C-1 Subcommittee Update on CLO C-1 Factors Modeling

March 2, 2026

Stephen Smith, MAAA, FSA, CFA

Chairperson, C-1 Subcommittee

American Academy of Actuaries

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Introduction

- The C-1 Subcommittee & the NAIC's Structured Securities Group (SSG) have collaborated to build a working model for CLO C-1.
- *Modeled* C-1 factors are shown based on ratings. The Academy has found ratings to include substantial information on tail risk so that ratings can serve as a comparable attribute when appropriate adjustments are made for horizon and tranche thickness.
- 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.
- Factors are horizon-neutral.

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.

Anticipated Project Timeline

- Sept. 8, 2025—initial presentation of model
- Dec. 15, 2025—status update to regulators
- Early 2026—presentation of residual tranche results, portfolio adjustment factor, model refinements, identification of potential comparable attributes, and resulting factors
- Q1 2026—incorporation of modifications requested by regulators, if any
- Q2 2026—If significant changes are not requested by regulators, expectation is for final factors to be available for exposure by April 30, 2026

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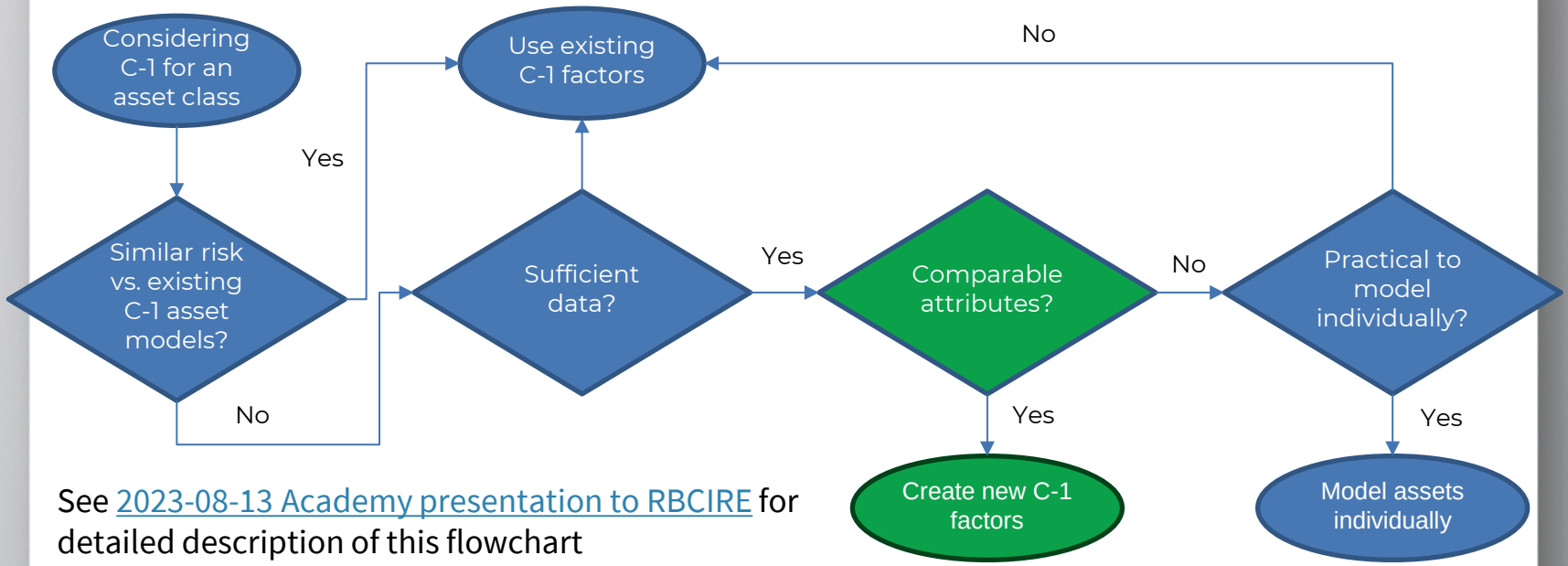
Acknowledgments

- 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
- NAIC SSG—modeling advice and running CDOnet
- NAIC Accounting Staff—guidance on CLO statutory accounting and reporting

C-1 Modeling Framework Flowchart



See 2023-08-13 Academy presentation to RBCIRE for detailed description of this flowchart

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Project Status Update as of March 2, 2026

- This presentation includes modeled base factors for CLO debt tranches.
- The Academy will quickly follow-up with modeled portfolio adjustment factors and residual tranche treatment.

Key Definitions

Raw C-1 Factors refer to the factors estimated using a 3-step modeling process (collateral model, cash flow model, and C-1 factor model) for the universe of CLOs in-scope, as described in the American Academy of Actuaries materials presented at the September 3, 2025, and December 12, 2025, NAIC RBC IRE public calls. Raw C-1 Factors are unique to each asset.

Modeled C-1 Factors refer to the factors derived using the comparable attributes modeling approach described in this presentation. Modeled C-1 Factors apply to asset groupings.

Tranche Thickness is defined as the difference between the detachment point and attachment point, both expressed as a % of the CLO balance, for a given tranche.

Reinvestment Horizon is defined as the time during which a CLO can reinvest principal payments made on its collateral into new loans.

Modeled C-1 Factors for CLO Debt Tranches

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Modeled Comparable Attributes

- Modeled tail risk can be largely explained by a combination of three attributes: remaining reinvestment horizon, rating, and tranche thickness.
- C-1 factors for other asset classes are horizon-neutral, therefore the C-1 factor for a given CLO debt tranche should not depend on its remaining reinvestment horizon.
- After adjusting for systematic differences in reinvestment horizons across ratings, CLO debt tranches can be sorted according to two comparable attributes: rating and tranche thickness (with tranche thickness only needed for CLO debt tranches rated Baa3 and lower).
- Tranche thickness can be treated in a simple manner, by dividing each rating into just two categories: tranche thickness greater than 4% and tranche thickness less than 4%.
- Alternative results are also presented that ignore tranche thickness, prioritizing ease of implementation in a rating-only framework

Option 1—Rating Only (After-Tax Factors)

Investment Grade

Rating	Simple Average Raw C-1	Modeled C-1
Aaa	0.03%	**0.03%**
Aa1	0.28%	**0.04%**
Aa2	0.00%	**0.04%**
Aa3	0.00%	**0.04%**
A1	0.40%	**0.14%**
A2	0.11%	**0.14%**
A3	0.12%	**1.45%**
Baa1	1.58%	**1.81%**
Baa2	3.02%	**2.70%**
Baa3	5.94%	**2.73%**

Below Investment Grade

Rating	Simple Average Raw C-1	Modeled C-1
Ba1	20.70%	**12.59%**
Ba2	27.37%	**20.93%**
Ba3	28.92%	**23.28%**
B1	17.34%	**26.04%**
B2	30.81%	**35.20%**
B3	56.39%	**47.32%**
Caa1	57.60%	**48.12%**
Caa2	66.51%	**55.20%**
Caa3	77.33%	**70.82%**

Option 2—Rating & Tranche Thickness (After-Tax Factors)

Investment Grade

Rating	Simple Average Raw C-1	Modeled C-1	
		Thickness > 4%	Thickness ≤ 4%
Aaa	0.03%	**0.03%**	
Aa1	0.28%	**0.04%**	
Aa2	0.00%	**0.04%**	
Aa3	0.00%	**0.04%**	
A1	0.40%	**0.14%**	
A2	0.11%	**0.14%**	
A3	0.12%	**1.45%**	
Baa1	1.58%	**1.81%**	
Baa2	3.02%	**2.70%**	
Baa3	5.94%	**2.73%**	**12.52%**

Below Investment Grade

Rating	Simple Average Raw C-1	Modeled C-1	
		Thickness > 4%	Thickness ≤ 4%
Ba1	20.70%	**12.59%**	**22.39%**
Ba2	27.37%	**20.93%**	**30.72%**
Ba3	28.92%	**23.28%**	**33.08%**
B1	17.34%	**26.04%**	**35.84%**
B2	30.81%	**35.20%**	**44.99%**
B3	56.39%	**47.32%**	**57.12%**
Caa1	57.60%	**48.12%**	**57.92%**
Caa2	66.51%	**55.20%**	**64.99%**
Caa3	77.33%	**70.82%**	**80.61%**

Appendix 1—Methodology for C-1 Factors

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Methodology for Modeled C-1 Factors

1. Ordinary Least Squares (“OLS”) regression C-1 factor model
2. Adjustments for remaining reinvestment horizon
3. Adjustments for tranche thickness
4. Isotonic regression (on CLO debt tranches rated Baa2 and higher)

Methodology for Modeled C-1 Factors
1. OLS Regression Model

The OLS regression model used to produce Modeled C-1 Factors uses the following independent variables:

- Ratings (19 indicator variables, one per rating)
- Reinvestment horizon (1 numerical variable)
- Interaction terms between reinvestment horizon and rating (6 interaction terms)
- Tranche thickness (1 indicator variable)

The adjusted R^2 for a ratings-only regression is 74.2%. Adding reinvestment horizon increases the adjusted R^2 to 76.2%. Adding interaction terms between reinvestment horizon and ratings increases R^2 to 81.6%. Adding the tranche thickness flag increases R^2 to 83.2%.

