The NAIC Capital Markets Bureau monitors developments in the capital markets globally and analyzes their potential impact on the investment portfolios of U.S. insurance companies. Previously published NAIC Capital Markets Bureau Special Reports are available via its web page and the NAIC archives (for reports published prior to 2016).

Collateralized Loan Obligation (CLO) – Stress Testing U.S. Insurers' Year-End 2020 Exposure

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Executive Summary

- Similar to year-end 2019, the Stress Thesis for the NAIC Capital Markets Bureau (CMB) and Structured Securities Group (SSG) remains that the consequences of less stringent underwriting on the underlying bank loan collateral will result in substantially lower recovery rates during the next recession.
    - Since the uncertainties associated with the COVID-19 pandemic have subsided and the potential impacts were addressed in the NAIC CMB and SSG's previous CLO stress testing scenarios, no additional pandemic stresses were included on the year-end 2020 data.
- Stress test results for year-end 2020 showed:
    - Losses on "normal" CLO tranches—i.e., those with regular promises of principal and interest—reached A-rated tranches under the worst-case scenario.
    - For Atypical CLO tranches—i.e., those with unusual payment promises, such as equity tranches and Combo Notes—losses reached AA-rated securities.
- Based on the NAIC's stress test results, U.S. insurer investments in CLOs remain an insignificant risk. However, significant CLO exposures relative to surplus and concentrated exposures to Atypical securities like Combo Notes and low-rated tranches are potential risks, particularly in a stressed environment.

U.S. Insurers' CLO Exposure

As of year-end 2020, U.S. insurers had exposure with a book/adjusted carrying value (BACV) of $192.9 billion to CLOs collateralized predominantly by leveraged bank loans and middle market loans. The year-end 2020 exposure represents a 23% increase from $156.9 billion at year-end 2019.

U.S. insurers' CLO exposure at year-end 2020 was determined via data reported in the annual statement filings, as well as through additional analysis that was completed with third-party data sources, allowing for a more granular review.

Please see the NAIC CMB special report titled "U.S. Insurers' Collateralized Loan Obligation (CLO) Exposure Jumps Almost 23% at Year-End 2020" published in September 2021 for additional detail on CLOs and U.S. insurers' CLO exposure as of year-end 2020.

CLO Stress Test Methodology

The NAIC SSG, along with the CMB, performed a series of stress tests on U.S. insurer holdings of CLOs as of year-end 2020. The stress testing included three scenarios, similar to previous stress testing on U.S. insurers' CLO exposure, each with increasing conservatism (Scenarios A, B, and C; see Table 1). Note that a probability of occurrence was not assigned to any of the stress test scenarios; these scenarios are not meant to value the securities. The goal was to measure the potential impact of CLO distress on insurance company balance sheets.

Table 1: NAIC CLO Stress Test – Summary

	Year-End 2019 Runs	Year-End 2020 Runs
Scenarios	A, B, C	A, B, C
CLOs Analyzed	Held at YE2019	Held at YE2020
Underlying Portfolio	As of December 2019	As of December 2020

Our Stress Thesis is that **the consequences of less stringent underwriting on the underlying bank loan collateral will result in substantially lower recovery rates during the next recession**. Specifically, the stress tests aim to show how CLOs would fare if bank loan recoveries deteriorated from historical norms as compared to unsecured debt recoveries. In addition, the recovery stress scenario was run under both a historical and a moderately stressful default environment.

The NAIC endeavored to model all tranches of broadly syndicated loan (BSL) CLOs held by U.S. insurers at year-end 2020. Excluded were CLOs securitized by middle market loans and commercial real estate; collateralized debt obligations (CDOs) collateralized by asset-backed securities (ABS) and trust preferred securities (TruPS); and collateralized bond obligations (CBOs) and resecuritizations.

A full report on the CLO Stress Tests Methodology may be found on the NAIC's CMB web page.

