

Session 29 Credit Derivatives
Valuation Actuary Symposium
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Credit Derivatives
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Why Discuss Credit Derivatives at the Valuation Actuary Symposium?

- Credit derivatives are a fast-growing segment of global derivatives
- Extensively used in financial institutions
- Insurance companies participate directly or indirectly through securitized transactions
- Substantial credit problems in 2001-2002 and expected to continue-creating need to manage credit risk
- Need to heighten awareness among Appointed Actuaries. Typically, cash flow testing has focused on interest rate risk.

Growth of Credit Derivatives

- In 1996 notional amount of credit derivatives was \$40 billion
- By the end of 2002, credit derivative notional expected reach \$1.5-\$2 trillion, or about 2% of total global derivatives
- U.S credit derivative notional was \$438 billion at the end of 1Q 2002, or about 1% of total domestic derivatives

Basic Types of Credit Derivatives

- Total Return Swap
- Credit Default Swap
- Credit Spread Option
- Trading generally occurs in an over the counter (OTC) transaction between an investor (company) and an investment bank.

Total Return Swap

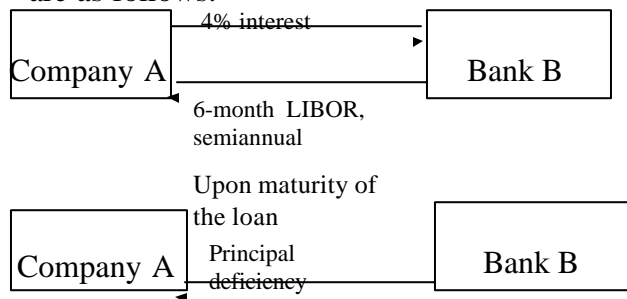
- The total return from one asset or group of assets is traded for the total return on another asset.
- Usually, one party pays the total return on a defined underlying asset and receives a stream of LIBOR-based cash flows.
- No notional amounts are exchanged
- Swaps are usually constructed so that the value of the swap at inception is 0.

Total Return Swap Example

- Company A has expertise in originating loans to clothing manufacturing companies, but it is about to exceed its investment guideline capacity in this sector.
- Clothing manufacturer XYZ requests an additional \$100 million loan to fund new plant construction.
- Company A does not want to disturb its relationship with XYZ and it makes the loan and enters into a total return swap with Investment Bank B.

Total Return Swap Example

- The loan interest rate is 8%, payable semiannually, and the swap is priced at LIBOR. The cash flows every six months are as follows:



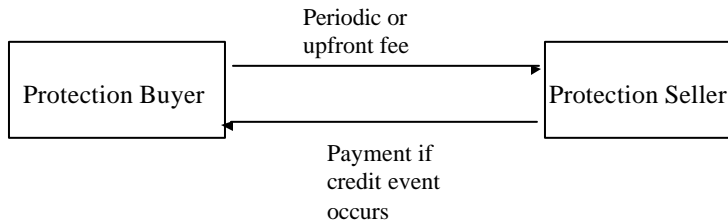
Results of Swap

- Company A able to make loan to XYZ and comply with internal and regulatory investment guidelines
- Credit exposure to XYZ transferred to Bank B
- Company A now has counter party exposure to Bank B
- By designating swap as a hedging transaction, Company A may receive appropriate balance sheet and RBC treatment.
- Note that total return swaps could also be used to gain exposure to credits that a company may not have access to.

Credit Default Swap

- Credit default swaps contracts capture the largest volume among credit derivatives.
- A credit default swap involves a protection buyer and a protection seller.
- The potential loss on a reference asset (e.g. bond) due to specific events such as default, credit downgrade, or bankruptcy becomes the responsibility of the protection seller.
- In return, the protection buyer pays the seller periodic or upfront fees.

Credit Default Swap



Credit Default Swap

- The payoff-qualifying credit events must be well-defined in the swap agreement.
- The protection buyer, depending on the agreement, delivers the reference asset to the seller and receives the face amount of the reference asset.
- Alternatively, there can be a net settlement equal to the face amount of the asset minus the market value of the asset determined within a short time (e.g one month) after the credit event.

Credit Default Swap

- Credit default swaps can also be based on a pool or basket of referenced assets.
- Payoffs can be specially tailored
- Definitions of default and standard documentation developed by International Swaps and Derivatives Association

Credit Spread Option

- A credit spread option provides protection against the yield on a reference asset (e.g bond) widening against the yield on another asset.
- For example the protection buyer purchases a credit spread option that pays off whenever the yield on recently issued 10-year bonds issued by ABC Corp exceed the yield on recently issued 10-year Treasuries by 400 basis points.
- The contingent payoff may be the difference between the value of the bond assuming a 400 basis point spread and the actual market value of the bond.

