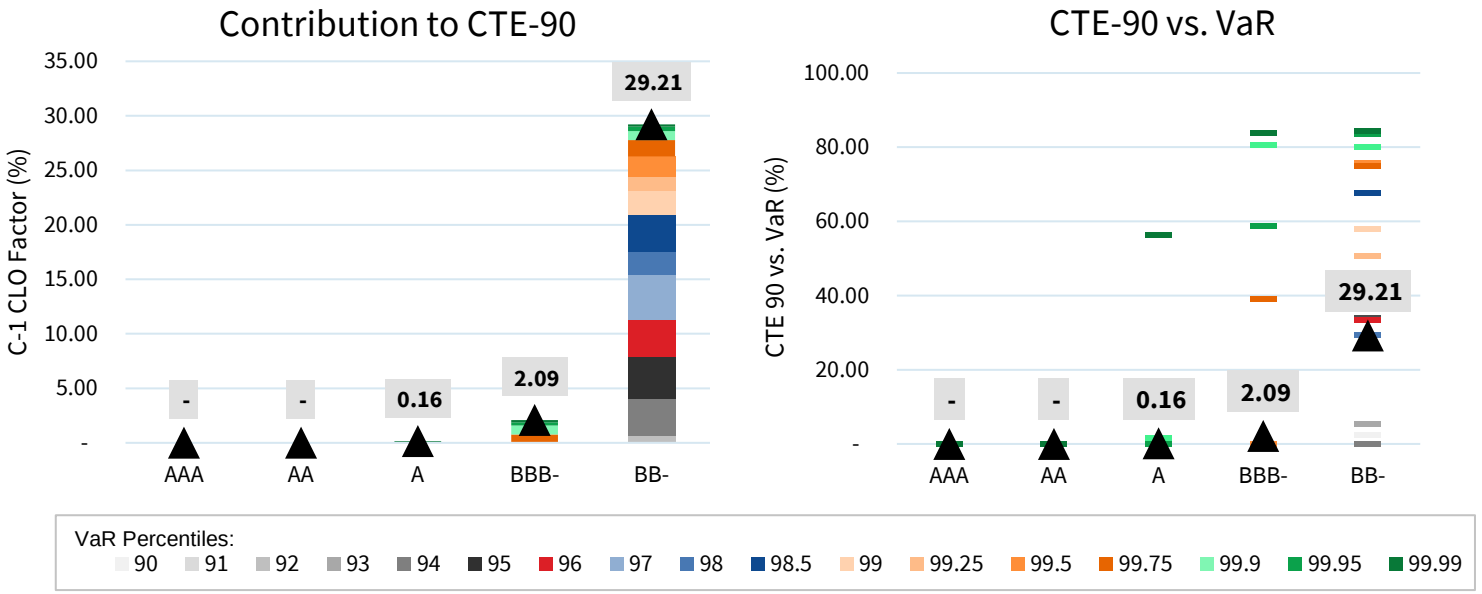
Hypothetical Results for Magnetite 27, Deal ID#867331201



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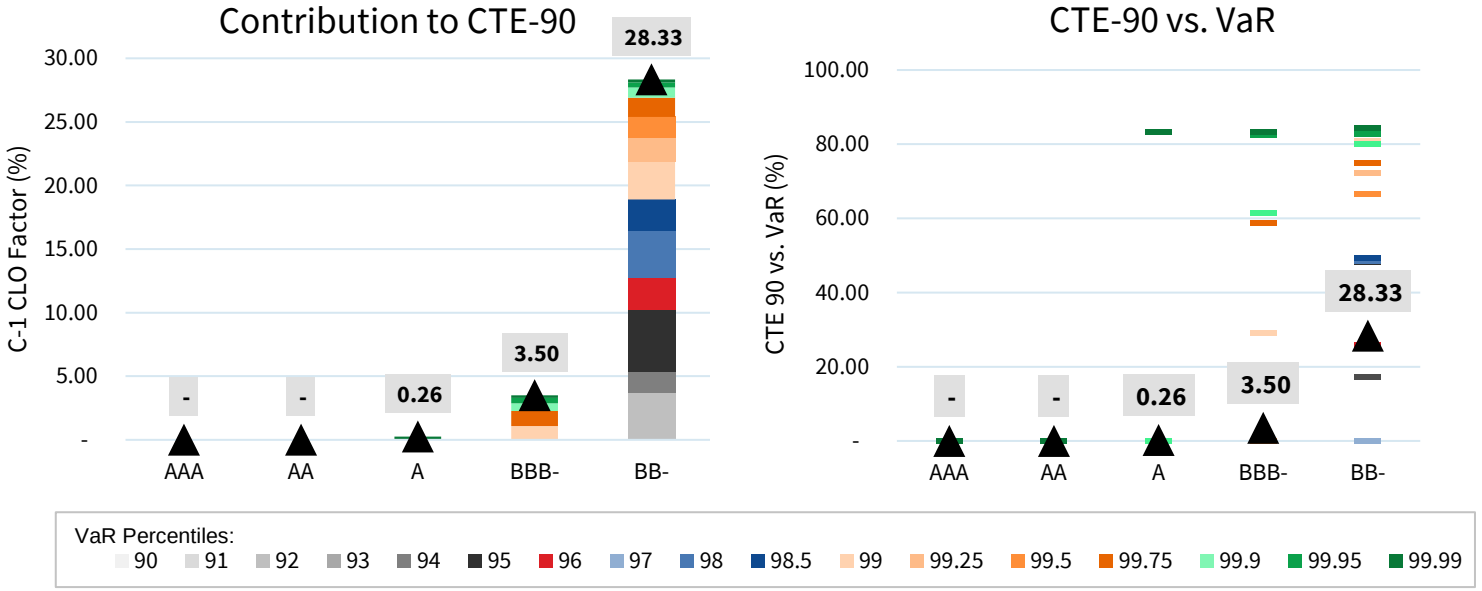
Hypothetical Results for OHA 3, Deal #830960738



