NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS

Date: 4/7/26

Virtual Meeting

RISK-BASED CAPITAL INVESTMENT RISK AND EVALUATION (E) WORKING GROUP
Friday, April 10, 2026
1:00 – 2:00 p.m. ET / 12:00 – 1:00 p.m. CT / 11:00a.m. – 12:00 p.m. MT / 10:00 – 11:00 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 Committee Support: Julie Gann/Maggie Chang

AGENDA

1. Hear an Update from the American Academy of Actuaries on the Collateralized Loan Obligations (CLO) Risk-Based Capital (RBC) Project: Residual Tranches—*Philip Barlow (DC)* — Attachment 1

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

3. Adjournment

Attachment 1

C-1 Subcommittee Update on CLO C-1 Factors Modeling—Residual Tranches

April 10, 2026

Stephen Smith, MAAA, FSA, CFA

Chairperson, Academy C-1 Subcommittee

American Academy of Actuaries

About the Academy

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Impact:
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Executive Summary

- The Academy calculated C-1 factors for residual tranches using Practical Expedient and Allowable Earned Yield methods under SAP
- The Academy considered the following potential comparable attributes:
  - Residual tranche detachment point
  - Deal's worst debt credit rating
  - Principal / interest paid to-date as a proportion of starting balance
  - Underlying collateral weighted average rating factor (WARF)
  - % in Baa1 and below tranches
  - % in Ba1 and below tranches
  - % in B1 and below tranches
- The Academy found that *% in Ba1 and below tranches* produces statistically significant trends among the considered covariates
- Comparable attributes for residual tranches C-1 factors do not add significant precision; the Academy recommends using a simple average Modeled C-1
- The average C-1 of both Practical Expedient and AEY methods does not differ from current post-tax C-1 factor with statistical significance; hence, the Academy recommends **no changes to the current post-tax factor of 35.55%**

Estimating C-1 Under Practical Expedient Accounting

$$C1 = \frac{PV(Max\ Accumulated\ Deficiency)_{\ YE\ 2024}}{Book\ Value_{YE\ 2024}}$$

- Book Value (BV) $_{t+1}$ = BV_t – Interest $_t$ – Principal Distributions[1] $_t$
- Accumulated Deficiency $_t$ = min{0, (1+r_{accum})× Accumulated Deficiency_{t-1} + Stat Net Income (NI) $_t$ + (Realized BV Loss_t) - (Realized Balance Loss $_t$ x Tax Rate) + Δ DTA $_t$ }
  - NI_t = – Interest $_t$ x Tax Rate
  - Deferred Tax Asset (DTA) = (Total Balance $_t$ – BV_t) x Tax Rate
  - Since the change in (Balance – BV) equals paid Interest, then NI and ΔDTA perfectly offset
  - Assuming buy and hold, the only Realized Loss is at the end of the projection period, equal to remaining BV or Balance
- When the loss is realized, the tax rate times the outstanding *balance* is counted as a tax recovery, which eliminates the DTA balance

[1] A Principal Contribution is a negative Principal Distribution

Estimating C-1 Under Allowable Earned Yield

$$C1 = \frac{PV(Max\ Accumulated\ Deficiency)_{\ YE\ 2024}}{Book\ Value_{YE\ 2024}}$$

- Allowable Earned Yield (AEY) = residual tranche IRR over run-off period
- $BV_{t+1} = BV_t - \max\{0, Interest_t - Max\ AEY_t + Cumulative\ Shortfall_t\} - Principal\ Distributions^1{}_t$
  - $Max\ AEY_t = AEY_t \times BV_{t-1}$
  - $Cumulative\ Shortfall_t = \min\{0, Interest_t - Max\ AEY_t + Cumulative\ Shortfall_{t-1}\}$
- $Accumulated\ Deficiency_t = \min\{0, (1+r_{accum}) \times Accumulated\ Deficiency_{t-1} + NI_t + (Realized\ Book\ Value\ Loss_t) - (Realized\ Balance\ Loss_t \times Tax\ Rate) + \Delta\ DTA_t\}$
  - $NI_t = \min(Interest_t, Max\ AEY_t) + \max(\Delta\ Cumulative\ Shortfall_t, 0) - Interest_t \times Tax\ Rate$
  - $DTA_t = (Total\ Balance_t{}^2 - BV_t) \times Tax\ Rate$
- When the loss is realized, the tax rate times the outstanding *balance* is counted as a tax recovery, which eliminates the DTA balance

