MOODY'S ANALYTICS

CMBS RESEARCH

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Author

Darrell Wheeler
Sr. Director, CMBS Research
Darrell.Wheeler@Moodys.com

David Salz
Director, CMBS
David.Salz@Moodys.com

Mukund Padmanabhan
Assc. Director, Data Production
Mukund.Padmanabhan@Moodys.com

Brian Schoenfeld
Financial Engineer, CMBS
Brian.Schoenfeld@Moodys.com

Contact Us

Americas
+1.212.553.1653
clientservices@moodys.com

Europe
+44.20.7772.5454
clientservices.emea@moodys.com

Asia (Excluding Japan)
+852.3551.3077
clientservices.asia@moodys.com

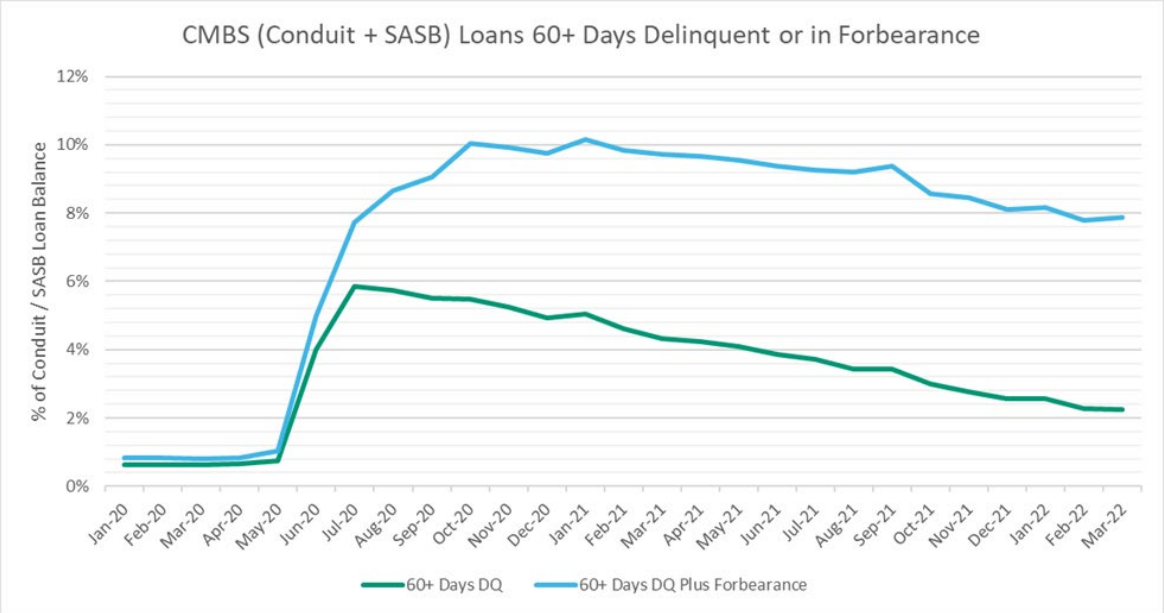
Japan
+81.3.5408 4100
clientservices.japan@moodys.com

How Might a 2022 Recession Affect CMBS Performance?

Given the increasing probability of a nearer term recession, this report studies the performance of loans originated in the years leading to the last recession and how they fared throughout. In practice, we translate the performance of 2004-2007 originated CMBS conduit loans into recession default vectors. No two interest rate environments are exactly the same, and so we also study the effect of recent interest rate increases that may challenge COVID-19 affected CMBS properties as they refinance. This is provided by a study of debt yield refinance hurdles since 2015. The combination of these two studies creates a consistent deal-specific default analysis that can be used to evaluate current vintage CMBS credit bonds (i.e., CMBS 2.0). The application of this approach suggests that most Baa3 bonds have some loss risk in a recession while most A3 rated bonds have credit enhancement that should see them avoid losses. The study has three parts:

During the COVID-19 crisis, both the CRE and CMBS markets have proven reasonably resilient by using forbearance to stabilize their troubled borrowers. Exhibit 1 shows delinquent loans transitioning to forbearance after May 2020 and then a steady improvement in both conditions starting in early 2021.

Exhibit 1. CMBS Troubled Conduit + SASB Loans (>60 Days Delinquent or in Forbearance) by Property Type



Source: Moody's Analytics CMBS Loan Data as of March 28, 2022

The potential negative economic effects of COVID-19 brought on record federal fiscal spending that supported both consumers and local governments. This spending created a strong recovery for loans that defaulted during COVID-19. *Exhibit 2 demonstrates this recovery by tracking borrower reported NOI DSCR for the loans that have cured since August 2020. This DSCR history, for the previously defaulted loans, displays the number of loans that had high DSCR back in 2019, how that DSCR shifted down during the height of COVID in 2020, and then how the loans that have reported 2021 DSCR have recovered.*

Exhibit 2. Debt Service and Debt Yield Summary -- For Loans Resolved After August 2020

