

Modelling Single-name and Multi-name Credit Derivatives

Dominic O’Kane



John Wiley & Sons, Ltd

Modelling Single-name and Multi-name
Credit Derivatives

Dominic O'Kane



John Wiley & Sons, Ltd

Modelling Single-name and Multi-name
Credit Derivatives

Dominic O'Kane



John Wiley & Sons, Ltd

Table of Contents

[Title Page](#)

[Copyright Page](#)

[Dedication](#)

[Acknowledgements](#)

[About the Author](#)

[Introduction](#)

[Notation](#)

[Chapter 1 - The Credit Derivatives Market](#)

[1.1 INTRODUCTION](#)

[1.2 MARKET GROWTH](#)

[1.3 PRODUCTS](#)

[1.4 MARKET PARTICIPANTS](#)

[1.5 SUMMARY](#)

[Chapter 2 - Building the Libor Discount Curve](#)

[2.1 INTRODUCTION](#)

[2.2 THE LIBOR INDEX](#)

[2.3 MONEY MARKET DEPOSITS](#)

[2.4 FORWARD RATE AGREEMENTS](#)

[2.5 INTEREST RATE FUTURES](#)

[2.6 INTEREST RATE SWAPS](#)

[2.7 BOOTSTRAPPING THE LIBOR CURVE](#)

[2.8 SUMMARY](#)

[2.9 TECHNICAL APPENDIX](#)

[Part I - Single-name Credit Derivatives](#)