Default Rates

The NAIC SSG and CMB used Moody's Analytics CDOnet to model the CLO waterfalls. CDOnet publishes the underlying bank loan portfolios, and the NAIC SSG and CMB used the reported collateral and ratings in the stress testing analysis. Base default rate data was obtained from Moody's Annual Default Study published in 2021 (Moody's Study).[1] The stress tests used 10-year cohort data for all cohorts with at least 10 years (1970–2011), and an issuer-weighted average term structure of default rates was calculated for each broad rating category (e.g., Baa, Ba, etc.). In addition, a weighted average standard deviation (σ) was calculated for each tenor.

Two of the original default scenarios were retained for the stress tests: "Historical" and "Historical + 1σ." For Scenarios A, B, and C, rating category default rates were scaled by historical ratios to produce rating-specific default vectors as shown in Table 2 and Table 3.

Table 2: "Historical" Default Vectors

	1	2	3	4	5	6	7	8	9	10
Ba1	0.6%	1.7%	3.0%	4.2%	5.4%	6.6%	7.5%	8.3%	9.0%	9.9%
Ba2	0.9%	2.2%	3.7%	5.2%	6.8%	8.1%	9.3%	10.6%	12.1%	13.6%
Ba3	1.7%	4.5%	7.5%	10.9%	13.8%	16.6%	19.1%	21.4%	23.6%	25.8%
B1	2.4%	6.2%	10.1%	13.6%	17.1%	20.3%	23.4%	26.2%	28.5%	30.6%
B2	3.7%	9.0%	14.1%	18.5%	22.4%	26.0%	28.9%	31.1%	33.4%	35.7%
B3	5.8%	12.3%	18.5%	23.7%	28.4%	32.5%	36.0%	39.1%	41.8%	44.1%
Caa	12.0%	21.5%	28.9%	34.7%	39.3%	43.0%	46.3%	49.1%	51.5%	53.6%
Ca-C	53.1%	65.5%	72.7%	77.2%	77.2%	77.2%	77.2%	77.2%	77.2%	77.2%

Table 3: "Historical + 1σ" Default Vectors

	1	2	3	4	5	6	7	8	9	10
Ba1	1.1%	3.3%	5.3%	7.1%	9.0%	10.6%	11.6%	12.4%	13.2%	14.0%
Ba2	1.8%	4.3%	6.6%	8.9%	11.2%	12.9%	14.4%	16.0%	17.7%	19.3%
Ba3	3.4%	8.7%	13.4%	18.6%	22.9%	26.5%	29.5%	32.2%	34.4%	36.4%
B1	4.4%	10.3%	15.8%	20.4%	24.3%	27.5%	30.7%	33.7%	36.6%	38.9%
B2	6.8%	15.0%	22.1%	27.8%	31.8%	35.2%	37.9%	40.1%	42.9%	45.5%
B3	10.6%	20.4%	29.0%	35.5%	40.2%	43.9%	47.1%	50.4%	53.6%	56.1%
Caa	19.0%	31.1%	39.5%	45.0%	49.3%	52.2%	54.6%	57.3%	59.5%	61.4%
Ca-C	84.0%	94.8%	99.3%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Certain Ca-C default rates (as highlighted in yellow in Table 2 and Table 3) were adjusted to ensure marginal defaults rates remained non-negative.

[1] Moody's, Corporates – Global Annual Default Study: Following a sharp rise in 2020, corporate defaults will drop in 2021, Excel Supplement, 2020.

Recovery Rates

Unlike the default rates, recovery rates have remained unchanged since the YE2018 stress testing. Recovery rate data was obtained from Exhibit 6 of the Moody's Study, which provides historical recovery rates for nine categories of corporate debt recoveries, ranging from first lien bank loans down to junior subordinated bonds. A portion of the defaulted amount of underlying bank loan collateral was modeled to recover at a set of recovery rate assumptions. The NAIC Stress Thesis expects the underlying bank loans to perform similar to unsecured debt in the next market downturn; other asset types in the portfolio were assumed to perform similar to their next worse category; i.e., the "stepdown" scenario.

