Credit Risk Markets: Opportunities and Challenges

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Josef's Questions

- What are the most important trends & innovations in Credit Risk Markets?
- How can asset managers and investors use these instruments?
- Do you see dangers arising from these new markets?
- What do you see as future developments in the area of credit?

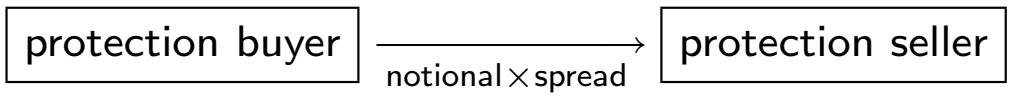
- Questions
- The CDS/CDX Market
- The CDO Market
- Advantages and Potential Dangers
- Future Developments & Challenges

Rapid evolution of credit markets

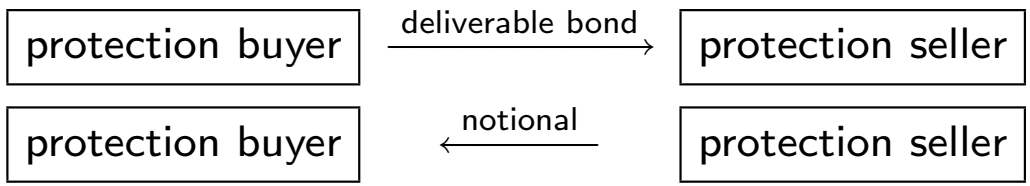
- Innovation in contracts,
  - from traditional *funded* securities: corporate bonds
  - to new *unfunded* derivatives: credit default swaps (CDS)
- And increased liquidity,
- Allow investors to express views on:
  - Single-names CDS
  - Baskets of names (CDX.IG, CDX.HV, iTraxx)
  - Correlation (Synthetic liquid CDO, Bespoke CDO, CDO^2...)
  - Emerging Market Countries (EMCDS)
  - Basket of Countries (EMCDX)
  - Asset Backed Securities such as credit card receivables or Home equity loans (ABS-CDS)
  - Baskets of Asset Backed Securities (ABX)
  - Correlation (TABX)
  - Senior secured Loans (LCDS)
  - Basket of Loans (LCDX)

CDS Contract Structure

- A CDS is an insurance contract against a credit event of counterparty:
  - Prior to credit event:



  - Upon arrival of credit event:



- Definition of credit event:

  Bankruptcy
  Failure to pay
  Obligation acceleration or default
  Repudiation/moratorium
  Restructuring (Full R, Mod R, ModMod R, No R)

Arbitrage Relation

- Buy XYZ bond + Buy XYZ protection $\sim$ Earn risk-free rate
- Buy risk-free bond + Sell XYZ protection $\sim$ Earn XYZ bond yield

$$\boxed{\text{CDS spread} \approx Y_{XYZ} - R_f}$$

$\Rightarrow$ CDS allows pure unfunded play on credit risk.

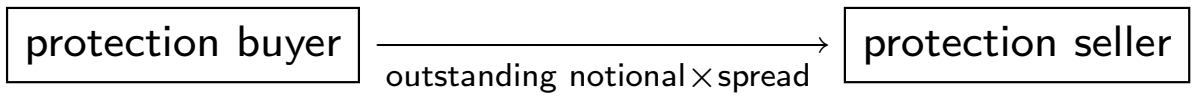
- Empirical evidence on *Basis* = CDS spread $-$ $(Y_{XYZ} - R_f)$.

	Basis wrt Tsy (bp)		Basis wrt Swap (bp)		implied R_f / Tsy	
	Mean	S.E. (of mean)	Mean	S.E.	Mean	S.E.
Aaa/Aa	-51.30	1.97	9.55	1.31	0.834	0.0250
A	-64.33	1.82	5.83	1.59	0.927	0.0229
Baa	-84.93	3.63	2.21	2.79	0.967	0.0364
All Categories	-62.87	1.38	6.51	1.06	0.904	0.0160

