

*Course Outline*

# **Credit Risk**

**Spring 2009 – B40.3305 20 TuThu 1:30-2:50PM**

**Contact information:**

**Viral Acharya**

Professor of Finance

Stern-NYU and London Business School

Room: Suite 9-84

Phone: 212-998-0354

e-mail: [vacharya@stern.nyu.edu](mailto:vacharya@stern.nyu.edu)

**\*Assistant:** Norma Rodriguez

Room: Finance department, 9<sup>th</sup> Floor  
(walk straight from elevators, turn right)

Phone: 212-998-0363

e-mail: [nrodrigu@stern.nyu.edu](mailto:nrodrigu@stern.nyu.edu)

**Teaching Assistant:**

Room: Farhang Farazmand  
NYU Stern School of Business  
Department of Finance

Phone: 212-998-0718

e-mail: [ffarazma@stern.nyu.edu](mailto:ffarazma@stern.nyu.edu)

## Aims and Objectives

Fuelled in part by burgeoning growth in the credit derivatives market in late 90's, the market in credit expanded dramatically for 10 years till 2Q 2007. These increased activity levels led to a much greater research focus on credit and one of the features of this work has been the high degree of complementarity between the research carried out by academics and by practitioners, for example, the investment banks and rating agencies.

As you know, the credit derivatives market has been at the heart of the ongoing sub-prime crisis, having contributed substantially to it by affecting lender incentives once loans were securitized, allowing banks to “game” regulatory capital requirements, and creating opacity due to their over-the-counter (rather than centralized or exchange-based) trading infrastructure. While the market for credit derivatives suffers at the current moment, its underlying rationale in terms of risk transfer from banking sector to rest of the economy remains robust. This market will perhaps never be as large as it was in 2Q 2007, but it will certainly continue to play a major role in the financial intermediation sector going forward, once the crisis abates.

The objective of the course is to provide an introduction as well as an in-depth understanding of issues in credit risk, its modelling and analysis of credit related instruments such as default-prone debt of credit derivatives. The objective is also to provide an understanding of how and why these products played such a critical role in the ongoing crisis. As with any derivatives model, the idea is to learn it well so that one knows when *not to use it!* Hence, the objective is to provide a balance between developing, on one hand, a sound conceptual framework and, on the other, market understanding and insight, especially with respect to liquidity effects that are often so important in markets from a practitioner's standpoint. We regard both as essential to the informed practitioner and academic.

## Topics Covered

The topics covered in the course will include:

- Historical default experience
- Structural models of credit risk (Merton, Leland, Collin-Dufresne et. al.)
- Applications of structural models of credit risk to default prediction and hedging; the KMV model
- Historical recovery experience
- Introduction to single-name credit derivatives
- Default-intensity models (Iben-Litterman, Duffie-Singleton, etc.)
- Application of default intensity models to:
  - Credit default swaps (single-name corporate and sovereign)
  - Credit spread options
- Historical experience on correlated defaults
- Correlation modelling and applications
- Basket default products: index tranches and CDOs
- Institutional features and liquidity issues relevant to credit derivatives
- Credit Crisis 2007-08 and implications for the credit derivatives market

## Format and Teaching Methods

The classes will include discussions around empirical facts about credit, guest speakers on market developments, lectures on models and their applications, and also some cases.

The class will be held on Tuesdays and Thursdays from 1:30pm to 2:50pm.

## Reading Materials

There are two quite recent and very good books that deal with the analysis of credit risk. While neither of them covers all the material we plan to discuss in the class, the following one has a very good treatment of the two main modelling frameworks (the structural and intensity approaches) and we suggest that you may wish to buy it:

Lando, David, *Credit Risk Modelling: Theory and Applications*, Princeton: Princeton University Press, 2004. [Lando]

The other book, also excellent, is:

Duffie, Darrell and Kenneth Singleton, *Credit Risk*, Princeton: Princeton University Press, 2003. [DS]

Additional recommended reading materials (especially for a brief summary of credit risk modelling):

Chacko, Sjoman, Motohashi and Dessain (2006): *Credit Derivatives – A Primer on Credit Risk, Modeling, and Instruments*. [Chacko et. Al]

Dominic O’Kane and Lutz Schogl, *Modelling Credit: Theory and Practice*, Lehman Brothers International (Europe), 2001. [Lehman]

*The Lehman Brothers Guide to Exotic Credit Derivatives*, Lehman Brothers and Risk Waters Group, 2003. [RISK]

## Binder

The final paper of this outline contains a list of the items that are included in the binder. Any remaining handouts, exercises, cases etc. will be either distributed in class or put on the Blackboard (or both).