Chapter 3 - Single-name Credit Modelling

3.1 INTRODUCTION

3.2 OBSERVING DEFAULT

3.3 RISK-NEUTRAL PRICING FRAMEWORK

3.4 STRUCTURAL MODELS OF DEFAULT

3.5 REDUCED FORM MODELS

3.6 THE HAZARD RATE MODEL

3.7 MODELLING DEFAULT AS A COX PROCESS

3.8 A GAUSSIAN SHORT RATE AND HAZARD RATE MODEL

3.9 INDEPENDENCE AND DETERMINISTIC HAZARD RATES

3.10 THE CREDIT TRIANGLE

3.11 THE CREDIT RISK PREMIUM

3.12 SUMMARY

3.13 TECHNICAL APPENDIX

Chapter 4 - Bonds and Asset Swaps

4.1 INTRODUCTION

4.2 FIXED RATE BONDS

4.3 FLOATING RATE NOTES

4.4 THE ASSET SWAP

4.5 THE MARKET ASSET SWAP

4.6 SUMMARY

Chapter 5 - The Credit Default Swap

5.1 INTRODUCTION

5.2 THE MECHANICS OF THE CDS CONTRACT

5.3 MECHANICS OF THE PREMIUM LEG

5.4 MECHANICS OF THE PROTECTION LEG

5.5 BONDS AND THE CDS SPREAD

5.6 THE CDS-CASH BASIS

5.7 LOAN CDS

5.8 SUMMARY

Chapter 6 - A Valuation Model for Credit Default Swaps

6.1 INTRODUCTION

6.2 UNWINDING A CDS CONTRACT

6.3 REQUIREMENTS OF A CDS PRICING MODEL

6.4 MODELLING A CDS CONTRACT

6.5 VALUING THE PREMIUM LEG

6.6 VALUING THE PROTECTION LEG

6.7 UPFRONT CREDIT DEFAULT SWAPS

6.8 DIGITAL DEFAULT SWAPS

6.9 VALUING LOAN CDS

6.10 SUMMARY

Chapter 7 - Calibrating the CDS Survival Curve

7.1 INTRODUCTION

7.2 DESIRABLE CURVE PROPERTIES

7.3 THE BOOTSTRAP

7.4 INTERPOLATION QUANTITIES

7.5 BOOTSTRAPPING ALGORITHM

7.6 BEHAVIOUR OF THE INTERPOLATION SCHEME

7.7 DETECTING ARBITRAGE IN THE CURVE

7.8 EXAMPLE CDS VALUATION

7.9 SUMMARY

Chapter 8 - CDS Risk Management

8.1 INTRODUCTION

8.2 MARKET RISKS OF A CDS POSITION

8.3 ANALYTICAL CDS SENSITIVITIES

8.4 FULL HEDGING OF A CDS CONTRACT

8.5 HEDGING THE CDS SPREAD CURVE RISK

8.6 HEDGING THE LIBOR CURVE RISK

8.7 PORTFOLIO LEVEL HEDGING

8.8 COUNTERPARTY RISK

8.9 SUMMARY

Chapter 9 - Forwards, Swaptions and CMDS

9.1 INTRODUCTION

9.2 FORWARD STARTING CDS

9.3 THE DEFAULT SWAPTION

9.4 CONSTANT MATURITY DEFAULT SWAPS

9.5 SUMMARY

Part II - Multi-name Credit Derivatives

Chapter 10 - CDS Portfolio Indices

10.1 INTRODUCTION

10.2 MECHANICS OF THE STANDARD INDICES

10.3 CDS PORTFOLIO INDEX VALUATION

10.4 THE INDEX CURVE

10.5 CALCULATING THE INTRINSIC SPREAD OF AN INDEX

10.6 THE PORTFOLIO SWAP ADJUSTMENT

10.7 ASSET-BACKED AND LOAN CDS INDICES

10.8 SUMMARY

Chapter 11 - Options on CDS Portfolio Indices

11.1 INTRODUCTION

11.2 MECHANICS

11.3 VALUATION OF AN INDEX OPTION

11.4 AN ARBITRAGE-FREE PRICING MODEL

11.5 EXAMPLES OF PRICING

11.6 RISK MANAGEMENT

11.7 BLACK'S MODEL REVISITED

11.8 SUMMARY

Chapter 12 - An Introduction to Correlation Products

12.1 INTRODUCTION

12.2 DEFAULT BASKETS

12.3 LEVERAGING THE SPREAD PREMIA

12.4 COLLATERALISED DEBT OBLIGATIONS

12.5 THE SINGLE-TRANCHE SYNTHETIC CDO

12.6 CDOs AND CORRELATION

12.7 THE TRANCHE SURVIVAL CURVE

12.8 THE STANDARD INDEX TRANCHES

12.9 SUMMARY

Chapter 13 - The Gaussian Latent Variable Model

13.1 INTRODUCTION

13.2 THE MODEL

13.3 THE MULTI-NAME LATENT VARIABLE MODEL

13.4 CONDITIONAL INDEPENDENCE

13.5 SIMULATING MULTI-NAME DEFAULT

13.6 DEFAULT INDUCED SPREAD DYNAMICS

13.7 CALIBRATING THE CORRELATION

13.8 SUMMARY

Chapter 14 - Modelling Default Times using Copulas

14.1 INTRODUCTION

14.2 DEFINITION AND PROPERTIES OF A COPULA

14.3 MEASURING DEPENDENCE

14.4 RANK CORRELATION

14.5 TAIL DEPENDENCE

14.6 SOME IMPORTANT COPULAE

14.7 PRICING CREDIT DERIVATIVES FROM DEFAULT TIMES

14.8 STANDARD ERROR OF THE BREAK-EVEN SPREAD

14.9 SUMMARY

14.10 TECHNICAL APPENDIX

Chapter 15 - Pricing Default Baskets

15.1 INTRODUCTION

15.2 MODELLING FIRST-TO-DEFAULT BASKETS

15.3 SECOND-TO-DEFAULT AND HIGHER DEFAULT BASKETS

15.4 PRICING BASKETS USING MONTE CARLO

