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Recent fears of weakness in the economy have raised concerns about commercial mortgage defaults in the next real estate downturn. Investors in commercial mortgages or commercial mortgage-backed securities (CMBS) are interested in evaluating the effect of such a downturn on their holdings. We think that the best method to quantify the credit risks of a real estate portfolio is to analyze the historical performance of pools of commercial mortgage loans over their lifetimes.

Snyderman [1991, 1994] has completed two pioneering studies of lifetime commercial mortgage performance that track the lifetime defaults of commercial mortgages held by life insurance companies. Snyderman [1994] tracks defaults on eight large insurance companies through 1991. The companies originated the loans between 1972 and 1986.

Using the same insurance companies and data sources as the original studies, we update the default data through 1997 for originations from 1972 to 1992. We examine the credit performance of over 15,000 individual loans, an increase of about 4,000 loans from the 1994 study. Our main findings are:

- The average cumulative default rate for loans originated in 1987 or earlier (that is, with at least ten years of seasoning) is 18.1% of the original pool balance. This average is slightly higher than in previous studies, but in line with earlier projections.
- The cumulative default rate of 28% on loans originated in 1986 is the highest for any cohort. The lowest cumulative default rate is 9% for loans originated in 1982.
- The severity of loss on liquidated loans averages about 37.7%, slightly higher than the 36% reported in the 1991 study. The severity on loans liquidated between 1992 and 1997 is 44%.
- Annual defaults rose to about 2% in years 3 through 7 after origination, and then fell off for the remaining life. Defaults do not increase in balloon years.
- About half the defaulting loans were liquidated and half restructured. The number of liquidated loans rose to about 60% in the 1992-1997 period.
- The median loan size in the study is about $4 million, comparable to current conduit originations.
- Investment-grade CMBS, as typically structured today, do not suffer a principal loss when subjected to the default rates of even the worst origination cohort since 1972.

NUMBER OF LOANS BY ORIGINATOR AND YEAR

We track commercial mortgage

default rates from life insurance company annual statements from 1992 to 1997, aggregating our data with the two previous Snyderman studies.[1] The insurance companies and number of loans tracked are shown in Exhibit 1.

Loan originations in the study peak in 1978-1979 and 1985-1988, and reach lows in 1982 and 1992. Of the 15,109 total loans originated, 2,663 (17.6%), defaulted by 1997.[2]

SIZE OF LOANS

The median loan size is about $4 million. About 75% of the loans are less than $8 million. The $4 million to $8 million loan category has the highest default rate, followed closely by the greater than $8 million category. The smallest loans have the lowest default rate.

GEOGRAPHIC DISTRIBUTION

The loans in the study are well diversified geographically, with the largest percentages in the West (24%), Northeast (22%), and South Central (19%). Within a given origination cohort, cumulative lifetime defaults vary widely by geographic region. For example, in the 1980 cohort, loans originated in the Northeast have a lifetime default rate of 6.0%, while loans on properties in the South Central region have a cumulative

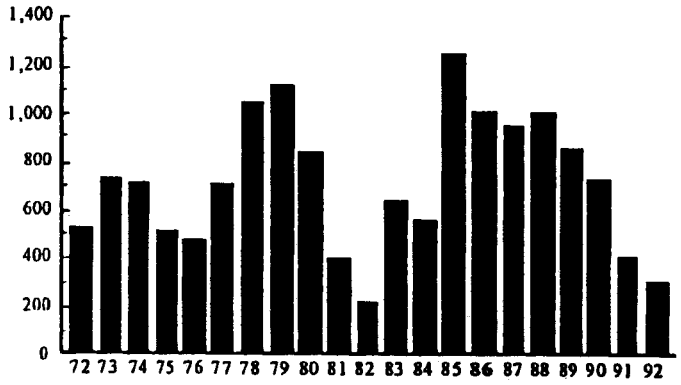
EXHIBIT 1
Number of Loans by Originator, 1972-1992

Originator	Number of Loans
Aetna Life Insurance Company	2,974
Connecticut Mutual Life Insurance Company*	863
Equitable Life Insurance Company	1,768
John Hancock Mutual Life Insurance Company	1,714
New England Mutual Life Insurance Company*	1,338
The Northwestern Mutual Life Insurance Company	719
The Prudential Insurance Company of America	3,522
The Travelers Insurance Company	2,211
Total	15,109

*Merged into other firms since 1991. Loans were tracked at the new firm.

Source: Morgan Stanley.

EXHIBIT 2
Number of Loans by Origination Year



Source: Morgan Stanley.

EXHIBIT 3
Loans Originated and Default Rates by Principal Amount

Loan Amount (millions of $)	Loans Originated	Total Default Rate (%)
0-2	3,842	13.5
2-4	3,949	17.4
4-8	3,459	20.1
> 8	3,859	19.8
Total	15,109	18.1

Source: Morgan Stanley.

