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VALUATION

Risk and Valuation of Collateralized Debt Obligations

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Abstract

In this discussion of risk analysis and market valuation of collateralized debt obligations, we illustrate the effects of correlation and prioritization on valuation and discuss the “diversity score” (a measure of the risk of the CDO collateral pool that has been used for CDO risk analysis by rating agencies) in a simple jump diffusion setting for correlated default intensities.

A collateralized debt obligation (CDO) is an asset-backed security whose underlying collateral is typically a portfolio of (corporate or sovereign) bonds or bank loans. A CDO cash flow structure allocates interest income and principal repayments from a collateral pool of different debt instruments to prioritized CDO securities (tranches). A standard prioritization scheme is simple subordination: Senior CDO notes are paid before mezzanine and lower subordinated notes are paid, and any residual cash flow is paid to an equity piece. CDOs form an increasingly large and important class of fixed-income securities. Our analysis may provide useful approaches to valuation and diagnostic measures of risk.

We concentrate on cash flow CDOs-those for which the collateral portfolio is not subjected to active trading by the CDO manager. The implication of this characteristic is that the uncertainty regarding interest and principal payments to the CDO tranches is determined mainly by the number and timing of defaults of the collateral securities. We do not analyze market-value CDOs, those in which the CDO tranches receive payments based essentially on the marked-to-market returns of the collateral pool as determined largely by the trading performance of the CDO manager.

In our analysis of the risk and market valuation of cash flow CDOs, we illustrate the effects of correlation and prioritization for the market valuation, “diversity score” (a measure of the risk of the CDO collateral pool that has been used for CDO risk analysis by rating agencies), and risk of CDOs in a simple jump diffusion setting for correlated default intensities. The main issue is the impact of the joint distribution of default risk of the underlying collateral securities on the risk and valuation of the CDO tranches. We also address the efficacy of alternative computational methods and the role of diversity scores.

We show that default-time correlation has a significant impact on the market values of individual tranches. The priority of the senior tranche, by which it is effectively “short a call option” on the performance of the underlying collateral pool, causes its market value to decrease with the risk-neutral default-time correlation. The value of the equity piece, which resembles a call option, increases with correlation. Optionality has no clear effect on intermediate tranches. With sufficient overcollateralization, the option “written” (to the lower tranches) dominates, but it is the other way around for sufficiently low levels of overcollateralization.

Spreads, at least for mezzanine and senior tranches, are not especially sensitive to the “lumpiness” of the arrival of information about credit quality, in that replacing the contribution of diffusion with jump risks (of various types), while holding constant the degree of mean reversion and the term structure of credit spreads, plays a relatively small role in determining the spreads.

Regarding alternative computational methods, we show that if (risk-neutral) diversity scores can be evaluated accurately, which is computationally simple in the framework

we propose, these scores can be used to obtain good approximate market valuations for reasonably well-collateralized tranches.

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