	DSCR < 1			1 -1.49			1.5 -1.99			> 2.0			Not Reported			Average Debt Yield		
Property Type	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**
Retail	7	32	24	65	66	47	54	19	48	27	18	20	81	99	95	10.5	9.2	9.8
Hotel	6	190	109	36	24	46	95	6	34	121	3	45	82	117	106	10.3	3.5	7.5
Multifamily	14	20	17	9	10	12	10	5	5	0	1	1	63	60	61	7.2	5.2	6.4
Office	0	0	2	5	4	5	2	1	1	1	0	0	23	26	23	9.6	8.7	8.8
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	33	33	33	13.6	9.2	11.4
Other	3	10	8	12	16	15	13	3	6	7	1	5	53	58	54	9.4	6.2	7.6
Overall (Balance $M)	$394	$5,225	$3,184	$3,758	$3,896	$2,841	$3,560	$628	$2,045	$3,813	$465	$2,217	$4,559	$5,870	$5,796			
Overall	**30**	**252**	**160**	**127**	**120**	**125**	**174**	**34**	**94**	**156**	**23**	**71**	**335**	**393**	**372**	**10.1**	**5.7**	**8.2**

Source: Moody's Analytics CMBS Loan Data as of March 28, 2022

In Exhibit 2, there is a clear progression of loans that had a DSCR < 1x moving to have DSCR > 1x or > 1.5x in the most recent reported 2021 figures. *Yet, the average debt yields remain at levels that would leave many of these loans challenging to refinance.* In recent discussions with investors and issuers, there are expectations that the DSCRs will continue to improve back towards the previous higher 2019 levels. However, the economy now faces a further potential setback from the Russia-Ukraine conflict. Initially, the conflict has generated market volatility and energy inflation that could decrease discretionary spending, causing a recession. *In some ways, the recent equity market correction and universal bond spread widening appear similar to early 2007, causing us to wonder how another Great Financial Crisis might disrupt the ongoing CMBS post-COVID-19 recovery.*

Part I: How Did The 2007 Financial Crisis Affect 2004-2007 CMBS Loan Performance?

In the early stages of the 2007 recession, the CMBS market continued to bring new issuance at wider spreads well into the summer of 2007, only to gradually cease issuance by early 2008. Well into 2007 market participants viewed the early CMBS spread widening as a relative value shift in sympathy with the large dislocations taking place in home prices, residential mortgage defaults, and RMBS/CDO spreads. *That 2007 experience highlights how recessions are difficult to anticipate and usually not fully appreciated until well after the economic indicators are reported.* Further, that experience suggests that when extraneous factors emerge (such as an RMBS selloff or another extraneous event), it may be prudent to consider that a recession could emerge within a six-month period. *To help with such an evaluation, this paper reviews how the Great Financial Crisis impacted CMBS performance and then applies that performance to CMBS 2.0 conduit transactions.*

To consider pre-recession securitizations, we selected $514.7 billion universe of pre-recession CMBS conduit loans from the Moody's Analytics CMBS loan database. The study tracked the performance of these loans as the recession set in and through to each loan's resolution. Exhibit 3 summarizes the pre-recession loans included in our default study. The majority of these loans were issued just before and during 2007. At that time, the average loan coupon was 5.69%, which was a relatively high interest obligation to carry through the recession. Nonetheless, the average precrisis NOI debt yield still averaged more than 11%, except for the trailing debt yield on the 2006 vintage, which had dropped down to 10.8%.

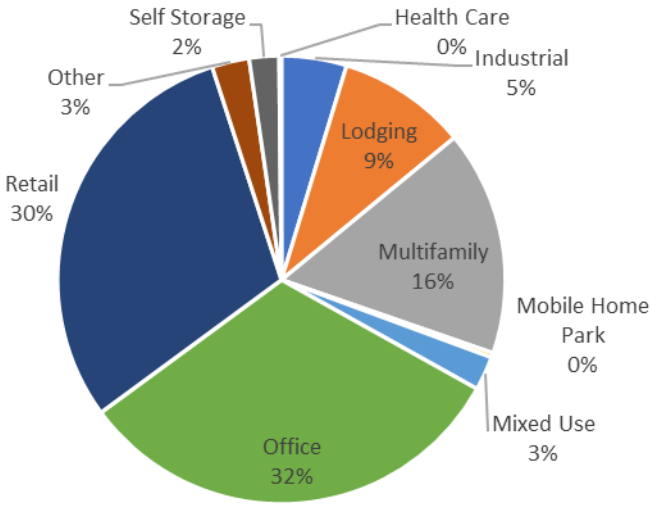
Exhibit 3. CMBS Default Study Universe (2004-2007)

