

# **ERM & Credit Risk**

**Niamh Crowley, Niall Dillon**  
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# ERM & Credit Risk

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## Agenda

- Defining Credit Risk
- Sources
- Credit Spread
- Mitigation Techniques
- Modelling Techniques
- Management Process
- Solvency II
- Financial Crisis

# Credit Risk Definition



## ST9 Syllabus:

**Credit Risk** is the risk that a counterparty to an agreement will be unable or unwilling to make the payments required under that agreement. It can also refer to risk arising from changes in the value of an asset (e.g. corporate bond) due to an actual or perceived change in the creditworthiness of the issuer.

**Moody's bond default** to have occurred in three types of events;

- a) there is a missed or delayed disbursement of interest and/or principal,
- b) a bankruptcy filing or legal receivership occurs, or
- c) there is a **distressed exchange** where (i) the issuer offers bondholders a new security or package of securities that amount to a diminished financial obligation (such as preferred or common stock, or debt with a lower coupon or par amount), or (ii) the exchange had the apparent purpose of helping the borrower avoid default.



# Examples of Credit Losses

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- A consumer or business does not make a payment due on a mortgage loan, credit card, line of credit, or other loan
- A business or government bond issuer does not make a payment on a coupon or principal payment when due
- An insolvent insurance company does not pay a policy obligation
- An insolvent bank won't return funds to a depositor
- A business or consumer does not pay a trade invoice when due
- A business does not pay an employee's earned wages when due
- A government grants bankruptcy protection to an insolvent consumer or business





# Credit Risk – Related Definitions

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## **Sovereign risk**

Sovereign risk is the risk of a government becoming unwilling or unable to meet its loan obligations, or reneging on loans it

Guarantees

## **Counterparty risk**

Counterparty risk, otherwise known as default risk, is the risk that an organization does not pay out on a bond, credit derivative, credit insurance contract, or other trade or transaction when it is supposed to. Even organizations who think that they have hedged their bets by buying credit insurance of some sort still face the risk that the insurer will be unable to pay, either due to temporary liquidity issues or longer term systemic issues.



# Insurer credit risk

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- **Retail clients and intermediaries**
- **Commercial clients and intermediaries**
- **Fixed income investments**
- **Commercial real estate investment**
- **Reinsurance recoverables**
- **Bank counterparties**

# Credit Risk - Life Insurers

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Much of **credit risk** and the analysis need comes from the **'asset side'**.

- Unrated fixed income
- 'Own view' of rated fixed income
- Commercial real estate tenants
- Reinsurance recoverables (current or future)

Also, via derivative based products (i.e. exposure to derivative counterparties).

Plus clients and distribution channels.



# Credit risk – Non-Life insurers

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Much is '**liability side**' – some directly linked to **credit risk**, some indirectly.

- Credit, surety and guarantee
- 'DnO'
- Liability / casualty in general

As well as

- Fixed income
- Commercial real estate
- Reinsurance recoverables

Plus client and distribution channels



# Credit Spread

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## Credit Spread – ST9 Syllabus

**Credit spread** is a measure of the difference between the yield on a risky and a risk free security, typically a corporate bond and a government bond respectively.

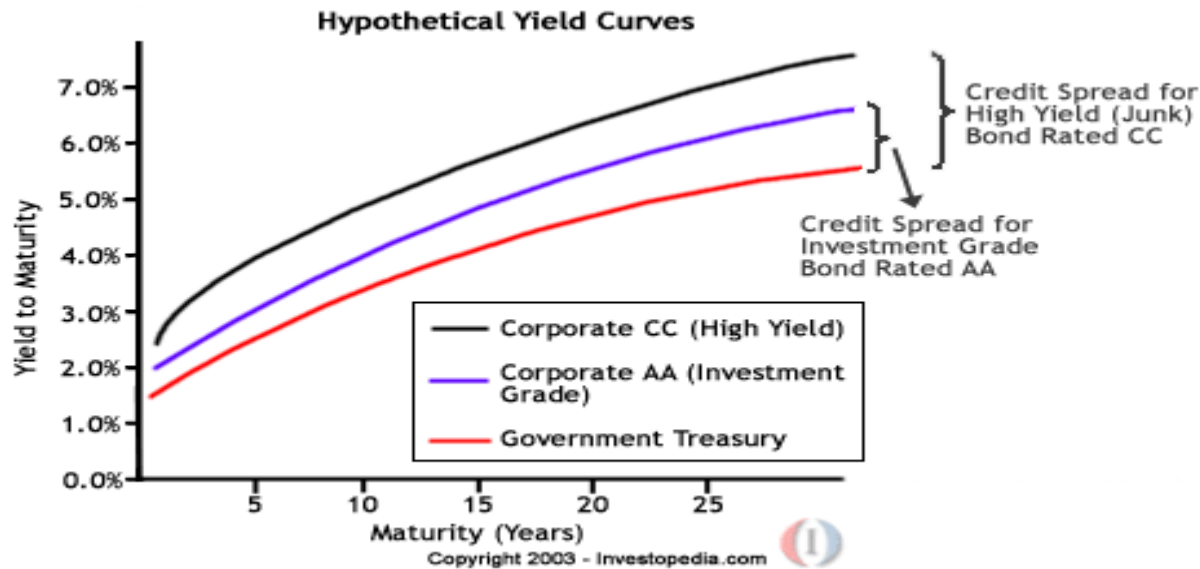
The credit spread reflects the following features:

- The expected probability of default
- Any risk premium attached to the risk of default
- A liquidity premium

### **Credit Spread: The Payoff For Assuming Credit Risk**

The payoff for assuming all these extra risks is a higher yield. The difference between the yield on a corporate bond and a government bond is called the credit spread (sometimes just called the yield spread).