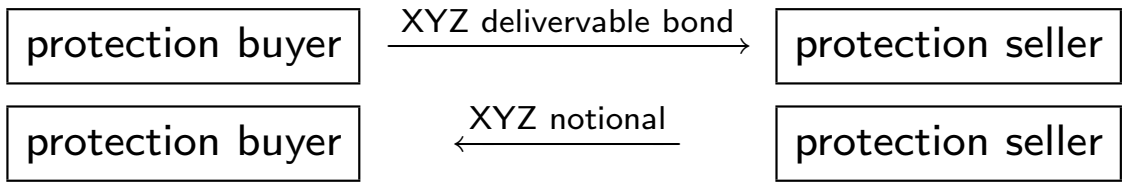
source: Hull, Pedrescu, White (2006)

The CDX index

- The CDX index is an insurance contract against credit events of a portfolio of counterparties (e.g., 125 names in CDX.IG):
  - Prior to credit event:



  - Upon arrival of credit event of XYZ:

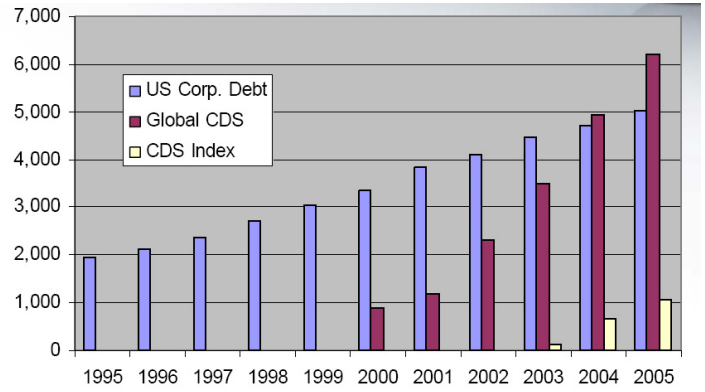


  - Following credit event outstanding notional is reduced by notional of XYZ in portfolio (i.e., $\frac{1}{125}$ in CDX.IG).
  - Contract expires at maturity or when notional exhausted.

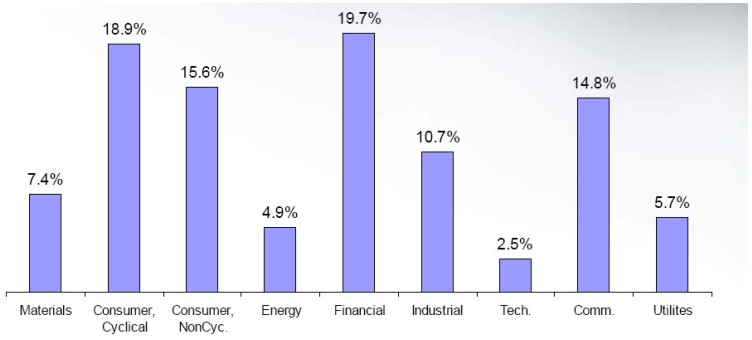
- N.B.: CDX contract $\neq$ equally weighted portfolio of single name CDS contracts
  CDX spread $\neq$ average of single name CDS spreads

Market Overview

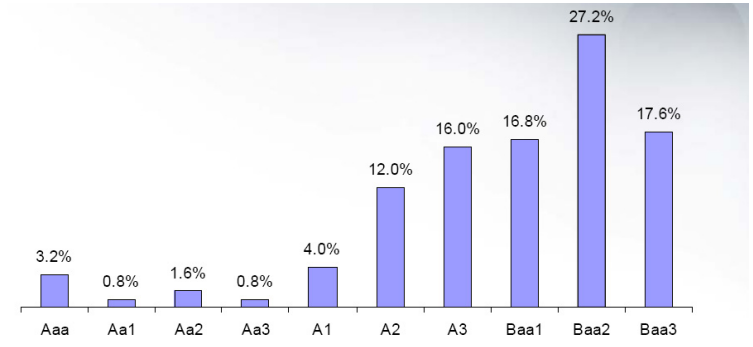
Growth Rate (notional)



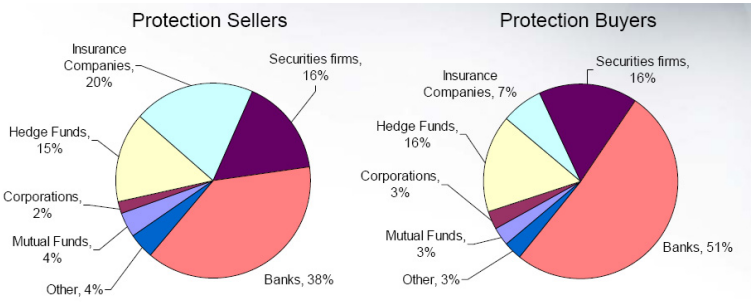
Industry Composition of CDX.IG



CDX.IG Moody's Ratings



End Users



source: BBA & White (2006)