Year of Securitization	2004	2005	2006	2007	Total
Balance	$64,506,848,701	$126,132,304,172	$147,330,034,911	$176,692,977,741	$514,661,165,525
Loan Count	6,023	9,835	10,448	11,009	37,149
Note Rate	5.54%	5.35%	5.84%	5.85%	5.69%
Remaining Term (months)	108	106	110	106	108
Remaining Amortization	298	258	233	153	220
Trailing LTV	62.5%	68.3%	68.3%	69.0%	67.8%
Trailing DSCR	1.87x	1.82x	1.55x	1.52x	1.65x
UW Debt Yield	14.1%	11.5%	11.4%	12.9%	12.3%
Trailing Debt Yield	16.6%	12.7%	10.7%	12.9%	12.7%
Average Loan Size	$10,710,086	$13,045,021	$14,101,267	$16,049,775	$13,853,971
Max Loan	$320,000,000	$349,730,000	$806,000,000	$1,500,000,000*	$1,500,000,000
Min Loan	$118,609	$94,890	$175,000	$179,699	$94,890

* The $1.5 billion loan from 2007 is a pari-passu A-Note from Peter Cooper Stuyvesant loan.
Source: Moody's Analytics CMBS Loan Data

Exhibit 4 provides a property type listing for this pre-crisis universe, with 32% of the loans being supported by office, 30% by retail, 16% by multifamily, and 9% by hospitality. *Even back in 2007, investors were concerned that hospitality could experience performance volatility but were still generally accepting of retail properties.* After risk retention was imposed in 2016, CMBS conduit pools contained less retail exposure, but had relatively high hotel concentrations into the mid-teen range.

Exhibit 4. Property Breakdown of CMBS Conduit Loan Universe Evaluated in Study, 2004-2007



Source: Moody's Analytics CMBS Loan Data

In order to apply historic performance to current vintages, we created cohorts based upon pre-recession financial strength as exhibited by the debt service coverage ratio (DSCR). ***For loans securitized prior to 2007, we used the available 2006 NOI and for loans securitized in 2007, we used the underwritten cash flow as the best proxy for expected performance.*** This provided four cohorts:

Category	Pre-Recession DSCR Range
Potential Defaults:	DSCR < 1x
Potential Extensions:	DSCR 1 – 1.399x
Likely to Perform:	DSCR 1.4 – 1.999x
Potentially Safe	DSCR > 2x

During the recession and subsequent recovery, defaults and resolutions for each loan were tracked within each cohort. Defaults were identified by a loan becoming 60+ days delinquent. ***This allowed the calculation of a weighted average annual default vector for each category, along with the loan realization time and loss severity.*** Exhibit 5 provides annual data for each of the four DSCR categories. (Note that the outstanding balance increased during 2007 to reach the study's total loan amount by the end of 2007). Each year, defaulted and matured loans were removed from the denominator. This allowed the calculation of a monthly default factor, which is annualized into a constant default rate ("CDR") for each year. ***The first year of the recession started with low CDRs, but then the CDRs increased through the recession in proportion to their initial DSCR leverage.***

Exhibit 5. Historical CMBS Default Vectors, Workout Periods and Severities for Each DSCR Category

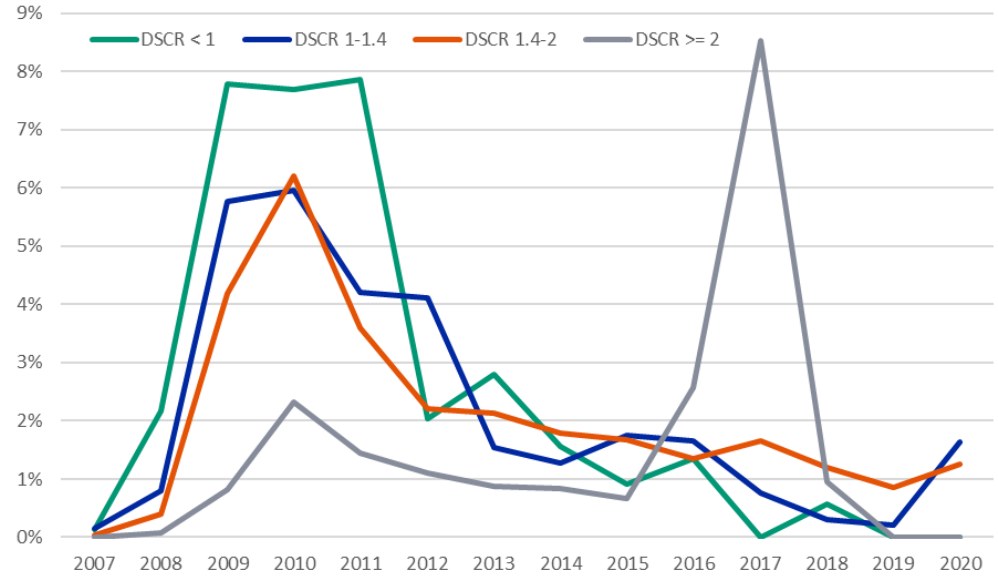
	DSCR < 1x		DSCR 1-1.399x		DSCR 1.4-1.999x		DSCR > 2x	
Year	Starting Balance ($MM)	Avg 12 Month CDR%	Starting Balance ($MM)	Avg 12 Month CDR%	Starting Balance ($MM)	Avg 12 Month CDR%	Starting Balance ($MM)	Avg 12 Month CDR%
2007	13,030	0.13%	100,338	0.14%	155,174	0.03%	74,341	0.01%
2008	15,067	2.17%	184,935	0.81%	226,231	0.41%	87,601	0.07%
2009	14,878	**7.78%**	183,380	**5.78%**	223,722	**4.19%**	84,490	0.83%
2010	14,470	**7.68%**	180,895	**5.97%**	219,015	**6.21%**	80,072	**2.32%**
2011	13,667	**7.86%**	174,522	**4.20%**	208,839	**3.59%**	73,308	**1.45%**
2012	11,503	2.04%	161,562	**4.12%**	193,068	**2.20%**	65,796	1.10%
2013	10,803	2.80%	147,192	1.55%	175,536	**2.13%**	58,305	0.87%
2014	9,448	1.57%	131,139	1.27%	155,696	1.80%	48,634	0.84%
2015	7,927	0.91%	108,602	1.76%	123,590	1.68%	37,046	0.67%
2016	5,595	1.34%	87,013	1.66%	80,348	1.35%	18,639	2.56%
2017	1,621	0.00%	45,470	0.75%	40,587	1.65%	6,897	8.52%
2018	675	0.58%	9,679	0.30%	11,233	1.20%	1,883	0.95%
2019	517	0.00%	6,432	0.21%	6,692	0.87%	1,120	0.00%
2020	330	0.00%	3,888	1.65%	4,056	1.26%	535	0.00%
Loss Severity %								
Original Balance		**39.7%**		**47.4%**		**50.2%**		**43.9%**
Liquidated Balance		**42.3%**		**51.3%**		**54.9%**		**48.0%**
Default Lag (Months)		**54**		**38**		**42**		**21**

