

## Book Review

Christian Bluhm, Ludger Overbeck and Christoph Wagner, *An Introduction To Credit Risk Modelling*, Chapman & Hall/CRC Financial Mathematics Series, 2010, 364pp. (hardback), £49.99 (\$79.95). ISBN: 9781584889922

### Chapman & Hall/CRC Financial Mathematics Series

#### Introduction

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This book was written for readers who either do not work on the bond market or the credit market (particularly the secondary market), but are sufficiently interested in either; or readers who work on either market but need to get up to speed with the modelling. Anyone who is reasonably au fait with probability theory and calculus can use the book – you do not need to be an expert.

At the time of writing this review, the bond market had just downgraded Portugal's sovereign debt, forcing Portugal to seek financial rescue from the European Union. In other words the market "changed an assumption" and policy makers ran for cover. Assumptions play a central part in this book, and indeed this review.

#### Basics Of Credit Risk Modelling

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The book introduces the concept of modelling the probability of default, the exposure amount and the losses on credit arrangements, with emphasis on default probability. The book highlights assumptions that are built into the construction of a tractable model. The book also discusses commonly used credit risk models, and some less common ones.

The first chapter introduces the fundamentals of a credit risk model for an over-the-counter bank loan. Of course, credit is much more complex than this, as should become clear in other chapters. Chapter One also introduces a simple definition of economic capital and discusses the challenges faced in applying this definition to a credit portfolio. The practical considerations for both defining economic capital and applying the definition to a business are only considered in Chapter Five.

#### Correlated Defaults

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You either know the joint distribution of the losses on your loan portfolio, or more likely, you do not – this is the most important challenge which Chapter One introduces, and it is also covered in subsequent chapters. The last section in Chapter One introduces Monte Carlo simulation and analytical approximation, both commonly used methods for dealing with this challenge, further introducing factor models, specifically the KMV<sup>®</sup> model and the CreditMetrics<sup>™</sup> model.

## Assumptions

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Two meanings of the word “Assumptions” are worth bearing in mind when you read this book, or any other related texts, being:

1. Simplifications that are applied in order to construct a model that is mathematically tractable (remember independence makes things easier in probability theory)
2. Conclusions that are drawn, once a model has been fitted, for example using historic data (“historic mean is the true mean”), as set out in the worked example at the end of Chapter Two.

Portuguese policy makers might have felt aggrieved by the rating downgrade, which would have been based on an assumption (definition two above); readers of this book will appreciate the first meaning of assumptions a lot more. Even policymakers should take note. In constructing simple models for expected and unexpected loss in Chapter One, or the more complex models in chapters Two to Eight, the assumptions (definition One) that are built into the process are set out so that you do not miss them.

## Mixture Distributions

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Mixture distributions, which in their most simplistic form are only suitable for modelling debt obligations to a small bank (small homogeneous loans), are first discussed in Chapter Two. Both the appeal and dangers of Poisson and Binomial mixture models, among others, is clear in Chapter Two. Should the fact that a Poisson model allows multiple defaults from a single obligor be dismissed as a mere unpleasantness? You will discover a rather widespread use of such models, regardless of your view, and some examples are given in this book.

Chapter Two also deconstructs the most commonly used risk models, side by side, to explain their application in modelling default risk on a portfolio. The same chapter demonstrates the ever-growing role of copulas in studying multivariate distributions. A different approach to the construction and deconstruction of copula function is also used to introduce less widespread uses of copula.

Of the risk models discussed in Chapter Two, CreditRisk+ gets a chapter to itself later on, on the basis of its acceptance by many institutions. CreditRisk+ offers a closed-form loss distribution model. Being a Gamma-mixed Poissonian model, the details of CreditRisk+ that are set out in Chapter Four are easy to follow.

## Asset Value Models

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Given that two credit risk models that are discussed extensively in this book are based on the asset value model (Black & Scholes, 1973, and Merton, 1974), it is no surprise that there is a chapter dedicated to the Black-Scholes partial differential equation and Merton’s option-theoretic approach.

The authors did not set out to conduct a scholarly examination of the Black-Scholes option pricing formula but they have done enough to allow readers to ask some questions: for example, do equity investors really consider their shares as a long call position on the company’s assets; what does a model user need to do about the fact that Geometric Brownian motion does not yield fat tails, yet log returns on assets actually do? These are probably some of the questions that followed Black Monday, October 19, 1987. Both questions are worth remembering in Chapter Seven which discusses the models used in the trillion dollar credit protection market.

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## Credit Protection

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There are two chapters dedicated to the secondary markets of credit protection and collateralised debt obligations. They are preceded by a discussion on the term structure of debt probabilities, which takes the modelling of default probabilities beyond the simple one-period horizon to the more realistic multi-period horizon.

You could read these three chapters alone and find value in the book.

Not only does the book offer simple explanations of the commonly used credit protection arrangements, focusing on derivatives rather than debt insurance, but it also offers (not-so-simple) techniques for evaluating the transactions.

The book does not offer a dialectic discussion on the merits or demerits of exchanging the economic performance of one asset with another (so some readers may need background reading on this subject).

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## Collateralised Debt Obligations

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If you are new to the credit or bond markets, it is worth reading the first five chapters before the last three. Chapter Eight explores the structure of simple asset backed securities; and the modelling of risk to both the originators of such contracts and the investors. A deeper treatment of this subject is not offered, and does not appear to be necessary. Through back-of-the-envelope calculations you can evaluate simple collateralised debt and loan obligations.

The examples go into the details of “tranching” (this contributes a lot to CDOs appeal) which leads to discussions of collateral and interest coverage tests, plus other mechanisms for identifying and quantifying risk on the contracts and for enabling investors to manage their exposure. It is then easy to understand both the charm (regulatory arbitrage) and dangers of the products. The folly of high average returns which ignore the fat tailed loss distributions on credit portfolios is laid bare.

More importantly, for the objectives of this book, Chapter Eight concludes by constructing a simple model and reviewing Moody’s BET model for collateralised debt obligations, at which point it should become clear that definition One of assumptions, see above, is often more important than definition Two.

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## Summary

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Whether this is what the authors intended or not, this book makes a strong case that when a model is presented to you, you should question the assumptions. By foregoing a lot of technical details, the authors deliver both relevant information on the models and critical assumptions for decision makers to consider.

While many readers will hope to learn some modelling tips from the book and may one day make assumptions that frighten policymakers; this is a concise book for exploring the limitations of credit risk models and, to a lesser degree, asset valuation models. Read this book for a companionable journey through some of the limiting assumptions that make the models tractable. For erudite debate on these assumptions, you will have to look elsewhere. This may not be the only book

that discusses the financial products that are set out in the last two chapters, but it may be the first one that wastes no time in getting to the point, and moving on.

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### References

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