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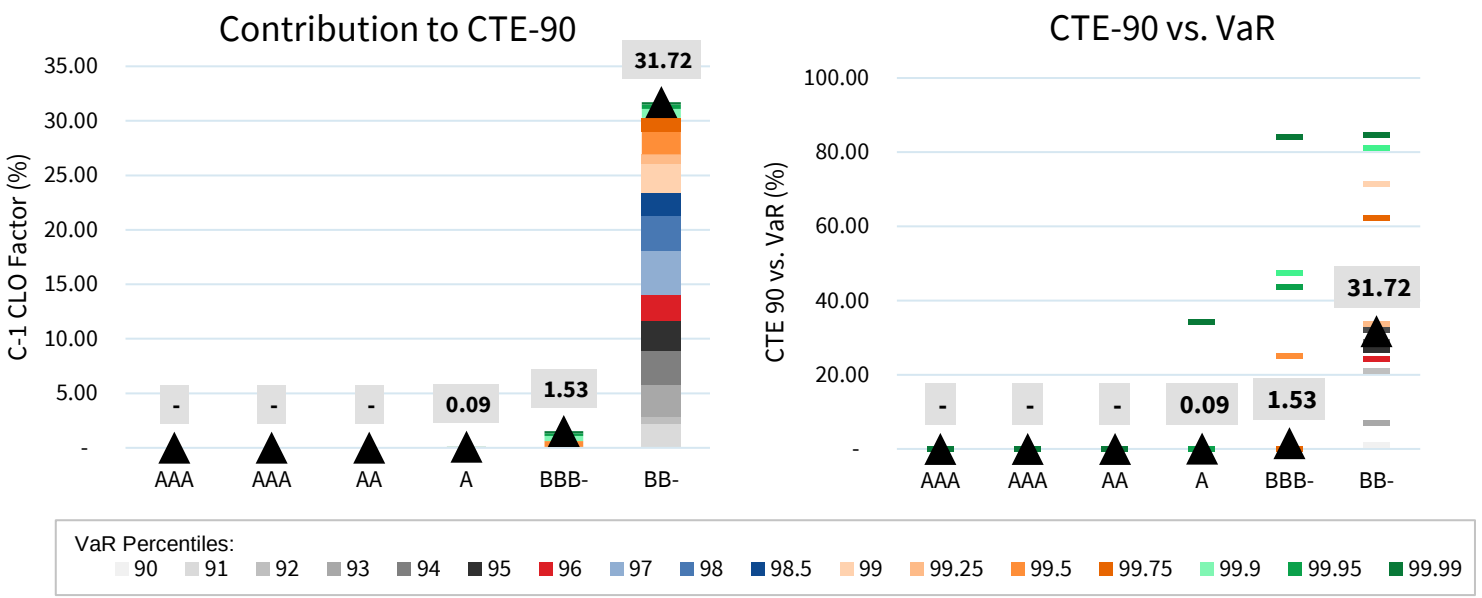
Hypothetical Results for Anchorage 17, Deal ID #867567170[38]