Source: Moody's Analytics CMBS Loan Data

Exhibit 5 summarizes the loss severity and the average time to loan resolution (term default loss data is aligned under the CDR column). Loss severities that happened during the term are expressed as a percentage of both the original loan balance and the final liquidated balance. This allows investors to use an original balance reference on new transactions, or current balance for seasoned collateral. The term default severities range from 39.7% of the original balance for loans with DSCR < 1x up to 54.9% of the liquidated balance for loans that start with DSCR 1.4 – 1.999x. *Looking at the low and high DSCR categories, there was an inverse relationship between original DSCR and the workout period, as the loans that started with DSCR > 2x were resolved in only 28 months, while the loans that started with DSCR < 1x took 54 months to resolve.* This could be a function of when the default occurred, as the lower DSCR loans defaulted sooner, and servicers likely hesitated to liquidate the loans during the heights of the recession. It is noteworthy that this trend breaks down for the middle DSCR categories, as loans in the 1.4 to 1.999x category required 4 more months to resolve than loans in the DSCR 1 to 1.399x category.

Exhibit 6 highlights the annual default rates for each DSCR category, comparing how these categories performed through the Great Financial Crisis and recovery.

Exhibit 6. Historical CMBS Default Vectors, Workout Periods and Severities for Each DSCR Category



Source: Moody's Analytics CMBS Loan Data

By year two, defaults in each category increased in proportion to their initial DSCR at the start of the recession. ***By year 3, the loans that started with DSCR < 1x approached 8% CDR, while the loans in the 1 - 2x DSCR categories had CDR of ~ 6%, and the loans that started with DSCR > 2x took until year 4 to peak at a 2.2% CDR.*** The loans with lower DSCR remained at higher default rates from 2011 to 2015 (years 4 to 8 of the recession), while the loans that started with DSCR > 2x quickly returned to a low default rate until 2016 and 2017. Loans that originally had DSCR > 2x incurred a CDR spike in years 10 and 11 to 2.6% and 8.5%, potentially caused by adverse survivorship as many of these loans prepaid or matured leaving this cohort with lease event risks (79% of this cohort successfully paid off before that CDR increase). ***Thus, even loans that initially had high DSCR can see events that cause defaults over a 10-year loan term.***

To create assumptions for loans that have already defaulted, any loan that incurred a monetary default during the study period was tracked. Exhibit 7 summarizes the resulting average loss severity and resolution for the various default states. Loans that became 30 days delinquent had the longest recovery period at 44 months and a low severity of 31.8%. Loans that become 30 days delinquent frequently cured and performed though to their original scheduled maturity with no loss. ***These re-preforming loans increase the average resolution time and decrease the loss severity, but the potential for a loan to cure and perform to maturity decreased the longer a loan was delinquent. The m***atured loans are usually less troubled than loans that default during term, so they have quicker resolutions of 17 and 19 months and average severities of only 15.7% and 25.8%, respectively.