C-1 factors are produced using an unweighted OLS, rather than weighted by $ balance.

Methodology for Modeled C-1 Factors

2. Adjustment for Remaining Reinvestment Horizon

We observe reinvestment horizon is predictive of raw C-1 factors; when a security has a shorter reinvestment horizon, its raw C-1 factor is on average smaller.

The effect of reinvestment horizon on C-1 varies by rating—C-1 and its slope is ~0 for Aaa/Aa but increases especially at Baa and below IG

Because Caa has materially fewer data points, we bucket Caa with B3 and offset all other ratings (i.e., B2/B1/Ba3 and Ba2/Ba1/Baa3 etc.) for the purpose of interaction terms which results in a minor improvement to R^2 and produces monotonicity for all below-IG ratings.

We observed no correlation between reinvestment horizon and rating (p-value = 0.19). Because non-CLO C-1 factors are horizon-neutral, the modeled C-1 factors are derived by using the average reinvestment horizon across ratings of 2.41 years (balance-weighted average is near-identical at 2.40 years).

Methodology for Modeled C-1 Factors

3. Adj. for tranche thickness and 4. Isotonic Regression (Baa2 / above)

After adjusting for reinvestment horizon, an isotonic regression is applied to produce monotonic C-1 factors across rating.

Rating	Simple Average Raw C-1	Modeled C-1, Reinvestment Adjusted	Modeled C-1, Isotonic Regression Applied
Aaa	0.03%	0.03%	0.03%
Aa1	0.28%	0.27%	0.04%
Aa2	0.00%	0.00%	0.04%
Aa3	0.00%	0.04%	0.04%
A1	0.40%	0.41%	0.14%
A2	0.11%	0.10%	0.14%
A3	0.12%	1.45%	1.45%
Baa1	1.58%	1.81%	1.81%
Baa2	3.02%	2.70%	2.70%

Note that the shift in A3 from 0.12% simple average of raw C-1 to 1.45% with reinvestment adjustment is due to the relatively short horizons present in the A3 tranches in the dataset. Also note that A3 tranches are less common than A2.

Methodology for Modeled C-1 Factors

3. Adjustments for tranche thickness (Baa3 / below)

Factors are monotonic after spiking out thickness and accounting for horizon

Rating	Simple Average Raw C-1	Simple Average Raw C-1		Modeled C-1, Reinvestment Adjusted	
		Thickness > 4%	Thickness ≤ 4%	Thickness > 4%	Thickness ≤ 4%
Baa3	5.94%	2.33%	16.27%	2.73%	12.52%
Ba1	20.70%	3.39%	26.09%	12.59%	22.39%
Ba2	27.37%	8.82%	38.13%	20.93%	30.72%
Ba3	28.92%	19.87%	35.61%	23.28%	33.08%
B1	17.34%	13.68%	53.96%	26.04%	35.84%
B2	30.81%	12.68%	65.04%	35.20%	44.99%
B3	56.39%	31.15%	57.35%	47.32%	57.12%
Caa1	57.60%	35.50%	67.07%	48.12%	57.92%
Caa2	66.51%	39.12%	70.16%	55.20%	64.99%
Caa3	77.33%	74.61%	81.47%	70.82%	80.61%

Appendix 2—Modeling Choices

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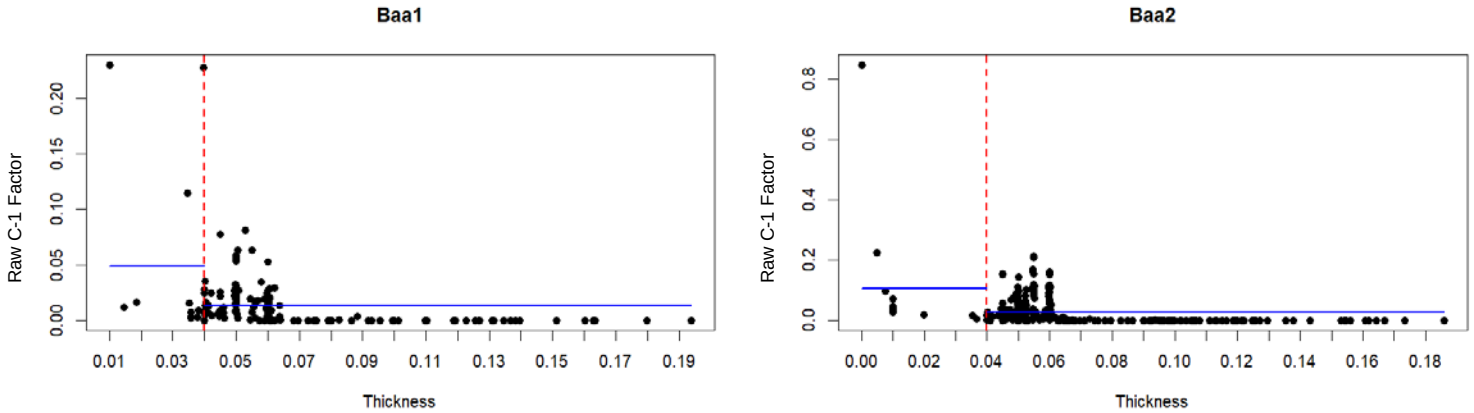
Tranche Thickness 4% Cut-Off
Baa1/Baa2

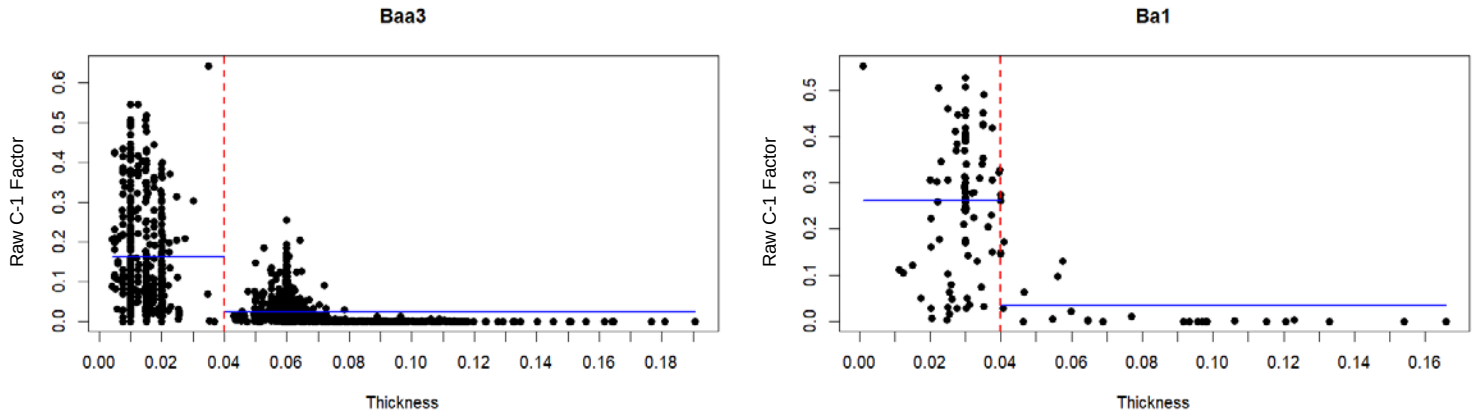


The scatterplots above show the relationship between tranche thickness and raw C-1 factor within a single rating bucket. Each dot represents one CLO debt tranche. The blue horizontal lines show the average raw C-1 factor across the dataset for CLO debt tranches of the given rating and tranche thickness (less than or equal vs. greater than 4%). The difference between the blue lines shows that tranche thickness provides information on tail risk, as represented by the raw C-1 factor, that is not captured by ratings.