15.5 PRICING BASKETS USING A MULTI-FACTOR MODEL

15.6 PRICING BASKETS IN THE STUDENT-T COPULA

15.7 RISK MANAGEMENT OF DEFAULT BASKETS

15.8 SUMMARY

Chapter 16 - Pricing Tranches in the Gaussian Copula Model

16.1 INTRODUCTION

16.2 THE LHP MODEL

16.3 DRIVERS OF THE TRANCHE SPREAD

16.4 ACCURACY OF THE LHP APPROXIMATION

16.5 THE LHP MODEL WITH TAIL DEPENDENCE

16.6 SUMMARY

16.7 TECHNICAL APPENDIX

Chapter 17 - Risk Management of Synthetic Tranches

17.1 INTRODUCTION

17.2 SYSTEMIC RISKS

17.3 THE LH+ MODEL

17.4 IDIOSYNCRATIC RISKS

17.5 HEDGING TRANCHES

17.6 SUMMARY

17.7 TECHNICAL APPENDIX

Chapter 18 - Building the Full Loss Distribution

- 18.1 INTRODUCTION
- 18.2 CALCULATING THE TRANCHE SURVIVAL CURVE
- 18.3 BUILDING THE CONDITIONAL LOSS DISTRIBUTION
- 18.4 INTEGRATING OVER THE MARKET FACTOR
- 18.5 APPROXIMATING THE CONDITIONAL PORTFOLIO LOSS DISTRIBUTION
- 18.6 A COMPARISON OF METHODS
- 18.7 PERTURBING THE LOSS DISTRIBUTION
- 18.8 SUMMARY

Chapter 19 - Implied Correlation

- 19.1 INTRODUCTION
- 19.2 IMPLIED CORRELATION
- 19.3 COMPOUND CORRELATION
- 19.4 DISADVANTAGES OF COMPOUND CORRELATION
- 19.5 NO-ARBITRAGE CONDITIONS
- 19.6 SUMMARY

Chapter 20 - Base Correlation

- 20.1 INTRODUCTION
- 20.2 BASE CORRELATION
- 20.3 BUILDING THE BASE CORRELATION CURVE
- 20.4 BASE CORRELATION INTERPOLATION
- 20.5 INTERPOLATING BASE CORRELATION USING THE ETL
- 20.6 A BASE CORRELATION SURFACE
- 20.7 RISK MANAGEMENT OF INDEX TRANCHES
- 20.8 HEDGING THE BASE CORRELATION SKEW
- 20.9 BASE CORRELATION FOR BESPOKE TRANCHES
- 20.10 RISK MANAGEMENT OF BESPOKE TRANCHES
- 20.11 SUMMARY

Chapter 21 - Copula Skew Models

21.1 INTRODUCTION

21.2 THE CHALLENGE OF FITTING THE SKEW

21.3 CALIBRATION

21.4 RANDOM RECOVERY

21.5 THE STUDENT-T COPULA

21.6 THE DOUBLE-T COPULA

21.7 THE COMPOSITE BASKET MODEL

21.8 THE MARSHALL-OLKIN COPULA

21.9 THE MIXING COPULA

21.10 THE RANDOM FACTOR LOADING MODEL

21.11 THE IMPLIED COPULA

21.12 COPULA COMPARISON

21.13 PRICING BESPOKES

21.14 SUMMARY

Chapter 22 - Advanced Multi-name Credit Derivatives

22.1 INTRODUCTION

22.2 CREDIT CPPI

22.3 CONSTANT PROPORTION DEBT OBLIGATIONS

22.4 THE CDO-SQUARED

22.5 TRANCHELETS

22.6 FORWARD STARTING TRANCHES

22.7 OPTIONS ON TRANCHES

22.8 LEVERAGED SUPER SENIOR

22.9 SUMMARY

Chapter 23 - Dynamic Bottom-up Correlation Models

23.1 INTRODUCTION

23.2 A SURVEY OF DYNAMIC MODELS

23.3 THE INTENSITY GAMMA MODEL

[23.4 THE AFFINE JUMP DIFFUSION MODEL](#)

[23.5 SUMMARY](#)

[23.6 TECHNICAL APPENDIX](#)

[Chapter 24 - Dynamic Top-down Correlation Models](#)

[24.1 INTRODUCTION](#)

[24.2 THE MARKOV CHAIN APPROACH](#)

[24.3 MARKOV CHAIN: INITIAL GENERATOR](#)

[24.4 MARKOV CHAIN: STOCHASTIC GENERATOR](#)

[24.5 SUMMARY](#)

[Appendix A - Useful Formulae](#)

[Bibliography](#)

[Index](#)

For other titles in the Wiley Finance series
please see www.wiley.com/finance

Copyright © 2008 Dominic O' Kane

Published by John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester,
West Sussex PO19 8SQ, England

Telephone (+44) 1243 779777

Email (for orders and customer service enquiries): cs-books@wiley.co.uk Visit
our Home Page on www.wiley.com

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except under the terms of the Copyright, Designs and Patents Act 1988 or under the terms of a licence issued by the Copyright Licensing Agency Ltd, 90 Tottenham Court Road, London W1T 4LP, UK, without the permission in writing of the Publisher. Requests to the Publisher should be addressed to the Permissions Department, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England, or emailed to permreq@wiley.co.uk, or faxed to (+44) 1243 770620.