## Assignments and Assessment

The grade for the course will be based on a total of six pieces of written work (three assignments and three cases due in the weeks given below, a mid-term exam (in-class in Week 8 of the course) and an in-class final exam on Tuesday, 12 May from 1:30pm to 3:30pm. The assignments, which may sometimes require extensive numerical computations, should be completed in groups of THREE. You should email Farhang (the course teaching assistant) with the composition of your group by 5pm on Tuesday 3 February.

All assignments must be handed in, in hard copy, at the beginning of the class in the week they are due (Tuesday or Thursday will be specified in class).

The weights attached to each of these components are (HW = Homework):

		<b><i>Due Week</i></b>	<b><i>Weight</i></b>
1	Lucent Technologies (HW)	3	8%
2	KBC (A) Case	4	8%
Exam	Mid-term Exam	6	20%
3	Single Name Credit Derivatives (HW)	7	8%
4	Sovereign CDS Case	8	10%
5	Basket Products (HW)	9	6%
6	Structured Credit Index Products (Case)	10	10%
Exam	Final Exam	11	30%
	<b><i>Total</i></b>		<b><i>100%</i></b>

## Summary Outline

<b>Week</b>	<b>Topic</b>
1 (27 January)	Overview of credit market and trends: Historical default experience, corporate finance issues (liquidity, strategic, technical defaults), abstraction from corporate finance issues Structural models I: Merton's model and extensions.
2 (3 February)	Structural models I: Merton's model and extensions, continued.
3 (10 February)	<b>Assignment 1 Due – Lucent</b> Structural models II : Leland's model and Moody's KMV Approach
4 (17 February)	<b>Case 1 Due: Structural model application – KBC(A)</b> <b>Guest Lecture: Application of structural models in practice</b>
5 (24 February)	Historical recovery or loss-given-default experience Introduction to single-name credit derivatives Intensity modelling I : Litterman and Iben's reduced-form model
6 (3 March)	Intensity modelling I : Litterman and Iben's reduced-form model continued
7 (10 March)	<b>Assignment 2 Due – Single-name credit derivatives</b> Intensity modelling II : Other reduced-form models <b>Guest Lecture: Counterparty risk issues in credit derivatives</b>
	<b>Mid-Term Break</b>
8 (24 March)	<b>Mid-term Exam</b> Study of General Motors and Ford Downgrade of May 2005
9 (31 March)	Historical experience on correlation of defaults Correlation: Products and modelling I
10 (7 April)	<b>Case 2 Due: Sovereign CDS – The case of Argentina's Default</b> Correlation: Products and modelling I continued
11 (14 April)	<b>Assignment 3 Due – Basket products</b> Correlation: Products and modelling II
12 (21 April)	<b>Case 3 Due: Structured Credit Index products</b> Correlation: Products and modelling II continued Implied correlation and liquidity effects

13  
(28 April)      **Guest lecture: The role of credit derivatives in the sub-prime crisis**  
Understanding the sub-prime crisis, SIVs, toxic waste  
Relationship between equity, bond and credit derivative markets and Insider trading issues

Final Exam      **Final exam will be held in-class**  
(12 May)      (1:30pm – 3:30pm)

## **Week 1**

**27 January**

### **Preparation**

#### **Overview**

#### **Structural models I**

1. Chacko, Sjoman, Motohashi and Dessain (2006): *Credit Derivatives – A Primer on Credit Risk, Modeling, and Instruments* (Chapter 2)
2. RISK, Credit Derivative Products (up to Page 30).
3. Lando, Ch. 2, Corporate liabilities as Contingent Claims (Pages 7-17 very thoroughly and then read the rest skipping the equations if you can't follow them).

### **Topics**

Overview of credit market and trends: Historical default experience, corporate finance issues (liquidity, strategic, technical defaults), abstraction from corporate finance issues

## **Week 2**

**3 February**

### **Preparation**

#### **Structural models I, continued.**

1. Lando, Ch. 2, Corporate liabilities as Contingent Claims (Pages 7-17 very thoroughly and then read the rest skipping the equations if you can't follow them).
2. Leland, "Predictions of Default Probabilities in Structural Models of Debt", *Journal of Investment Management*, Volume 2, No. 2, 2004.

### **Topics**

Equity as call; risky debt as riskless debt minus put; Merton; discussion of limitations of Merton; Exogenous default boundaries; first hitting time values.