Tranche thickness is not included as a comparable attribute in modeled factors for Baa1 and Baa2 due to low sample size in these ratings, even though the pattern can be observed here.

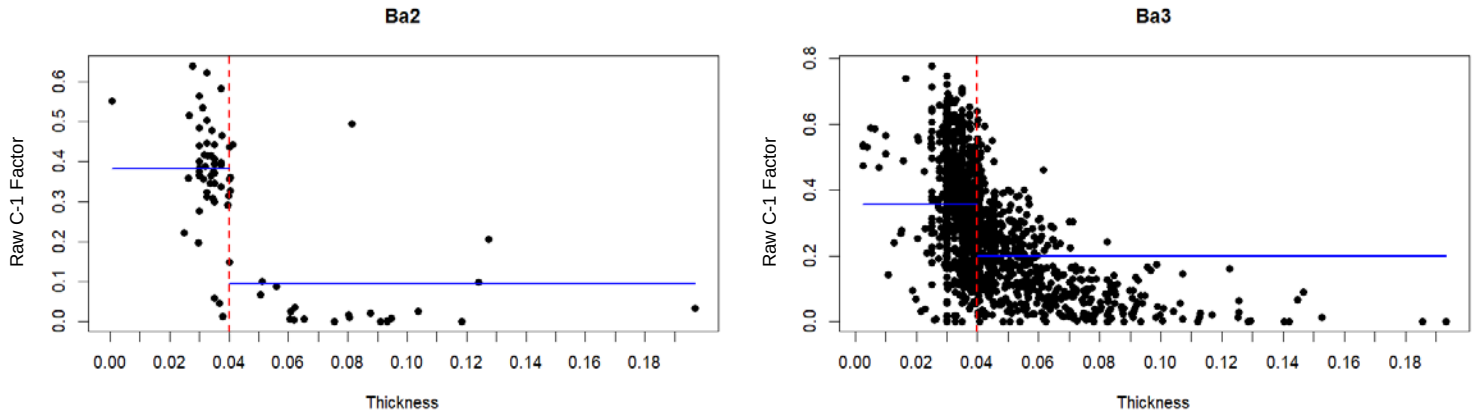
Tranche Thickness 4% Cut-Off

Baa3/Ba1



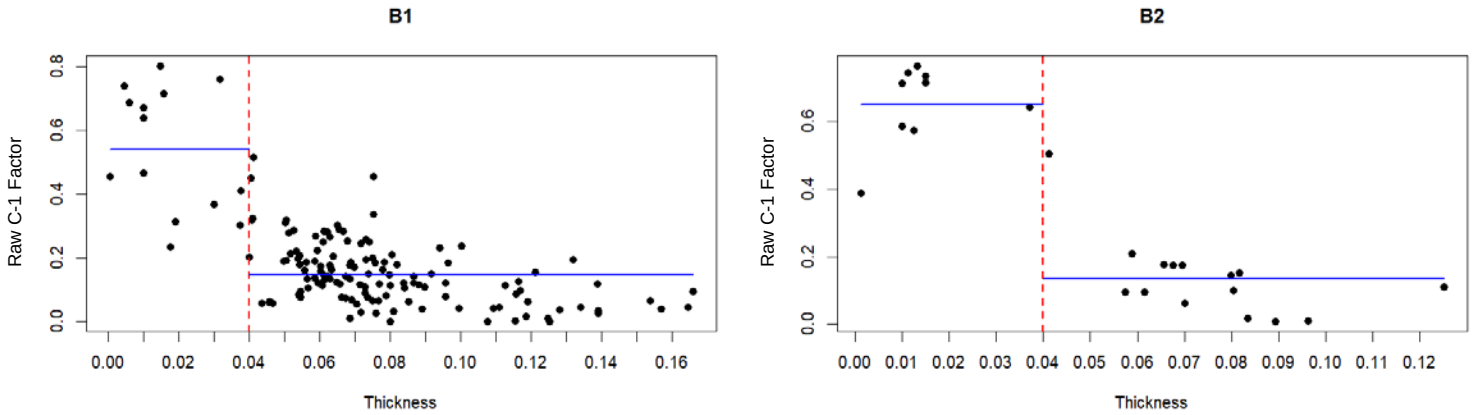
The scatterplots above show the relationship between tranche thickness and raw C-1 factor within a single rating bucket. Each dot represents one CLO debt tranche. The blue horizontal lines show the average raw C-1 factor across the dataset for CLO debt tranches of the given rating and tranche thickness (less than or equal vs. greater than 4%). The difference between the blue lines shows that tranche thickness provides information on tail risk, as represented by the raw C-1 factor, that is not captured by ratings.

Tranche Thickness 4% Cut-Off
Ba2/Ba3



The scatterplots above show the relationship between tranche thickness and raw C-1 factor within a single rating bucket. Each dot represents one CLO debt tranche. The blue horizontal lines show the average raw C-1 factor across the dataset for CLO debt tranches of the given rating and tranche thickness (less than or equal vs. greater than 4%). The difference between the blue lines shows that tranche thickness provides information on tail risk, as represented by the raw C-1 factor, that is not captured by ratings.

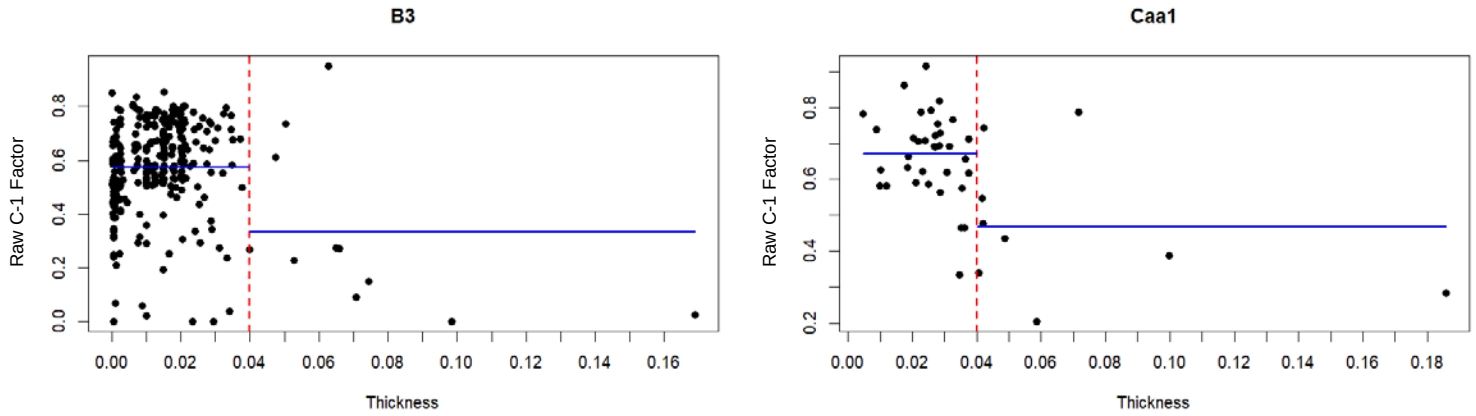
Tranche Thickness 4% Cut-Off
B1/B2



The scatterplots above show the relationship between tranche thickness and raw C-1 factor within a single rating bucket. Each dot represents one CLO debt tranche. The blue horizontal lines show the average raw C-1 factor across the dataset for CLO debt tranches of the given rating and tranche thickness (less than or equal vs. greater than 4%). The difference between the blue lines shows that tranche thickness provides information on tail risk, as represented by the raw C-1 factor, that is not captured by ratings.