Designations used by companies to distinguish their products are often claimed as trademarks. All brand names and product names used in this book are trade names, service marks, trademarks or registered trademarks of their respective owners. The Publisher is not associated with any product or vendor mentioned in this book.

This publication is designed to provide accurate and authoritative information in regard to the subject matter covered. It is sold on the understanding that the Publisher is not engaged in rendering professional services. If professional advice or other expert assistance is required, the services of a competent professional should be sought.

Other Wiley Editorial Offices

John Wiley & Sons Inc, 111 River Street, Hoboken, NJ 07030, USA

Jossey-Bass, 989 Market Street, San Francisco, CA 94103-1741, USA

Wiley-VCH Verlag GmbH, Boschstr. 12, D-69469 Weinheim, Germany

John Wiley & Sons Australia Ltd, 42 McDougall Street, Milton, Queensland 4064,
Australia

John Wiley & Sons (Asia) Pte Ltd, 2 Clementi Loop #02-01, Jin Xing Distripark,
Singapore 129809

John Wiley & Sons Canada Ltd, 6045 Freemont Blvd, Mississauga, ONT, L5R 4J3,
Canada

Wiley also publishes its books in a variety of electronic formats. Some content
that appears in print may not be available in electronic books.

Library of Congress Cataloging in Publication Data

O'Kane, Dominic.
Modelling single-name and multi-name credit derivatives /Dominic O'Kane. p.
cm. — (Wiley finance)
Includes bibliographical references and index.
ISBN 978-0-470-51928-8 (cloth : alk. paper)
1. Credit derivatives. I. Title.
HG6024.A3039 2008
332.64'57 — dc22

2008019031

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

ISBN 978-0-470-51928-8 (HB)

Typeset in 10/12pt Times by Integra Software Services Pvt. Ltd, Pondicherry,
India
Printed and bound in Great Britain by Antony Rowe Ltd, Chippenham, Wiltshire

To Penny, Rory and Fergal.

Acknowledgements

Many thanks go to all the quants I have worked with on credit derivative modelling. First and foremost is Lutz Schloegl, a superb quant and a good friend with whom I have collaborated for many years. Other quants with whom I have collaborated and whose help I gratefully acknowledge are Ren-Raw Chen, Andrei Greenberg, Sebastian Hitier, Matthew Livesey, Sam Morgan, Claus Pedersen, Lee Phillips, Wenjun Ruan and Saurav Sen. I would especially like to acknowledge collaborations with Professor Stuart Turnbull.

On the trading side, I would like to acknowledge many fruitful conversations with Georges Assi. A large debt of gratitude is also owed to Mark Ames, Ugo Calcagnini, Assan Din and Ken Umezaki who all helped me get my head around the basics of credit derivatives way back in the late 1990s when there was nothing to read and the asset swap looked exotic.

Extra special thanks go to all those others who read earlier versions of this book, especially Lutz Schloegl whose extensive comments were a great help. I also thank Robert Campbell and Matthew Leeming who both read the entire manuscript and provided valuable feedback. Thanks also go to Matthew Livesey, Michal Oulik, Claus Pedersen and Jeroen Kerkhof for reading and commenting on selected chapters. In all of these cases, it was a significant request and they all responded generously. It must also be stated that any errors which remain in this book are mine.

I am grateful to Dev Joneja at Lehman Brothers for providing access to the LehmanLive[®] website, to the British Bankers' Association and Moody's Investor Services for

permission to quote from their reports, and to the valuation experts at Markit Group Limited for answering some technical questions. Conversations with Robert McAdie are also gratefully acknowledged.

Finally I would like to reserve my biggest thanks for my wife who provided both support and encouragement. I dedicate this book to her and to my two wonderful boys.

Dominic O’Kane

April 2008.