CDOnet labels the underlying collateral as senior secured bank loan, second lien bank loan, and senior unsecured bond. We also added an "Other" category for any debt not covered by the three aforementioned categories (see Table 4).

Table 4: Mapping Recovery Rates

Collateral Label	Historical Priority Position	Stepdown Priority Position	Notes
Senior Secured Loan	1st Lien Bank Loan	Sr. Unsecured Bank Loan	Consistent with our Stress Thesis
Second Lien Loan	2nd Lien Bank Loan	Sr. Subordinated Bond	Lowest recovery avail.
Senior Unsecured Bond	Sr. Unsecured Bond	Subordinated Bond	Consistent with the Stress Thesis
Other	Jr. Subordinated Bond	Sr. Subordinated Bond	Lowest recovery avail.

Since the bulk of CLO collateral are classified as senior secured loans, the assumed recovery rate was reduced from 64% to 40% in the stepdown scenario. Recoveries were assumed to occur six months after default.

Stress Test Scenarios

Three scenarios were run: A, B, and C with varying default and recovery rate assumptions, as shown in Table 5.

Table 5: Scenarios of Stress Testing

Scenario	Default Rate	Recovery Rate
A	Historical	Historical
B	Historical	Stepdown
C	Historical + 1σ	Stepdown

What Was Not Modeled

Correlations were not explicitly modeled, as each CLO has a unique underlying portfolio, which can be diversified across several issuers and industries, and advanced correlation analysis is beyond the scope of this project.

CLO managers were also not factored into the stress testing, given the difficulty of this task. There are limited purchases and sales permitted after the reinvestment period; and while CLO managers intend to improve the credit quality of the portfolio, sometimes they do not. Historical performance is indicative, but no a guarantee of future returns, and given the dominant position of CLOs in the leveraged bank loan market, CLO manager trading decisions may be a "zero-sum game" for the CLO market in general.

Stress Test Results

At the deal level, more than 1,700 unique transactions were analyzed, totaling about $827.9 billion par value. Our analysis of the U.S. insurance industry's total CLO exposure resulted in four categories for the purposes of this report, as shown in Table 6.

Table 6: CLO Categories[2]

Category	Description	Total $bil BACV 2019	Total $bil BACV 2020
Mapped and Modeled "Normal"	Security mapped and modeled; pays normal principal and interest.	$117.07	$140.92
Mapped and Modeled "Atypical"	Security mapped and modeled; atypical promises: primarily equity and Combo Notes.	$1.38	$1.28
Out of Scope	Security can be modeled but is out of scope of our current project.	$18.90	$26.19
Need Information	More information is needed; includes CLO tickers and Combo Notes.	$19.53	$24.52

Mapped and Modeled

We were able to model $142.2 billion of U.S. insurers' year-end 2020 CLO exposure (an increase from $119 billion at year-end 2019), which was separated into two categories: Normal and Atypical. There were $140.9 billion of Normal tranches, which pay regular promises of principal and interest, and $1.3 billion of Atypical tranches. Atypical tranches have unusual payment promises, and they consist of mostly equity and Combo Note tranches.

Mapped and Modeled – Normal

The exposure to modeled Normal tranches increased by about 20% to $140.9 billion at year-end 2020 from $117.1 billion at year-end 2019. Our analysis showed that the highest-rated Normal tranches that suffered losses were rated single A in our most conservative Scenario C. However, the loss was limited to a single bond and does not necessarily indicate weakness in the structure and quality of CLOs overall.

[2] The NAIC SSG and CMB recently revised YE2019 CLO Exposure from $158.4 billion to $156.9 billion as a result of the availability of a more granular review. Accordingly, YE2019 CLO exposure by category (Total $bil BACV 2019) was updated reflecting the revised YE2019 CLO Exposure.

