Course Outline

Credit Risk

Spring 2010 – B40.3305 20 TuThu 1:30-2:50PM

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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 was 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 the 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.

Given the important role played by credit derivatives in the crisis, the course will also devote substantial amount of time understanding this role. We will also understand the new financial sector reforms and their direct or indirect impact on credit derivatives, and credit markets in general, going forward.
Topics Covered

The topics covered in the course will include:

- Historical default experience
- Structural models of credit risk
- Applications of structural models of credit risk to default prediction and hedging; the KMV model
- The success of structural models in explaining credit spreads and corporate bond returns
- Liquidity risk of corporate bond returns
- Historical recovery experience
- Introduction to single-name credit derivatives
- Default-intensity or reduced-form models
- Application of default intensity models to:
  - Credit default swaps (single-name corporate and sovereign)
  - Credit spread options
- Basket default products: index tranches and CDOs
- Correlation modelling and applications
- Institutional features such as insider trading as relevant to credit derivatives
- Credit Crisis 2007-09 and the role played by credit derivatives in the crisis
- Implications of the proposed financial sector reforms 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

The only required book for the course is the NYU-Stern contribution on the financial crisis as it makes an excellent reading for facts relating to the financial crisis, which anyone aspiring to learn about credit markets must know:


There are two quite recent and very good books that deal with the analysis of credit risk. However, neither of them covers all the material we plan to discuss in the class:


Additional recommended materials (for a brief summary of credit markets and modelling):

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


*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 five pieces of written work (three assignments and two cases due in the weeks given below, a mid-term exam (in-class in Week 9 of the course) and an in-class final exam on Tuesday, 11 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 the course teaching assistant with the composition of your group by 5pm on Tuesday 2 February. All assignments must be handed in hard copy, at beginning of the class in the week when they are due.

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

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Due Week</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Lucent Technologies (HW)</td>
<td>4</td>
<td>8%</td>
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<tr>
<td>KBC (A) Case</td>
<td>5</td>
<td>8%</td>
</tr>
<tr>
<td>Single Name Credit Derivatives (HW)</td>
<td>8</td>
<td>8%</td>
</tr>
<tr>
<td>Mid-term Exam</td>
<td>9</td>
<td>30%</td>
</tr>
<tr>
<td>Basket Products (HW)</td>
<td>11</td>
<td>6%</td>
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<tr>
<td>Structured Credit Index Products (Case)</td>
<td>12</td>
<td>10%</td>
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<tr>
<td>Final Exam</td>
<td>14</td>
<td>30%</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>100%</strong></td>
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# Summary Outline

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>1 (26 January)</td>
<td>The role played by credit derivatives in the crisis of 2007-09 - I</td>
</tr>
<tr>
<td>2 (2 February)</td>
<td>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.</td>
</tr>
<tr>
<td>3 (9 February)</td>
<td>Structural models II: Moody’s KMV Approach Empirical performance of structural models</td>
</tr>
<tr>
<td>4 (16 February)</td>
<td><strong>Assignment 1 Due – Lucent</strong> Introduction to single-name credit derivatives and historical recovery or loss-given-default experience Liquidity risk of corporate bond returns</td>
</tr>
<tr>
<td>5 (23 February)</td>
<td><strong>Case 1 Due: Structural model application – KBC(A)</strong> <strong>Guest Lecture: Application of structural models in practice</strong> Intensity modelling I: Litterman and Iben’s reduced-form model</td>
</tr>
<tr>
<td>6 (2 March)</td>
<td>Intensity modelling I: Litterman and Iben’s reduced-form model continued</td>
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<tr>
<td>7 (9 March)</td>
<td>Intensity modelling II: Other reduced-form models Study of General Motors and Ford Downgrade of May 2005</td>
</tr>
<tr>
<td><strong>Mid-Term Break</strong></td>
<td></td>
</tr>
<tr>
<td>8 (23 March)</td>
<td><strong>Assignment 2 Due – Single-name credit derivatives</strong> <strong>Guest Lecture: “Big-bang” protocol and its impact on credit derivatives</strong> The role played by credit derivatives in the crisis of 2007-09 – II</td>
</tr>
<tr>
<td>9 (30 March)</td>
<td><strong>Mid-term exam in-class (based on all material covered until the break)</strong> Correlation: Products overview</td>
</tr>
<tr>
<td>10 (6 April)</td>
<td>Correlation: Products and modelling I</td>
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<tr>
<td>11 (13 April)</td>
<td><strong>Assignment 3 Due – Basket products</strong> Correlation: Products and modelling II</td>
</tr>
<tr>
<td>12 (20 April)</td>
<td><strong>Case 2 Due: Structured Credit Index products</strong> Correlation: Products and modelling III</td>
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<tr>
<td>Date</td>
<td>Topic</td>
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<tr>
<td>13 (27 April)</td>
<td><strong>The implications of financial sector reforms on credit markets</strong></td>
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<tr>
<td></td>
<td>Relationship between equity, bond and credit derivative markets and Insider trading issues</td>
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<tr>
<td>Final Exam (11 May)</td>
<td><strong>Final exam in-class (based on all material covered in the course)</strong></td>
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<td>(1:30pm – 3:30pm)</td>
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**Week 1**