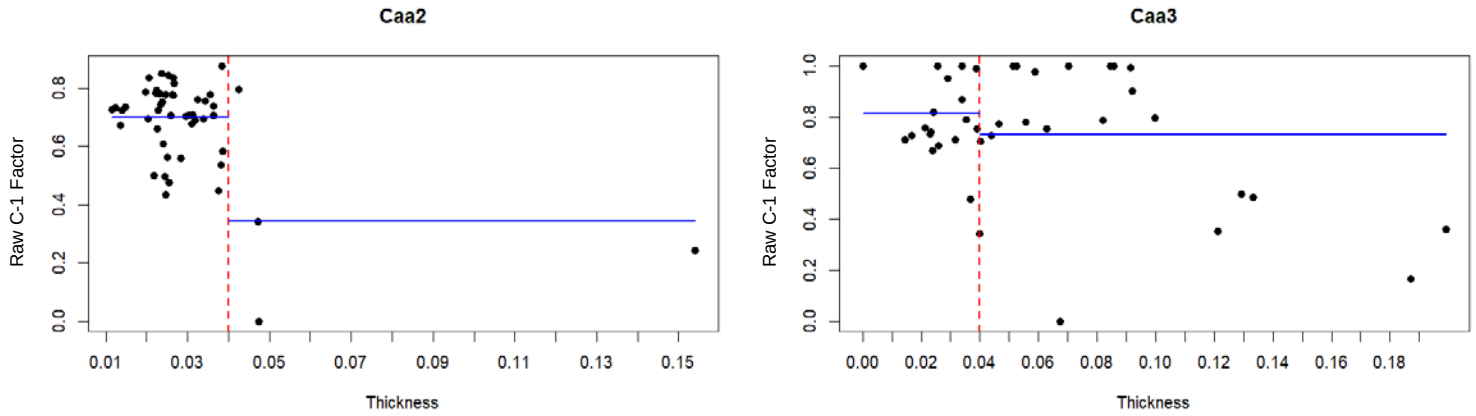
Tranche Thickness 4% Cut-Off

B3/Caa1



The scatterplots above show the relationship between tranche thickness and raw C-1 factor within a single rating bucket. Each dot represents one CLO debt tranche. The blue horizontal lines show the average raw C-1 factor across the dataset for CLO debt tranches of the given rating and tranche thickness (less than or equal vs. greater than 4%). The difference between the blue lines shows that tranche thickness provides information on tail risk, as represented by the raw C-1 factor, that is not captured by ratings.

Tranche Thickness 4% Cut-Off
Caa2/Caa3

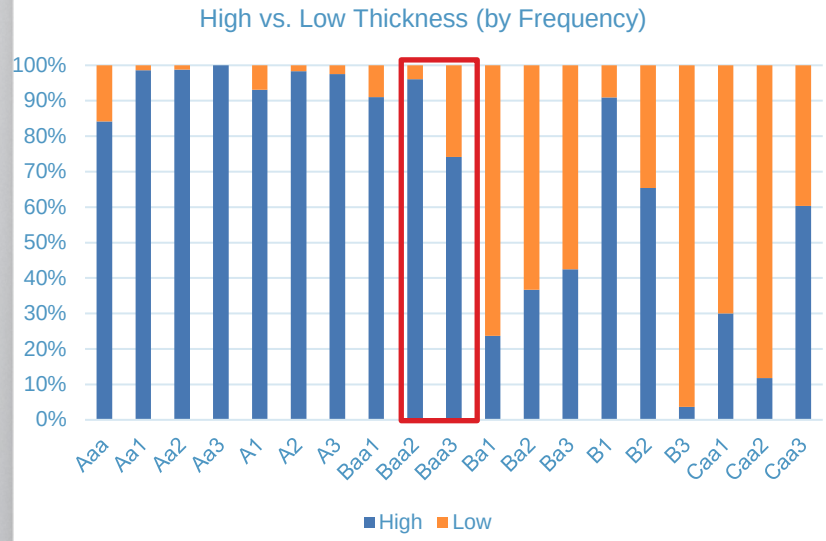


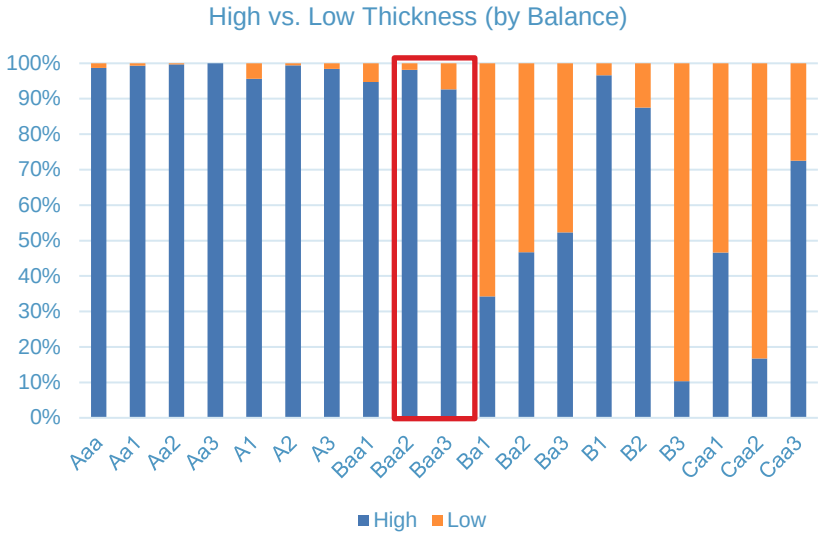
The scatterplots above show the relationship between tranche thickness and raw C-1 factor within a single rating bucket. Each dot represents one CLO debt tranche. The blue horizontal lines show the average raw C-1 factor across the dataset for CLO debt tranches of the given rating and tranche thickness (less than or equal vs. greater than 4%). The difference between the blue lines shows that tranche thickness provides information on tail risk, as represented by the raw C-1 factor, that is not captured by ratings.

*High vs. low is defined as greater than vs. less than 4%

Distribution by Tranche Thickness

Differences between Baa2 and Baa3 tranche thickness are driven by securities with smaller $ balances. In other words, the intuitive result holds that thin tranches have smaller $ balances than thick tranches for most ratings.





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*High vs. low is defined as greater than vs. less than 4%

