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A Structural Analysis of Credit Risk With Risky Collateral: A Methodology for Haircut Determination

Didier Cossin, 1 Tomas Hricko 2

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Abstract

Although many credit risk pricing models exist in the academic literature, very little attention has been paid to the impact of risky collateral on credit risk. It is nonetheless well known that practitioners often mitigate credit risk with collateral, using so–called haircuts for collateral level determination. The presence of collateral has a complex effect that can not be analysed simply with existing models. We analyse the value of credit risk when there is collateral in a range of different situations, including dual–default in a simple setting, stochastic collateral, stochastic bond collateral with stochastic interest rates, continuous and discrete marking–to–market and margin calls. The models confirm many practical intuitions, such as the impact on the haircut level required of the risks of the collateral asset and of the underlying asset to the forward as well as the impact of their correlation. Moreover, the model supports the intuition that the frequency of marking–to–market and collateral are substitutes. The models also stress the possibly unexpected magnitude of these factors. More importantly, they give actual solutions to determining the value of the credit risk depending on the haircut chosen and the frequency of marking–to–markets, results not presented before in the literature. The models are also a good basis to understand the portfolio effect of collateral management. Finally, they illustrate how differences in prices may arise from pure differences of credit risk management, as illustrated here in the case of futures and forwards.

(J.E.L.: G13).

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