[1] A Principal Contribution is a negative Principal Distribution
[2] Total Balance = Original Balance + Principal Contributions and Distributions

Liability- vs. Surplus-Backing Assumption

Liability-Backing	Surplus-Backing
• Statutory income is used to fulfill liability cashflows • When a loss occurs, the insurer uses its capital to absorb it • Typically leads to higher C-1 factors	• Statutory income is retained in surplus and earns interest • When a loss occurs, the insurer uses the accumulated statutory income first then its own capital to absorb it • Typically leads to lower C-1 factors

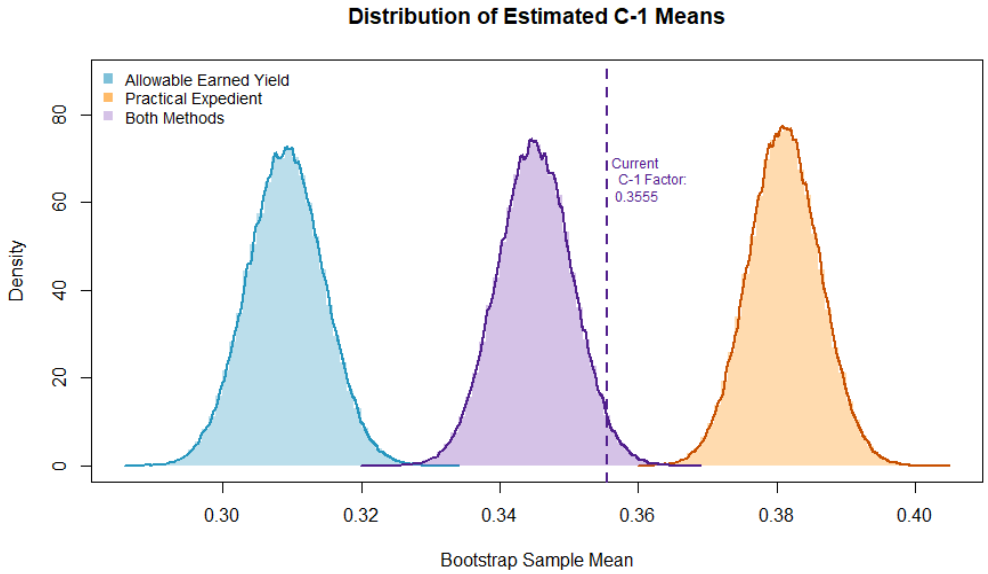
- Accumulated deficiencies under AEY are sensitive to the assumption of whether the residual tranches are liability- or surplus-backing, but not under Practical Expedient
- The results presented assume residual tranches are surplus-backing

Practical Expedient vs. AEY

Modeled C-1 factors under Practical Expedient are higher than AEY for two reasons:

1. Under Practical Expedient, BV shrinks faster; denominator effect increases C-1 factor as a proportion of BV for residual tranches that have been held by insurers for several years prior to the model start date.
2. AEY accumulates more interest that offsets deficiencies

The current post-tax factor of 35.55% sits between the Practical Expedient and AEY averages; the average of both methods does not differ from 35.55% with statistical significance



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Initial Comparable Attributes Results

- The Academy regresses Modeled C-1 against potential comparable attributes
- Tranche thickness (detachment point) shows up as *not statistically significant*
- The std dev of C-1 is 23.4% while the std dev of model residuals is 20.4%