About the Author

Dominic O’Kane is an affiliated Professor of Finance at the French business school EDHEC which is based in Nice, France. Until May 2006, Dominic O’Kane was a managing director and ran the European Fixed Income Quantitative Research group at Lehman Brothers, the US investment bank. Dominic spent seven of his nine years at Lehman Brothers working as a quant for the credit derivatives trading desk. Dominic has a doctorate in theoretical physics from Oxford University.

Introduction

The aim of this book is to present an up-to-date, comprehensive, accessible and practical guide to the models used to price and risk-manage credit derivatives. It is both a detailed introduction to credit derivative modelling and a reference for those who are already practitioners.

This book is up-to-date as it covers many of the important developments which have occurred in the credit derivatives market in the past 4-5 years. These include the arrival of the CDS portfolio indices and all of the products based on these indices. In terms of models, this book covers the challenge of modelling single-tranche CDOs in the presence of the correlation skew, as well as the pricing and risk of more recent products such as constant maturity CDS, portfolio swaptions, CDO squareds, credit CPPI and credit CPDOs.

For each model, the reader is taken through the underlying assumptions and then the mathematical derivation. The application of the model to pricing and risk-management is explained with the goal of trying to build intuition. There is also a focus on the efficient implementation of each model.

Product coverage is extensive and is split into two parts. Part I covers single-name credit derivatives and Part II covers multi-name credit derivatives. We begin the first part with the traditional credit products including the credit risky bond, the floating rate note and the asset swap. Although they are not credit derivatives, these are included for the sake of completeness and because they are a pricing reference for the credit default swap. We then move on to the credit default swap (CDS) which, reflecting its importance, is covered in considerable detail. We also

include a discussion of digital CDS, forward CDS and loan CDS. We then cover other single-name products including the constant maturity default swap and the default swaption.

Part II covers products whose risk is linked to the credit performance of more than one credit. These are known as 'multi-name' products. We begin with the biggest growth product of the credit derivatives market, the CDS index. This then leads us to the many product innovations which have resulted from the arrival of these CDS indices. These include the tranching CDS indices and CDS index swaptions. We also cover advanced correlation products such as the CDO-squared and the leveraged super senior. Dynamically managed structures such as the credit CPPI and CPDO are also examined. Towards the end of the book we consider a number of the newer products which are beginning to be traded. These include forward starting tranches and tranche options.

In this book we set out in detail the models which have been developed to address the challenges posed by these products. Of these challenges, the most important has been the modelling of default correlation. We therefore cover in detail the Gaussian copula and the modelling of default dependency in general, especially within a copula framework. After establishing the arbitrage-free conditions for a correlation model, we devote an entire chapter to *base correlation*, which has become a widely used pricing and risk-management approach. We discuss its implementation and in doing so highlight the advantages and disadvantages of base correlation as a pricing and risk-management framework. We then discuss a range of specific copula models, highlighting the pros and cons of each. This takes us to the subject of much current research—the development of usable dynamic correlation models. In the final two chapters of this book we discuss the two main categories of

dynamic models known as bottom-up and top-down. We also set out in detail some specific models which fall into these two categories.

The credit derivatives market has changed significantly in the past four to five years and most of these developments are contained within this book. However, the market continues to evolve. As a result, I would suggest that readers keen to keep abreast of the latest modelling and market developments periodically visit www.defaultrisk.com and the technical forums of www.wilmott.com.

Notation

Symbol	Description
t	today (valuation date).
$t = 0$	Contract initiation date.
t_S	Contract settlement date.
t_E	Option expiry date.
T	Contract maturity date.
t_n	n th cash flow date on the premium leg. Usually $t_0 = t$ and $t_N = T$.
$\Delta(t_{n-1}, t_n, b)$	The year fraction from date t_{n-1} to t_n in a basis b . We typically drop the b .
$Z(t, T)$	Libor zero coupon bond price from time t to T . We sometimes use $Z(t) = Z(0, t)$.
$\hat{z}(t, T)$	Zero recovery credit risky zero coupon bond price from today time t to time T .
$L(T_1, T_2)$	The observed value of the Libor rate which sets at time T_1 for a period $[T_1, T_2]$.
$L(t, T_1, T_2)$	The value at time t of a forward Libor rate which sets at time T_1 for a period $[T_1, T_2]$.
$D(t, T)$	Present value of \$1 paid at the time of

default as seen at time t .

