The Single Name Corporate CDS Market

Alan White
CDS Structure

### Single Name

- **Buyer**
  - Notional $x \text{ [ ] bp p.a.}$
  - Credit Risk of ABC

- **Seller**

### DJ Index Products

- **Buyer**
  - Delivery 10MM
  - Principal ABC Sr. Unsecured Debt
  - $10 MM Cash

- **Seller**
  - 125 Equally Weighted Names
Market Growth  Notional Outstanding

- US Corp. Debt
- Global CDS
- CDS Index


Notional Outstanding:
- 0
- 1,000
- 2,000
- 3,000
- 4,000
- 5,000
- 6,000
- 7,000
CDX-IG Index Industry Composition

- Materials: 7.4%
- Consumer, Cyclicall: 18.9%
- Consumer, NonCyc.: 15.6%
- Energy: 4.9%
- Financial: 19.7%
- Industrial: 10.7%
- Tech.: 2.5%
- Comm.: 14.8%
- Utilities: 5.7%
End Users

**Protection Sellers**
- Banks: 38%
- Securities firms: 16%
- Hedge Funds: 15%
- Corporations: 2%
- Mutual Funds: 4%
- Other: 4%
- Insurance Companies: 20%

**Protection Buyers**
- Banks: 51%
- Securities firms: 16%
- Hedge Funds: 16%
- Corporations: 3%
- Mutual Funds: 3%
- Other: 3%
- Insurance Companies: 7%
Risk and Return
Corporate Bonds vs. CDS

ABC Corporate Bond Return

- Credit Risk
- Interest Rate Risk

ABC Corporate CDS

- Credit Risk
- Allows direct trading of credit risk
Arbitrage Trade

• Buy the bond, buy protection earn the risk-free rate of interest
• Make a riskless investment, sell protection earn the bond yield

⇒ CDS spread, $s ≈ y - r$

⇒ return on trade, $r ≈ y - s$
Comparing with Treasury and Swap Rates

<table>
<thead>
<tr>
<th>Rating</th>
<th>$r - r_T$ Mean</th>
<th>S.E.</th>
<th>$r - r_S$ Mean</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaa / Aa</td>
<td>51.30</td>
<td>1.97</td>
<td>−9.55</td>
<td>1.31</td>
</tr>
<tr>
<td>A</td>
<td>64.33</td>
<td>1.82</td>
<td>−5.83</td>
<td>1.59</td>
</tr>
<tr>
<td>Baa</td>
<td>84.93</td>
<td>3.63</td>
<td>−2.21</td>
<td>2.79</td>
</tr>
<tr>
<td>All Ratings</td>
<td>62.97</td>
<td>1.38</td>
<td>−6.51</td>
<td>1.06</td>
</tr>
</tbody>
</table>
Ratings and CDS Spreads
# CDS Spreads and Ratings Events

## Conditioning on Ratings Event

### Average CDS Spread Change (bp)

<table>
<thead>
<tr>
<th>Event</th>
<th>Window (days relative to event)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Downgrade</td>
<td>83</td>
</tr>
<tr>
<td>Review for Downgrade</td>
<td>114</td>
</tr>
<tr>
<td>Negative Outlook</td>
<td>69</td>
</tr>
</tbody>
</table>

* 5% significance  
** 1% significance
## CDS Spreads and Ratings Events
### Conditioning on CDS Spread Changes

Percent of events in following 30 days in the subset of firms with the top p% of credit spreads

<table>
<thead>
<tr>
<th>p</th>
<th>Downgrade</th>
<th>Review for Downgrade</th>
<th>Negative Outlook</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>80**</td>
<td>72**</td>
<td>68**</td>
</tr>
<tr>
<td>25</td>
<td>59**</td>
<td>46**</td>
<td>48**</td>
</tr>
<tr>
<td>10</td>
<td>37**</td>
<td>28**</td>
<td>15</td>
</tr>
</tbody>
</table>

* 5% significance
** 1% significance
Recovery Rates and Probability of Default
CDS Structure

LGD = \( P(1 - R) \)

\[ PD(1.75) - PD(1.50) \]
Extracting Hazard Rates – I

Fixed Recovery Model

- CDS value is the PV of payments weighted by the probability that the payment occurs
- Often set \( PD(t) = 1 - \exp(-\lambda t) \)
- Find the hazard rate \( \lambda \) that sets the CDS value to zero
- Implied \( \lambda \) is sensitive to assumed recovery rate, \( R \)
Implied Hazard Rate
CDS Spread = 50 bp

Recovery Rate
A Recovery Model
Hamilton, Varma, Ou, and Cantor 2005

Exhibit 10 – Correlation between Recovery Rates and Annual Default Rates, 1983-2004

Recovery Rate = 0.52 - 6.9* Default Rate

$R^2 = 0.6521$
Gaussian Copula

- Latent variable $x \sim N(0,1)$
- Conditioning on $x$

$$PD(t|x) = N \left[ \frac{N^{-1}(PD(t)) - \sqrt{\rho}x}{\sqrt{1-\rho}} \right]$$

$$R \mid x = 0.52 - 6.9 \times N \left[ \frac{N^{-1}(PD(1)) - \sqrt{\rho}x}{\sqrt{1-\rho}} \right]$$
Conditional 1-Year PD

Unconditional PD(1) = 0.02
Conditional Recovery Rate

Unconditional PD(1) = 0.02

<table>
<thead>
<tr>
<th>Rho</th>
<th>0.0001</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp. Recovery</td>
<td>38.2%</td>
<td>38.4%</td>
<td>39.3%</td>
<td>40.5%</td>
</tr>
</tbody>
</table>

Probability

Rho = 0.0001
rho = 0.1
rho = 0.2
rho = 0.3
For CDS with spread \( s \), hazard rate \( \lambda \), copula correlation \( \rho \), and latent variable value \( x \), the probabilities of default are known and the conditional CDS value can be computed.

Integrating the conditional values over \( x \) produces the unconditional CDS value.

\( \lambda_{IC}(s, \rho) \) is the copula implied hazard rate,

\[
V_C(s, \lambda_{IC}(s, \rho), \rho) = 0
\]
Extracting Recovery Rates

- $E_C[R(\lambda, \rho)]$ is the expected recovery rate under the copula model found by integrating over the latent variable

- $R_{IF}(s, \lambda_{IC})$ is the implied fixed recovery rate based on the copula implied hazard rate
Copula Implied Hazard Rate

CDS spread = 50 bp
CDS spread = 200 bp
Recovery Rates

![Graph showing recovery rates with varying copula correlations and implied and expected recoveries for different values of s (50 and 200)]
Conclusion

• If CDS quotes reflect a recovery model in which probability of default and recovery are negatively related, and
• A fixed recovery rate model is used to infer probabilities of default
• The appropriate recovery rate needed to determine the probability of default is much lower than intuition would suggest