Credit Spread Option

- Similar to the Credit Default Swap the Credit Spread Option requires the protection buyer to pay a premium or fee to the protection seller.
- Unlike the Credit Default Swap no specific event needs to occur in order for the Credit Spread Option to payoff. As long as the spread widens to above the strike price, the option pays off.

Applicability to Insurance Companies

- Insurance companies have not been major participants in total return swaps or credit spread options.
- Insurance companies have not been major protection buyers of credit default swaps. Protection buyers have been financial institutions and hedge funds.
- Insurers have, explicitly or implicitly, been credit protection sellers. Much of the protection selling has involved Collateralized Debt Obligations (CDO).

Pricing Credit Default Swaps(CDS)

- Assume that a 5-year corporate bond rated BBB2 trades at 200 basis points over the 5-year Treasury.
- Moody's annual corporate bond default study indicates that the average annual default cost (annualized cumulative default probability times 1 minus recovery rate) is 25 basis points.
- If the credit default swap cost is around 25 basis points, an investor can buy the bond, purchase a credit default swap, and earn a spread of about 175 bp. The default risk of the bond issuer is replaced by the counter party risk of the protection seller (investment bank), which is probably a much smaller risk.
- Actually, credit default swap pricing is much different than our above assumption indicates.

Pricing Credit Default Swaps

- Hull and White¹ describe a process for valuing credit default swaps, assuming no counter party risk:
 - First, it is assumed that the value of a Treasury Bond (risk-free) exceeds the value of the reference corporate bond solely due to the possibility of defaults. Also, temporarily assume no counter party risk.
 - Value of Treasury Bond – Value of Corporate Bond = Present Value of Cost of Defaults
 - If the reference issuer has a sufficient range of bond maturities that are actively traded, we can estimate the probability of the issuer defaulting at different future times.
 - If this is not the case we can use bonds from other issuers that have the same default risk as the reference entity.

Pricing Credit Default Swaps

- Note that default probabilities are risk-neutral, not historical default probabilities.
- In order to determine default probabilities, we need to make an assumption about recovery amounts upon default.
- Assuming a given difference between the value of a corporate bond and its corresponding maturity Treasury bond, higher recovery amounts imply higher risk-neutral default probabilities.
- Inductively, we can calculate the default density at each time interval.
- Then, (A) the present value of the expected payoff from the credit default is calculated.

Pricing Credit Default Swaps

- Also, (B) the present value of \$1 per year credit default swap periodic fees (premium) is calculated.
- The credit swap premium is the spread that equates (A) and (B).

Example of CDS Pricing
Ashland, Inc
July 13, 2000

Maturity	Actual Bond Yield Spread to Treasuries in bp	CDS Spread (Premium) from Hull and White Model
1	199	189
5	213	209
10	240	227
20	269	253

Pricing Credit Default Swaps
Revised

- Note that the credit default swap premium is close to the actual bond yield spread.
- If the credit default swap premium is materially higher than the yield spread, the investor would short the corporate bond, sell the credit default swap, and buy the Treasury bond.
- Conversely, if the credit default swap is materially lower than the bond yield spread, the investor would buy the bond, buy the credit default swap, and short the Treasury bond.

Pricing Credit Default Swaps

- There are situations in which the CDS spread calculated in the model differs somewhat from the bond yield spread
 - The Treasury curve is very steep
 - The bond is trading at a deep discount or premium
 - Recovery rates are assumed to be well above 50%

Pricing Credit Default Swaps Extension to Multiple Reference Entities

- For many CDS applications more than one reference entity will be used.
- Also, the value of the payoff from the CDS may depend on the distribution of defaults on a pool of, say N , reference bonds.
- The model we previously discussed can be extended to price a CDS based on the distribution of default losses for N reference bonds, by constructing correlations of “credit indices” between each pair of reference bonds.