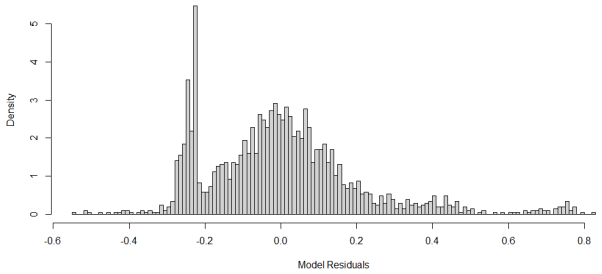
Regression Results

```
Residuals:
     Min       1Q   Median       3Q      Max
-0.54200 -0.14513 -0.01448  0.09418  0.82102

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)     0.469939   0.039508  11.895  < 2e-16 ***
TR_DP          -0.041690   0.140636  -0.296 0.766926
max_rating_num  0.008390   0.002495   3.363 0.000784 ***
int_prin_to_face -0.353712   0.014022 -25.225  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2044 on 2061 degrees of freedom
Multiple R-squared:   0.24,     Adjusted R-squared:  0.2389
F-statistic:   217 on 3 and 2061 DF,  p-value: < 2.2e-16
```

Comparable Attributes Considered

- TR_DP: Tranche Detachment Point
- max_rating_num: Deal's worst debt rating (where Aaa=1, Aa1=2, etc.)
- int_prin_to_face: Ratio of the sum of interest and net principal paid to model start-date, as a proportion of original face value (capped at 0 and 1)

Model Residuals



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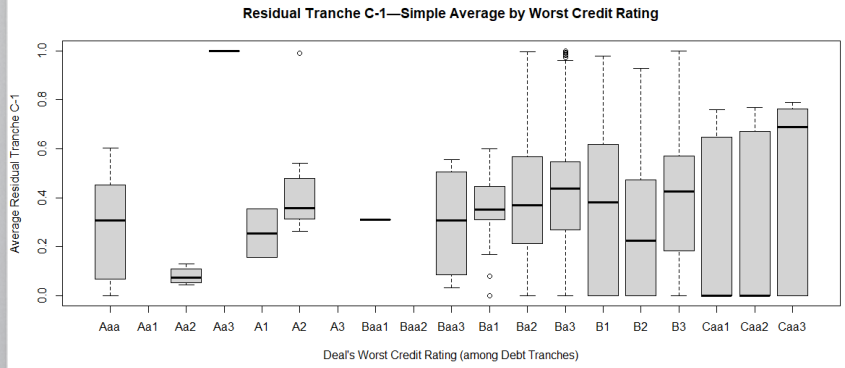
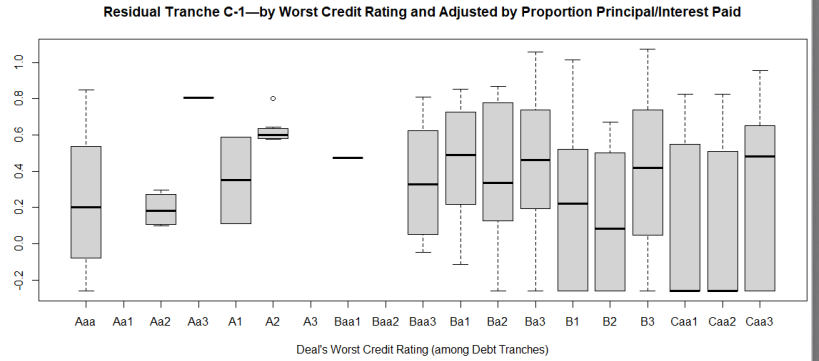
Limitations of Worst Credit Rating

- While a lower worst credit rating does *on average* indicate a greater C-1, there is not monotonicity across ratings
- When adjusting for the proportion of principal and interest already paid (assuming the mean value), the same problem persists
- The wide inter-quartile ranges (IQRs) indicate potential credibility issues with the data





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Alternative Comparable Attributes Results

- To address the issue of credibility, the Academy considered the proportion of balance within "low quality" debt CLO tranches (defined by different cutoff points)
  - The different cutoff points considered are: Baa1, Ba1, B1 and Caa1
- When adding these variables, max_rating_number becomes not statistically significant
- Condensing the credit covariates to just Ba1 / below balance improves adjusted R^2

Regression Results

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.56188 -0.13789 -0.01022  0.09615  0.79782