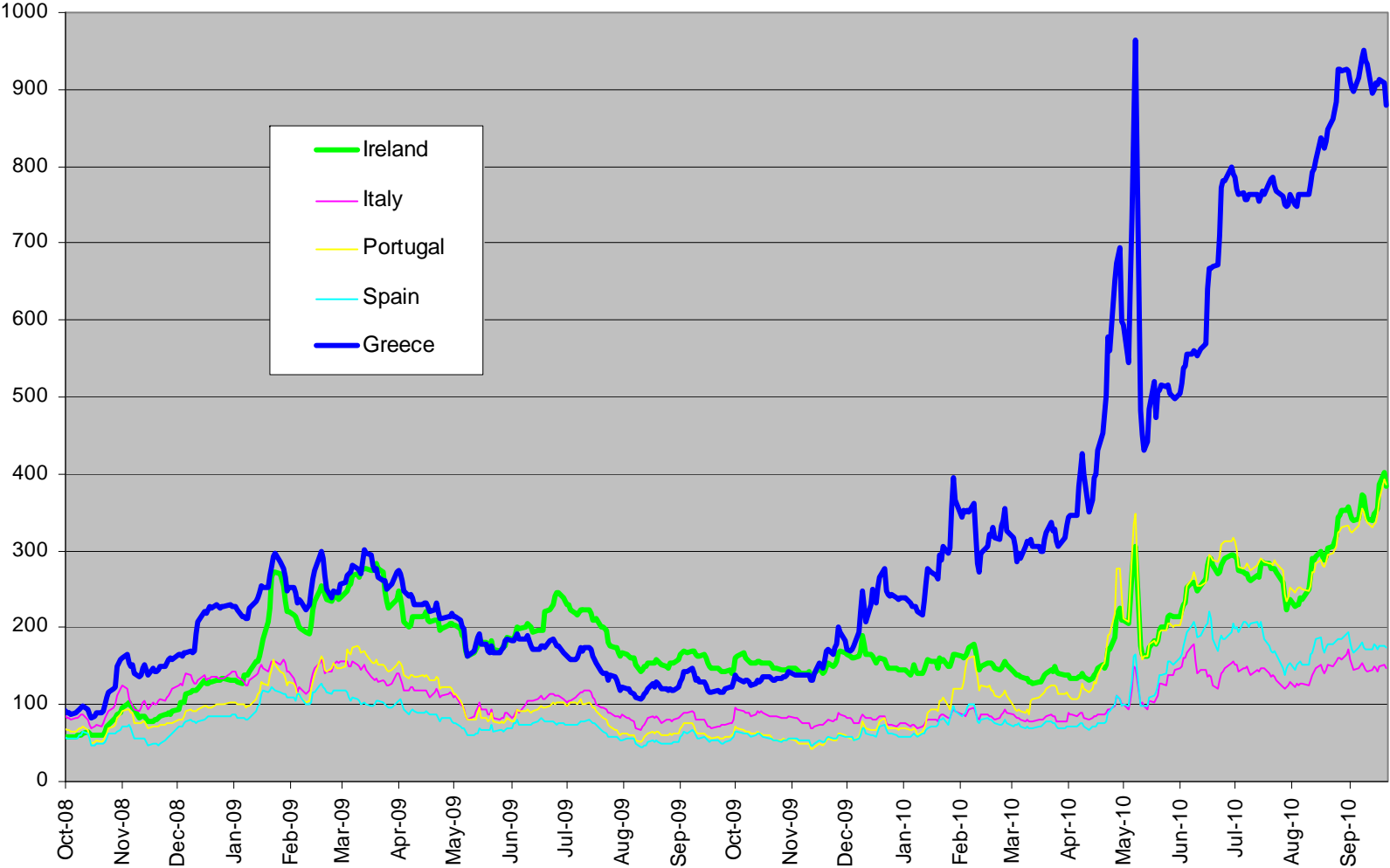
# Credit Spread



Three common measures of credit spread

- **Nominal spread** – difference in GRY of risky and risk free bonds
- **Static Spread** – the addition to the risk-free rate at which the discounted cashflows from risky bonds equal its price
- **Option-adjusted spread** – further adjusts spread for any bond optionality via stochastic modelling

# Spread 10-year German Bund (Basispoints)





# Mitigating credit risk

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Lenders mitigate credit risk using several methods:

- **Risk-based pricing:** Lenders generally charge a higher interest rate to borrowers who are more likely to default, a practice called **risk-based pricing**.
- **Covenants:** Lenders may write stipulations on the borrower into loan agreements.
- **Collateral:** A borrower's pledge of specific assets to a lender to secure repayment of a loan.
- **Credit insurance and credit derivatives:** Lenders and bond holders may hedge their credit risk by purchasing **credit insurance** or **credit derivatives**. The most common credit derivative is the **credit default swap**.
- **Tightening:** Lenders can reduce credit risk by reducing the amount of credit extended, either in total or to certain borrowers.
- **Diversification:** Lenders reduce this risk by diversifying the borrower pool.
- **Deposit insurance:** Many governments establish **deposit insurance** to guarantee bank deposits of insolvent banks.
- **Credit Policies, Process & Procedures**

# ERM & Credit Risk

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- Credit Spread
- Mitigation Techniques
- Modelling Techniques
- Management Process
- Solvency II
- Financial Crisis

# Credit Risk Modelling - Basics



Loss Event

**Exposure**

x

**Default (boolean)**

x

**Severity**

Predicting the Loss Event

**Exposure at Default**

**EAD**

x

**Probability of Default**

**PD**

x

**Loss given Default**

**LGD**

- Key concepts
- Expected Loss = EAD \* PD \* LGD
- Portfolio EL = Sum (EL on each transaction)