EXHIBIT 4
Number of Loans Originated by Geographic Region

	Number of Loans	Percent of Total
West Coast	3,679	24.3
South Central	2,928	19.4
Northeast	3,295	21.8
Mid-Central	2,113	14.0
Southeast	2,309	15.3
Canada/Other	785	0.5
Total	15,109	100.0

Source: Morgan Stanley.

default rate of 31.0%.

For the period 1972-1992, the South Central region has the highest average cumulative default rate, while Canada and the West Coast have the lowest average default rates. The higher default rates in the South Central region reflect the deep oil state recession of the 1980s.

DEFAULTS BY ORIGINATION COHORT

Cumulative lifetime default rates for cohorts with at least ten years of history range from 9.2% for 1977 originations to 27.6% for 1986 originations. The average default rate for cohorts with a minimum of ten years seasoning is 18.1%.

EXHIBIT 5

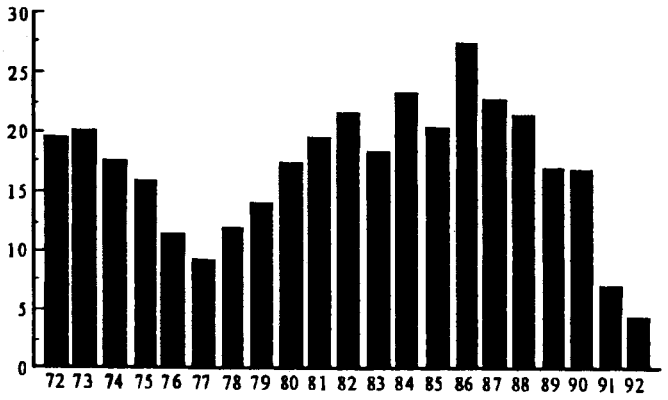
Average Default Rate by Geographic Region

	Default Rate
West Coast	12.3
South Central	27.4
Northeast	15.1
Mid-Central	17.3
Southeast	19.7
Canada/Other	11.7

Source: Morgan Stanley.

EXHIBIT 6

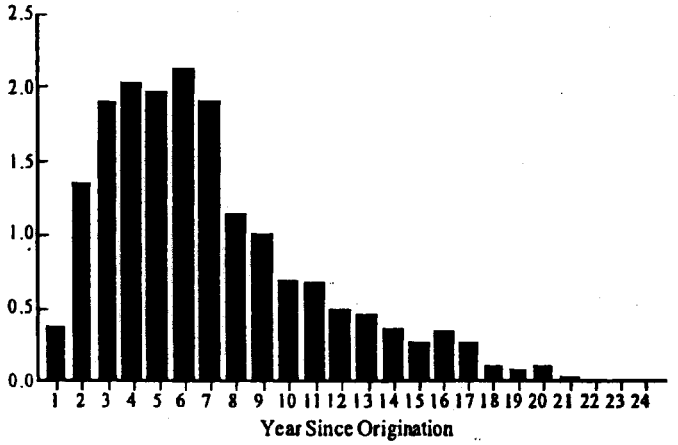
Lifetime Default Rates by Origination Cohort



Source: Morgan Stanley.

EXHIBIT 7

Average Timing of Defaults (as a % of original balance)



Source: Morgan Stanley.

SEVERITY OF LOSS

The average severity of loss on liquidated loans for the entire 1972-1997 period is 37.7%, slightly higher than the 36% severity reported in Snyderman [1991]. The severity calculation includes forgone interest and expenses, as well as lost principal.

The weighted average severity of loss on loans that were foreclosed and subsequently sold in the period 1992-1997 is 43.8%. The higher severity in this period reflects the steep downturn in real estate prices in the early 1990s. For individual insurance companies, the weighted average severity rates range from 26% to 72% in the 1992-1997 period.

Also during this period, about 60% of the loans entering foreclosure were liquidated, compared to 46% in the 1972-1991 period. There are no data available on the non-liquidated loans, which presumably were restructured by the lender.

TIMING OF DEFAULTS

Averaged over all cohorts, commercial mortgage defaults rise over the first three years after origination to about 2% of original balances, remain near 2% for years 3 through 7, and then fall off over the remaining life of the cohort. Although we do not have data on the

amortization schedules of the loans in the study, there does not appear to be any increase in default rates at balloon dates.

The default rate curve shown in Exhibit 7 masks individual cohort patterns, which can vary substantially from the average. Default timing for individual origination cohorts varies depending on the state of the commercial real estate market at the time of origination and the subsequent years.

