

CMBS RESEARCH

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Screening Environmental and Physical Risk in CMBS Utilizing RMS Hazard Data

Moody's Analytics' acquisition of RMS this past September expanded Moody's insurance business and accelerated the development of Moody's global integrated risk capabilities. RMS has climate, environmental, and terrorism models for property insurers that capture natural and man-made hazards allowing for assessment of specific property physical risk probabilities over different time horizons. Commercial property insurance policies provide coverage for natural and man-made disasters, typically considered "all-perils" policies, and contain business interruption insurance. ***Frequently coverage is sub-limited, or capped, in areas of high risk, particularly for flood, terrorism, or earthquake coverage, which, after an "event," has caused CMBS transactions to experience limited bond market liquidity and in some cases, loan defaults.*** When such an event occurred, the related bonds experience decreased liquidity, and market participants questioned whether replacement or business interruption insurance would sufficiently cover property downtime and required mortgage payments. To analyze such risks, we have incorporated RMS property specific risk modeling with Moody's Analytics CMBS structured products data.

CMBS participants may benefit from proactively considering these potential property risks. To facilitate this type of screening, Moody's Analytics attached individual RMS peril scores that describe the impact of a hazard to each property in the existing CMBS universe. Available peril risk scores include:

- » Convective Storm
- » Earthquake
- » Flood
- » Windstorm
- » Terrorism
- » Winter Storm
- » Wildfire

Each property peril receives a score from 1 – 10 (with 1-4 being low risk, 4-7 being medium risk, and 8 or more being high risk). Each peril is scaled based upon modeled property damage. The calculation of these property risk scores takes into account numerous building and location characteristics, such as year built/renovated, distance to the shoreline or a fault line, altitude, number of floors, construction material, underlying soil conditions, and distance to nearby burnable vegetation and vegetation type. ***While these peril scores do not substitute for the in-depth analysis based upon more specific model inputs that are provided to insurance underwriters, for CMBS participants the peril risk scores are sufficient to identify higher risk properties.*** Each risk peril also receives a business interruption score based upon the likelihood that damage to a property from any perils would interrupt use/operations in a given year.

To demonstrate how these scores can be used to understand climate and disaster risk in conduit transactions Moody's Analytics screened CMBS conduit transactions for loans with high risk (scores of 8+) for each peril and created a listing of the top ten CMBS transactions with high-risk exposures to these perils. Most CMBS pools have significant exposure to medium levels of peril risk, which provides only limited ability to differentiate among CMBS transactions. *In contrast, focusing on higher risk loans (8+) highlights the properties that could incur damages that are sufficient to prevent tenant operations, which could challenge business interruption insurance coverage and could lead to a loan default.* Exhibit 1 shows the top 10 CMBS conduit exposures for each peril. *In many cases, the CMBS transaction high risk exposure to a peril is multiples of the weighted average CMBS conduit universe exposure figures at the bottom of each section.*

Many CMBS participants may not have previously considered some of these perils in their analysis, such as convective storms (which encompass hail, tornado, lightning, and straight-line wind risk). These types of events are generally considered unpredictable and are covered by general commercial insurance. Yet the past year has seen a significant number of natural storm disasters, many in the form of tornado strikes. In March 2022, tornados caused significant damage along a 200 mile stretch in the Midwest, even eliminating one building that had been securitized in an industrial loan portfolio. In that case, the single building will be covered by insurance, and the CMBS transaction's diversity limited the default risk. *Yet, looking at our top ten list, there are transactions with oversized convective storm risks. For example, in one transaction, 11% of the loan balance is high risk relative to a CMBS universe average convective storm risk of only 0.21%.* Most of the other perils have similar distributions, with several transactions having concentrations of high-risk loans versus a much lower average conduit universe exposure:

<u>Risk Factor</u>	<u>Conduit Average High Risk</u>	<u>3 Highest Conduit Transaction Exposures</u>
Convective Storm	0.21%	11.3%, 9.3%, 5.7%
Windstorm	3.29%	23.4%, 20.1%, 18.1%
Flood Risk	2.15%	15.4%, 15.3%, 14.0%
Earthquake	2.53%	29.5%, 14.3%, 13.5%
Terrorism	17.03%	71.3%, 54.4%, 52.3%
Wildfire	0.68%	12.6%, 12.2%, 11.5%

Looking through these conduit exposures, investors should ask questions about commercial insurance coverage on the high-risk loans and whether business interruption insurance has been sufficiently sized.

