



Enterprise Risk Management in the Insurance Industry

ERM Symposium 2007

Steve D'Arcy

Fellow of the Casualty Actuarial Society
Professor of Finance - University of Illinois

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Overview

- Basic risk management principles
- Banking and insurance regulation
- How different industries classify risk
- Insurance products
- Insurers and ERM
- Credit derivatives
- Interest rate models
- ERM resources

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Basic Risk Management Principles

1. Identifying loss exposures
2. Measuring loss exposures
3. Evaluating the different methods for handling risk
 - Risk assumption
 - Risk reduction
 - Risk transfer
 - Hedging
4. Selecting a method
5. Monitoring results



Evolution of Application of Risk Management

- Corporate risk management – 1960s
- Financial risk management – 1980s
- Enterprise risk management – late 1990s



Risk Management in Financial Services Regulation

- Both banking and insurance regulators are now taking an enterprise risk management approach
- Basel Committee of the Bank for International Settlements – Basel II now applies to banks
- European Commission developed similar approach to insurance
 - Solvency I – adopted in 2002 – increased capital requirements
 - Solvency II – regulations go into effect in 2009
 - Modeled after Basel II

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The Three Pillars of Basel/Solvency II

1. Minimum Capital Requirements
 - Quantitative approach
 - Banks use standard conventions to measure exposure
 - Insurers will use internal data for best estimates
2. Supervisory Review
 - Qualitative
 - Banking regulators build on Pillar 1 requirements
 - Insurance regulation is intended to be consistent
3. Market Discipline
 - Goal is transparency

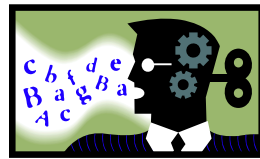
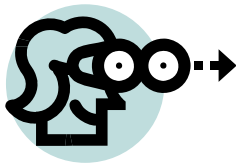
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How Industries Classify Risk

Banks

Insurers



How Banks View Risk

Risk According to Basel II

- Credit risk
 - Loan and counterparty risk
- Market risk (financial risk)
- Operational risk
 - Failed processes, people or systems
 - Event risk



How Insurers View Risk

Insurance companies have more complex risks than banks

- Underwriting risk
- Loss reserve risk
- Catastrophic risk
- Financial risk (market risk)
- Operational risk
 - Failed processes, people or systems
- Strategic risk

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Insurance Products - Life Insurance

- Pay benefit at uncertain time of death
 - Fixed benefit most common
 - Some benefits tied to investment performance
- Embedded options
 - Settlement options
 - Policy loans
 - Surrender option
- Minimum guaranteed rate of return

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Insurance Products - Annuities

- Pay a periodic benefit for an uncertain duration
 - Fixed benefit
 - Variable benefit
 - Indexed to inflation
 - Tied to investment performance
- Embedded options
 - Surrender option on deferred annuities
 - Payout guarantees

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Insurance Products - Property-Liability Insurance

- Pay an uncertain amount contingent on the occurrence of an event
 - Multiple events possible
 - Primary risk factors
 - Latent exposures (asbestos, environmental)
 - Claim value escalation
 - Catastrophic losses

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Insurers and ERM

- Industry has far to go
 - Cummins, Phillips and Smith (1997 - NAAJ)
 - In 1994, 88% of life insurers and 93% of casualty insurers did not use derivatives at all
 - Santomero and Babel (1997 - JRI)
 - “Not very well”
 - Even the best processes need to be improved
- Reasons for slow development
 - Regulation inhibits use of derivatives
 - Liability cash flows are variable and could be interest rate dependent



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Rating Agencies and ERM

- Standard & Poor's Approach
 - ERM Quality Classification
 - Risk Management Culture
 - Risk Tolerance
 - Emerging Risk Management
 - Risk and Economic Capital Models
 - Strategic Risk Management
 - Risk Control
 - Credit Risk
 - ALM
 - Property/Liability vs. Life Insurance Risk
 - New Product Risk Control



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Financial Position by Industry

(Figures are in billions)

Industry	Assets	Liabilities	Capital (Surplus)	Leverage: $\frac{\text{Assets}}{\text{Capital}}$
P-L	1,183	789	394	3.0
Life	4,253	4,003	250	17.0
Banks	10,877	9,758	1,119	9.7

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Credit Derivatives

- Rapidly growing area of risk management
- Banks are using credit derivatives to reduce risk and lower capital requirements
- Insurers are becoming involved in this market

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What are Credit Derivatives?