For example, the 1973 cohort had the highest default rates in year 3 after origination (nearly 5%), as this cohort was originated near the peak of a real estate cycle followed by a sharp downturn in real estate prices. Not a single cohort, however, has a peak in default rates in years 7, 10, or 15, which are typically balloon payment dates. (See the appendix for yearly default data for each origination cohort.) Many of the loans originated in the 1970s and 1980s, however, were fully amortizing and not balloon mortgages.

COMPARISON TO PREVIOUS STUDIES

Our study extends from 1991 to 1997 the two previous commercial mortgage default studies by Snyderman [1991, 1994]. These studies covered 7,205 loans and 10,955 loans, respectively, while we increase the coverage to over 15,000 loans. The methodology and data source for all three studies are the same.

This study incorporates a period of sharp decline in commercial real estate markets. The average default rate for all cohorts rose from 13.8% in Snyderman [1994] to 16.2% in our study. For cohorts with at least ten years of data, the average default rate here is 18.1%, with a range of 9% to 23%. Snyderman [1994] does not report the average default rate for cohorts with a minimum of ten years of seasoning. Although we show higher default rates than previous studies, the new average for all cohorts with a minimum of ten years of history is very close to Snyderman's projected default rates made for these cohorts before this study.

IMPACT OF PRICE CHANGES ON DEFAULT RATES

To test the effect of changes in commercial property prices on commercial mortgage default rates, we run a regression of annual default rates on cumulative property appreciation and time since origination. The regression results are:

$$D = 0.018 - 0.000626P - 0.00570T$$
$$\quad (15.6) \qquad (-5.6) \qquad (-3.0)$$

where

R-squared = 0.162;
t-statistics in parentheses below are estimated coefficients;
the number of observations = 335;
D = an annual default observation for a cohort of loans;
P = the estimated cumulative increase in commercial property prices since origination;[3] and
T = the number of years since origination.

With no price appreciation, the estimated annual default rate starts out at 1.8% in the first year and declines slightly each year thereafter. The ten-year cumulative default rate for a cohort is just over 17%, consistent with the results of the current study.

A cumulative increase in real estate prices of 10% lowers the annual default rate by about 0.6% to 1.2%. Similarly, a cumulative fall in prices of 10% raises the annual default rate to 2.4%. The regression suggests that an immediate and sustained drop in property values of 20% would raise default rates to a 3% annual rate, or slightly less than a 30% cumulative rate over the life of the cohort. The cumulative default rate is less than ten times 3% because of the tempering effects of seasoning.

IMPACT OF DEFAULTS ON CURRENT BOND STRUCTURES

Our study finds that the worst origination cohort since 1972 has a cumulative default rate of 27.6%. Applying a 37.7% severity rate to this default rate gives an estimated cumulative loss of 10.4%. The current subordination levels for BBB CMBS range from 12% to 15%, implying that investment-grade CMBS will withstand the equivalent of the worst real estate downturn of the post-World War II era.

The estimated 10.4% loss rate is very conservative, since it implies that all defaulting loans are liquidated. In reality, we conservatively estimate that only about 50% of defaulting loans are liquidated, and the rest are restructured. In the insurance company data, we are able to ascertain the severity of loss only on liquidated loans, and not on restructured loans. If, as in the earlier studies, we assume that the severity on restructured loans is half that on liquidated loans, the average severity rate on defaulting loans drops to 28.2%. Applying this severity to the highest

default cohort gives a cumulative loss of 7.8%, well below the BBB subordination level.

While estimated default and loss rates should leave the principal of investment-grade CMBS untouched, they can have an impact on non-investment-grade securities. Applying the estimated severity of 28.2% to the average cohort gives a cumulative loss of 4.4%. The best cohort has an estimated loss of 2.6%. In comparison, single-B and BB CMBS subordination levels currently average about 3% and 6%, respectively.

CONCLUSION

Our update of the two earlier commercial mortgage default studies by Snyderman [1991, 1994] includes the effects of the commercial real estate recession of the early 1990s. Our results raise the average expected cumulative default rate of an origination cohort, but do not significantly change expectations of severity of loss on liquidated loans.

In applying the results of this study to current CMBS collateral, analysts should be careful to note the potential differences between insurance company and mortgage conduit originations. Loan size, property concentrations, LTVs, debt service coverage, and geographic distribution of a given conduit's originations may vary significantly from the life insurance company average.