CDS Pricing Example
Multiple Reference Entities
Payoff on First Default
Spread in bp*

Cred Index Corr	Number of Reference Entities (all BBB rated)			
	1	2	5	10
0	194	386	946	1842
0.4	194	351	707	1122
0.8	194	289	444	580
5-Year Swap; Recovery Rate: 30%				

*Source: Hull and White (2001)

Pricing Credit Default Swaps
Counter party Risk

Cred Index Corr	CDS Spread in bp*			
	Counterparty Rating			
	AAA	AA	A	BBB
0	194.3	194.3	194.3	194.1
0.4	187.4	185.2	181.3	174.6
0.8	177.1	170.5	156.8	134.1
5-Year Swap: Recovery Rate: 30%				
Reference Entity is BBB				
*Source: Hull and White (2001)				

CDS As a Leading Indicator Case Studies

- Tyco International (TYC). Between Dec, 2001 and Feb, 2002 TYC stock fell from \$60 to \$30. Its bond yield spread against widened from 110bp to over 500bp. TYC default swaps traded 50bp to 200bp wider than bond spreads. (Source: Creditmetrics)
- Sprint Corp. Sprints senior debt has steadily declined in value throughout 2002-a 15% decline from Jan to July. However, its CDS spread increases have lead the actual bond declines. In July, the CDS spread was about 900 basis points. (Source: Wall Street Journal)

Collateralized Debt Obligations (CDO)

- CDO's are securities issued by a bankruptcy-remote Special Purpose Vehicle and backed by collateral such as bank loans and high-yield debt.
- Insurance companies participate both as investors and as issuers
- In some ways similar to Asset Backed Securities
- Servicer and portfolio managers play more important role in CDO vs. ABS-more timely decision making required

CDO Structures

- Funded CDO's
 - Balance Sheet CDO
 - Arbitrage CDO
 - Cash Flow
 - Market Value
- Unfunded CDO's
 - Synthetic CDO's

Balance Sheet vs.. Arbitrage CDO

- Balance sheet CDO
 - Collateral: high-grade bank loans
 - Issuer motivation: Reduce balance sheet to improve capital ratios
 - Investor motivation: Exposure to asset class not otherwise accessible
 - Issuers: Banks
- Arbitrage CDO
 - Collateral: High-yield corporate bonds or loans
 - Issuer motivation: Increase assets under management
 - Investor motivation: Participate in asset class otherwise not accessible; arbitrage opportunities
 - Issuers: Insurance companies, banks, mutual funds, private equity funds

Arbitrage CDO Opportunities*

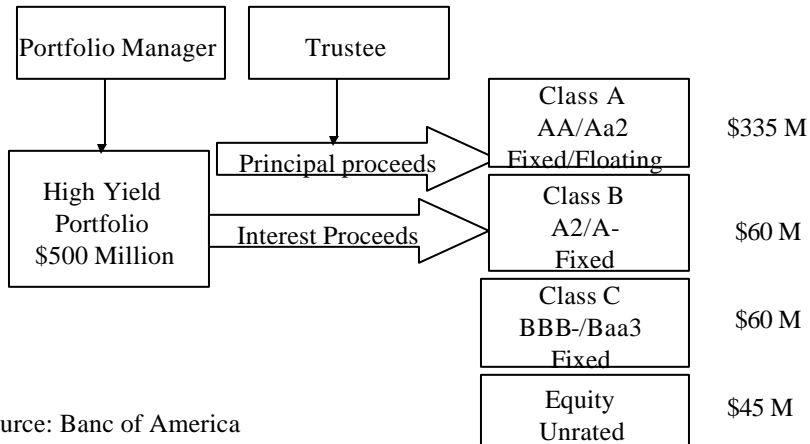
- High yield vs.. investment grade spreads
- Liquidity premium in high-yield investments
- Implied default rates (risk-neutral, such as those used in CDS pricing)) vs.. expected or historical default rates
- Advantage of diversification
- LIBOR vs.. Treasury spread

*Source: Banc of America Securities

Arbitrage CDO Cash Flow vs. Market Value

- | | |
|--|---|
| <ul style="list-style-type: none">• Cash Flow CDO<ul style="list-style-type: none">– Objective is to select credits that will pay coupons and redeem par at maturity– Minimize defaults– Sound credit quality, but allow for some illiquidity– Buy and hold strategy– Collateral is rated, high-yield current debt | <ul style="list-style-type: none">• Market Value CDO<ul style="list-style-type: none">– Objective is to select credits that will appreciate in value– Portfolio may include defaulted credits or other distressed debt– Actively managed portfolio– 70-75% of collateral is high yield current debt; 25-30% is distressed debt, foreign loans or other |
|--|---|

Cash Flow CDO Structure*



Determination of Class Ratings

- Subordination: A Class is supported by B, C, and Equity; B Class is supported by C and Equity
- Priority rules for both interest and principal. A Class principal retired before principal allocated to other classes.
- Over-collateralization tests for each asset class
- Interest coverage tests
- Diversity ratings tests
- If tests not met manager must correct or redeem collateral until tests met.