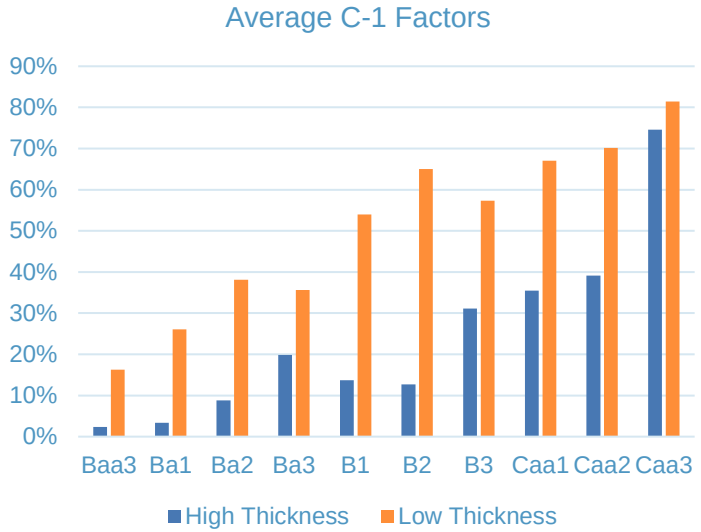
Distribution by Tranche Thickness

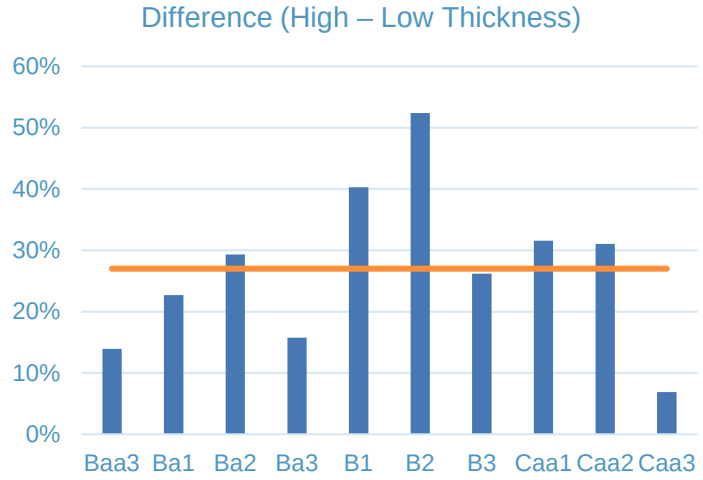
	Counts		Balance		Difference (Balance - Counts)	
	High	Low	High	Low	High	Low
Aaa	84%	16%	99%	1%	15%	-15%
Aa1	99%	1%	99%	1%	1%	-1%
Aa2	99%	1%	100%	0%	1%	-1%
Aa3	100%	0%	100%	0%	0%	0%
A1	93%	7%	96%	4%	3%	-3%
A2	98%	2%	99%	1%	1%	-1%
A3	98%	2%	98%	2%	1%	-1%
Baa1	91%	9%	95%	5%	4%	-4%
Baa2	96%	4%	98%	2%	2%	-2%
Baa3	74%	26%	93%	7%	19%	-19%
Ba1	24%	76%	34%	66%	10%	-10%
Ba2	37%	63%	47%	53%	10%	-10%
Ba3	43%	57%	52%	48%	10%	-10%
B1	91%	9%	97%	3%	6%	-6%
B2	65%	35%	88%	12%	22%	-22%
B3	4%	96%	10%	90%	7%	-7%
Caa1	30%	70%	47%	53%	17%	-17%
Caa2	12%	88%	17%	83%	5%	-5%
Caa3	60%	40%	73%	27%	12%	-12%

*High vs. low is defined as greater than vs. less than 4%

Raw C-1 Factor Averages by Tranche Thickness

Differences between high thickness and low thickness factors do not trend across rating and only have minor improvements to model fit; we use one premium across all ratings to avoid overfitting





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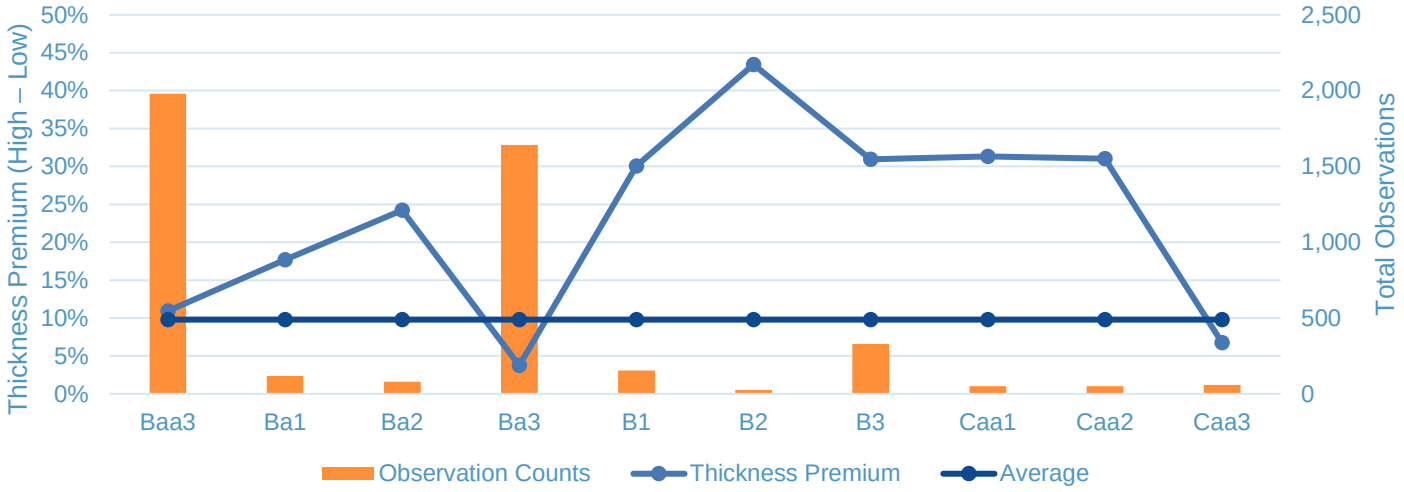
*Applying regression to standardize reinvestment horizon to mean, spiking out 4% thickness for Baa3/below and applying isotonic regression to A2/above

Model* Output Thickness Premiums

After accounting for reinvestment horizon (see next section) and estimating the thickness premium at each rating, we observe noisy results for B1/below and elect to use a single average across all Baa3/below ratings



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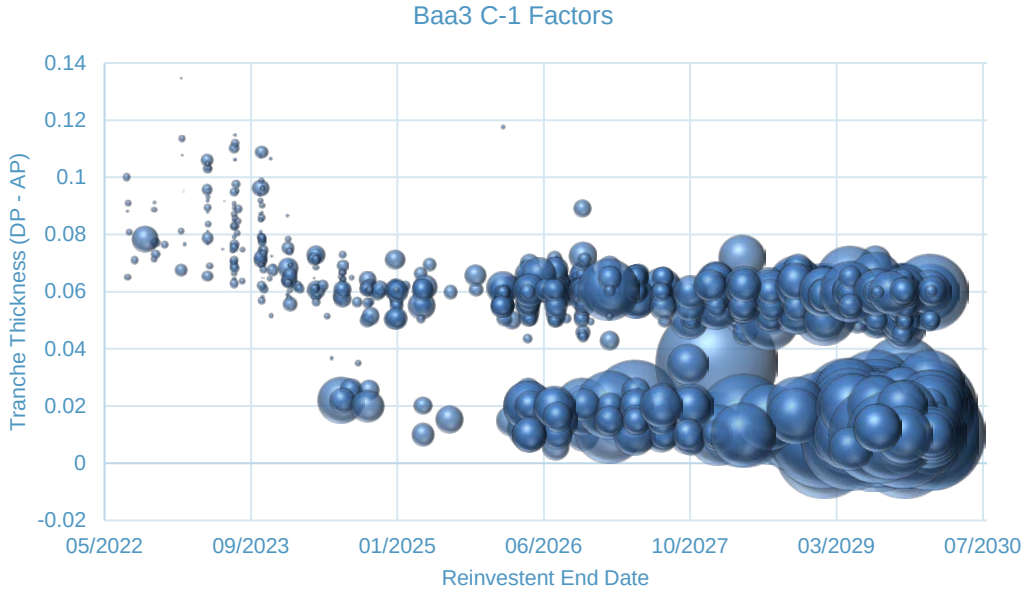
Tranche Thickness and Reinvestment Horizon

- Within Baa3 tranches, two distinct groups are represented here by two horizontal lines of bubbles.
- Each bubble represents one CLO debt tranche, with larger bubbles having higher C-1 factors.
- Bubbles are larger in the bottom row, showing that thin tranches are riskier.
- Bubbles are larger on the right, showing that longer remaining reinvestment horizons have more modeled risk.



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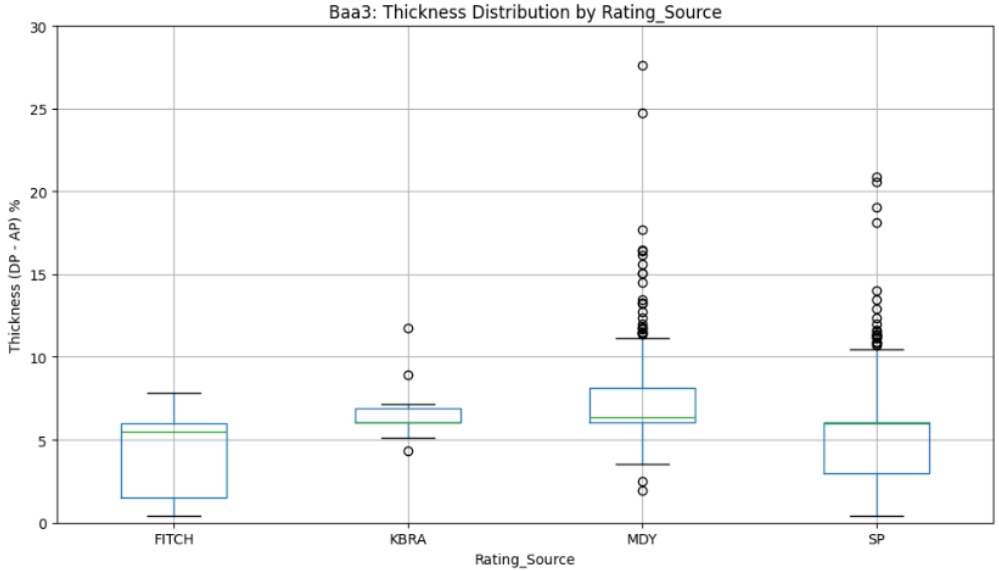
Tranche Thickness by Rating Agency

- Thinner tranches can qualify for an investment-grade rating from S&P or Fitch, which rate to the first dollar of loss (attachment point drives rating, detachment point does not).
- Moody's and KBRA* ratings incorporate severity of loss, as do modeled C-1 factors, and thus higher detachment points tend to be required for an investment-grade rating from Moody's or KBRA*.