“Credit derivatives are derivative instruments that seek to trade in credit risks.”

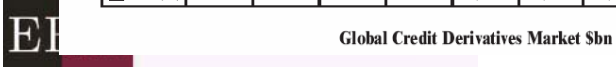
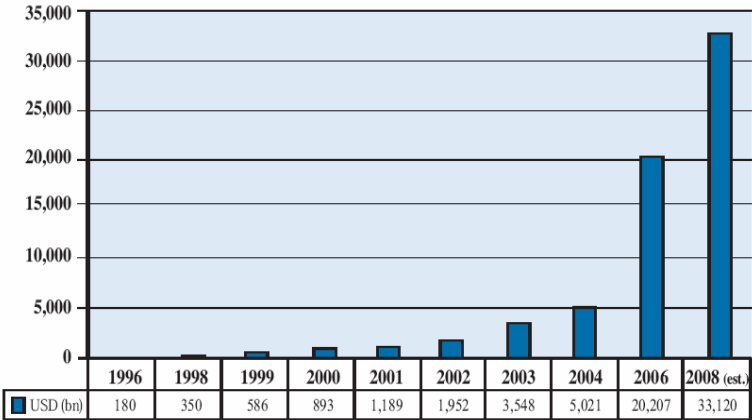
<http://www.credit-deriv.com/meaning.htm>

Credit risk is the risk that a counterparty to a financial transaction will fail to fulfill their obligation.



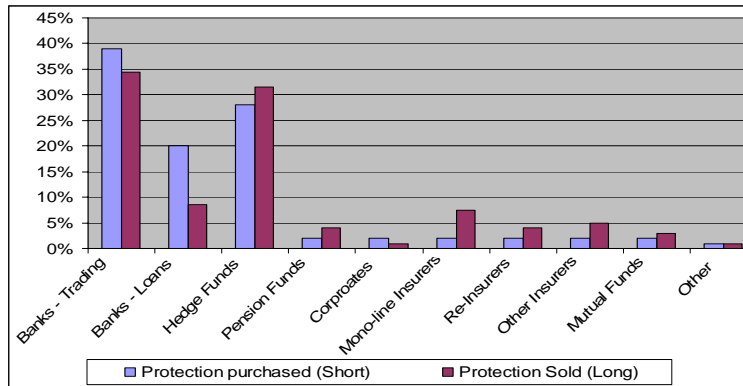
Growth in Credit Derivatives

Source: BBA Credit Derivatives Report 2006



Comparison of 2006 Market Share, Buyers v. Sellers

Source: British Bankers' Association Credit Derivatives Report 2006



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Types of credit derivatives

- Credit default swap
- Credit spread option
- Credit linked note

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What is Credit default swap?

Credit default swaps allow one party to "buy" protection from another party for losses that might be incurred as a result of default by a specified reference credit (or credits).

The "buyer" of protection pays a premium for the protection, and the "seller" of protection agrees to make a payment to compensate the buyer for losses incurred upon the occurrence of any one of several specified "credit events."

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Bloomberg Credit Default Swap Model

1<GD> to save Deal, 2<GD> to save curve source

Deal	Curve	View	Reference Obligation	USD Info	Amortization
CREDIT DEFAULT SWAP					
Deal Information			RED Pair:	Spreads	
Reference:	International Business Machines Corp		Deal#:	Curve Date:	3/15/07
Counterparty:			Privilege:	Benchmark:	S 23 Ask
Ticker:	Series:		Settlement Code:	US BGN Swap Curve	
Business Days:	USD		Currency:	Spnds:	Contributor Ask
Business Day Adj:	Following		Amortizing:	100801 USD Senior	IMM
BUY National:	10.00	MM	Knock Out:		
Effective Date:	3/16/07		Day Count:	ACT/360	
Maturity Date:	3/16/12		Month End:	N	
Payment Freq:	Quarterly		First Cpn:	6/18/07	
Pay Accrued:	True		Next to Last Cpn:	12/16/11	
Curve Recovery:	True		Date Gen Method:	Backward	
Recovery Rate:	0.40		Debt Type:	Senior	
Deal Spread:	9.630 bps		Model:	Mod Hull-White	
Calculator			Mode:	Calc Price	
Valuation Date:	3/16/07		Liq Prem:	0.0	OAS: 0.0
Cash Settled On:	3/20/07		Frequency:	Quarterly	
Price:	99.99999947	Repl Sprd:	9.630 bps	Day Count:	ACT/360
Principal:	0.05	Days:	0	Recovery Rate:	0.40
Accrued:	0.00	Spnd DV01:	4,457.06		
Market Val:	0.05	IR DV01:	.00		