Exhibit 7. Default Status Resolution Times and Loss Severities

Loan Status During Loan Life	Count	Balance	Lag (months)	Average Severity
30 Day Delinquent	8,404	119,768,036,538	44	31.8%
60 Day Delinquent	7,217	99,324,772,017	40	37.9%
90 Day Delinquent	7,285	99,492,013,003	37	38.6%
120 Days Plus Delinquent	356	5,405,333,050	21	63.2%
Matured Performing Loans	2,245	41,780,180,219	17	15.7%
Matured Nonperforming Loans	5,446	76,567,206,100	19	25.8%
In Foreclosure	5,330	75,356,556,401	30	44.8%
Real Estate Owned (REO)	2,265	24,514,773,318	23	56.1%

Source: Moody's Analytics CMBS Loan Data

The Moody's Analytics CMBS loan sample was also used to evaluate prepayment rates for each DSCR category. Exhibit 8 isolates the loans that paid off using a penalty or defeasance to calculate an annual *prepayment rate (CPR).* During the recession there was limited liquidity for refinancing, so borrowers delayed refinancing. Even as financing became more accessible after 2012, refinancing remained low as many loans were still recovering from the recession. Further, rates were not much different from the current mortgage coupons. This resulted in low prepayments in the first five years for the recession-affected loan sample until 2014 when the ten-year Treasury yield dropped 83bps.

Exhibit 8. Prepayment Rates During the Loan Term

DSCR:	< 1X		1 - 1.399X		1.4 - 1.999X		> 2X	
YEAR	CPR%	Cumulative CPR	CPR%	Cumulative CPR	CPR%	Cumulative CPR	CPR%	Cumulative CPR
2007	0.03%	0.03%	0.02%	0.02%	0.03%	0.03%	0.06%	0.06%
2008	0.27%	0.30%	0.06%	0.08%	0.06%	0.09%	0.06%	0.12%
2009	0.02%	0.32%	0.06%	0.14%	0.06%	0.15%	0.31%	0.43%
2010	0.24%	0.56%	0.20%	0.34%	0.11%	0.26%	0.40%	0.83%
2011	0.11%	0.68%	0.72%	1.05%	0.59%	0.85%	0.25%	1.08%
2012	0.44%	1.12%	0.60%	1.65%	0.39%	1.24%	0.64%	1.72%
2013	1.41%	2.53%	1.43%	3.08%	0.94%	2.18%	1.05%	2.77%
2014	0.77%	3.30%	1.02%	4.10%	1.08%	3.26%	1.54%	4.31%
2015	5.30%	8.60%	1.70%	5.80%	2.91%	6.17%	1.82%	6.13%
2016	1.78%	10.38%	2.04%	7.85%	2.99%	9.16%	2.23%	8.35%
2017	0.00%	10.38%	2.17%	10.02%	1.38%	10.54%	2.26%	10.61%
2018	0.00%	10.38%	3.66%	13.69%	6.54%	17.08%	12.53%	23.14%
2019	1.71%	12.09%	2.07%	15.75%	9.55%	26.63%	10.02%	33.16%
2020	1.59%	13.68%	6.28%	22.04%	9.47%	36.10%	4.94%	38.11%

Source: Moody's Analytics CMBS Loan Data

This 2014 rate rally allowed two of the DSCR categories to achieve cumulative prepayments > 4%, and by 2015, all of the categories exceeded 5%. *It is noteworthy that the DSCR < 1x loan category was the first category to reach 8% cumulative prepayments in 2015, suggesting that repayments during a lower interest rate environment may have been an active loan recovery strategy.* But this high prepayment rate for low DSCR categories lasted only a couple years as other categories started to prepay in relation to the original DSCR by year 8. *Nonetheless, these CPRs are still relatively low suggesting fixed-rate prepayment protection is so effective that it limits the benefits that might arise from predicting CPR based upon DSCR. But the increase in prepayments after the 2014 rate rally did demonstrate that interest rates play a role in a borrower's decision to prepay. Given the challenge in predicting future rates and penalty sharing among the bond classes, CMBS investors rarely focus on prepayment analysis during loan lockout periods.* Even when investors implement a CPR assumption, the input assumption is usually intended to create a "yield to worst" bond result.

But after their penalty period commercial mortgages try to encourage timely maturity repayments by having a 3 to 6 month period of time when the loan is freely prepayable without penalty. *When considering this open prepayment option, commercial real estate borrowers should be expected to use their first refinance opportunity if interest rates have decreased.* Given this expectation, CMBS investors usually price open prepayment risk at a 100% prepayment speed during the open period (100% CPY). But the reality is not every borrower is efficient enough to prepay in the first month in which the mortgage is freely prepayable. *In fact, when we calculated prepayment speeds during the open period for each DSCR category in Exhibit 9, no category average exceeded 59% CPY.*

Exhibit 9. CMBS Prepayment Rates in Open Period ("CPY")

Category	Principal Paid Off	Resulting CPY%
DSCR < 1x	4,026,744,103	52.7%
DSCR 1 - 1.399x	67,896,676,501	56.6%
DSCR 1.4 - 1.999x	81,731,039,234	55.3%
DSCR > 2x	39,092,241,801	58.8%

Source: Moody's Analytics CMBS Loan Data

There is a small correlation between DSCR and CPY speeds, ranging from 52.7% up to 58.8%, yet none of these speeds are anywhere near the 100% CPY speed that is frequently used by the CMBS market to price premium bonds or interest only ("IO") bond classes.