## **Week 3**

**10 February**

### **Preparation**

#### **Structural models II**

#### **Moody's KMV Approach**

1. Lando Ch. 3, "Endogenous Default Boundaries and Optimal Capital Structure".
2. Lehman Brothers Fixed Income Quantitative Credit Research, *Hedging Debt with Equity*, November 2003.

### **Topics**

Leland type models; predictions of Leland model; Measuring asset volatilities; KMV.

## **Week 4**

**17 February**

#### **Case: KBC(A)**

**Guest Lecture:** Application of structural models in practice

## **Week 5**

**24 February**

#### **Introduction to reduced-form models**

#### **Introduction to single-name credit derivatives**

#### **Intensity modelling I: Litterman - Iben's reduced-form model**

- Preparation**
1. Viral Acharya, Sreedhar Bharath and Anand Srinivasan, “Does Industry-wide Distress Affect Defaulted Firms? Evidence from Creditor Recoveries”, *Journal of Financial Economics*, 85(3), 2007, 787-821.
  2. Litterman, Robert and Thomas Iben (1991): "Corporate Bond Valuation and the Term Structure of Credit Spreads", *The Journal of Portfolio Management*, Spring, pp. 52-64

**Topics**

Historical recovery or loss-given-default experience  
Relationship between spreads and expected loss  
Litterman and Iben’s reduced-form model

## **Week 6**

### **Intensity modelling I continued**

**3 March**

- Preparation**
1. Lando, Ch. 8, “Credit Default Swaps, CDOs and Related Products” (up to Section 8.5, inclusive)
  2. Darrell Duffie, “Credit Swap Valuation”, *Financial Analysts Journal*, Jan-Feb 1999, pp. 73-85.

**Topics**

Pricing of single-name credit derivatives

## **Week 7**

### **Intensity modelling II**

**10 March**

- Preparation**
1. Lando, Ch. 8, “Credit Default Swaps, CDOs and Related Products” (up to Section 8.5, inclusive)
  2. Darrell Duffie, “Credit Swap Valuation”, *Financial Analysts Journal*, Jan-Feb 1999, pp. 73-85.

**Topics**

## **Week 8**

### **In-class Mid-Term Exam**

**24 March**

- Preparation**
- Study of Ford, GM Downgrade**
- Viral Acharya, Stephen Schaefer and Yili Zhang, “Liquidity Risk and Correlation Risk: A Clinical Study of the General Motors and Ford Downgrade of May 2005”, Working paper, London Business School and NYU-Stern

**Topics**

## **Week 9**

### **Default Correlation I**

**31 March**

- Preparation**
- DS, Ch. 10, “Correlated Defaults”.

**Topics**

Other reduced-form models; Sovereign credit derivatives

## **Week 10**

### **Default Correlation I continued**

**7 April**

**Case: Sovereign CDS – The case of Argentina’s Default**

<b>Preparation</b>	Lando, Ch. 9, pp. 213-223 and skim the rest of the chapter.
<b>Topics</b>	Historical experience on correlation of defaults, Introduction to correlation products, Introduction to correlation modelling
<b>Week 11</b>	<b>Default Correlation II</b>
<b>14 April</b>	
<b>Preparation</b>	<ol style="list-style-type: none"><li>1. RISK, Credit Derivative Products (up to Page 30).</li><li>2. RISK, Credit Derivatives Modelling (Pages 31-52).</li></ol>
<b>Topics</b>	Correlation modelling to price index products, Relationship between equity, bond and credit derivative markets, Implied correlation and liquidity effects
<b>Week 12</b>	<b>Case: Structured Credit Index Products</b>
<b>21 April</b>	<b>Default Correlation II continued</b>
<b>Preparation</b>	<ol style="list-style-type: none"><li>1. Stanford University GSB case, F268, "Emergence of Default Swap Index Products", 2004.</li><li>2. JP Morgan European Credit Research, "Introducing iTraxx Series 7", 16 March 2007.</li></ol>
<b>Topics</b>	Institutional framework for credit derivatives
<b>Week 13</b>	<b>Understanding the sub-prime crisis, SIVs, toxic waste...</b>
<b>28 April</b>	<b>Information and liquidity issues</b>
	<b>Guest lecture: The role of credit derivatives in the sub-prime crisis</b>
<b>Preparation</b>	<ol style="list-style-type: none"><li>1. Viral Acharya, "The Sub-prime Smoke Shield: Is Credit Risk Transfer to Blame?" Insight Finance, London Business School</li><li>2. Darrell Duffie, "Innovations on Credit Risk Transfer: Implications for Financial Stability", Working Paper, Graduate School of Business, Stanford University.</li><li>3. Moody's Investor Service, International Structure Finance, "Update on Moody's Perspective on the Ongoing Liquidity Crisis and the Ratings of Debt Programmes in the SIV Sector", 5 September 2007.</li><li>4. Viral Acharya and Timothy Johnson, "Insider Trading in Credit Derivatives", Journal of Financial Economics, 84(1), 2007, 110-141.</li><li>5. Viral Acharya and Timothy Johnson, "More Insiders, More Insider Trading: Evidence from Private Equity Buyouts", Working Paper, London Business School and NYU-Stern.</li></ol>
<b>Topics</b>	Lessons from the sub-prime crisis
<b>12 May</b>	<b>Final Exam (in-class)</b>
<b>Preparation</b>	All material covered in the course
<b>Topics</b>	All topics covered in the course