$Q_i(t, T)$	Survival probability from today time t to time T for issuer i . We sometimes use $Q_i(0, t)$.
$S(t, T)$	$Q_i(t) =$ CDS contractual spread at time t for a contract which matures at time T .
$S(t, t_F, T)$	Forward CDS contractual spread at time t for a contract with forward start t_F which matures at time T . Note that $S(t, t, T) = S(t, T)$.
$PV01(t, T)$	The time t present value of a \$1 Libor quality annuity which matures at time T .
$RPV01(t, T)$	The time t present value of a credit risky \$1 annuity which matures at time T .
$r(t)$	The risk-free short interest rate at time t .
$\beta(t)$	Value of the rolled-up money-market account $\beta(t) = \exp(r(s)ds)$.
$\beta(t, T)$	Value of $\beta(T)\beta(t) - 1$.
$\lambda(t)$	The hazard rate or intensity process at time t .
$\Pr(x)$	The probability that x is true.
$C(u_1, \dots, u_n)$	The n -dimensional default copula.
$\hat{C}(u_1, \dots, u_n)$	The n -dimensional survival copula.
$\phi(a)$	The Gaussian density.

$\Phi(a)$	The uni-variate Gaussian cumulative distribution function.
$\Phi_2(a, b, \rho)$	The bi-variate Gaussian cumulative distribution function.
$\Phi_n(\mathbf{a}, \Sigma)$	The n -variate Gaussian cumulative distribution function with correlation matrix Σ .
$t_v(x)$	The uni-variate Student- t cumulative distribution function with v degrees of freedom.
$L(T)$	The fractional portfolio loss at horizon time T .
$L(T, K_1, K_2)$	The fractional tranche loss at horizon time T .
$F(x)$	The cumulative portfolio loss distribution, i.e. $F(x) = \Pr(L \leq x)$.
$f(x)$	The density of the portfolio loss distribution $f(x) = \partial F(x) / \partial x$.
$O(x)$	'Order of' x . If $f(x)$ is $O(x^n)$ then n is the exponent of the dominant polynomial term in $f(x)$.
$\text{int}(x)$	Function which returns the integer part of a number without rounding, e.g. $\text{int}(5.7322) = 5$.
$\text{ceil}(x)$	Function which returns the smallest integer value greater than or equal to x , e.g. $\text{ceil}(5.7322) = 6$.

1

The Credit Derivatives Market

1.1 INTRODUCTION

Without a doubt, credit derivatives have revolutionised the trading and management of credit risk. They have made it easier for banks, who have historically been the warehouses of credit risk, to hedge and diversify their credit risk. Credit derivatives have also enabled the creation of products which can be customised to the risk-return profile of specific investors. As a result, credit derivatives have provided something new to both hedgers and investors and this has been a major factor in the growth of the credit derivatives market.

From its beginning in the mid-1990s, the size of the credit derivatives market has grown at an astonishing rate and it now exceeds the size of the credit bond market. According to a recent ISDA survey,¹ the notional amount outstanding of credit derivatives as of mid-year 2007 was estimated to be \$45.46 trillion. This significantly exceeds the size of the US corporate bond market which is currently \$5.7 trillion and the US Treasury market which is currently \$4.3 trillion.² It also exceeds the size of the equity derivatives market which ISDA also estimated in mid-2007 to have a total notional amount outstanding of \$10.01 trillion.

In addition to its size, what is also astonishing about the credit derivatives market is the breadth and liquidity it has attained. This has been due largely to the efforts of the

dealer community which has sought to structure products in a way that maximises tradability and standardisation and hence liquidity. The CDS indices, introduced in 2002 and discussed extensively in this book, are a prime example of this. They cover over 600 of the most important corporate and sovereign credits. They typically trade with a bid-offer spread of less than 1 basis point and frequently as low as a quarter of a basis point.³