Exhibit 1. CMBS Conduit Exposure To RMS Property Risk Perils

Convective Storm High Risk		High Risk Characteristics			
Transaction	Deal Bal. (\$ mil)	WA Risk Score	# of Loans	Loan Bal. (\$ mil)	% of Deal
CGCMT 2015-GC35	936.0	1.89	2	106.0	11.32
GSMS 2015-GS1	754.9	1.73	1	70.0	9.27
WFRBS 2013-UBS1	371.5	2.00	1	21.2	5.70
COMM 2013-CR6	881.4	1.39	2	45.1	5.12
MSBAM 2013-C8	780.5	1.32	1	31.8	4.07
CGCMT 2016-GC36	1,061.7	1.26	1	30.0	2.83
CGCMT 2013-GC11	804.4	1.25	1	19.6	2.44
WFCM 2015-LC20	660.8	1.48	2	14.2	2.15
CFCRE 2016-C7	609.0	1.29	1	12.4	2.03
WFRBS 2013-C18	714.4	1.20	2	13.6	1.91
Conduit Universe	368,654	1.22	97		0.21%

Flood High Risk		High Risk Characteristics			
Transaction	Deal Bal. (\$ mil)	WA Risk Score	# of Loans	Loan Bal. (\$ mil)	% of Deal
GSMS 2014-GC18	676.3	2.53	3	104.4	15.43
JPMCC 2013-LC11	765.6	2.37	5	117.0	15.28
GSMS 2012-GCJ7	371.2	2.27	2	52.0	14.01
GSMS 2015-GC30	960.6	2.30	3	124.0	12.91
CGCMT 2015-GC31	659.3	2.25	3	83.1	12.60
GSMS 2012-GC6	128.4	2.07	1	15.9	12.38
JPMDB 2016-C2	591.9	2.29	3	67.4	11.38
WFCM 2015-NXS3	531.8	2.04	1	59.5	11.20
DBJPM 2016-C3	708.6	2.60	2	76.6	10.81
MSBAM 2017-C34	946.0	1.98	4	101.2	10.70
Conduit Universe	368,654	1.38	835		2.15%

Terrorism High Risk		High Risk Characteristics			
Transaction	Deal Bal. (\$ mil)	WA Risk Score	# of Loans	Loan Bal. (\$ mil)	% of Deal
BMARK 2020-IG1	660.0	7.86	9	470.5	71.29
MSBAM 2012-C5	404.5	6.30	5	220.3	54.46
BANK 2020-BN27	617.3	5.67	7	323.0	52.33
CGCMT 2012-GC8	406.8	6.45	4	196.2	48.22
CD 2016-CD2	668.6	6.27	10	317.7	47.51
COMM 2013-CR8	661.5	5.59	3	312.6	47.26
WFCM 2012-LC5	747.3	5.22	5	324.0	43.35
BMARK 2020-B16	897.8	5.30	9	382.1	42.56
JPMCC 2013-C16	719.5	5.09	6	303.8	42.22
BMARK 2020-B22	812.5	5.14	9	342.3	42.12
Conduit Universe	368,654	2.96	1,917		17.03%