Table 7 shows the losses by broad rating category, where only missed principal payments were counted as losses.

Table 7: Principal Losses (P Loss) on Normal Tranches

Lowest Rating	Mapped Exposure ($ mil)	Scenario A Dec. 2020 P Loss	Scenario B Dec. 2020 P Loss	Scenario C Dec. 2020 P Loss
AAA	64,571	-	-	-
AA	34,411	-	-	-
A	22,230	-	-	0.02%
BBB	14,665	0.001%	0.1%	18.4%
BB	3,661	0.2%	25.9%	73.2%
B	751	1.5%	40.1%	94.6%
CCC	87	15.8%	61.5%	90.7%

During periods of credit stress, some mezzanine tranches may not receive interest payments if a senior overcollateralization (O/C) test was triggered. This would not constitute a default; rather, the missed interest is capitalized. If the capitalized interest is not subsequently paid back to the mezzanine tranche, then the total loss may be greater than the BACV of the tranche. Table 8 presents the losses across the three scenarios when considering both missed principal and interest payments.

Table 8: Principal and Interest Losses (PI Loss) on Normal Tranches

Lowest Rating	Mapped Exposure ($ mil)	Scenario A Dec. 2020 PI Loss	Scenario B Dec. 2020 PI Loss	Scenario C Dec. 2020 PI Loss
AAA	64,571	-	-	-
AA	34,411	-	-	-
A	22,230	-	-	0.04%
BBB	14,665	0.002%	0.1%	27.2%
BB	3,661	0.3%	36.4%	112.7%
B	751	1.9%	61.3%	158.0%
CCC	87	34.4%	113.3%	164.3%

Mapped and Modeled – Atypical

The exposure to Atypical securities remains relatively small at $1.28 billion at year-end 2020. For the stress testing, we grouped a number of obligations into the Atypical category (see Table 9). These include securities that do not have a standard principal balance (e.g., equity) or have components that do not have a standard principal balance (e.g., Combo Notes).

Equity tranches have a notional balance and are not entitled to receive principal payments. In stressed environments, O/C tests cut off cash payments to equity holders. As a result, it is not possible to calculate a principal loss on these tranches. Combo Notes are a combination of equity tranches and other tranches within a capital structure, typically rated to a return of principal only. Combo Notes have a principal balance, and all cash flows from the underlying securities are directed to their repayment.

Table 9: Principal Losses (P Loss) on Atypical Tranches

Lowest Rating	Mapped Exposure ($ mil)	Scenario A Dec. 2020 P Loss	Scenario B Dec. 2020 P Loss	Scenario C Dec. 2020 P Loss
AAA	31	-	-	-
AA	103	26.6%	26.6%	26.6%
A	126	18.6%	19.8%	20.0%
BB	21	0.0%	14.9%	86.5%
No Rating	998	77.9%	79.0%	80.8%

Similar to prior stress testing, we found that the risk on rated Combo Notes is not comparable with similarly rated Normal tranches. Rated Atypical tranches are particularly concerning, as they are susceptible to high losses in stress scenarios; however, they are concentrated in only a few companies. Additionally, about 86% of the exposure to Atypical tranches is with large insurers; i.e., insurers with total cash and invested assets of more than $5 billion. Small insurers, those with total cash and invested assets of less than $500 million, accounted for less than 1% of exposure to Atypical tranches.

Out of Scope

Tranches that were deemed "Out of Scope" for this project totaled $26.2 billion, as shown in Table 10. This represents an increase from $19 billion at year-end 2019 and was driven by the middle market CLO category.