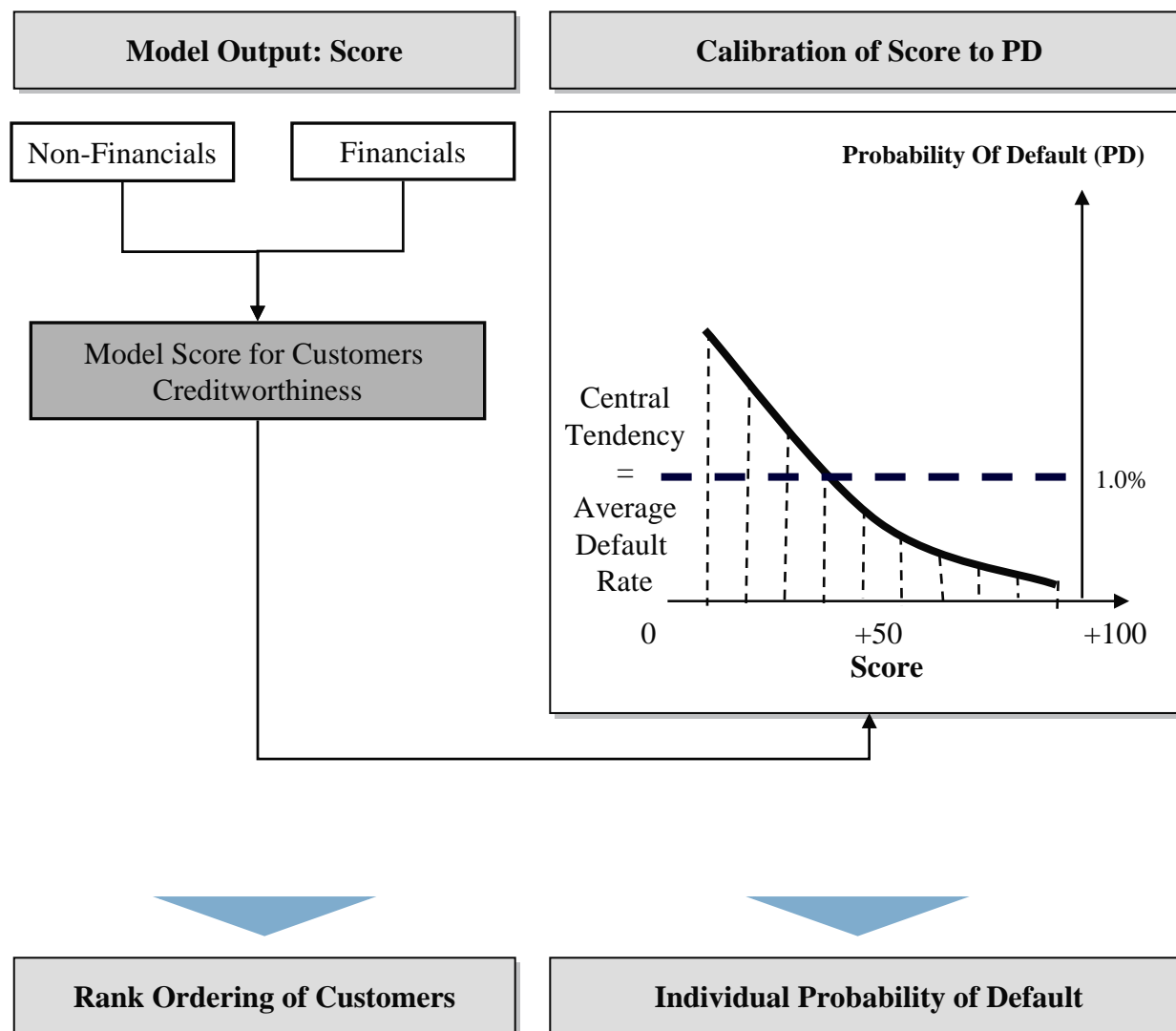
# Parameterisation

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- How to we specify PD,LGD EAD?
- Each individual loan\exposure must be assessed and rated
- Retail Exposures - Borrower Characteristics
  - Banks - Internal grading systems
  - Behavioural Scorecards, Observational data
  - Independent validation\Data collection\statistical analysis teams
  - Large resource requirements
- Corporate Exposures - Credit Ratings
  - S&P\Moodys\Fitch
  - Industry models – KMV, CreditMetrics
  - Agencies are subject to regulatory approval
- Definition of default? One missed payment? 3 months?
  - Total default v highly unlikely to pay?
  - Final loss may not be known for years – bankruptcy, restructuring
  - “Non performing loan” category – requires provision
  - Recovery Rates?



# PD Calibration - Retail



**Continuous  
Back-testing  
and  
Validation**





# Default Models - Corporates

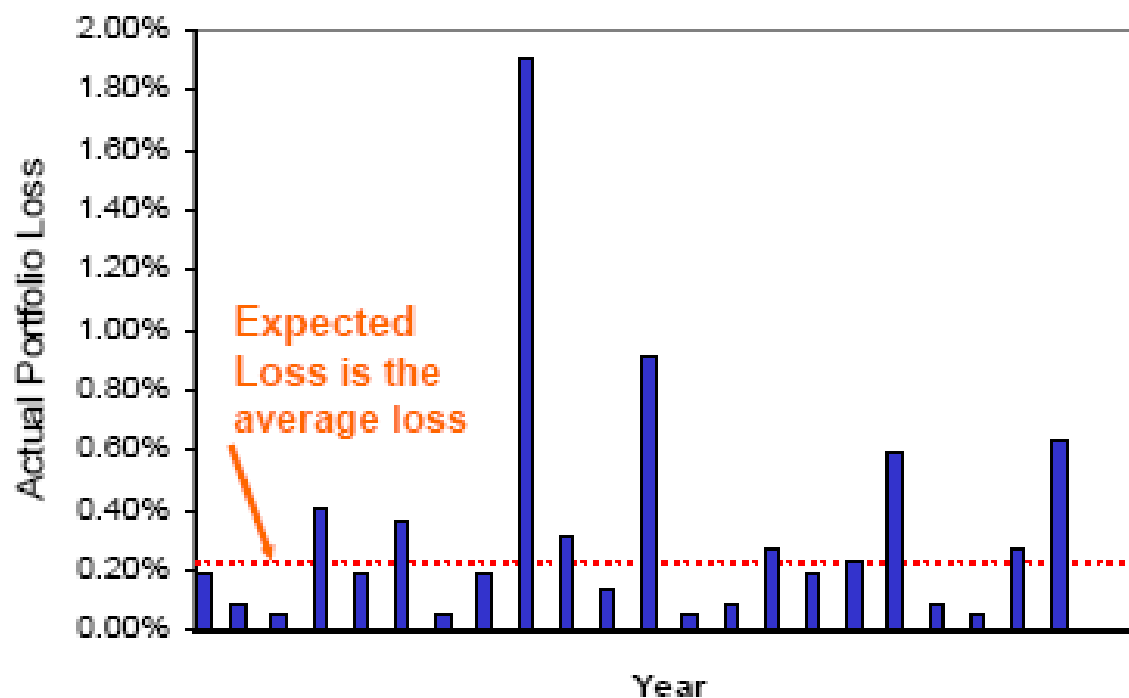
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Modelling the default probability of a firm