Synthetic CDO Tranches

- Selling protection on CDO tranche with attachment points $[L, U]$ (i.e., notional $= U - L$) written on underlying basket of 125 single names (CDX):
  - Prior to a credit event:

$$\boxed{\text{protection buyer}} \xrightarrow[\text{outstanding notional} \times \text{spread}]{} \boxed{\text{protection seller}}$$

  - Upon arrival of credit event ($LGD =$ notional $-$ deliverable bond price), if cumulative loss exceeds lower attachment point (i.e., $\mathcal{L}_t = \sum_{i=1}^{125} LGD_i \mathbf{1}_{\{\tau_i \leq t\}} > L$) then

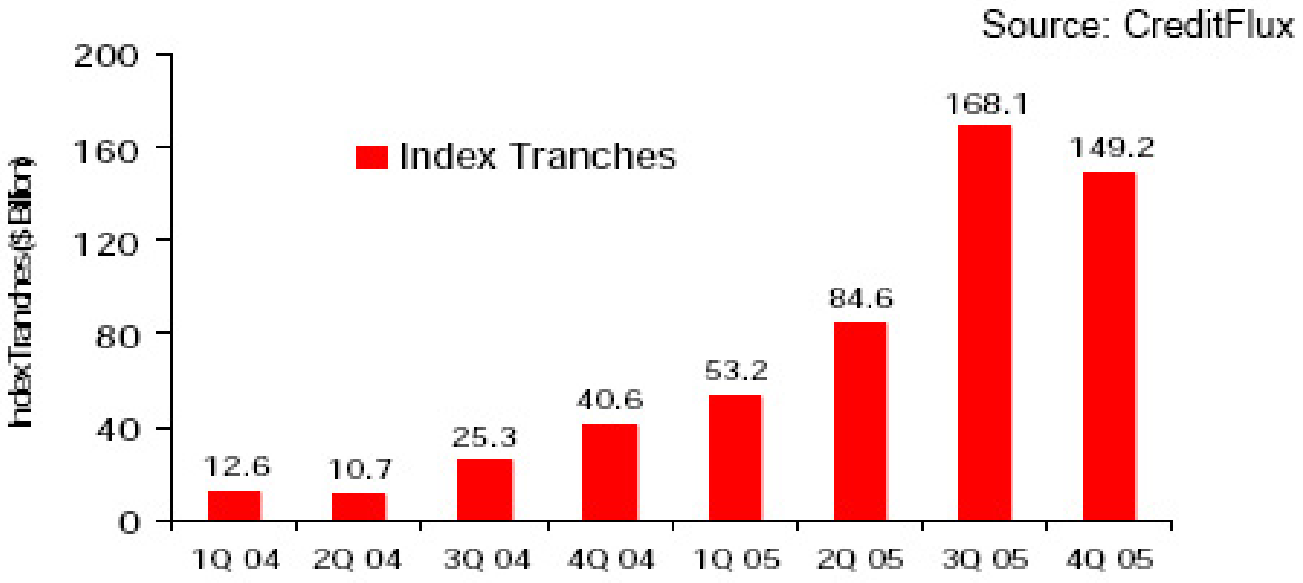
$$\boxed{\text{protection buyer}} \xleftarrow{\min(LGD, \text{outstanding notional})} \boxed{\text{protection seller}}$$

  - Following credit event outstanding tranche notional is reduced by LGD (up to exhaustion of outstanding notional).
  - Contract expires at maturity or when tranche notional is exhausted.
- Tranche payoff is call spread on cumulative loss: $\max(\mathcal{L}_t - L, 0) - \max(\mathcal{L}_t - U, 0)$.

$\Rightarrow$ Tranche valuation depends on entire distribution of cumulative portfolio losses and crucially on default event correlation model.