Part II: CMBS 2.0's Lower Coupon and COVID-19's Cashflow Impact Require a Study of Debt Yield Refinance Hurdles

The analysis of the financial crisis data provides several insights that CMBS investors can implement to consider a new potential CRE recession. *However, the underlying loans from our designated pre-crisis period had coupons in the 5% range, whereas recent mortgages and CMBS loans have much lower coupons, typically ranging from 2.95% up to 5.79%. These lower interest costs should decrease term default risk for CMBS 2.0 but increase the potential for maturity refinance defaults.* COVID-19 further complicates the analysis, as many properties are still recovering and, in some cases, have insufficient cashflow to refinance. *To consider the lower rate environment that has been in place since late 2014 and for the recent property income lost to COVID-19, we analyzed the refinance experience of all loan maturities since 2015.* Exhibit 10 provides loan maturity outcomes stratified by the last reported NOI debt yield and sorted by property type. The format shows the percentage of loans in each debt yield / property type category that failed to pay off at maturity. *This extension analysis in the top section shows that hotel and retail loans with debt yields < 6% extended past their maturities 74.2% and 73.4% of the time, respectively.*

Exhibit 10. CMBS Post-2015 Maturity Outcomes (Extensions), Stratified by NOI Debt Yield

	Debt Yield					
Extension Rate:	**< 6%**	**6% - 7.999%**	**8% - 9.999%**	**10% - 11.999%**	**>= 12%**	**Overall**
Office	47.5%	13.8%	26.9%	20.4%	13.2%	**22.3%**
Retail	73.4%	34.6%	22.5%	23.5%	24.2%	**29.5%**
Multifamily	25.4%	6.0%	3.6%	3.3%	3.8%	**5.3%**
Hotel	74.2%	48.3%	27.4%	25.7%	10.6%	**22.9%**
Industrial	32.6%	15.6%	15.9%	12.4%	13.8%	**16.2%**
Average:	**55.5%**	**20.7%**	**19.9%**	**18.8%**	**15.4%**	**22.3%**
Extension (mths)						
Office	9.8	1.6	4.3	3.8	2.6	**4.0**
Retail	18.5	6.9	3.5	3.0	2.9	**5.0**
Multifamily	3.2	0.5	0.5	0.1	0.1	**0.5**
Hotel	13.4	14.0	3.8	5.6	1.0	**3.7**
Industrial	8.8	3.5	1.7	1.4	1.3	**2.4**
Average:	**12.1**	**3.6**	**3.0**	**2.9**	**2.0**	**3.8**
Loss Severity						
Office	47.9%	9.5%	26.4%	21.4%	24.3%	**26.5%**
Retail	66.1%	33.8%	26.1%	20.2%	10.3%	**31.7%**
Multifamily	27.2%	4.5%	11.1%	5.6%	1.4%	**10.0%**
Hotel	53.3%	64.0%	25.3%	25.9%	13.5%	**27.9%**
Industrial	51.3%	21.4%	18.3%	18.9%	4.5%	**17.9%**
Average:	**54.2%**	**20.7%**	**24.8%**	**20.3%**	**14.3%**	**27.3%**

Source: Moody's Analytics CMBS Loan Data

The table highlights a significant refinance cliff below a 6% NOI debt yield for most property types (8% for hotels). This debt yield cutoff at < 6% (< 8% for hotels) correlates with relatively high loss severities in the bottom section of the summary. The analysis only classified whether loans were paid on time, so extension length included a wide range of distress including many loans that quickly repaid in full after missing their initial maturity. This inclusion of full payoff loans brought down the overall loss severities (including on the < 6% debt yield loans). Multifamily property extension rates outperformed other property types, as conduit multifamily loans with < 6% debt yield extended only 25.4% of the time, resulting in a relatively low 27.2% loss rate. *Given the extension rate relationship by property type, investors should combine our initial DSCR-driven CDR vectors with a property type-specific extension debt yield hurdle.*

Using NOI debt yields with the maturity default data provides a rate-agnostic refinance estimate for most vintages of CMBS as they mature. However, COVID-19 has severely impacted recently reported NOIs, so some participants may want to show a further NOI recovery, while others that want to reflect a severe recession may even further decrease NOIs. To be applicable across a universe of maturities, these tables summarize all loans and failed defaults, including many loans that quickly repaid. *These late, but full, repayment extension events frequently happen when a borrower has a property that can make the loan's debt service payments but has insufficient cashflow to refinance the property.* In that instance, the borrower may require pressure from the servicer or the threat of being transferred to special servicing to motivate them to consider alternative capital sources.