To understand the success of the credit derivatives market, we need to understand what it can do. In its early days, the credit derivatives market was dominated by banks who found credit derivatives to be a very useful way to hedge the credit risk of a bond or loan that was held on their balance sheet. Credit derivatives could also be used by banks to manage their regulatory capital more efficiently. More recently, the credit derivatives market has become much more of an investor driven market, with a focus on developing products which present an attractive risk-return profile. However, to really understand the appeal of the credit derivatives market, it is worth listing the many uses which credit derivatives present:

- Credit derivatives make it easier to go short credit risk either as a way to hedge an existing credit exposure or as a way to express a negative view on the credit market.
- Most credit derivatives are unfunded. This means that unlike a bond, a credit derivative contract requires no initial payment. As a consequence, the investor in a credit derivative does not have to fund any initial payment. This means that credit derivatives may present a cheaper alternative to buying cash bonds for investors who fund above Libor. It also makes it easier to leverage a credit exposure.

- Credit derivatives increase liquidity by taking illiquid assets and repackaging them into a form which better matches the risk-reward profiles of investors.
- Credit derivatives enable better diversification of credit risk as the breadth and liquidity of the credit derivatives market is greater than that of the corporate bond market.
- Credit derivatives add transparency to the pricing of credit risk by broadening the range of traded credits and their liquidity. We estimate that there are over 600 corporate and sovereign names which have good liquidity across the credit derivatives market.⁴ The scope of the credits is global as it includes European, North American and Asian corporate credits plus Emerging Market sovereigns.
- Credit derivatives shift the credit risk which has historically resided on bank loan books into the capital markets and in doing so it has reduced the concentrations of credit risk in the banking sector. However, this does raise the concern of whether this credit risk is better managed in less regulated entities which sit outside the banking sector.
- Credit derivatives allow for the creation of new asset classes which are exposed to new risks such as credit volatility and credit correlation. These can be used to diversify investment portfolios.

The relatively short history of the credit derivatives market has not been uneventful. Even before the current credit crisis of 2007-2008, the credit derivative market has weathered the 1997 Asian Crisis, the 1998 Russian default, the events of 11 September 2001, the defaults of Consecro, Railtrack, Enron, WorldCom and others, and the downgrades of Ford and General Motors. What has been striking about all of these events is the ability of the credit derivatives market to work through these events and to emerge

stronger. This has been largely due to the willingness of the market participants to resolve any problems which these events may have exposed in either the mechanics of the products or their legal documentation. Each of these events has also strengthened the market by demonstrating that it is often the only practical way to go short and therefore hedge these credit risks.

In this chapter, we discuss the growth in the credit derivatives market size. We present an overview of the different credit derivatives and discuss a market survey which shows how the importance of these products has evolved over time. We then discuss the structure of the credit derivatives market in terms of its participants.

1.2 MARKET GROWTH

The growth of the credit derivatives market has been phenomenal. Although there are different ways to measure this growth, each with its own particular approach, when plotted as a function of time, they all show the same exponential growth shown in [Figure 1.1](#). Let us consider the three sources of market size data:

1. The British Bankers' Association (BBA) surveys the credit derivatives market via a questionnaire every two or so years. Their questionnaire is sent to about 30 of the largest investment banks who act as dealers in the credit derivatives market. Their latest report was published in 2006 and estimated the total market notional at the end of 2006 to be \$20.207 trillion.
2. The International Swaps and Derivatives Association (ISDA) conducts a twice-yearly survey of the market. In the most recent, they surveyed 88 of their member firms including the main credit derivatives dealers about the size of their credit derivatives positions. The

collected numbers were adjusted to correct for double-counting.⁵ The mid-2007 survey estimated the size of the credit derivatives market to be \$45.25 trillion, an increase of 32% in the first six months of 2007.

3. The US Office for the Comptroller of the Currency conducts a quarterly survey of the credit derivatives market size. The survey covers just the US commercial bank sector. The June 2007 survey found that the total notional amount of credit derivatives held by US commercial banks was \$10.2 trillion, an increase of 86% on the first quarter of 2006. This number is lower than the others partly because it excludes trades done by many non-US commercial banks and investment banks.

Although these numbers all differ because of the differing methodologies and timings, what is beyond doubt is the rapid growth that has been experienced by the credit derivatives market.

Figure 1.1 Evolution of the credit derivatives market size using estimates calculated in the BBA Credit Derivatives Report 2006. Source: British Banker's Association