*KBRA is drawn from a smaller sample size in the data-set, consisting of only 10 Baa3 CLOs (see following slide for further details on the dataset)

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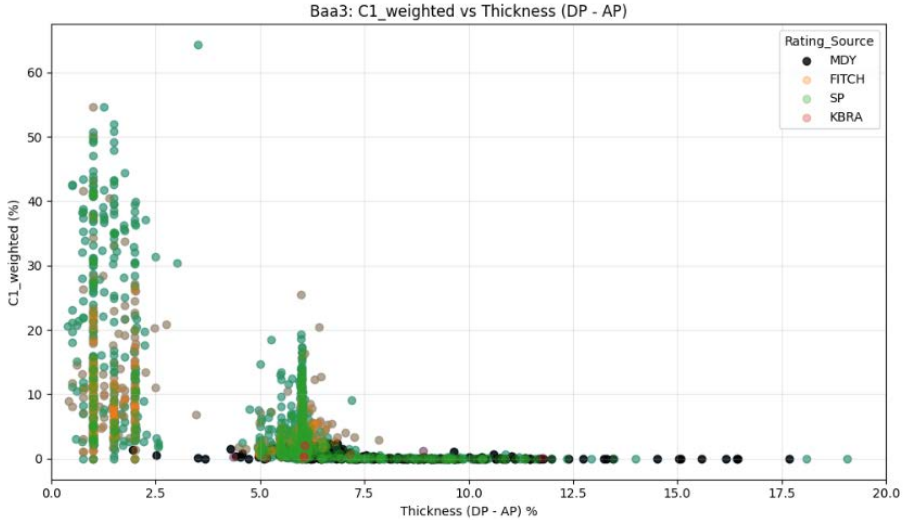
Tranche Thickness by Rating Agency

- Baa3 CLOs are clustered at a 6% thickness (typical Baa3 attaches at 12% and detaches at 18%).
- Moody's ratings (black dots) tend to have higher thickness than S&P ratings (green dots).



Thickness Distribution by Rating_Source (Baa3 only):

index	Rating_Source	count	mean	std	total_balance	avg_C1_weighted	simple_avg_C1	bal_thickness_<4%	bal_thickness_>=4%
0	FITCH	583	3.98	2.29	10371142500	4.5219	6.8773	15.35	84.65
1	KBRA	10	6.76	2.13	347144739	0.8527	0.7481	0	100
2	MDY	354	7.73	5.36	10257986866	0.6521	0.6579	0.76	99.24
3	SP	1033	5.19	2.65	23010314334	3.774	7.2659	6.72	93.28

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Reinvestment Horizon

- Adjusting reinvestment horizon to mean fixes non-monotonicity in average C-1 factors, among below investment grade ratings.

	High Thickness		Low Thickness	
Rating	Simple Average	Constant Reinvestment Horizon	Simple Average	Constant Reinvestment Horizon
Aaa	0.03%	0.03%		
Aa1	0.28%	0.27%		
Aa2	0.00%	0.00%		
Aa3	0.00%	0.04%		
A1	0.40%	0.41%		
A2	0.11%	0.10%		
A3	0.12%	1.45%		
Baa1	1.58%	1.81%		
Baa2	3.02%	2.70%		
Baa3	5.94%	2.73%	16.27%	12.52%
Ba1	20.70%	12.59%	26.09%	22.39%
Ba2	27.37%	20.93%	38.13%	30.72%
Ba3	28.92%	23.28%	35.61%	33.08%
B1	17.34%	26.04%	53.96%	35.84%
B2	30.81%	35.20%	65.04%	44.99%
B3	56.39%	47.32%	57.35%	57.12%
Caa1	57.60%	48.12%	67.07%	57.92%
Caa2	66.51%	55.20%	70.16%	64.99%
Caa3	77.33%	70.82%	81.47%	80.61%

*The effect of reinvestment horizon on C-1 is not homogenous across ratings. Due to data limitations (total observations and variance in C-1), not all ratings are credible enough to have their own interaction term; buckets were chosen to optimize adjusted R^2.

Reinvestment Horizon

Ratings with short reinvestment horizons have suppressed average C-1 factors

To estimate this effect, we regress C-1 against reinvestment horizon, with interactions to the following buckets*:

Bucket 1: Aaa

Bucket 2: Aa1, Aa2

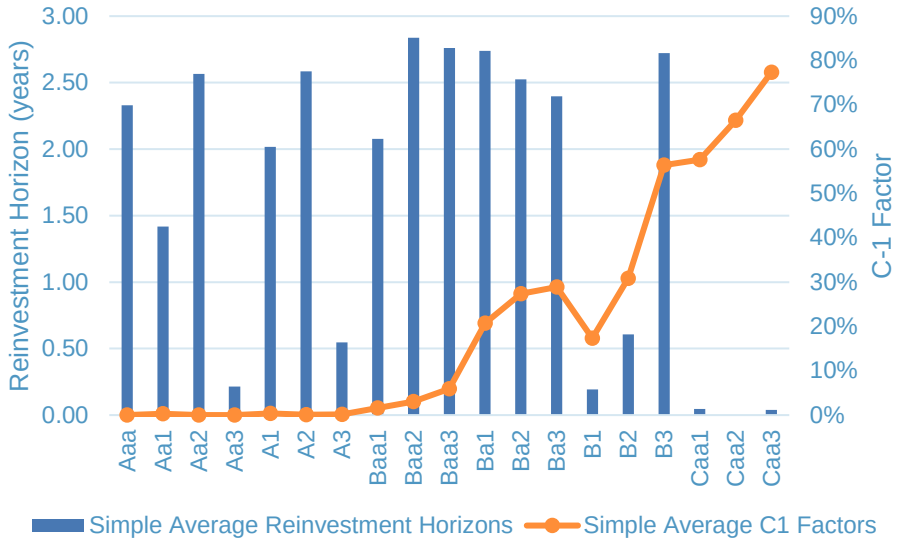
Bucket 3: Aa3, A1, A2

Bucket 4: A3, Baa1, Baa2

Bucket 5: Baa3, Ba1, Ba2

Bucket 6: Ba3, B1, B2

Bucket 7: B3, Caa1, Caa2, Caa3



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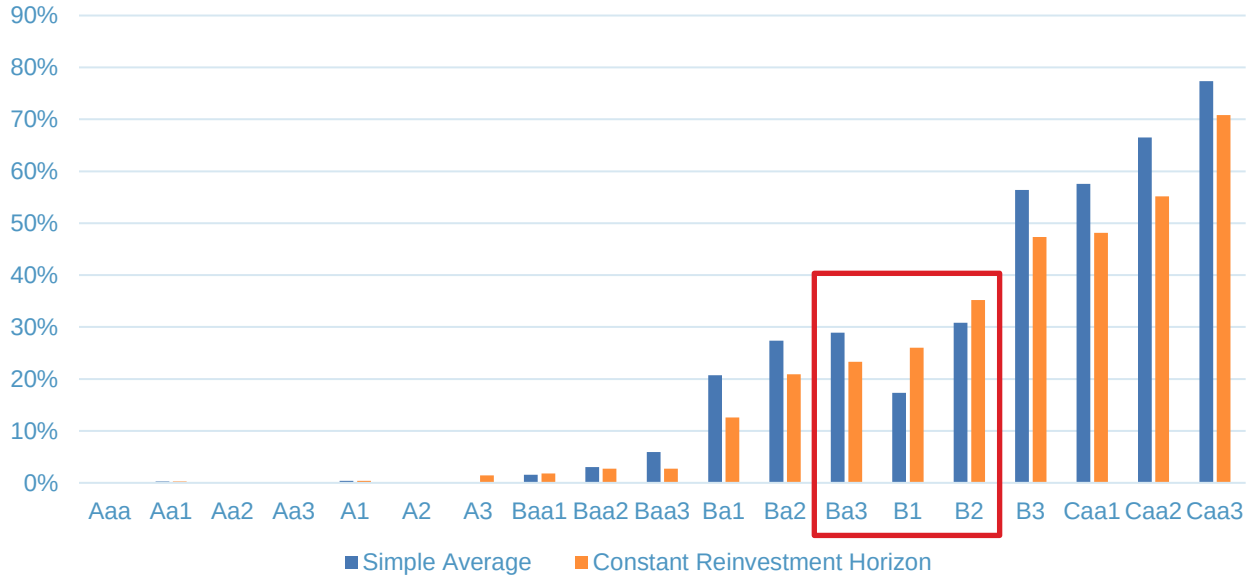
Reinvestment Horizon—High Thickness Factors



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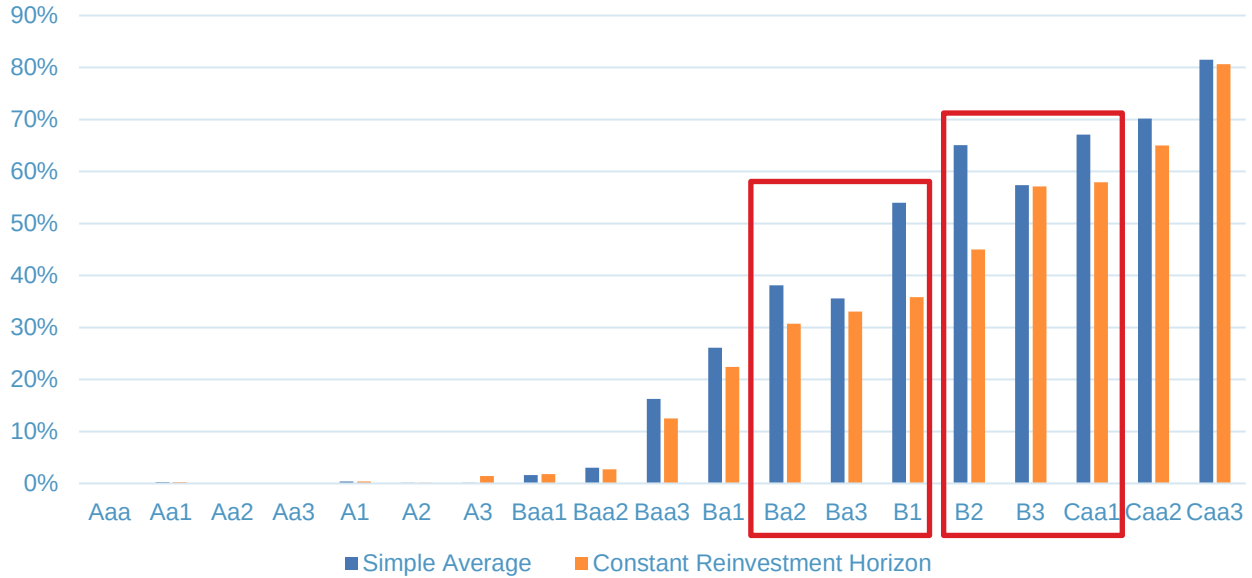
Reinvestment Horizon—Low Thickness Factors



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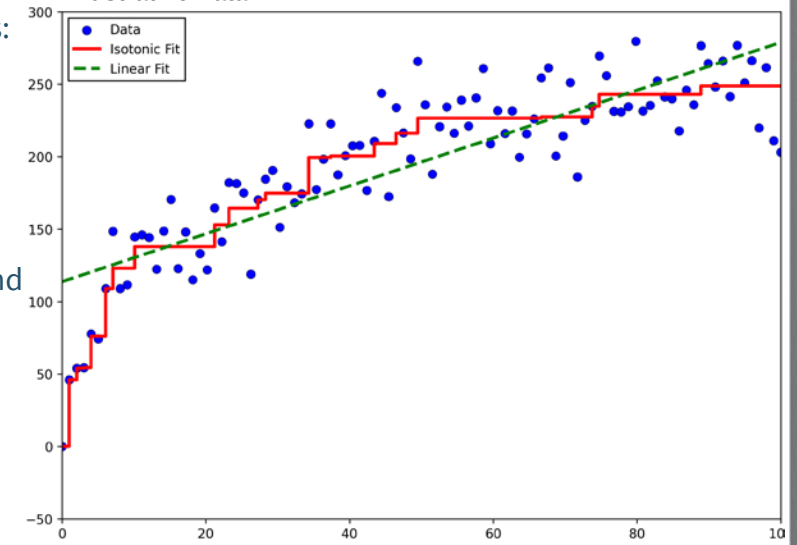
Isotonic Regression

- For $x_1 \leq x_2 \leq \cdots \leq x_n$, the isotonic regression solves:

$$\min_{\hat{y}_1,\ldots,\hat{y}_n} \sum_{i=1}^{n} (y_i - \hat{y}_i)^2 \;\; s.t. \hat{y}_1 \leq \hat{y}_2 \leq \cdots \leq \hat{y}_n$$

- The isotonic regression forces **monotonicity**, i.e., constrains data to be non-decreasing.
- The result is a **stepwise** fit where the steps correspond to weighted averages of the local points.
- The **Pool-Adjacent-Violators (PAV) algorithm** starts with $y_i = \hat{y}_i$ and identifies points where $\hat{y}_i > \hat{y}_{i+1}$.
- When violations occur, the two adjacent steps are averaged together (weighted by number of points) until monotonicity is achieved.

Illustrative Data:



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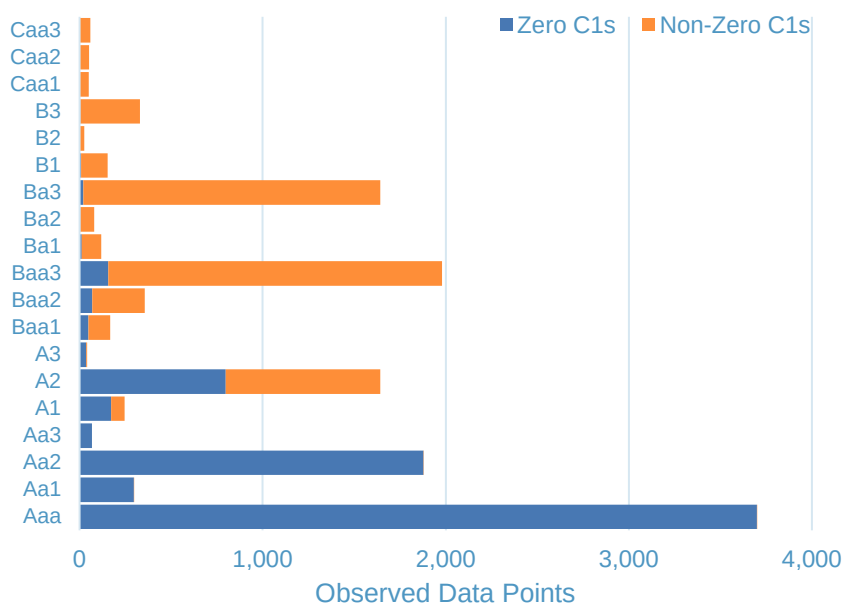
Isotonic Regression—Applied to A3/above CLO C-1 Factors

- Average C-1 factors are not monotonic across rating for Aa1 to A2.
- The frequency for non-zero C-1 factors is too low for factors to be credible for Aa1 to A2.
- Isotonic regression smooths the average C-1s.

