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Manuel Ammann

Credit Risk Valuation

Methods, Models, and Applications

Second Edition

With 17 Figures
and 23 Tables



Springer

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Preface

Credit risk is an important consideration in most financial transactions. As for any other risk, the risk taker requires compensation for the undiversifiable part of the risk taken. In bond markets, for example, riskier issues have to promise a higher yield to attract investors. But how much higher a yield? Using methods from contingent claims analysis, credit risk valuation models attempt to put a price on credit risk.

This monograph gives an overview of the current methods for the valuation of credit risk and considers several applications of credit risk models in the context of derivative pricing. In particular, credit risk models are incorporated into the pricing of derivative contracts that are subject to credit risk. Credit risk can affect prices of derivatives in a variety of ways. First, financial derivatives can be subject to counterparty default risk. Second, a derivative can be written on a security which is subject to credit risk, such as a corporate bond. Third, the credit risk itself can be the underlying variable of a derivative instrument. In this case, the instrument is called a credit derivative. Fourth, credit derivatives may themselves be exposed to counterparty risk. This text addresses all of those valuation problems but focuses on counterparty risk.

The book is divided into six chapters and an appendix. Chapter 1 gives a brief introduction into credit risk and motivates the use of credit risk models in contingent claims pricing. Chapter 2 introduces general contingent claims valuation theory and summarizes some important applications such as the Black-Scholes formulae for standard options and the Heath-Jarrow-Morton methodology for interest-rate modeling. Chapter 3 reviews previous work in the area of credit risk pricing. Chapter 4 proposes a firm-value valuation model for options and forward contracts subject to counterparty risk, under various assumptions such as Gaussian interest rates and stochastic counterparty liabilities. Chapter 5 presents a hybrid credit risk model combining features of intensity models, as they have recently appeared in the literature, and of the firm-value model. Chapter 6 analyzes the valuation of credit derivatives in the context of a compound valuation approach, presents a reduced-form method for valuing spread derivatives directly, and models credit derivatives subject to default risk by the derivative counterparty as a vulnerable exchange option. Chapter 7 concludes and discusses practical im-

plications of this work. The appendix contains an overview of mathematical tools applied throughout the text.

This book is a revised and extended version of the monograph titled *Pricing Derivative Credit Risk*, which was published as vol. 470 of the Lecture Notes of Economics and Mathematical Systems by Springer-Verlag. In June 1998, a different version of that monograph was accepted by the University of St.Gallen as a doctoral dissertation. Consequently, this book still has the "look-and-feel" of a research monograph for academics and practitioners interested in modeling credit risk and, particularly, derivative credit risk. Nevertheless, a chapter on general derivatives pricing and a review chapter introducing the most popular credit risk models, as well as fairly detailed proofs of propositions, are intended to make it suitable as a supplementary text for an advanced course in credit risk and financial derivatives.

St. Gallen, March 2001

Manuel Ammann

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