## List of Materials Included in Binder.

1. Course Outline
2. Acharya, Viral, "Illustrations on the use of Bloomberg for applications to Options and Futures, Fixed Income and Credit Risk electives"
3. "Bloomberg tutorial for Credit Derivatives -- Credit Default Swap".
4. Dominic O'Kane and Lutz Schogl, *Modelling Credit: Theory and Practice*, Lehman Brothers International (Europe), 2001. [*Lehman*]
5. The Lehman Brothers Guide to Exotic Credit Derivatives, Lehman Brothers and Risk Waters Group, 2003. [*RISK*]
6. Chacko, Sjoman, Motohashi and Dessain (2006), *Credit Derivatives – A Primer on Credit Risk, Modelling, and Instruments* (Chapter 2).
7. Lucent Technologies, Inc (Case), Rajiv Guha & Stephen Schaefer, London Business School.
8. Leland, "Predictions of Default Probabilities in Structural Models of Debt", *Journal of Investment Management*, Volume 2, No. 2, 2004.
9. Lehman Brothers Fixed Income Quantitative Credit Research, Hedging Debt with Equity, November 2003.
10. Viral Acharya, Sreedhar Bharath and Anand Srinivasan, "Does Industry-wide Distress Affect Defaulted Firms? Evidence from Creditor Recoveries", *Journal of Financial Economics*, Volume 85, No. 3, 2007, page 787-821.
11. INSEAD case, 104-101-1, "KBC Alternative Investment Management (A): Convertible Bond Arbitrage".
12. Darrell Duffie, "Credit Swap Valuation", *Financial Analysts Journal*, Jan-Feb 1999, pp. 73-85.
13. Litterman, Robert and Thomas Iben (1991): "Corporate Bond Valuation and the Term Structure of Credit Spreads", *The Journal of Portfolio Management*, Spring, pp. 52-64.
14. Duffie, Darrell and Kenneth Singleton, "Correlated Defaults", Chapter 10 in: *Credit Risk*, Princeton: Princeton University Press, 2003.
15. Stanford University GSB case, F268, "Emergence of Default Swap Index Products", 2004. (Permission from Harvard Business School Publishing).
16. JP Morgan European Credit Research, "Introducing iTraxx Series 7", 16 March 2007.
17. Viral Acharya and Timothy Johnson, "Insider Trading in Credit Derivatives", forthcoming, *Journal of Financial Economics*, 84(1), 2007, 110-141.
18. Viral Acharya and Timothy Johnson, "More Insiders, More Insider Trading: Evidence from Private Equity Buyouts", Working Paper, London Business School.
19. Viral Acharya, Stephen Schaefer and Yili Zhang, "Liquidity Risk and Correlation Risk: A Clinical Study of the General Motors and Ford Downgrade of May 2005", Working paper, London Business School.
20. Viral Acharya, "The Sub-prime Smoke Shield: Is Credit Risk Transfer to Blame?" Insight Finance, London Business School
21. Darrell Duffie, "Innovations on Credit Risk Transfer: Implications for Financial Stability", Working Paper, Graduate School of Business, Stanford University.
22. Moody's Investor Service, International Structure Finance, "Update on Moody's Perspective on the Ongoing Liquidity Crisis and the Ratings of Debt Programmes in the SIV Sector", 5 September 2007.
23. Peter Madigan and Nick Sawyer, "All Fall Down", *Credit*, October 2008 Supplement.
24. "Clearing a path to lower op risk", *Credit*, October 2008 Supplement.
25. Sarfraz Thind, "Lawmakers Take Aim at CDS Market", *Credit*, November 2008, volume 9 issue 10.

26. Joseph Pimbley, "Collateral Damage", *Credit*, November 2008, volume 9 issue 10.