Table 10: Out of Scope Categories

Category	Description	Total $bil BACV 2019	Total $bil BACV 2020
Collateralized Bond Obligations	Transactions classified as backed primarily by bonds - likely to include in the future.	$2.80	$5.53
Middle Market CLO	Transactions backed by Middle market companies, with little available data. Will seek to find a data source for analysis.	$14.80	$19.30
Other	Misc. categories, including resecuritizations and preferred stock.	$1.40	$1.37

Middle market CLOs are backed by loans to small and medium-sized companies. These loans have less publicly available information and may have materially different performance. For example, middle market loans have less liquidity, which may have a negative impact on recovery rates. Nevertheless, we continue seeking a data source that will allow us to analyze these CLOs.

Need Information

CLO tranches for which we need information for stress testing increased by about 17% to $24.5 billion at year-end 2020 from $21 billion at year-end 2019. This follows a 40% increase from $15.1 billion at year-end 2018. These tranches include those for which we do not have a CLO model available from our vendor,

are a Combo Note where the underlying CLO is modeled but terms and conditions of the transaction are unknown, or the insurer identified the investment as a CLO but did not identify the relevant tranche.

Analysis of Stress Test Results

The stress test analysis found that 946 U.S. insurers, with surplus of about $928.5 billion held some amount of CLO tranches modeled. Similar to last year's stress testing results, we found that the losses on insurers' CLO investments that were modeled, even in the stressed scenarios, were highly concentrated.

To understand the impact of potential losses on insurers, principal loss (compare with Table 7) for Scenarios A, B, and C was divided by each insurer's year-end 2020 total surplus. For each scenario, the principal loss as a percentage of total surplus for each of the 946 insurers was sorted from highest to lowest, and then the insurer with the largest percentage loss was referenced as "Insurer 1," the insurer with the second largest percentage loss was referenced as "Insurer 2" and so on until the smallest percentage loss, which was referenced as "'Insurer 946" (x-axis). Please note the difference in the scale of the y-axis in Charts 1, 2, and 3.

Chart 1 shows the distribution of losses as a percentage of surplus for December 2020's Scenario A. Although the bulk of insurers show no losses, 33 of the 946 insurers experienced losses in this scenario. Intuitively, the losses were derived primarily from CCC-rated CLO tranches. The largest loss as a percentage of surplus under Scenario A was 5.52%. Unlike the year-end 2019 analysis, where four insurers experienced double-digit losses, the analysis for year-end 2020 analysis resulted in no insurers with double digit losses.

Chart 1: Loss as a Percent of Surplus in December 2020 by Insurer, Scenario A

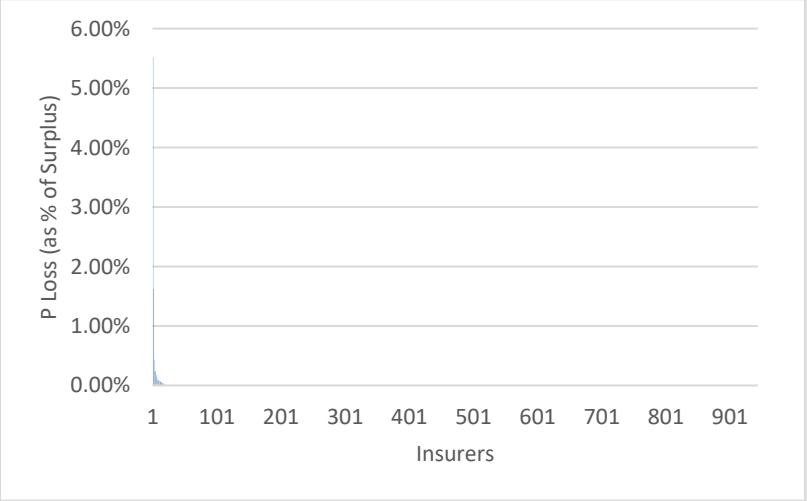


Chart 2 shows the distribution of losses as a percentage of surplus under Scenario B. Under this scenario, 107 insurers, representing a surplus of $244 billion, experienced losses. Five of the 107 insurers experienced double-digit losses, with the largest loss representing 77% of that insurer's surplus.