Rating Agencies

- Moody's, Standard and Poor's, and Fitch all rate CDO's.
- Rating determinants
 - Quality of collateral
 - Expertise of issuer and portfolio manager
 - Structure of CDO
- A CDO class is given a rating that reflects the loss profile that a bond of a similar rating would have. That loss profile is based on regular default and recovery rate historical studies.

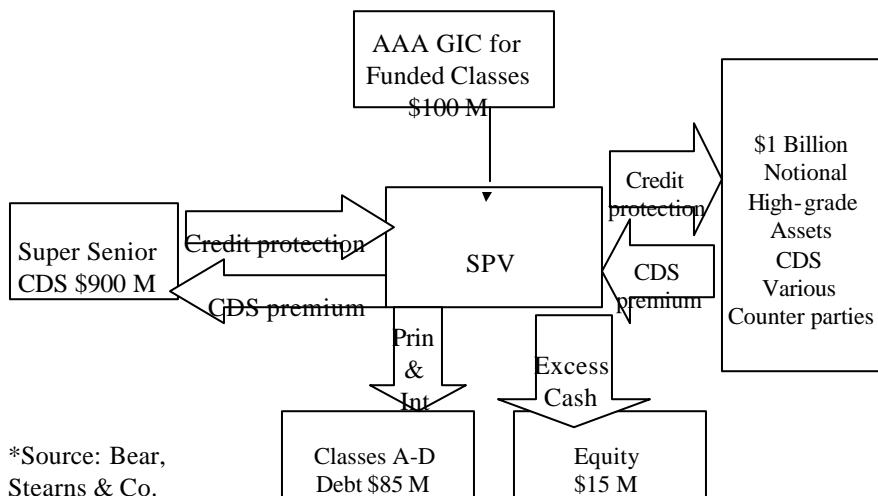
Moody's CDO Rating Process

- Use a binomial modeling method
- Reduce the actual collateral to a homogeneous pool of uncorrelated assets, using diversity score
- Assign default probabilities and recoveries based on Moody's experience studies. Note that these are not risk-neutral probabilities.
- Project deal cash flows using binomial method and random number generator
- Develop loss distribution and expected loss
- Set rating based on expected IRR change due to defaults

Synthetic CDO

- Amount of actual funding is very small in relation to reference portfolio. For example, the notional amount of the reference portfolio is \$1 billion and the cash-funded tranches total \$100 million.
- Maximum use of Credit Default Swaps (CDS) employed.
- Super senior tranche writes \$900 million CDS in return for 6-10 basis points.

Synthetic CDO Structure*



*Source: Bear, Stearns & Co.

Issues for Insurers

- GAAP Accounting
 - FAS 133
 - Hedge accounting treatment
- International Accounting
 - IAS 39
 - Are CDS derivatives?
- Statutory Accounting
 - Hedge accounting treatment
 - RBC
- State Insurance Investment Laws

Recent Experience

- Enron CDS clean payoffs
- WorldCom CDS payoffs expected to be clean
- Nomura controversy with Railtrack
 - Wanted to deliver convertible bonds when Railtrack went into receivership
 - CSFB refused to accept, forcing Nomura to deliver plain debt
 - ISDA clarified definitions prospectively in November, 2001
- CDO downgrades
 - Some equity classes wiped out
 - Some mezzanine tranches downgraded

Summary

- Continued focus on credit
- CDO's, both funded and synthetic, offer yield enhancement opportunities, but company needs to understand risk
- Appointed Actuaries will need to upgrade credit modeling capabilities to measure risk and properly model investments

Credit Derivatives

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1998 ISDA

CONSECO Restructure

Moody's 2001 Pronouncement

1. A restructure is considered a default if it meets the definition used in Moody's default studies
2. Settlement is by delivery to the provider of protection of (i) securities with a maturity of no greater than 30 months or (ii) a restructured asset

2001 ISDA

Credit Derivative Pricing

Premium » Bond Yield – LIBOR

If Default Swap Premium < Credit Spread

Buy Bond, Buy Protection

Receive Difference

If Default Swap Premium > Credit Spread

Short Bond, Sell Protection

Receive Difference

Cash Bonds

Interest Rates Rise ⇨ Value Falls

Fall in value compensates for an interest payment that is insufficient to pay current market yields