In addition, the procedures taken by a life insurance company on problem loans may differ from a CMBS servicer. For example, life insurance companies generally operate under regulatory constraints that, in terms of capital

APPENDIX

Timing of Defaults by Cohort (%)

	Years Since Origination																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Average	0.38	1.34	1.89	2.03	1.97	2.12	1.89	1.13	1.01	0.68	0.67	0.50	0.46	0.36	0.26	0.34	0.26	0.11	0.08	0.10	0.03	0.01	0.01	0.01	0.00
1972	0.00	2.44	3.75	3.56	3.19	1.31	0.19	0.38	0.00	0.00	0.00	0.19	0.19	0.38	0.75	0.94	0.56	0.19	0.19	0.75	0.38	0.00	0.19	0.00	0.00
1973	0.14	2.99	4.76	3.40	1.63	0.54	0.00	0.14	0.14	0.14	0.14	0.00	0.82	0.95	0.54	0.95	0.68	0.14	0.27	0.82	0.27	0.27	0.00	0.14	0.00
1974	0.71	5.67	2.97	2.27	0.57	0.71	0.14	0.00	0.28	0.28	0.14	0.14	0.42	0.71	0.42	0.71	0.71	0.28	0.28	0.14	0.00	0.00	0.00	0.00	
1975	2.33	2.33	1.94	0.58	0.58	0.58	0.39	0.00	0.39	0.39	0.00	1.17	1.36	0.58	0.78	0.78	0.78	0.58	0.39	0.00	0.00	0.00	0.00		
1976	0.21	0.82	0.41	1.23	0.21	0.00	0.21	0.00	0.00	1.03	0.62	1.23	0.41	0.21	0.21	1.85	0.82	0.41	0.62	0.62	0.21	0.00			
1977	0.00	0.85	0.14	0.28	0.14	0.28	0.14	0.71	0.56	1.55	0.99	0.56	0.14	0.56	0.42	0.56	0.85	0.00	0.28	0.14	0.00				
1978	0.28	0.19	0.09	0.00	0.38	0.00	0.09	0.66	1.80	1.14	1.52	0.85	1.42	0.66	0.95	0.95	0.66	0.09	0.00	0.00					
1979	0.27	0.18	0.09	0.62	0.18	0.36	0.18	2.13	1.07	1.96	1.16	1.16	1.51	1.42	0.80	0.36	0.18	0.36	0.00						
1980	0.24	0.47	0.24	0.00	0.59	1.30	2.25	1.54	2.01	1.54	2.01	2.01	1.42	0.83	0.12	0.24	0.36	0.24							
1981	0.75	0.00	1.00	0.50	0.75	2.74	2.00	2.49	2.49	1.25	1.75	2.24	0.75	0.25	0.00	0.50	0.00								
1982	1.38	0.92	2.29	2.75	5.05	1.83	0.00	1.38	3.67	0.00	0.92	0.92	0.00	0.46	0.00	0.00									
1983	1.26	0.31	1.10	4.40	2.51	3.30	0.78	0.47	1.88	0.78	1.10	0.16	0.16	0.00	0.00										
1984	0.00	1.41	3.18	1.94	4.59	2.12	3.71	1.77	2.30	1.59	0.53	0.35	0.00	0.00											
1985	0.08	2.40	2.08	2.48	2.56	3.68	3.28	1.68	1.12	0.32	0.48	0.16	0.16												
1986	0.00	1.18	2.16	2.06	3.44	4.92	8.46	2.26	1.28	0.49	1.08	0.29													
1987	0.21	0.31	1.77	2.71	4.27	5.63	3.65	2.08	1.04	0.31	0.73														
1988	0.10	0.29	1.87	4.72	4.13	4.52	2.75	1.28	1.28	0.29															
1989	0.35	0.92	3.12	3.35	2.54	2.08	2.66	1.62	0.35																
1990	0.41	3.13	4.63	2.18	2.18	3.00	1.09	0.14																	
1991	0.72	1.20	1.68	1.68	1.20	0.24	0.48																		
1992	0.93	0.31	1.87	1.25	0.00	0.00																			

Source: Morgan Stanley.

charges, give preference to restructured loans rather than foreclosed loans, which are treated as real estate equity.

Finally, we have yet to fully evaluate the impact of the growing public nature of commercial real estate finance on real estate credit cycles. Some analysts believe that the growth of the CMBS and REIT markets will dampen the traditional boom/bust cycle of commercial real estate. If these analysts are correct, future updates of commercial default studies may show less volatility in commercial mortgage default rates.

ENDNOTES

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[1]As in the earlier studies, the sample comes from publicly available life insurance company annual statements that are filed with state insurance regulatory offices. If a loan is more than ninety days delinquent, it is counted as "defaulted." For more details on the data, see Snyderman [1991].

[2]While insurance company loans are very diverse geographically and by property type, they may differ in some respects from the entire universe of commercial mortgages. For example, in the period we study, insurance company portfolios tended to have a higher concentration of office properties than all commercial mortgages, and included a higher concentration of large "trophy" properties. For more details on insurance company originations, see Snyderman [1994].

[3]For 1978–1997, we use the capital value change of the Russell-NCREIF property index. For earlier years, we use nominal total returns and subtract the annual ten-year UST plus 150 bp to estimate the capital value component of total returns. Nominal returns are obtained from Eagle, Hudson-Wilson, and Wurtzebach [1993], the same source used in Snyderman [1994].

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