- 2 classes of model
- Firm-value (structural) models
  - The Merton model (1974) – the prototype
  - Company's credit is assessed by characterising its equity as a call option on its assets
  - Uses Black-Scholes diffusion model
  - KMV (Kealhofer, McQuown, Vasicek) model descends from Merton
  - KMV (Moody's) is widely used in industry
- Credit Migration models
  - Each firm assigned credit rating category
  - Probability of moving from one rating to another is specified
  - Transition matrix determined by historical default data
  - CreditMetrics (JP Morgan) is the industry standard



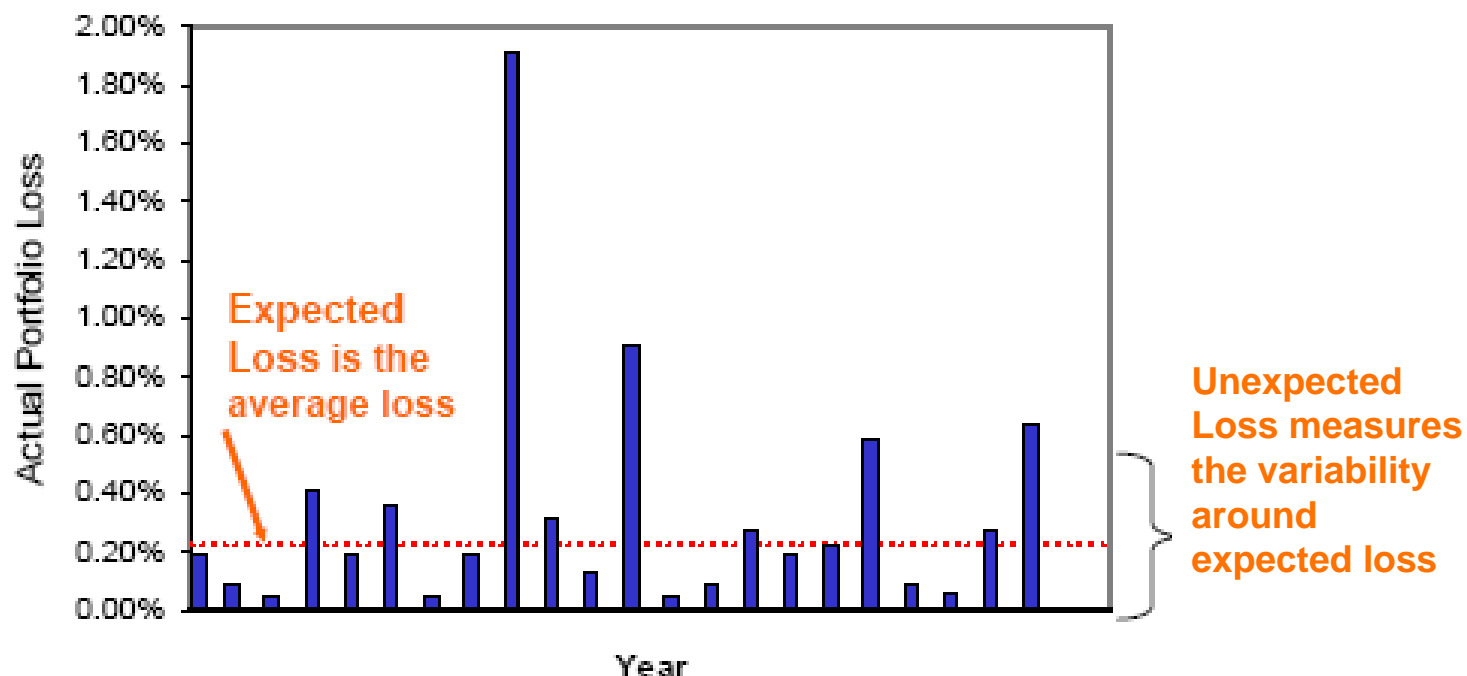
# Expected Loss



- EL is a reasonable predictable average rate of loss
- Organisations would not hold capital against EL if it has been correctly priced into the relevant transactions
- Foreseeable cost - expect to meet from normal revenue streams