Windstorm High Risk		High Risk Characteristics			
Transaction	Deal Bal. (\$ mil)	WA Risk Score	# of Loans	Loan Bal. (\$ mil)	% of Deal
COMM 2014-LC17	752.4	2.93	4	176.3	23.43
JPMBB 2014-C18	597.7	2.66	3	120.1	20.09
COMM 2013-LC6	847.2	2.28	3	153.6	18.13
JPMBB 2015-C31	806.0	2.21	6	146.1	18.12
WFRBS 2013-C12	631.1	2.36	2	113.7	18.02
COMM 2014-CR20	928.0	2.57	5	154.0	16.60
WFRBS 2013-C17	595.1	2.13	4	93.6	15.73
GSMS 2014-GC18	676.3	2.22	2	106.2	15.70
CD 2018-CD7	697.4	2.25	4	103.1	14.78
UBSBB 2013-C6	1,074.8	2.27	5	156.1	14.53
Conduit Universe	368,654	1.23	924		3.29%

Earthquake High Risk		High Risk Characteristics			
Transaction	Deal Bal. (\$ mil)	WA Risk Score	# of Loans	Loan Bal. (\$ mil)	% of Deal
MSC 2012-C4	324.3	2.77	1	95.7	29.51
BANK 2019-BN23	1,105.6	3.32	4	158.1	14.30
BMARK 2021-B30	951.6	2.29	3	128.9	13.54
JPMBB 2014-C24	942.0	1.87	1	115.0	12.21
DBJPM 2016-C3	708.6	2.77	3	86.2	12.16
BANK 2019-BN22	944.4	2.45	3	112.8	11.94
BMARK 2019-B11	1,092.3	2.23	4	129.6	11.86
JPMCC 2016-JP2	687.3	2.10	1	80.0	11.64
BANK 2019-BN20	1,164.3	2.76	3	133.8	11.49
CFCRE 2016-C3	620.1	2.81	2	69.3	11.18
Conduit Universe	368,654	1.81	646		2.53%

Wildfire High Risk		High Risk Characteristics			
Transaction	Deal Bal. (\$ mil)	WA Risk Score	# of Loans	Loan Bal. (\$ mil)	% of Deal
GSMS 2016-GS2	597.0	1.90	1	75.0	12.56
WFRBS 2014-C23	799.5	2.53	5	97.7	12.22
WFCM 2015-NXS3	531.8	2.06	2	61.2	11.51
WFRBS 2014-C24	783.7	2.16	2	67.2	8.58
MSBAM 2014-C19	896.1	2.03	3	71.7	8.00
MSC 2016-UBS9	553.0	1.77	1	40.0	7.23
BACM 2016-UB10	546.0	1.96	1	35.0	6.41
MSC 2015-MS1	808.0	1.97	1	50.0	6.19
COMM 2013-LC13	533.1	1.91	2	32.4	6.08
BACM 2017-BNK3	861.0	1.77	3	49.7	5.77
Conduit Universe	368,654	1.42	251		0.68%

Source: Moody's Analytics CMBS loan database and RMS data

To consider the property specific risks, it is helpful to look at the related risk perils along with the overall business interruption exposure. For each peril, Exhibit 2 selects a conduit transaction that had a high overall loan exposure and provides the loan scores for each perils, along with the business interruption score. Risk scores for the perils earthquake, flood and windstorm are computed based on one in 500 year events, convective storm risk scores reflect one in one hundred year risk, and terrorism and wildfire risk scores are computed based on average annual event losses. If market participants use this data to consider high risk flood exposure within our GSMS 2014-GC18 example, they would initially be concerned about the 15.4% of deal exposed to high risk. *But they would then realize that there are 3 smaller risks within two portfolio loans and that most of the risk is a result of the \$102 million Shops on Canal Street retail loan in New Orleans.* This loan is likely deemed high risk due to previous flooding in that area during

Hurricane Katrina. *The RMS analysis also has a high business interruption score for the loan, so additional investigation should include information on the current in-force property, contents/inventory and business interruption coverage available to protect the value of the building and operations.*