Default Swaps

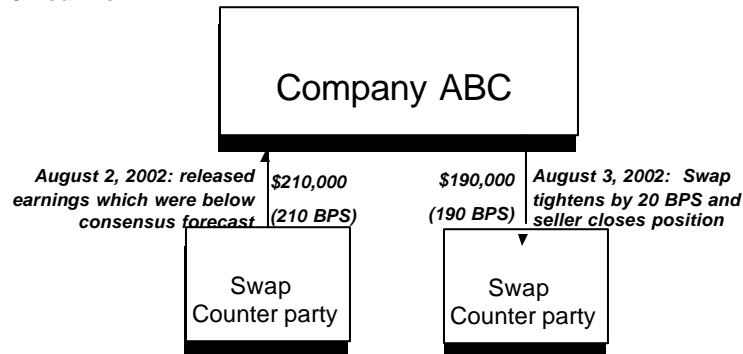
Credit Spreads Widen ⇨ Value Falls

Fall in value compensates for risk premium payment that is insufficient to cover current credit spread

Example - Walt Disney Co. (DIS)

\$10,000,000 Notional

5 Year Term



- PV of \$20,000 per year assuming 0% interest rate increase in market value of \$100,000

What a Valuation Actuary Needs to Know

1. What is my investment department doing with these things?
2. How can credit default swaps impact cash flow?
3. How can credit default swaps affect liquidity?
4. How can credit default swaps affect income?
5. What structured transactions depend on these instruments?

Return on Capital Analysis

	<u>GICs</u>	<u>Credit Default Swaps</u>
C1 Capital Charge (NAIC 1)	0.3%	0.3%
C1 Capital Charge (NAIC 2)	1.0%	1.0%
C3 Capital Charge	0.77%	-
Total Capital	\$1.42 MM	\$0.65 MM
x2.5 RBC Multiplier	\$3.55 MM	\$1.625 MM
Net Annual Income (no defaults)	<u>\$0.6 MM</u>	<u>\$1.0 MM</u>
<u>RETURN ON CAPITAL (no defaults)</u>	<u>16.9%</u>	<u>62%</u>
Annual Loss assuming 1 default over 5 years (50% recovery, 100 names)	\$0.1 MM	\$0.1 MM
Net Annual Income (1 default)	<u>\$0.5 MM</u>	<u>\$0.9 MM</u>
RETURN ON CAPITAL (1 default)	14.1%	55%

Advantages of Credit Default Swaps vs.. GICs

LIBOR Based Funding

No C-3 Risk

Easier to Diversify

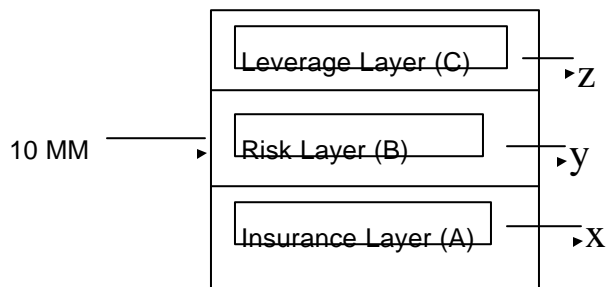
Reasons Why Companies do not Sell Credit Protection

- Volatility
- Concerns over Fallen Angels
- State Regulations
- Benefits of Structuring

Types of Structures

- Leverage Corporate Credit
- Insured Corporate Credit
- Insured Leveraged Corporate Credit

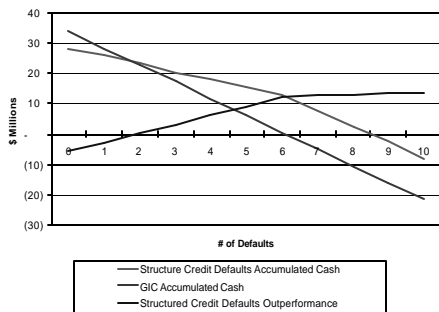
Credit Default Swap Structure 100 Credit Default Swaps of \$10MM Pay 100 Basis Points Each



$$A+B+C=1.0 \text{ BN}$$

$$X+Y+Z=10.0\text{MM}$$

Comparison of \$1.0 BN Structured Credit Default vs.. \$1.0 BN GIC Strategies



Assumptions

- Gross portfolio spread of 107 bps
- GIC Issuance cost of 45 bps (all-in)
- 95 investment grade corporates
- Default timing: immediate

# of Defaults	0	1	2	3	4	5	6	7	8	9	10
Structured Credit Defaults Accumulated Cash	28.6	26.0	23.3	20.7	18.1	15.4	12.8	8.0	2.7	(2.5)	(7.8)
GIC Accumulated Cash	34.1	28.5	23.0	17.4	11.8	6.3	0.7	(4.9)	(10.5)	(16.0)	(21.6)
Structured Credit Defaults Outperformance	(5.5)	(2.6)	0.4	3.3	6.3	9.2	12.1	12.9	13.2	13.5	13.8

Issues

- 1. Market Value vs.. Fair Value**
- 2. State Restrictions on Derivatives**
- 3. Liquidity**