# Unexpected Loss



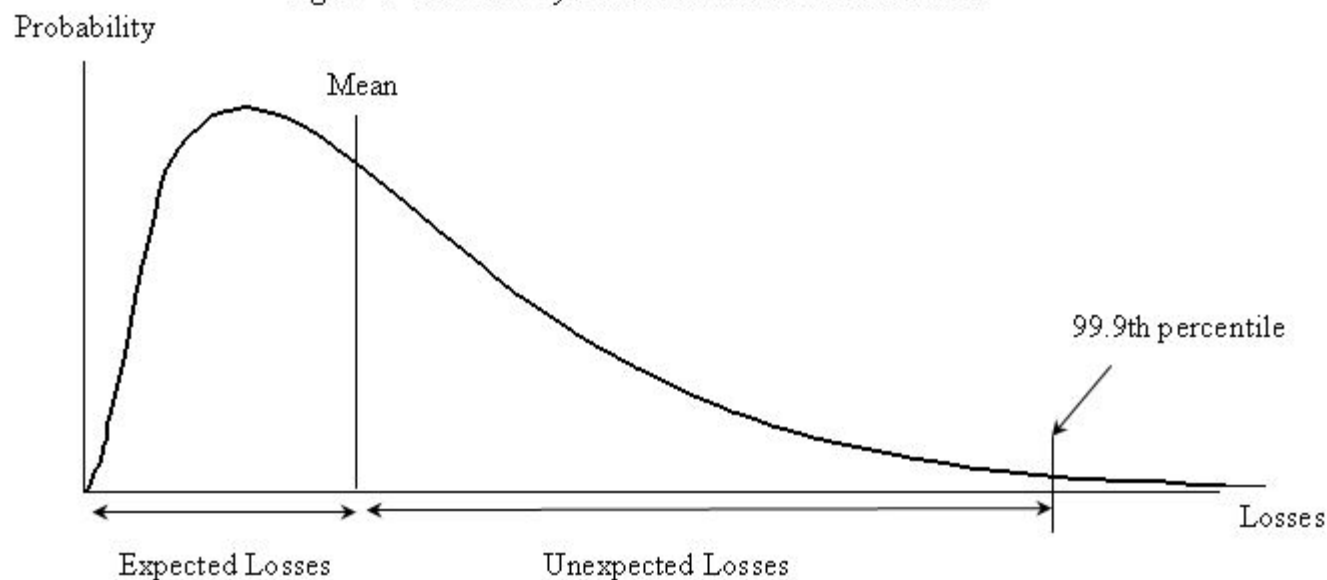
- Unexpected loss (UL) ~ volatility of losses around the mean (EL)
- Organisations required a **Capital Buffer** to cushion against these losses
- Avoid insolvency in times of stress



# How much capital?

- Credit Risk loss distributions are skewed to the right
- All losses  $\geq 0$ , no gains!
- Beta and Gamma distributions are a good fit for this type of distribution
- $UL * \text{capital multiplier (CM)} = \text{Capital required}$
- CM depends on confidence level required
- Basel II = 99.9% confidence