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)        0.549651   0.035209  15.611  < 2e-16 ***
int_prin_to_face  -0.379164   0.014863 -25.511  < 2e-16 ***
max_rating_num     0.001610   0.002666   0.604    0.546
prop_Baa1_or_worse -0.337739   0.208908  -1.617    0.106
prop_Ba1_or_worse   1.243862   0.314028   3.961 7.72e-05 ***
prop_B1_or_worse    0.063491   0.236081   0.269    0.788
prop_Caa1_or_worse -0.217409   0.237772  -0.914    0.361
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2022 on 2058 degrees of freedom
Multiple R-squared:  0.2574,    Adjusted R-squared:  0.2553
F-statistic: 118.9 on 6 and 2058 DF,  p-value: < 2.2e-16
```

Regression Results

```
Residuals:
     Min       1Q   Median       3Q      Max
-0.57390 -0.13933 -0.01038  0.09677  0.79860

Coefficients:
                  Estimate Std. Error t value Pr(>|t|)
(Intercept)       0.552376   0.009091  60.759  < 2e-16 ***
int_prin_to_face -0.379661   0.014275 -26.596  < 2e-16 ***
prop_Ba1_or_worse  0.866327   0.112676   7.689 2.28e-14 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2021 on 2062 degrees of freedom
Multiple R-squared:  0.2562,    Adjusted R-squared:  0.2555
F-statistic: 355.2 on 2 and 2062 DF,  p-value: < 2.2e-16
```


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Considering WARF and Detachment Point

- The Academy also considered WARF and residual tranche detachment point (TR_DP) as potential covariates
- Both are statistically significant when the only other covariate is the interest/principal paid to-date
- They become less significant when max debt rating is added and have p-values > 70% when proportion Ba1 / below is added
- Adjusted R^2 is optimized when WARF/TR_DP are subsumed into debt ratings and removed from the regression

```
Residuals:
     Min       1Q   Median       3Q      Max
-0.57888 -0.13838 -0.01083  0.09705  0.79928

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)        5.430e-01  3.344e-02  16.238  < 2e-16 ***
int_prin_to_face  -3.808e-01  1.462e-02 -26.041  < 2e-16 ***
WARF               5.219e-06  1.420e-05   0.368    0.713
TR_DP             -4.264e-02  1.488e-01  -0.287    0.774
prop_Ba1_or_worse  8.266e-01  1.524e-01   5.425 6.49e-08 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2022 on 2060 degrees of freedom
Multiple R-squared:  0.2563,    Adjusted R-squared:  0.2548
F-statistic: 177.5 on 4 and 2060 DF,  p-value: < 2.2e-16
```

```
Residuals:
     Min       1Q   Median       3Q      Max
-0.52588 -0.13984 -0.01463  0.09715  0.83088

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)        4.584e-01  2.978e-02  15.392  < 2e-16 ***
int_prin_to_face  -3.711e-01  1.461e-02 -25.395  < 2e-16 ***
WARF               5.582e-05  1.078e-05   5.178 2.46e-07 ***
TR_DP             -3.882e-01  1.354e-01  -2.867  0.00419 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2036 on 2061 degrees of freedom
Multiple R-squared:  0.2457,    Adjusted R-squared:  0.2446
F-statistic: 223.7 on 3 and 2061 DF,  p-value: < 2.2e-16
```

```
     Min       1Q   Median       3Q      Max
-0.52383 -0.14003 -0.01299  0.09547  0.85346