Market Size

- Liquid tranche market is growing steadily



- Bespoke portfolio tranche market is roughly ten times the size of the synthetic tranche market:
  - Investors sell or buy protection on a portfolio of specific names for speculative or hedging motives.
  - Dealers take the other side and turn to the synthetic tranche market to hedge their resulting net exposure (keep some basis risk).
  - Hedge funds and other dealers participate in synthetic tranche market to redistribute risks.

Market Model: Implied Gaussian Copula Correlation

- Market standard for quoting CDO tranche prices is the *implied correlation* of the Gaussian Copula framework.

- Intuition builds on structural model of default (CDO model due to Vasicek 1987):
  - Each name in basket characterized by an 'asset value' driven by two factors: a common market factor and an idiosyncratic factor ($V_i = \sqrt{\rho_i}\, M + \sqrt{1-\rho_i}\, \epsilon_i$ with M, ϵ_i independent centered Gaussian).
  - Pairwise 'asset correlation' is the product of the individual asset betas ($\sqrt{\rho_i \rho_j}$).
  - Default occurs when asset value falls below a constant barrier (DefProb $= P(V_i \leq B_i)$).

- Market convention for quoting tranche values in terms of *implied correlation* assumes:
  - The individual beta is identical across all names in the basket.
  - The default boundary is identical and calibrated to average CDS level (or index level)
  - All firms have identical LGD of 60%.

$\Rightarrow$ With these heroic assumptions, a single number, the *implied correlation* ($= \rho$), allows to match a given tranche's model price with the market price (for a given index CDS level).

The implied correlation smile

- Market Quotes on Aug. 4, 2004 (CDX index spread 63.25 bp)

Tranche	0-3%	3-7%	7-10%	10-15%	15-30%
CDX.IG	41.38%	3.49%	1.355%	0.46%	0.14%

- The market displays an *implied correlation smile*:

Tranche	0-3%	3-7%	7-10%	10-15%	15-30%
CDX.IG	21.7%	4.1%	17.8%	18.5%	29.8%

$\Rightarrow$ The smile shows that the Gaussian copula model is mis-specified (analogous to the implied option smile).

- Market quotes on June 1st IG4-5Y (CDX index spread of 42 bp):

Tranche	0-3%	3-7%	7-10%	10-15%	15-30%
CDX.IG	30.5%	0.66%	.095%	.075%	0.04%

- The current *implied correlation smile*:

Tranche	0-3%	3-7%	7-10%	10-15%	15-30%
CDX.IG	9.08%	5.8%	10.02%	16.77%	27.62%

What are Advantages and Potential Dangers of these Products

- Practical advantages:
  - Reduced funding costs
  - Access to leverage
  - Take long and short position more easily
  - Simplifies hedging of Counterparty risk
- Economic benefits:
  - Completes markets
  - Leads to wider Risk-sharing
  - Better transmission of information (as prices reflect information of both long and short) and allocation of resources
- Potential Dangers:
  - May promote excessive risk-taking (moral hazard)
  - Complexity may lead to risks being held by agents for wrong reasons (e.g., leveraged super-senior, CPDO)
  - Diffusion of risks may lead to increased complexity/opacity of economic linkages and more difficult measurement of counterparty risk
  - Combined with increased leverage may lead to increased exposure to liquidity risk and possibly to higher systemic risk

- Continued rapid growth in new products:
  - Leveraged Super-Senior tranches
  - CPDO, CPPI
  - CDOs of Long-short portfolios
  - IO, PO, Zero-coupon tranches, Tranchlets.
  - Forward starting CDOs.
  - LCDX
- Some maybe very useful, but market participants need to see through complexity and marketing/rating game (e.g., AAA rated products offering LIBOR + 100/200bps!).
- In need of better modeling framework (beyond Gaussian Copula) to tackle new (and older!) products:
  - Implied Gaussian copula correlation is not a good indicator of correlation
  - There is no corresponding measure of 'realized correlation' ($\neq$ implied option volatility)
  - Predicted hedges don't work well during volatile periods.
  - The model is inherently static (one-period).
- Microstructure: towards increased transparency (exchange-traded cds or credit futures?)
- Operational challenges (netting/collateral management, settlements, assignments, and order processing).
- Credit Risk premia (spread and default dynamics) may be very different going forward than historical levels suggest.