Figure 1 – Probability Distribution of Potential Losses



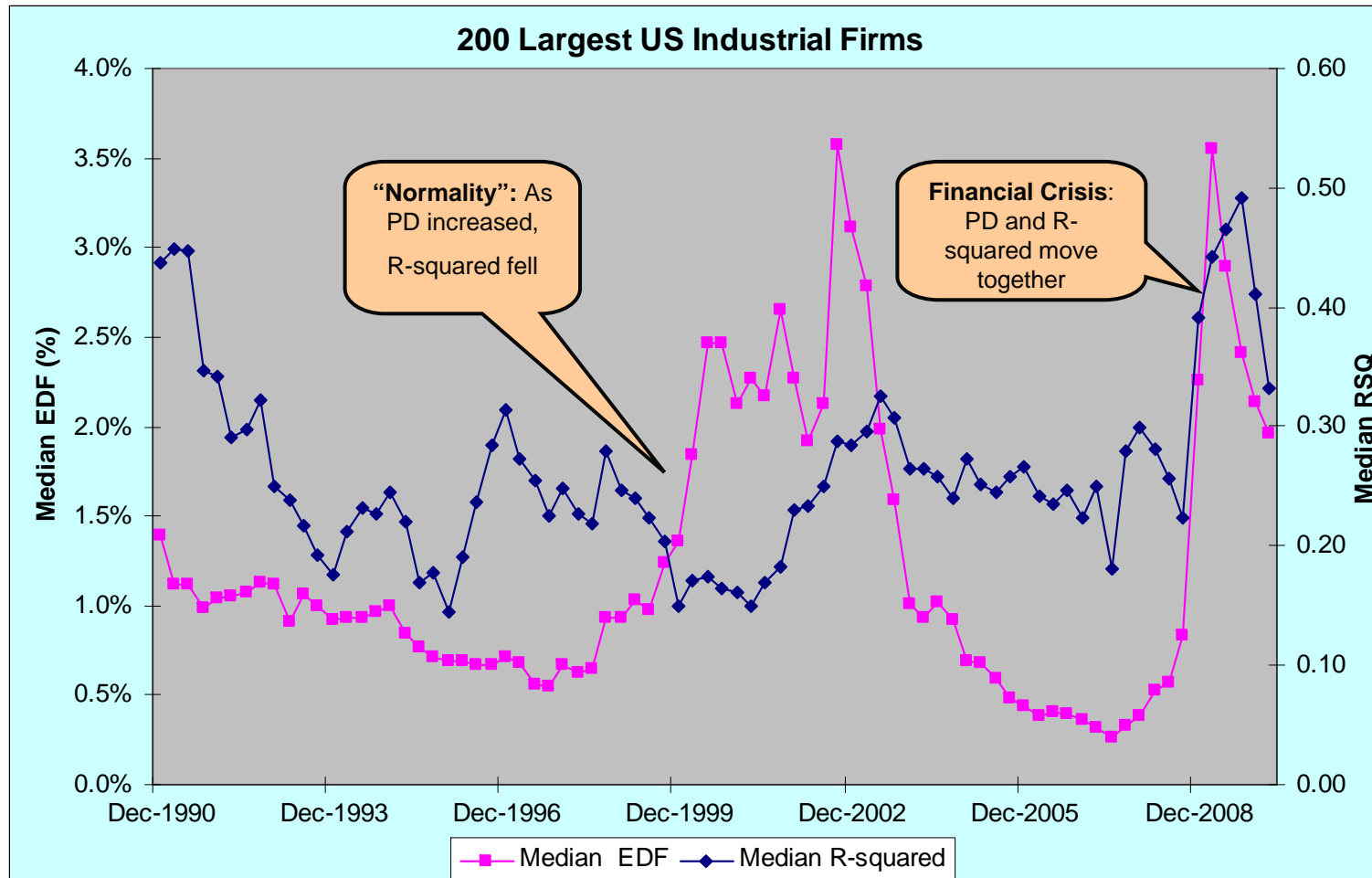


# Correlation is important

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- The likelihood of two or more borrowers defaulting at the same time
- Higher correlation = higher variability = higher ULs
- Tails are longer and fatter
- Estimation is difficult
- Can use a joint distribution for a pair of borrowers
- But not possible to compute all possible pairwise default correlations for a large portfolio!
- 1,000 borrowers => 50 million pairs!
- A solution: map each borrower to an industry. Calculate pairwise industry correlations
- Basel II – prescribed correlation factors
- Also, correlations tend to break down in periods of economic stress.
- Collapse scenario – all correlations move to 100%

# Correlation – US Data Example

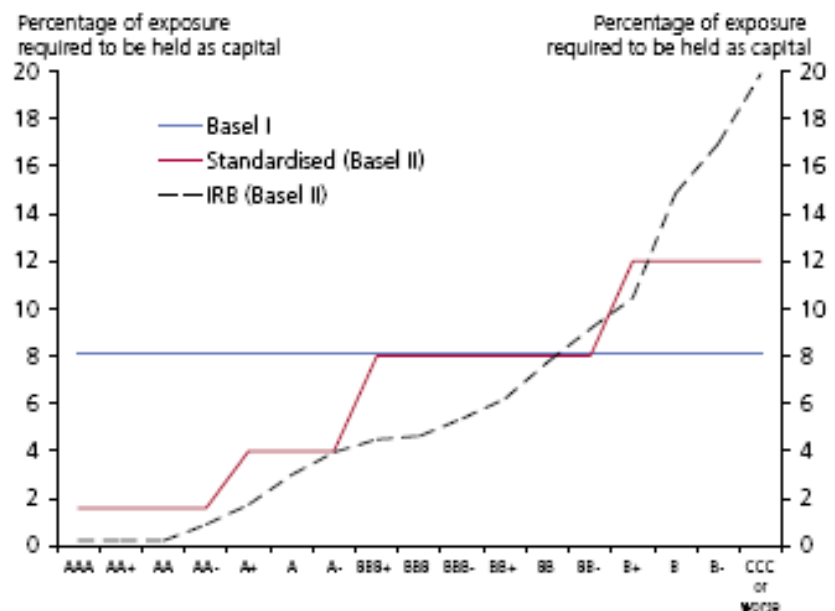


Data: Moodys KMV



# Basel II – new banking regime

- Basel Committee on Banking Supervision (BCBS)
  - Formulates banking supervisory standards
- Basel II - Inforce since 2008
- Movement away from simplistic “risk weight” methodology
- EL and UL: core concepts for regulatory capital
- Aim: to align capital requirement better to risk
- Long-tailed model developed specifically for the BCBS
- 3 approaches to model parameterisation
  - Standardised Approach (conservative prescribed risk weights)
  - Foundation Internal Ratings Based (IRB) Approach
  - Advanced IRB Approach





# Basel II – problems!

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- Procyclical
- Recession -> Increased PDs -> Increased capital requirements in times of stress
- Light historical data, poor historical relationships (correlation)
- Subjectivity in model parameters
  - Firms calculating own parameters
  - Over-optimistic?
- Basel III – aiming to address some of these problems
- Target implementation Dec 2012
  - Tougher Stress Tests
  - Improved model calibrations
  - Mandatory “Downturn” parameter estimates
  - Counter-cyclical capital buffer requirements