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)        3.886e-01  4.325e-02   8.985  < 2e-16 ***
int_prin_to_face  -3.738e-01  1.465e-02 -25.516  < 2e-16 ***
WARF               5.002e-05  1.108e-05   4.514 6.71e-06 ***
TR_DP             -2.559e-01  1.478e-01  -1.731   0.0836 .
max_rating_num     5.675e-03  2.555e-03   2.221   0.0264 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2034 on 2060 degrees of freedom
Multiple R-squared:  0.2475,    Adjusted R-squared:  0.246
F-statistic: 169.4 on 4 and 2060 DF,  p-value: < 2.2e-16
```


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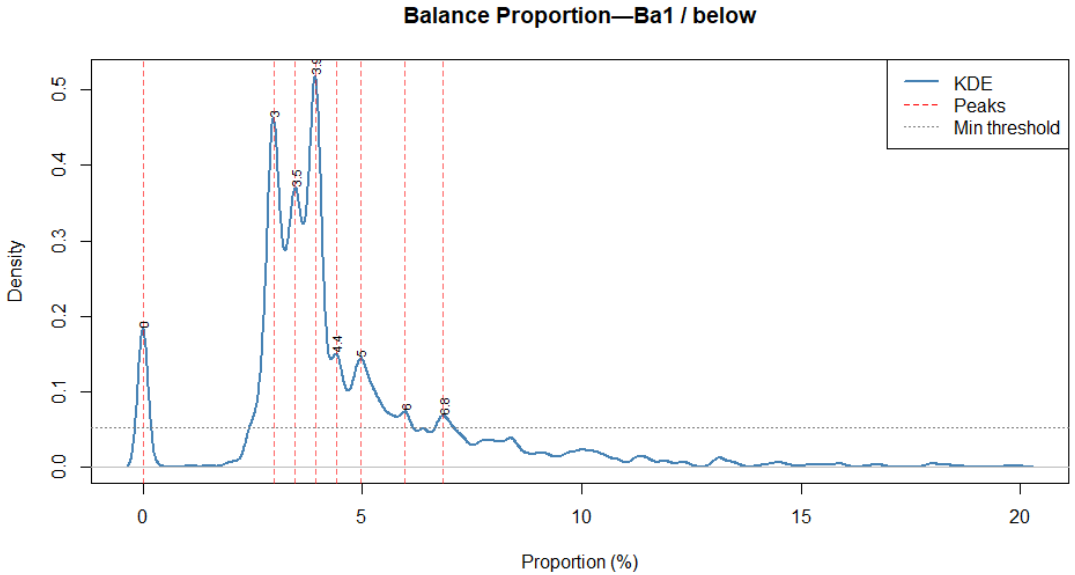
Distribution of Ba1 / Below Credit

- Balance in Ba1 or below credit averages 4.53% of total deal balance
- Proportions are clustered around 0%, 3% and 3.9%
- 87% of deals have less than 7% of balance in Ba1 or below credit



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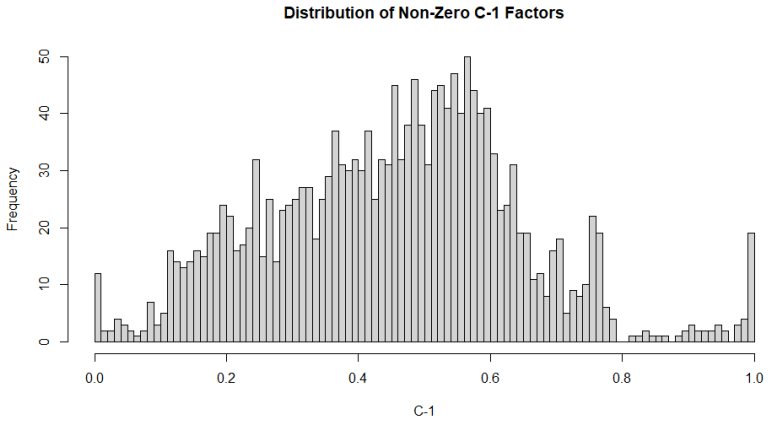
Considerations for Additional Comparable Attributes

- Assuming the range of 0% – 7% for the proportion of Ba1 / below (debt credit quality, by balance), the implied C-1 factors range from 33.87% to 39.94%
- Given the wide range of C-1 factors (large standard deviation and large IQR), the Academy proposes that the Ba1 / below credit does not add enough information to justify changes to the reporting templates; i.e., the simple average is sufficient

Considered Formula:

$$33.87\% + 86.63\% \times Proportion\ of\ Ba1/below$$

C-1 Summary Statistics:
Mean: 38.11%
Std: 24.01%
Q1: 20.02%
Median: 41.44%
Q3: 55.69%



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Questions?

For more information, please contact

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