	Total Observations	Non-Zero C-1 Observations	Average C-1 Factors	Isotonic C-1 Factors
Aaa	3,701	2	0.03%	0.03%
Aa1	297	1	0.27%	0.04%
Aa2	1,879	1	0.00%	0.04%
Aa3	68	0	0.04%	0.04%
A1	246	73	0.41%	0.14%
A2	1,642	844	0.10%	0.14%
A3	41	5	1.45%	1.45%



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Equal-Weighted (Simple) vs. Balance-Weighted Raw C-1

All Tranches

Rating	Counts	Non-Zero C-1 Counts	Simple Average	Weighted Average	Diff
Aaa	3,701	2	0.03%	0.01%	-0.02%
Aa1	297	1	0.28%	0.31%	0.03%
Aa2	1,879	1	0.00%	0.00%	0.00%
Aa3	68	-	0.00%	0.00%	0.00%
A1	246	73	0.40%	0.38%	-0.02%
A2	1,642	844	0.11%	0.10%	-0.01%
A3	41	5	0.12%	0.13%	0.01%
Baa1	168	120	1.58%	1.33%	-0.24%
Baa2	356	286	3.02%	2.56%	-0.46%
Baa3	1,980	1,824	5.94%	3.20%	-2.74%
Ba1	118	107	20.70%	19.21%	-1.50%
Ba2	79	75	27.37%	23.67%	-3.70%
Ba3	1642	1621	28.92%	26.65%	-2.27%
B1	154	146	17.34%	15.46%	-1.89%
B2	26	25	30.81%	18.70%	-12.10%
B3	330	326	56.39%	57.38%	0.99%
Caa1	50	50	57.60%	49.49%	-8.10%
Caa2	51	50	66.51%	65.78%	-0.73%
Caa3	58	57	77.33%	70.71%	-6.62%

- Average C-1 factors tend to be **lower** when weighting by current balance, as opposed to simple average
- This gap is driven by correlation between balance and tranche thickness—it dissipates when accounting for thickness and reinvestment horizon (see next page)
- Because weighted regressions have fewer effective degrees of freedom, we present unweighted results

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*Applying regression to standardize reinvestment horizon to mean, spiking out 4% thickness for Baa3/below and applying isotonic regression to A2/above

Unweighted vs. Weighted Modeled* C-1 Factors

Tranche Thickness > 4%

Rating	Counts	Non-Zero C-1 Counts	Unweighted	Weighted	Diff
Aaa	3,701	2	0.03%	0.01%	-0.02%
Aa1	297	1	0.04%	0.04%	0.00%
Aa2	1,879	1	0.04%	0.04%	0.00%
Aa3	68	-	0.04%	0.04%	0.00%
A1	246	73	0.14%	0.14%	-0.01%
A2	1,642	844	0.14%	0.14%	-0.01%
A3	41	5	1.45%	1.39%	-0.06%
Baa1	168	120	1.81%	1.70%	-0.11%
Baa2	356	286	2.70%	2.44%	-0.26%
Baa3	1,468	1,322	2.73%	2.68%	-0.05%
Ba1	28	17	12.59%	13.09%	0.49%
Ba2	29	25	20.93%	19.23%	-1.70%
Ba3	698	682	23.28%	23.57%	0.29%
B1	140	132	26.04%	25.48%	-0.56%
B2	17	16	35.20%	27.25%	-7.95%
B3	12	11	47.32%	48.53%	1.21%
Caa1	15	15	48.12%	48.53%	0.41%
Caa2	6	5	55.20%	57.99%	2.79%
Caa3	35	34	70.82%	68.02%	-2.80%

Tranche Thickness <= 4%

Rating	Counts	Non-Zero C-1 Counts	Unweighted	Weighted	Diff
Aaa	3,701	2	0.03%	0.01%	-0.02%
Aa1	297	1	0.04%	0.04%	0.00%
Aa2	1,879	1	0.04%	0.04%	0.00%
Aa3	68	-	0.04%	0.04%	0.00%
A1	246	73	0.14%	0.14%	-0.01%
A2	1,642	844	0.14%	0.14%	-0.01%
A3	41	5	1.45%	1.39%	-0.06%
Baa1	168	120	1.81%	1.70%	-0.11%
Baa2	356	286	2.70%	2.44%	-0.26%
Baa3	512	502	12.52%	11.79%	-0.73%
Ba1	90	90	22.39%	22.20%	-0.19%
Ba2	50	50	30.72%	28.34%	-2.38%
Ba3	944	939	33.08%	32.69%	-0.39%
B1	14	14	35.84%	34.59%	-1.24%
B2	9	9	44.99%	36.36%	-8.64%
B3	318	315	57.12%	57.65%	0.53%
Caa1	35	35	57.92%	57.65%	-0.27%
Caa2	45	45	64.99%	67.10%	2.11%
Caa3	23	23	80.61%	77.13%	-3.48%

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Appendix 3—Alternative Models Considered

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Tested Regressions—Part 1

Regression Exogenous Variables	Adjusted R^2	Number of Parameters	Notes
All Variables, excluding Rating (no transformations)	42.6%	47	Baseline estimate for non-rating characteristics
Attachment Point Percentile Buckets (50 equal-sized)	66.5%	50	
Thickness (DP – AP) Percentile Buckets (50 equal-sized)	45.3%	50	
Detachment Point Percentile Buckets (50 equal-sized)	76.5%	50	New baseline for non-rating characteristics. Downside: agnostic towards underlying credit quality.
Rating	74.2%	19	Baseline for ratings. Explanatory power comparable to detachment point
Rating + Detachment Point	74.4%	20	Adds little additional explanatory power over rating

Rating modeled as individual indicator variables for each of the 19 ratings

Tested Regressions—Part 2

Regression Exogenous Variables	Adjusted R^2	Number of Parameters	Notes
Rating + Detachment Point Buckets	81.8%	68	Explains an additional 7.6% of variance over ratings only
Rating + Reinvestment Horizon	76.2%	20	Reinvestment horizon explains an additional 2.0% of variance over ratings only; is the most explanatory variable when added to rating (w/o transformation)
Rating + Reinvestment Horizon x Rating (interaction terms with rating)	82.4%	37	Explains an additional 8.2% of variance over ratings only; potential overfitting on thin tranches
Rating + Reinvestment Horizon x Rating Letter (interactions with AAA, AA, A, etc.)	81.6%	26	Loses less than 1% of variance explained Adds credibility to non-standard tranches
Rating + Reinvestment Horizon x Rating Bucket (interactions with B3/below, B2/B1/Ba3, Ba1/Ba2/B3, etc.)	81.6%	26	Comparable R^2 as rating letter; adds credibility to CCC (adds observations and adds variance in horizon)
Rating + Reinvestment Horizon x Rating Bucket + Detachment Point	81.7%	27	Negligible improvement over model without DP

Rating modeled as individual indicator variables for each of the 19 ratings

Tested Regressions—Part 3

Regression Exogenous Variables	Adjusted R^2	Number of Parameters	Notes
Rating + Reinvestment Horizon x Rating Bucket + Detachment Point Buckets	85.6%	75	Detachment point (at the granular level) explains an additional 4.0% of variance
Rating + Reinvestment Horizon x Rating Bucket + Thickness	81.7%	27	Negligible improvement over model without thickness
Rating + Reinvestment Horizon x Rating Bucket + Flag for [Thickness ≤ 4% & Baa3/below Rating]	83.2%	27	Explains additional 1.6% of variance over model without thickness or DP; **chosen model**
Rating + Reinvestment Horizon x Rating Bucket + Flag for [Thickness ≤ 4% & Baa3/below Rating] * Rating	84.3%	36	Explains only 1% additional variance with 9 additional variables; potential overfitting for below-IG
Rating + Reinvestment Horizon x Rating Bucket + Flag for [Thickness ≤ 4% & Baa3/below Rating] + Detachment Point Buckets	85.7%	76	Reference point: granular detachment point data only explains an additional 2.5% of variance over chosen model

Rating modeled as individual indicator variables for each of the 19 ratings

References

- American Academy of Actuaries (2025, Sept 8). *C-1 Subcommittee Update on CLO-C1 Factors Modeling [Slides].* NAIC RBC IRE Public Call.
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Questions?

For more information, please contact

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