**26 January**

**Preparation**

1. AR, Prologue: A Bird’s Eye View
2. AR, Chapters 1-3, 5, 10.
3. (Optional) AR, Chapter 4, 6.

**Topics**
The role played by credit derivatives in the crisis of 2007-09 – I

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**Week 2**

**2 February**

**Preparation**

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; Equity as call; risky debt as riskless debt minus put; Merton model.

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**Week 3**

**9 February**

**Preparation**

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).

**Topics**
Discussion of limitations of Merton. Measuring asset volatilities; KMV model and its implementation.
Week 4 Credit risk or liquidity risk?
16 February
Preparation Introduction to single-name credit derivatives and recovery

Topics Liquid risk of corporate bonds returns and credit spreads
Historical recovery or loss-given-default experience
Relationship between spreads and expected loss

Week 5 Guest Lecture: Application of structural models in practice
23 February
Preparation Intensity modelling I: Litterman - Iben’s reduced-form model

Topics Litterman and Iben’s reduced-form model

Week 6 Intensity modelling I continued
2 March
Preparation
1. Lando, Ch. 8, “Credit Default Swaps, CDOs and Related Products” (up to Section 8.5, inclusive)

Topics Pricing of single-name corporate and sovereign credit derivatives

Week 7 Intensity modelling II
9 March
Preparation Study of Ford, GM Downgrade
1. Lando, Ch. 8, “Credit Default Swaps, CDOs and Related Products” (up to Section 8.5, inclusive)

Topics Recovery of market-value assumption and Duffie-Singleton model
**Week 8**

**23 March**

**Guest Lecture: Big-bang” protocol and its impact on credit derivatives** (Sivan Mahadevan, Morgan Stanley Research)

**Credit Derivatives and the Crisis of 2007-09 - II**

**Preparation**

2. AR, Chapter 11, (optional)

**Topics**

Analysis of CDS prices around the GM and Ford downgrade of May 2005.
The role played by counterparty risk and opacity of credit derivatives in the financial crisis of 2007-09.

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**Week 9**

**30 March**

**In-class Mid-Term Exam**

**Overview of Correlation Products**

**Preparation**

1. RISK, Credit Derivative Products (up to Page 30).

**Topics**

Introduction to Basket and index credit derivatives.

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**Weeks 10, 11**

**6 April, 13 April**

**Default Correlation Modeling I and II**

**Preparation**

1. Lando, Ch. 9, pp. 213-223 and skim the rest of the chapter.
2. RISK, Credit Derivatives Modelling (Pages 31-52).
3. DS, Ch. 10, “Correlated Defaults”.

**Topics**

Introduction to Gaussian-copula based correlation modelling to price and hedge index products.
<table>
<thead>
<tr>
<th>Week 12</th>
<th>Default Correlation III</th>
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</thead>
<tbody>
<tr>
<td>20 April</td>
<td></td>
</tr>
<tr>
<td>Preparation</td>
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</tbody>
</table>

**Topics**

Vasicek’s model to estimate loan loss portfolio distribution (based on Merton’s structural model of credit risk)

<table>
<thead>
<tr>
<th>Week 13</th>
<th>Information issues and insider trading in credit derivatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>27 April</td>
<td>The impact of financial sector reforms on credit derivatives</td>
</tr>
<tr>
<td>Preparation</td>
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</tbody>
</table>

**Topics**

Detecting information flows between equity and CDS markets; Understanding proposed reforms to credit derivatives trading.

<table>
<thead>
<tr>
<th>11 May</th>
<th>Final Exam (in-class), 1:30-3:30 pm</th>
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</thead>
<tbody>
<tr>
<td>Preparation</td>
<td></td>
</tr>
<tr>
<td>All material covered in the course</td>
<td></td>
</tr>
</tbody>
</table>

**Topics**

All topics covered in the course
List of Materials Included in Binder.

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

Week 1

Week 2
7. Chacko, Sjoman, Motohashi and Dessain (2006), Credit Derivatives – A Primer on Credit Risk, Modelling, and Instruments (Chapter 2).

Week 3

Week 4-5

Week 6

Week 7-8
Week 9


Week 10-11


Week 12


Week 13