

## Property Diversification, Risk, And Return In CMBS Investment

Paul D. Childs, Steven H. Ott, and Timothy J. Riddiough

*This paper considers issues of risk, return and diversification with multi-class commercial mortgage-backed securities (CMBS). By employing an option-pricing methodology that overcomes state variable dimensionality problems, we consider mortgage pools with many distinct underlying assets and whose loan cash flow values are subject to interest rate uncertainty. Security structure and the correlation structure of collateralizing assets within a pool are found to be important determinants of tranche price and required yield spread. Of particular interest is the finding that reduced cash flow volatility through asset diversification may actually decrease the value of the first loss (junior) tranche. When examining the relationship of pool size and tranche value, we find that five to ten distinct mortgages are required to realize most of the effects of asset diversification.*

Over \$80 billion of commercial mortgages have been securitized in the last several years, which represents approximately 8 percent of the total \$1 trillion commercial mortgage market. Growth is expected to continue into the future, with some estimates that securitized commercial real estate debt will represent anywhere from 20 to 50 percent of the total commercial mortgage market within ten to fifteen years. From an evolutionary perspective, it is interesting to know that the residential mortgage-backed security (MBS) market had a similar 8 percent market share in the late 1970's, whereas today one out of every two mortgages is securitized and the total residential MBS market capitalization is over \$1.5 trillion.

The CMBS market is therefore expected to continue to be an important source of capital for commercial real estate. However, primarily because of the relative immaturity of this market, little is known about the risk/return characteristics of CMBS. This research is the first to rigorously examine risk and return in commercial mortgage-backed security investment. In doing so we pay particular attention to security pricing as affected by security design, property uncertainty, and the correlation structure of properties that comprise a CMBS pool.

We employ several innovative option pricing techniques to value these securities. The table below shows that our model provides security yields that are generally in line with yields observed in the marketplace, although with some apparent differences. For example, given the parameter values employed in this study, our analysis indicates that senior investment classes that comprise 70 percent or less of the pool are essentially free from default loss, which suggests pricing comparable to an AAA bond. The currently observed positive yield spreads of 70-100 basis points suggests that there may be other non-default risks to consider or that pricing is conservative given investor and rating agency unfamiliarity with this new debt security. To the extent that the latter effect is relevant, we should observe a gradual narrowing of spreads over comparable duration Treasury bond yields.

Investment Class	Pool Share	Observed Yield Spreads	Modeled Yield Spreads
Senior	70%	70-100 basis points	≈0 basis points
Mezzanine	10-25%	150-400 basis points	0-500 basis points
Junior	20-5%	450-1500 basis points	350-2250 basis points

With respect to the more junior payment classes, we find ranges of prices that vary substantially over a plausible range of model input parameter values. The impact of property diversification on security value, in particular, yields interesting results which contradict the conventional wisdom with respect to the first loss payment class. Our results suggest that increased diversification may actually *decrease* first-loss tranche value, a finding that, in our opinion, merits close examination by those who are intimately involved in this new and developing market. Indeed, this finding contrasts with statements made by investment

banks and rating agencies, who have recently touted the general *positive* effects of diversification on CMBS value.

Given our finding that indicates property diversification plays a large and perhaps underappreciated role in the equilibrium valuation of these investments, a natural follow-up question is how many individual mortgages in a CMBS pool are required to realize most of the effects from asset diversification. An answer to this question is provided in a series of graphs under several different security design and correlation structure assumptions.<sup>1</sup> These graphs vividly demonstrate the opposing effects of diversification on higher (senior and mezzanine) versus lower (junior) priority investment classes. Overall, it appears that pool sizes of only five to ten mortgages are required to realize a majority of the total potential effect of diversification.<sup>2</sup>

In summary, we have taken a "top-down" approach to provide a framework for understanding risk and return in CMBS investment. In doing so we have attempted to keep the analysis as simple as possible, while still reflecting the critical factors that drive pricing of these securities. As a tool for investment analysis, models like the one developed in this paper can enable market participants to improve their financial decision-making in areas such as optimal security structure, development of buy/sell strategies (for both whole loans and their securities), and the search for arbitrage profit opportunities.

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<sup>1</sup> Because security value rather than yield provides a more standardized measure of the effects of diversification, we show market value as a percent of face value on the vertical axis and the number of properties in the pool (N) on the horizontal axis.

<sup>2</sup> These findings in part depend on the fact that all mortgages are the same size in our analysis, the fact that parameter values are identical for each loan, and the fact that the pool is valued at par at the date of sale. Having one mortgage that is much larger than the other mortgages in the pool, for example, would require a relatively larger number of smaller-value loans to realize significant diversification effects.