Chart 2: Loss as a Percent of Surplus in December 2020 by Insurer, Scenario B

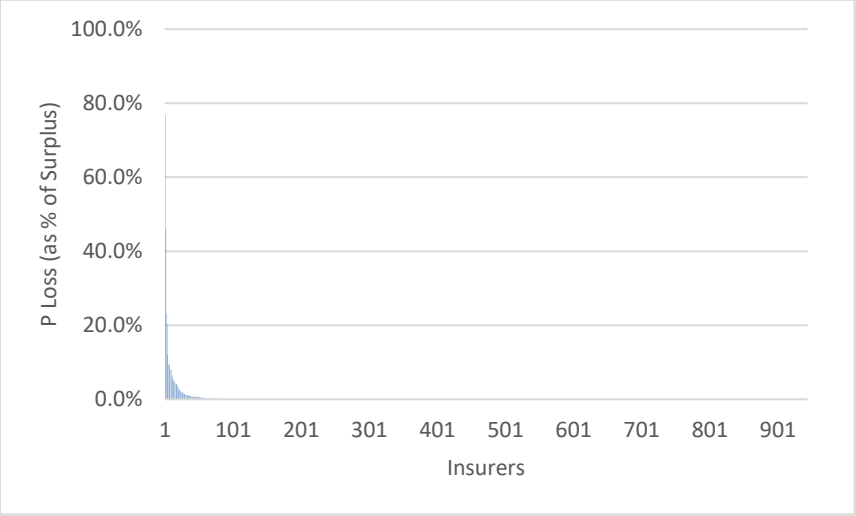
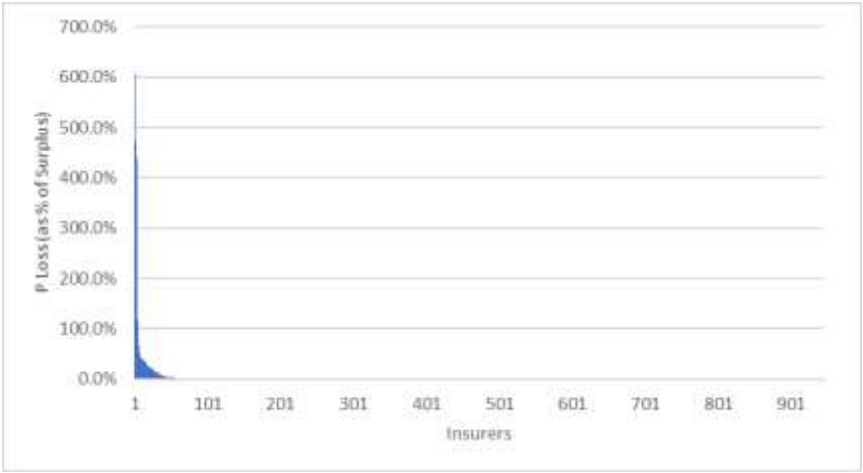


Chart 3 shows the distribution of losses as a percentage of surplus under Scenario C, the most conservative scenario. The number of insurers experiencing losses is greatest in this scenario at 215, representing $361 billion of surplus. However, 172 of the 215 insurers experienced losses of less than 5%. Five insurers experienced triple-digit losses, while 29 experienced double-digit losses. The largest loss among these insurers represented 607.5% of that insurer's surplus.