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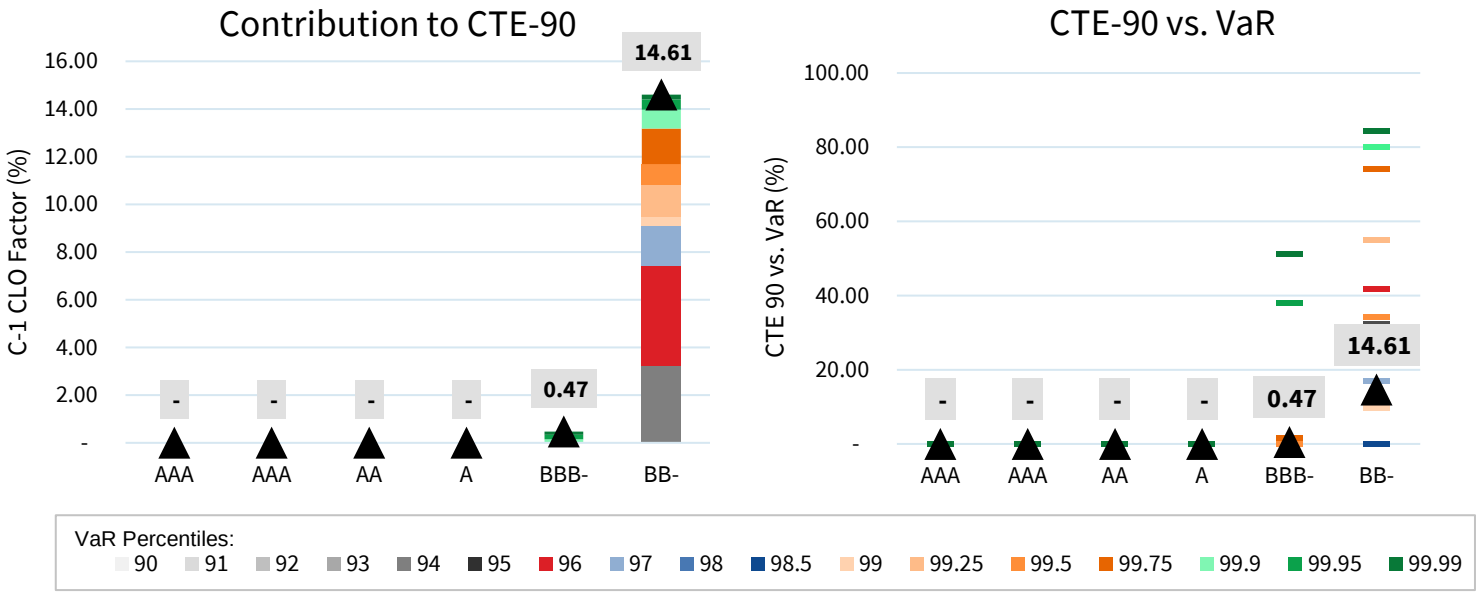
Hypothetical Results for Ares 52, Deal ID#830871594



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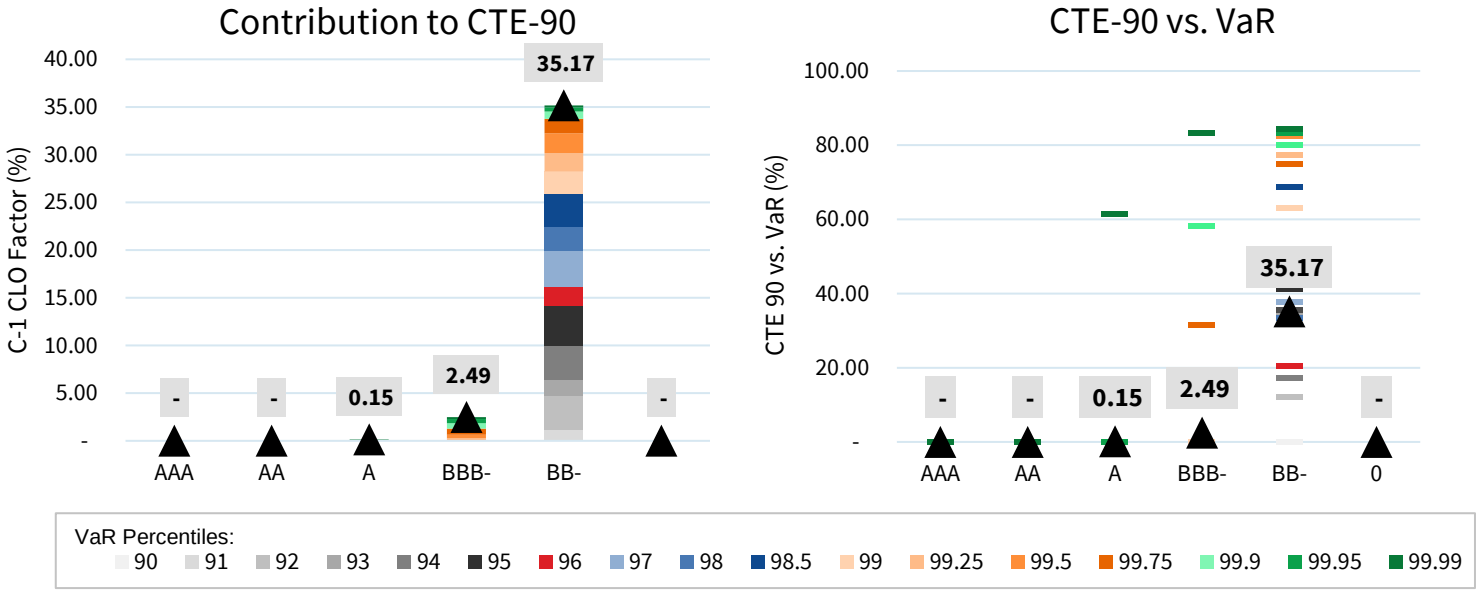
Hypothetical Results for Carlyle 2021-1, Deal ID#867578342 40



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