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What is credit spread option?

A credit spread option grants the buyer the right, but not the obligation, to purchase a bond during a specified future “exercise” period at the contemporaneous market price and to receive an amount equal to the price implied by a “strike spread” stated in the contract.



Credit-linked notes

A credit-linked note (CLN) is essentially a funded CDS, which transfers credit risk from the note issuer to the investor.

The issuer receives the issue price for each CLN from the investor and invests this in low-risk collateral.

If a credit event is declared, the issuer sells the collateral and keeps the difference between the face value and market value of the reference entity’s debt.



Current Credit Crisis

- Sub-prime mortgage lending
- Default rate increase
- Widening of credit spreads
- Financial difficulties for sub-prime lenders
- Banks may have accepted more risk than they realized

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Modeling Issues

- Property-Liability insurers
 - Model catastrophes well
 - Credit risk not modeled effectively
 - Especially nonperforming reinsurance
 - Dynamic Financial Analysis approach
- Life insurers
 - Use models to value embedded options
 - Interest rate and equity models important
- Banks
 - Model credit risk well, generally
 - Stress testing codified, but not modeled fully
 - Catastrophe models need improvement

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Classifications of Interest Rate Models

Discrete vs. Continuous

Single Factor vs. Multiple Factors

General Equilibrium vs. Arbitrage Free



Examples of Interest Rate Models

- One-factor Vasicek

$$dr = \alpha (\hat{r} - r) dt + \sigma dz$$

- Two-factor Vasicek

$$dr_t = \kappa_r (l_t - r_t) dt + \sigma_r dB_r$$


$$dl_t = \kappa_l (\mu_l - l_t) dt + \sigma_l dB_l$$

- Cox-Ingersoll-Ross (CIR)

$$dr = \alpha (\hat{r} - r) dt + \sigma \sqrt{r} dz$$



- Heath-Jarrow-Morton (HJM)

$$df(t, T) = \mu(t, T, f(t, T)) dt + \sigma(t, T, f(t, T)) dB_t$$




Which Type of Model is Best?

- There is no single ideal term structure model useful for all purposes
- Single factor models are simpler to use, but may not be as accurate as multiple factor models
- General equilibrium models are useful for modeling term structure behavior over time
- Arbitrage free models are useful for pricing interest rate contingent securities
- How the model will be used determines which interest rate model would be most appropriate

Use of Interest Rate Models

- Property-liability insurers
 - Interest rates are not a primary risk factor
 - Objective is to analyze long term horizon
 - One factor general equilibrium models are adequate
- Life insurers
 - Long term policies, long term horizon
 - Interest rates are key variables
 - Two factor general equilibrium models are appropriate, for now
- Banks
 - Need to evaluate interest rate contingent claims
 - Short term horizon
 - Arbitrage free models necessary





Key Points about Interest Rate Models

- Interest rates are not constant
- Interest rate models are used to predict interest rate movements
- Historical information useful to determine type of fluctuations
 - Shapes of term structure
 - Volatility
 - Mean reversion speed
 - Long run mean levels
- Don't assume best model is the one that best fits past movements
- Pick parameters that reflect current environment or view
- Recognize parameter error
- Analogy to a rabbit

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Conclusion

- Banks and insurers will have different approaches to ERM, but should understand each other's methods and terminology
- Each type of institution has various strengths that can benefit other industries
- Regulation can generate arbitrage opportunities, internationally or across industries
- ERM is likely to be a growth area in insurance over the next decade

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