Exhibit 2 includes MSBAM 2012-C5 to provide insight on how a conduit transaction may have a high exposure to loans with high terrorism scores. Within MSBAM 2012-C5, there are five different loans in three different cities, so diversification of the exposures somewhat offsets the risks. *Geographic diversification offsets risks in many of the transactions, but there are exposures where two loans are in the same city, as is the case with the high wildfire risk example transaction.* The data selection contains some blank fields as RMS only models perils in regions where there is known risk (e.g. there is no hurricane risk in Chicago). *Yet the small sample within Exhibit 2 highlights numerous loans for which CMBS participants may want to request additional information, such as an insurance coverage summary or the term of the business interruption coverage.* For the higher earthquake exposure loans, participants may also want information from the maximum probable loss study to determine if there was a 20% score that would require additional earthquake insurance.

Exhibit 2. Loan Level RMS Data For CMBS Transactions With High RMS Risk Exposure

Loan Name	Property Type	Address	City	State	# of Prop.	Orig. LTV	Current Allocated Balance	Convective Storm (100yr)	Wind Storm (500yr)	Flood Risk (500yr)	Earth Quake Risk (500yr)	Terrorism Risk	Wild Fire Risk	Business Interruption Score
<u>Convective Storm High Risk - CGMT 2015-GC35</u>														
Independence Village	MF	4700 South Virginia St	Amarillo	TX	1	62.2	6,000,000	8	1	1	1	1	1	4
South Plains Mall	RT	5702 And 6002 Slide Rd	Lubbock	TX	1	54.3	100,000,000	8	1	1	1	1	1	4
<u>Wind Storm High Risk - COMM 2014-LC17</u>														
Loews Miami Beach Hotel	LO	1601 Collins Avenue	Miami Beach	FL	1	53.1	120,000,000	1	10	1	1	10	1	9
Myrtle Beach Marriott	LO	8400 Costa Verda Drive	Myrtle Beach	SC	1	69.8	47,541,020	1	9	1	1	1	1	9
Regency Square	RT	9023 Little Road	New Port Richey	FL	1	73.2	7,517,630	1	8	1	1	1	1	6
U-Haul Pool 4	SS	4 Westbank Expressway	Gretna	LA	17	51.3	1,205,635	1	9	10	1	1	1	9
<u>Flood High Risk - GSMS 2014-GC18</u>														
Dollar General Portfolio	RT	1812 Highway 71 South	Lecompte	LA	44	58.2	262,248	1	4	8	1	1	1	5
Dollar General Portfolio	RT	3518 Highway 70 South	Pierre Part	LA	44	58.2	388,424	1	5	8	1	1	1	9
The Shops at Canal Place	RT	301-333 Canal Street	New Orleans	LA	1	65.1	101,901,296	1	8	10	1	7	1	9
Wal-Mart Shadow	RT	2000 Drive NW Atkinson Blvd	Alice	TX	4	74.8	1,824,527	1	5	9	1	1	1	9
<u>Earthquake High Score - BANK 2019-BN23</u>														
Arabian Gardens MHC	Other	81600 Fred Waring Drive	Indio	CA	1	64.1	15,000,000	1		1	10	1	2	9
Cedar Village MHC	Other	10701 Cedar Avenue	Bloomington	CA	1	66.0	15,125,000	1		1	9	1	5	5
El Mercado Shop Center	RT	Rd & 1601-1801 Decoto	Union City	CA	1	63.9	28,000,000	1		3	10	1	3	9
Park Tower at Transbay	OF	250 Howard Street	San Francisco	CA	1	49.1	100,000,000	1		1	8	10	1	9
<u>Terrorism High Risk - MSBAM 2012-C5</u>														
929-933 Broadway	RT	929-933 Broadway	New York	NY	1	57.0	7,886,298	1	1	1	1	10	1	9
EconoLodge Times Square	LO	767 Eighth Avenue	New York	NY	1	65.1	8,660,989	1	1	1	1	10	1	9
Galleria Park Hotel	LO	191 Sutter Street	San Francisco	CA	1	66.9	29,522,532	1		1	7	10	2	9
Legg Mason Tower	OF	100 International Drive	Baltimore	MD	1	68.2	141,204,756	1	1	3	1	10	1	5
The Distrikt Hotel	LO	342 West 40Th Street	New York	NY	1	60.5	33,014,922	1	1	1	1	10	1	8
<u>Wild Fire High Risk - WFRBS 2014-C23</u>														
Crossings at Corona	RT	2489 Tuscany Street	Corona	CA	1	65.3	69,005,620	1		1	7	1	9	9
Pomona Ranch Plaza	OF	75 Rancho Camino Drive	Pomona	CA	1	66.2	14,502,693	1		1	3	1	9	8
Shiloh Business Park	IN	399 Business Park Court	Windsor	CA	1	71.7	6,000,000	1		1	6	1	8	8
Statewide Self Storage	SS	2650 Mission Street	Santa Cruz	CA	1	31.4	2,290,495	1		1	4	1	9	7
Temescal Storage Center	SS	20310 Temescal Canyon	Corona	CA	1	52.2	5,900,000	1		5	7	1	9	9