Part III: Applying the Great Recession and Extension Results to CMBS 2.0

Combining the defaults and prepayment assumptions from our financial crisis analysis with the post-2015 extension analysis creates a consistent recession stress scenario. With the extension data gathered during a period of strong economic growth, investors may want to negatively adjust property NOIs to reflect further fundamental deterioration beyond the current COVID-19 impact. This can be achieved with a pre-maturity cashflow adjustment as small as 10% for most properties and potentially a further 20% to 30% decrease for office properties that are anticipated to incur significant lease rollover before maturity. Investors may also want to consider assigning property-specific NOI projections, such as those available via Moody's Commercial Mortgage Metrics ("CMM"), to forecast recession NOI paths. This model applies market fundamentals specific to each loan to derive NOI projections.[1] *No matter how the analyst implements future NOI projections, the combination of the severe Great Recession CDRs with specific post-COVID-19 debt yield-driven extensions can provide a conservative initial credit analysis for CMBS bonds.*

Exhibit 11 implements this Great Recession term default DSCR vector with our debt yield-driven extension matrix on the bonds from a 2018 and a 2019 transaction. To reflect a severe recession in the property-specific refinance debt yield hurdle, we reduced all NOIs by a further 10%. These vectors were applied using cash flow waterfall models that are available through Moody's Analytics CMBS Cash Flow Engines. *To allow for loans that may have had investment grade characteristics and should have better recovery prospects, we set a 0% CDR and 59% CPY for larger A-notes or loans that were initially underwritten with LTV < 55% as long as they had recent DSCR > 1.6x.* These leverage exclusion criteria are a simple filter that should be consistent with most investment grade leverage levels, while still defaulting these loans if they have shown extreme underperformance during the pandemic.

Exhibit 11. Great Recession Stress Vectors Applied to UBSCM 2018-C11 and BANK 2019-BN22:

Deal	Class	Rating Category	Current Face	WAL (yrs)	Prin. Window	Loss %	Price	Yield (%)	Spread (bps)
UBSCM 2018-C11	A-3	Aaa	57,478,000	1.54	5/23 - 8/24	0.00	101.44	3.26	240
	A-4	Aaa	162,000,000	5.35	8/24 - 4/28	0.00	100.82	3.80	223
	A-5	Aaa	210,569,000	6.40	4/28 - 6/28	0.00	102.90	3.73	209
	A-S	Aaa	78,372,000	6.51	6/28 - 7/28	0.00	102.21	4.11	246
	B	Aa3	35,167,000	6.54	7/28 - 7/28	0.00	98.34	5.03	338
	C	A3	33,157,000	6.62	7/28 - 12/28	0.00	93.08	6.36	470
	D	Baa3	35,758,000	N/A	N/A	100.00	82.45	-25.67	-2,577
	E-RR	Ba3	18,500,000	N/A	N/A	100.00	N/A	N/A	N/A
	F-RR	B3	10,047,000	N/A	N/A	100.00	N/A	N/A	N/A
	NR-RR	NR	30,144,085	N/A	N/A	100.00	N/A	N/A	N/A
BANK 2019-BN22	A-3	Aaa	306,500,000	7.40	6/26 - 8/29	0.00	93.64	3.72	203
	A-4	Aaa	450,348,000	7.75	8/29 - 10/29	0.00	95.33	3.68	198
	A-S	Aaa	117,060,000	7.79	10/29 - 10/29	0.00	95.11	3.95	225
	B	Aa3	48,536,000	7.79	10/29 - 10/29	0.00	93.72	4.38	268
	C	A3	49,965,000	7.84	10/29 - 11/29	0.00	89.58	5.16	345
	D	Baa2	31,406,000	7.87	11/29 - 11/29	0.00	74.01	6.84	514
	E	Baa3	22,841,000	7.92	11/29 - 12/29	0.00	72.27	7.17	546
	F	Ba3	22,840,000	8.11	12/29 - 12/31	23.90	N/A	N/A	N/A
	G	B3	11,421,000	N/A	N/A	100.00	N/A	N/A	N/A
	H	NR	12,848,000	N/A	N/A	100.00	N/A	N/A	N/A