Chart 3: Loss as a Percent of Surplus in December 2020 by Insurer, Scenario C

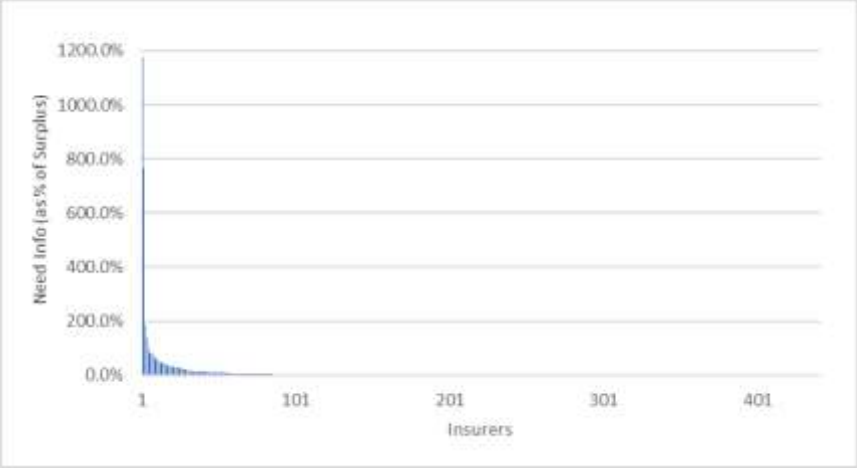


Concern remains with the concentrated exposures to CLO tranches that we cannot model; i.e., for those CLOs in the "Need Information" category. CLOs are categorized as such for several reasons. For example, we may not have a valid identifier reported, while others may be too new to have a model in place. Generally, the concern lies with the Atypical securities, either related to a broadly syndicated transaction or one that is bespoke.

Chart 4 shows the "Need Information" CLO tranches as a percentage of surplus. Note, since these tranches are not modeled, the chart does not represent loss as a percentage of surplus but rather CLO exposure as a percentage of surplus. About 441 insurers, representing about $799.2 billion of surplus, hold CLO tranches categorized as "Need Information." As a group, CLO tranches that "Need Information" represent 3.1% of surplus. However, to the extent that these are Atypical tranches and perform similarly to those we modeled, they can have an impact on solvency.

Four insurers have CLO exposures greater than 100% of surplus, with one at 1,175%; the four insurers have a total surplus of about $3.6 billion.

Chart 4: Need Info (Year-End 2020 BACV) as a Percent of Surplus by Insurer



Conclusion

The Stress Thesis for the NAIC's modeling of U.S. insurer CLO investments as of year-end 2020 assumes that lower recovery rates are expected on the underlying bank loan portfolios in the next recession due to less stringent underwriting terms. As the NAIC SSG and CMB performed stress testing on U.S. insurer CLO investments—the majority of which are high credit quality based on credit ratings—year-end 2020 **results showed that Normal tranches rated AA and higher did not experience any losses under the three scenarios tested**. The year-end 2020 stress test mirrors the year-end 2019 stress test, wherein Normal CLO A-rated tranches experienced losses under the worst-case Scenario C. In comparison, the year-end 2018 stress test resulted in no losses on Normal CLO tranches rated A and higher under the three scenarios.

Although U.S. insurer exposure to CLOs as of year-end 2020 increased to $192.9 billion from about $156.9 billion as of year-end 2019, exposure remains relatively small, at about 2.6% of total cash and invested assets. The majority (78%) of these investments are rated single A or above, so we do not believe the CLO asset class currently presents a risk to the industry as a whole.

Nevertheless, our analysis also showed that a few insurers have concentrated investments in Combo Notes and low-rated tranches. Even though they tend to perform well during stable market conditions, significant losses may occur when the environment is stressed. Given the complexity and volatility of CLO investments in general, exposure as a percent of total surplus is worth identifying, particularly for insurers with large exposures as a percentage of total surplus.

The NAIC will continue to monitor U.S. insurer investments in CLOs and report as deemed appropriate.

Useful Links:

NAIC Capital Markets Special Report – U.S. Insurers' Collateralized Loan Obligation (CLO) Exposure Jumps Almost 23% at Year-End 2020, September 2021.

NAIC Capital Markets Primer – Leveraged Bank Loans, November 2018

NAIC Capital Markets Primer—Collateralized Loan Obligations, August 2018

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