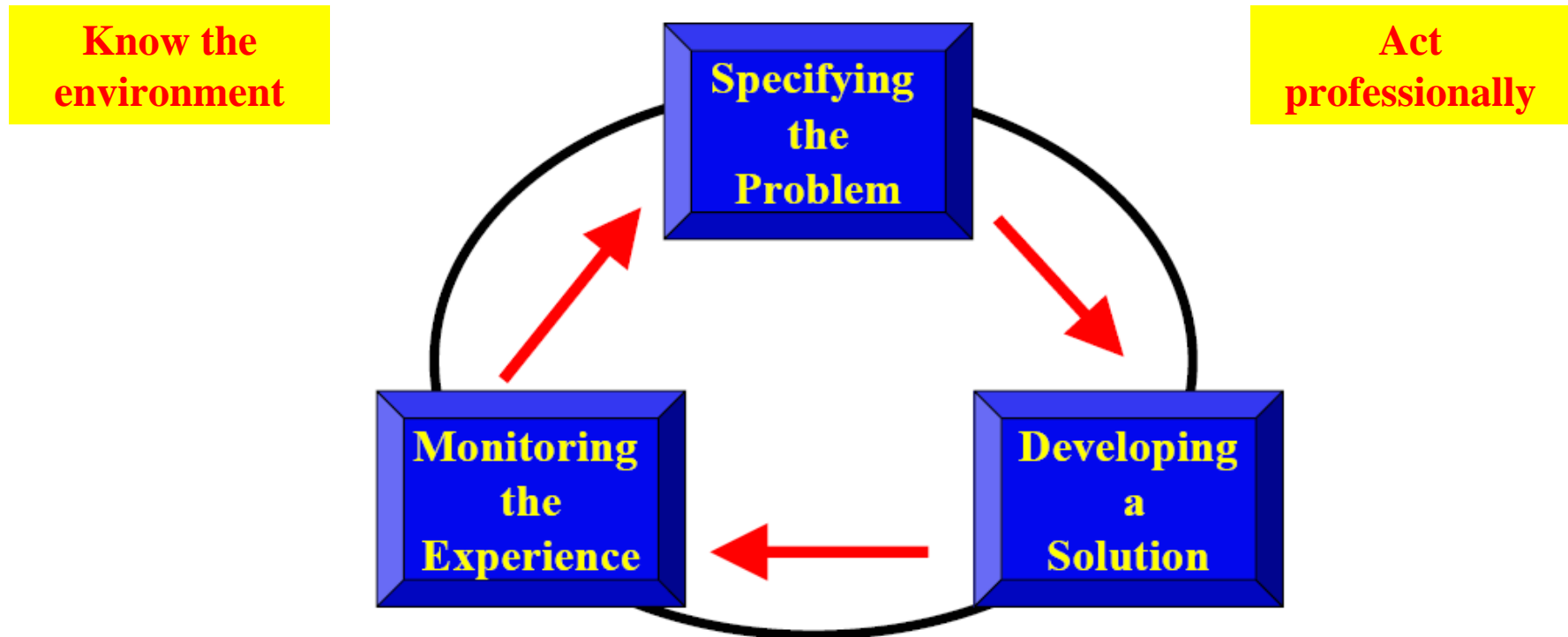


# Credit Management Process



Credit Management can make use of the Actuarial Control Cycle

## Actuarial Control Cycle





# Credit Management Process



- Establish appropriate credit risk environment
  - Credit Risk Policy
  - Credit Risk Infrastructure: procedures, models, systems, data standards
- Analyse and approve of counterparties
  - Assessment & rating process
  - Pricing, documentation
- Monitor exposures against policy limits
  - Single counterparties
  - Concentrations by industry, country, economic sector
- Risk transfer via Portfolio management
  - Securitisation, credit derivatives, insurance
- Periodic Review
  - Policy compliance, testing, audit

# Credit Policy

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An organisation's credit policy underlies its credit risk framework

No one size fits all but a Credit Policy Should Include:

- Organisation's philosophy and principles – Risk Appetite
  - Credit Analysis & Approval Process
  - Credit Rating systems and linkage to reserve and economic capital requirements
  - Underwriting standards and risk-adjusted pricing guidelines
  - Target portfolio mix
  - Delegation of lending authority and exposure limits
  - Credit monitoring and auditing processes
  - Exception and problem management
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- Adopted by Board and Senior Management
  - Communicated to all employees involved in credit management

# Solvency II



- Solvency II will demand sophisticated credit risk management and governance

## CP33 Advice

An undertaking should be.....

- Capable of identifying and mitigating any credit risk in relation to internally defined limits
- Alert to changes in credit ratings through regular, appropriate and proportionate monitoring processes
- Capable of evaluating probabilities of default where exposures are unrated
- Capable of demonstrating that not overly reliant on any counterparty



# Credit Insurance

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**Credit insurance** is a term used to describe both business credit insurance (a.k.a. trade credit insurance) and consumer credit insurance, e.g. credit life insurance, credit disability insurance (a.k.a. credit accident and health insurance), and credit unemployment insurance,

The easy way to differentiate between these two types of insurance is:

- Business credit insurance is credit insurance that businesses purchase to insure payment of credit **extended by** the business (their accounts receivable).
- Consumer credit insurance is credit insurance that consumers purchase to insure payment of credit **extended to** the consumer (insurance pays lender or finance company).

# Credit Derivatives

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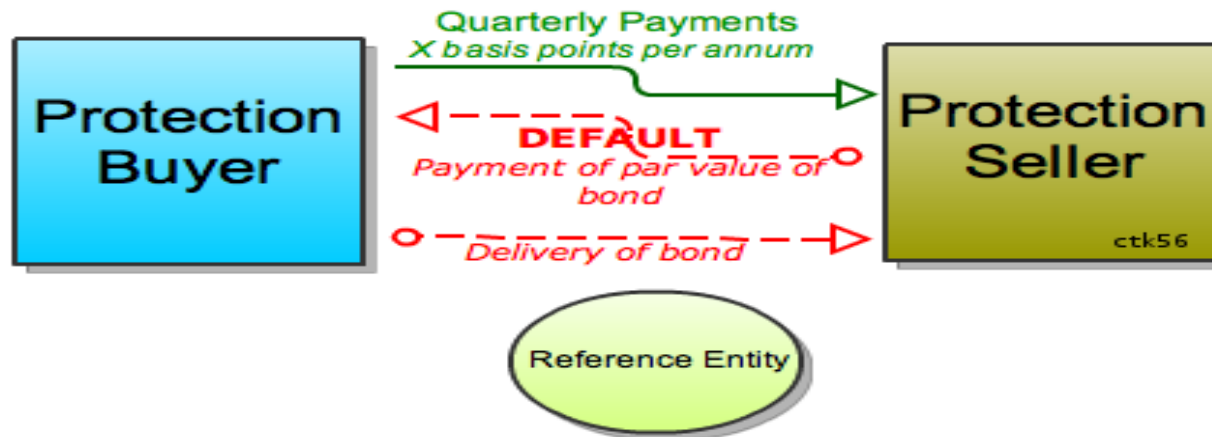
Credit derivatives are derivative instruments that seek to trade in credit risks.

Credit Default Swaps (CDS) is a swap contract in which the protection buyer of the CDS makes a series of payments (often referred to as the CDS "fee" or "spread") to the protection seller and, in exchange, receives a payoff if a credit instrument (typically a bond or loan) experiences a credit event.

# Credit Default Swaps (CDS)



## Credit Default Swaps



If "Reference Entity" experiences a default event before maturity of the swap, the "Protection Seller" makes a default payment to the "Protection Buyer", which mimics the loss on a security issued by the "Reference Entity"

# CDSs – Insurance posing as a Derivative

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- First introduced by JP Morgan in 1994/95.
- Peak market (2007) estimated to be c \$60 TRILLION.
- Sold by Bear Sterns, Lehman Brothers, AIG, Citigroup, and many other banks and financial service companies.
- Buyer pays a premium to seller so that in case of a “negative credit event,” the seller takes on the credit risk.
- ***If*** no credit default, seller pockets the premium and everyone is happy (not unlike insurance / reinsurance).