Source: Moody's Analytics CMBS loan database and RMS data

SASB Exposure Is More Binary:

The individual loan scores can be applied to SASB transactions to determine if a SASB portfolio has outsized risk relative to the SASB universe. *Among these larger trophy properties, it is expected that several retail and office buildings are located in terrorism risk areas. Further, several San Francisco and Los Angeles properties have exposure to earthquake risk.* To produce Exhibit 3, we attached the risk scores to 389 SASB transactions (\$174.5 billion in collateral). In these instances, investors, underwriters, or the rating agencies may have already asked specific questions about the property's flood, windstorm or earthquake coverage. However, this information allows SASB investors to consider their overall exposure risks.

Exhibit 3. SASB Universe Average Score Exposure:

Risk Factor	Average Score	High Risk Loans (8+)	
		# of SASB Loans	SASB Average Exposure
Convective Storm	1.16	8	0.44%
Windstorm	1.10	54	2.76%
Flood	1.25	56	0.98%
Earthquake	1.93	52	5.23%
Terrorism	3.86	171	26.60%
Wildfire	1.20	23	0.36%

Source: Moody's Analytics CMBS loan database and RMS data

For example, having a high earthquake score should cause CMBS participants to inquire about a property's earthquake maximum probable loss and whether additional insurance is necessary. Regarding terrorism risk, since 2002, properties have been able to obtain terrorism insurance coverage with the assistance of the Terrorism Risk Insurance Act. This Act has been extended four times but is currently scheduled to expire in 2027. We expect if the Act requires further extensions, the government will undertake to provide such support, so insurance risk is not the issue for terrorism. *CMBS participants should manage their overall exposure, as an event would affect bond liquidity. From that perspective, knowing that 26.6% of the SASB universe is high risk for terrorism is an important benchmark.*

The same type of portfolio exposure comment applies to the other perils and how they should be considered. *In most cases, having a diversified portfolio of SASB or conduit transactions should limit absolute exposure to any single natural disaster or terrorism event. But having these additional risk measures can aid CMBS participants to minimize their portfolio's exposure.* Beyond these insurance risk perils, we should mention that Moody's Analytics also has regional environmental measures for heat and water stress. Recent droughts suggest that these environmental factors may play a larger role in future property performance, as the occurrence of these events could affect landlord utility, water, and insurance costs. As we evaluate these factors for further research, we may find that higher scores may translate into higher future expenses and potentially additional default risks.

This application of these peril scores to CMBS is a conservative analysis, as pools do offer diversification, and loan origination standards require that loans have standard commercial real estate insurance. *However, it is also possible that a property in an earthquake or flood zone is underinsured based upon the underwriter's or borrower's mis-assessment of risk, so this additional level of analysis allows CMBS participants to anticipate risks that may affect a transaction's secondary market liquidity.* Given recent industry focus, these types of data should only become more widely available over the next few years, elevating their importance as factors for CMBS participants to evaluate.

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