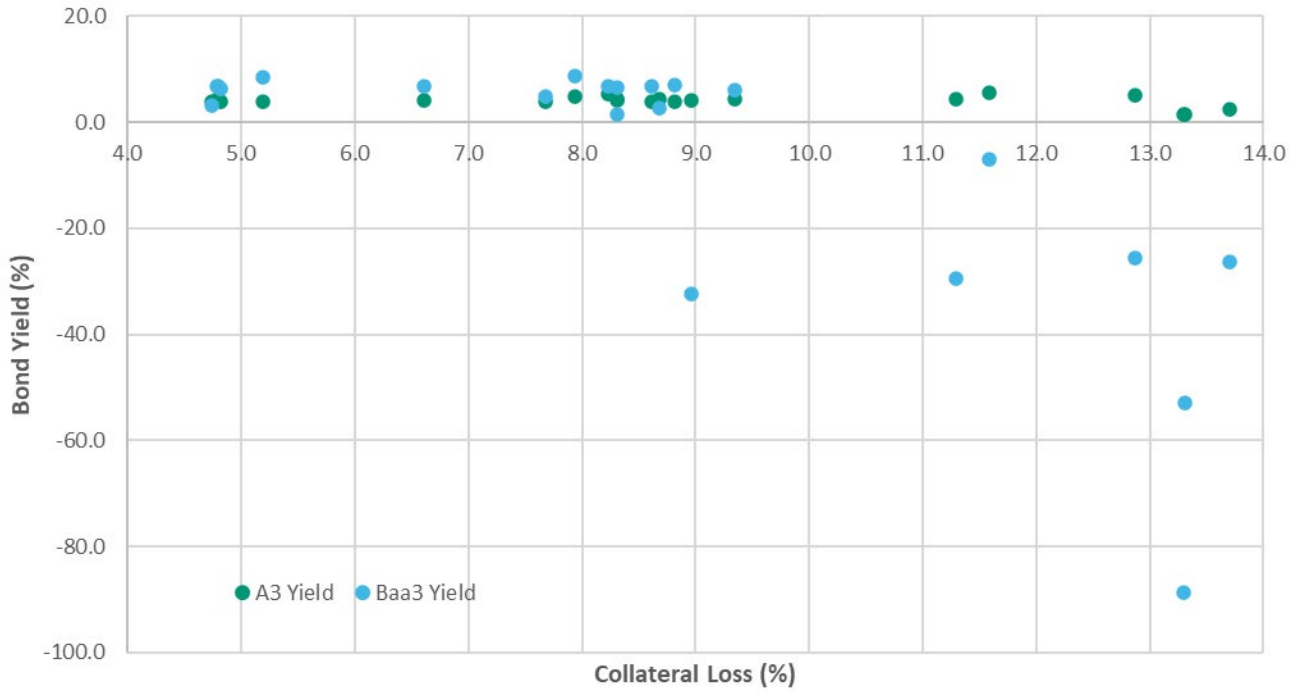
Source: Moody's Analytics CMBS Loan Data

Servicer advancing was reduced to 56% upon default, as that was the average advance rate realized within the study loan universe. This advancing rate may seem low, but CMBS 2.0 has implemented a proactive appraisal reduction process that is driven based upon appraisals and includes an automatic appraisal reduction. This proactive appraisal reduction process may result in advances near 50% for CMBS.

[1] Further information on CMM can be found at https://www.moodysanalytics.com/product-list/cmm-commercial-mortgage-metrics.

Given these recession default vectors and extension triggers, what is the fulcrum point for most CMBS 2.0 bonds? Exhibit 12 applies the CDR stress vectors, along with a 10% NOI decline for the extension test, to create projected collateral losses and yields for a cohort of Baa3 and A3 bonds. *The transaction losses ranged from 4% up to 13.8%, which was sufficient to create negative projected yields for 7 Baa3 bonds, but no A3 bond incurred a negative yield.*

Exhibit 12. Recession Stress Analysis of A3 and Baa3 Conduit Bonds (Selection of 2016-2021 Bonds)



Source: Moody's Analytics CMBS Loan Data

The Great Recession stress created losses up into nine Baa3 and small losses for three A3 bond classes within our 20-bond sample portfolio. The loss results were only large enough to create negative yield outcomes for the Baa3 bonds, which is somewhat consistent with market expectations that low rated investment grade classes may be at risk during a significant recession. *The Baa3 losses reflect CMBS 2.0 Baa3 credit bonds having credit enhancement levels that range from 6% to 11%, whereas CMBS 2.0 A3 credit enhancement provides roughly double the Baa3 level, ranging from 12% to 18%.* We should stress that the Great Recession vectors are intended to be conservative to bluntly highlight credit differences among bonds and provide an initial credit triage for the credit analyst. For actual credit investment decisions, an analyst should review the individual projected loan losses and may make further individual loan adjustment for situations that they expect can recover. This analyst judgement is important, as the underwriting within CMBS 2.0 should contribute to lower transaction loss rates. As evidence, we compare the initial leverage in the CMBS 1.0 sample, which had LTV of 67.8% and DSCR of 1.65 times, which is weaker than the post-2010 CMBS 2.0 underwritten leverage of 61.9% LTV and DSCR of 1.99 times. *This lower leverage on CMBS 2.0 means the analyst should review loan values and be prepared to adjust this study's approach to create fewer term defaults and more extension defaults.*

Our DSCR-driven stress filter is intended to consistently capture and classify pools based upon performance and then implement near-term recession expectations. *In the current market, this also means the term default filter captures many retail and hospitality loans that have been impacted by COVID-19. These loans have been recovering, as we saw back in Exhibit 2, but their future recovery is still uncertain and subject to how the economy stabilizes.* Some loans in the lower DSCR category are high quality and may stabilize further allowing them to defy the 2007-11 term default experience. The application of the preceding recession analysis should be viewed as a starting point*. For loans within the lower DSCR categories, an analyst should consider further detailed loan-level and market level analysis, as our general recession default vectors may miss specific property strengths that could drive further post-COVID-19 recovery. Thus, these types of generic default vector assumptions should be viewed as only an initial pool triage that can be improved upon with further loan underwriting that accounts for specific tenancy or market conditions.*

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