# CDS spreads Vs Probability of Default

- Consider a 1-year CDS contract and assume that the total premium is paid up front
- Let  $S$ : CDS spread (premium),  $p$ : default probability,  $R$ : recovery rate
- The protection buyer expects to pay:  $S$
- His expected pay-off is  $(1-R)p$
- When two parties enter a CDS trade,  $S$  is set so that the value of the swap transaction is zero, i.e.
- $S=(1-R)p \leftrightarrow S/(1-R)=p$
- If  $R=25\%$ , a spread of 500 bps translates into  $p=6.6\%$ .
- If  $R=0$ , we have  $S=p=5\%$ .

1 Year CDS Spread (bps)	Recovery Rate	Probability of Default %
2,000	40%	33%
1,500	40%	25%
1,000	40%	17%
500	40%	8%

# Corporate Debt Recovery Rates



EXHIBIT 7

Average Corporate Debt Recovery Rates Measured by Post-Default Trading Prices

LIEN POSITION	ISSUER-WEIGHTED			VALUE-WEIGHTED		
	2009	2008	1982-2009	2009	2008	1982-2009
1st Lien Bank Loan	54.0%	61.7%	65.6%	56.6%	46.9%	59.1%
2nd Lien Bank Loan	16.0%	40.4%	32.8%	20.5%	36.6%	1.9%
Sr. Unsecured Bank Loan	34.5%	31.6%	48.7%	38.1%	22.8%	40.0%
Sr. Secured Bond	37.5%	54.9%	49.8%	29.5%	40.3%	48.5%
Sr. Unsecured Bond	37.7%	33.8%	36.6%	35.5%	26.2%	32.6%
Sr. Subordinated Bond	22.4%	23.7%	30.7%	17.9%	10.4%	25.0%
Subordinated Bond	46.8%	23.6%	31.3%	24.7%	7.3%	23.5%
Jr. Subordinated Bond	n.a.	n.a.	24.7%	n.a.	n.a.	17.1%

Moody's Investors Service

- Historically, Default Rates and recovery rates negatively correlated
- 2009, Default rates increased sharply, loan recovery rates significantly below long term average
- Exceptions – Senior unsecured and Subordinated Bonds – due to distressed exchanges

# 1 Year CDS Spreads – Sub-Debt Irish Banks

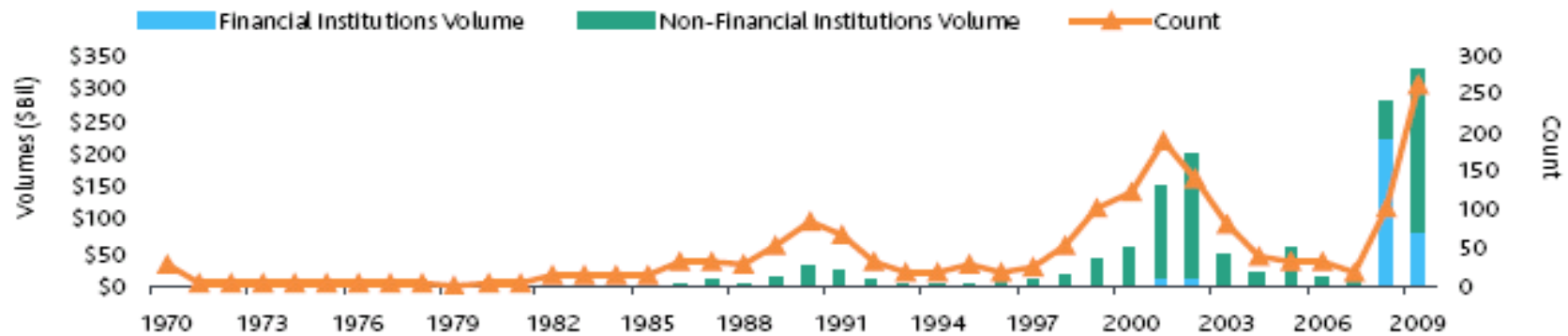


# Corporate defaults – 2009 a Record Year!



EXHIBIT 1

Default Counts and Volumes Soar in 2008-2009



Moody's Investors Service

## Spikes

- Black Monday 1987 kicked off US Savings and Loans crisis – US recession & Bank bail-outs!
- Early 2000s dotcom bubble
- ...currently the Credit Crunch & Banking Crisis..

# CDSs: A lucrative product?



## **AIG's Financial Products Unit:**

- Revenue rose to \$3.26 billion in 2005 from \$737 million in 1999.
- Operating income ... also grew, rising to 17.5% of AIG's overall operating income in 2005, compared with 4.2% in 1999.
- In 2002, operating income was 44% of revenue; in 2005, it reached 83%.

("Behind Insurer's Crisis, Blind Eye to a Web of Risk"  
New York Times, 28/09/2008)

# CDSs – A ticking time bomb

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- Problem... the bonds and other underlying debts referenced by these swaps started to deteriorate.
  - The market started experiencing “negative credit events,” well in excess of what sellers *assumed (priced?)* would never happen.
- Even bigger problem... the sellers of these instruments didn’t set aside adequate capital to cover possible payments on these contracts.

“It is hard for us, without being flippant, to even see a scenario within any kind of realm of reason that would see us losing one dollar in any of those transactions.”

— Joseph J. Cassano, a former A.I.G. executive, August 2007

Failure to correctly price credit risk is a significant contributor to worldwide banking crisis including AIG’s bail-out and Irish banks.....



# Causes of the Financial Crisis

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- Poor Corporate Governance
- Inappropriate remuneration structures
- Easy access to Credit
- Housing Bubble
- Inappropriate Regulation

All either contributed to or derived from:

Incorrect pricing of **Risk** and in particular **Credit Risk**